Post-commencement analysis of the Dutch 'Mission-oriented Topsector and Innovation Policy' strategy

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Preface

Much in line with the rising international interest for mission-oriented innovation policy (MIP), the Netherlands has recently begun to transform its 'Topsector approach' into a 'Mission-oriented Topsector and Innovation Policy' (MTIP) strategy. Over the course of 2019, different ministries have put forward a total of 25 missions belonging to 4 central themes. In their latest Knowledge and Innovation Agendas, the Topsectors have specified how they plan to contribute to the development of innovations that address these missions. Moreover, by signing the Knowledge and Innovation Covenants 2020-2023 in November 2019, around 30 stakeholders have committed themselves and their budgets (totalling to €4.9bln for 2020) to supporting these development efforts.

What remains unclear at this point is how exactly the shift to mission-oriented innovation and Topsector policy has an actual impact on the processes leading to the development and implementation of potential solutions. The Dutch Ministry of Economic Affairs and Climate Policy (EZK) has expressed an interest in an analysis of the governance arrangements and monitoring possibilities that are being developed for the new policy approach. Such an analysis should provide a better understanding of how missions are being coordinated, and on what accounts (measurable) impact may be expected.

The post-commencement analysis provided in this report offers a first scan of how the Dutch MTIP is currently unfolding. Apart from describing the outlines of the MTIP as such, it presents some early findings on policy designs and associated challenges for the particular mission on 'a carbon-free built environment by 2050'. The analysis covers the origins of the mission, how it is embedded in a wider policy and institutional landscape, what governance structures have been deployed, which policy instruments are being mobilized, and how progress is intended to be monitored. The report concludes with a synthesis based on findings from studying the overall MTIP strategy, the built environment mission, and additional interviews on the mission for 'a sustainable, fully circular economy by 2050'.

1. Introduction

1.1. Background of the study

The view that innovation policies can help to address societal challenges has been gaining popularity rapidly over the past few years. Instead of only spurring the search for novelty, innovation policies may also be designed to provide and diffuse novel solutions for urgent societal problems related to topics like sustainability, health, safety, or demographic change.[1] One way of linking innovation policies to battling societal challenges, largely popularized by the economist Mariana Mazzucato, is by prioritizing a mission. The notion of 'mission-oriented innovation policy' (MIP) refers to innovation policies that aim to mobilize public and private innovative capacities in order to pursue an ambitious and concrete societal goal.[2] A typical example of such a goal would be "a 25% reduction of CO_2 emissions in aviation by 2030".

While the idea of uniting innovation efforts around a clear societal goal is very concrete, it is far from straightforward which policies may support the pursuit of that goal. At this point not much is known about the specific forms appropriate policies can take, nor under which circumstances they can be effective. Despite ample policy interest for the notion of MIPs, so far very few empirical studies have looked into how MIP-related governance arrangements and policy instruments have been designed, and how they are working out. In order to start filling that gap, this report presents a case study on one of the few examples of a national innovation strategy explicitly focused on completing missions. The Dutch 'Mission-oriented Topsector and Innovation Policy' (MTIP) succeeds the national Topsector-based research and innovation strategy established in 2012. After announcing the shift towards a mission approach in 2018, in fall 2019 the ministry of Economic Affairs and Climate Policy ('EZK') announced which 25 missions would feature centrally in the updated policy approach.[3]

The pivot towards missions has implications for how innovation governance and the innovation policy mix are organized. Transitioning from a Topsector-focused strategy to a mission-oriented innovation approach (still also involving Topsectors) is at this moment – and maybe permanently - an ongoing process. For some missions, new governance structures have been designed and implemented already. The actors involved in these structures have also started to propose ideas or even to undertake actions regarding the creation of a policy mix suitable for pursuing missions.

As the first steps towards a national MIP strategy have been taken, with many more still on their way, the case of the Dutch MTIP presents an opportunity to study what an actual instance of MIP might look like. A priori there are very different approaches that could be followed here (see section 2.2), which begs the question which specific choices have been made in the Dutch case, and why. An early stage or 'post-commencement' investigation of the emerging policy strategy allows for in-depth analysis of the questions and tensions that arise when designing governance structures and policy instruments. Of particular interest at this point is the relation between those designs, and the impacts they have (or are supposed to have) when it comes to engaging and mobilizing different types of stakeholders in processes of solution development and application.

In the case of the MTIP, studying the governance and instruments already developed for a 'mature' mission can be particularly helpful as for some other missions only a few concrete steps have been made so far. Moreover, reporting on decisions and challenges may also be of relevance for other governments currently considering whether and how to respond to the rise of MIPs.

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[1] Boon, W., & Edler, J. (2018). Demand, challenges, and innovation. Making sense of new trends in innovation policy. *Science and Public Policy, 45*(4), 435-447.

[2] Mazzucato, M. (2018) Mission-oriented innovation policies: challenges and opportunities. *Industrial and Corporate Change, 27*(5), 803-815.

[3] Ministry of EZK (26-04-2019). Missies voor het topsectoren- en innovatiebeleid.

1.2. Research questions

When commissioning this report, the ministry of Economic Affairs and Climate Policy has proposed the following questions for guiding the nature and scope of the case study:

1. *Governance: What is the current form of governance? Does the mission actually guide the various activities? Do the governing arrangements offer a suitable range of instruments for researchers and innovators? Does it offer them a seamless and efficient continuum of support, covering all TRLs and the investment stages, and including also supporting policies like helpful regulation and procurement? What could be next steps for further improvement?*
2. *Monitoring: What are the (planned) arrangements to monitor inputs, activities, outputs and impacts? What would be next steps to improve monitoring and feed resulting information back into the governance?"*

To obtain maximally relevant information in terms of comparability and maturity of investigated missions, the requested research focuses on two missions belonging to the 'Energy transitions & Sustainability' theme of the Dutch MTIP strategy (see box below, and chapter 3):

- **A carbon-free built environment by 2050.** This mission is drawn up by the Ministries of the Interior (BZK) and EZK, and supported by the Topsector Energy.
- **A sustainable, fully circular economy by 2050**. The goal for 2030 is halving the use of natural (fossil) resources. This mission is drawn up by the Ministries of Infrastructure and Water Management (I&W) and EZK, and supported (primarily) by the Topsector Chemistry.

While both missions have been investigated, this particular report only contains an in-depth case study on the Carbon-free Built Environment mission (chapter 4). Findings on the Circular Economy mission are documented in a separate policy memo, but have been used also for the synthesis presented in chapter 5.

Box 1: Energy transition and sustainability (Source: EZK, 2019, p. 3-4)[3]

"Our society is sustained by what the planet and the economy can offer us. In order to ensure that we have a habitable and sustainable planet in 2050, we need to take action now on the climate issues facing us. We aim to cut the country's greenhouse gas emissions by 49% in 2030, rising to 95% in 2050, compared with 1990. In addition, we need to be more inventive with the raw materials that we now have. We currently waste many of these raw materials, without giving them a second life. Premised on reuse and recycling of raw materials, a circular economy knows no waste.

As a result, we will commit to improving the sustainability of the electricity system and the built environment, eliminating reliance on natural gas, as well as achieving a carbon-neutral and competitive industry, zero-emission mobility, a fully circular economy and carbon-neutral agriculture, among other things. Two missions have been formulated under this theme. The first mission is directly linked, one-on-one, to the national Climate Agreement; this mission is further elaborated in the Integrated Knowledge and Innovation Agenda (IKIA) for Climate and Energy. In addition, the underlying document contains several additions to this mission outside the scope of the IKIA, relating to sustainable mobility in respect of smart mobility, sustainable aviation and a sustainable maritime sector. The second mission is linked to the government-wide programme A Circular Economy in the Netherlands by 2050 and the Raw Materials Agreement.

The missions are:
- To cut national greenhouse gas emissions by 49% in 2030, increasing to 95% in 2050, compared with 1990. This mission breaks down into: an entirely carbon-free electricity system in 2050; a carbon-free built environment in 2050; a carbon-neutral industry based on the re-use of raw materials and products in 2050; zero-emission mobility for people and goods in 2050; a net carbon-neutral agricultural and nature system in 2050;
- A sustainably driven, fully circular economy in 2050. The objective for 2030 is to achieve a 50% reduction in resource use."

1.3. Methodology

Desk research

Various types of documents were consulted to get an accurate understanding of what goals are pursued and which government arrangements, policies and funding streams this involves. These documents include letters sent to parliament, publicly available descriptions of the missions, and the knowledge and innovation agendas and covenant associated with these missions. In addition, the ministry of EZK and various stakeholders shared internal documents and public presentations providing details on the governance arrangements.

Interviewees

Over the course of July 2020 till September 2020, a total of 19 interviews were conducted. Conversations lasted over one hour on average. The list of interviewees (see Appendix) includes two policy makers with expert knowledge on the MTIP and 'Energy transition & Sustainability' theme as such, and seventeen interviewees with knowledge about either the Carbon-free Built Environment mission and/or the Circular Economy mission. The interviewees for the two missions were roughly equally divided over people with a background in policy, science, industry, or some type of representation of societal interests (e.g. NGO). With a few exceptions, most interviewees had in-depth knowledge about the unfolding MTIP approach due to their own involvement in the governance structures. This underlines that this study is not a critical assessment, but rather an orienting investigation of how the MTIP is being designed and which challenges are being encountered.

Box 2: Overview of interview topics

How has the mission been **formulated**?
- What are the main events/documents on the timeline leading up to the mission formulation; which consultations, negotiations, strategic deliberations preceded the mission statement?
- Who were involved in formulating the mission? What are their interests?
- What were the main considerations when framing and scoping the mission?
- What types of (un)certainties characterize the nature of the targeted problems – and, if applicable, the solution directions that regarded as promising for solving the problem?

How is the **governance** organized?
- Who carries what responsibilities?
- What coordination structures are in place; which information is used for what decisions?
- How is the mission being translated in manageable (sub)goals?
- What instruments are being developed/adapted to ensure mission progress?
- How does the mission approach add to existing structures/policies like the Topsector approach or an industries/Ministries' own strategic agenda?
- Which resources have been committed to the mission; under what conditions?
- Are there checks and balances when it comes to decisions on the mission itself, the use of particular policy instruments, and the support for potential solutions?

What **substantive actions** are being considered / designed / implemented?
- Which strategies, policies, events, etc.? What *change dynamics* should they engender?
- How do the goals of these actions align with each other, and with the overall mission?
- What actors/networks should the actions engage? Which solution paths do they target?
- What determines the success of each action?

What **effects** (different orders of outcomes) are being pursued; overall and per action?
- Is there already an official monitoring framework? Is there a structure of KPIs? Is there a strategy for conducting contribution and/or attribution analyses?
- How do the substantive actions (and envisaged *change dynamics*) relate to those KPIs?

What **tensions** emerge when engaging stakeholders and deploying actions?
- What sources of resistance (or acceleration) influence the mission direction / governance?
- Are there any bottlenecks in relation to managing/choosing solutions, losers and winners, etc.?

What **governance and monitoring improvements** should be considered?
- Which ones on the short term, which ones on the long term?

1.4. Reading guide

The remainder of this report is structured as follows:
- Chapter 2 briefly lays out the theoretical concepts on which the empirical analysis in the subsequent chapters will draw.
- Chapter 3 describes how the Dutch MTIP strategy builds on the original Topsector approach, as well as other policy developments outside the domain of research and innovation. Besides listing the 25 missions that were proposed in 2019, the chapter also discusses the overall governance structure, funding arrangements and policy instruments associated with the MTIP.
- Chapter 4 provides the in-depth empirical analysis of the Carbon-free Built Environment mission.
- Chapter 5 offers a synthesis of findings retrieved from studying the overall setup, the Carbon-free Built Environment mission analysed in chapter 4, and the Circular Economy that was investigated but not documented in more detail in the current report.
- Chapter 6 finalizes with the conclusions.

2.   The 'mission-oriented innovation policy' concepts

2.1. Missions

The current debate on MIPs emphasizes how ambitious and measurable missions launched by bold governments can provide the directionality that is needed to activate and align the innovation efforts of broad ranges of stakeholders.[4] Especially for 'wicked' societal challenges, it is expected that they often require multidisciplinary and cross-sectoral solutions drawing on technological as well as non-technological (e.g. behavioural, institutional) changes.[5]

As reaching the stated societal goal is the final objective, policies focused on completing a mission should be concerned with both the development as well as the actual use of suitable solutions. This implies that missions affect significantly more stakeholders than just the ones engaged in developing and applying new knowledge. Moreover, as the adoption of innovative solutions for societal problems can have important socio-economic consequences in turn, it is likely that some of these stakeholders may have an active role in determining which directions for change are being considered when pursuing a mission. The Mission-oriented Innovation Policy Observatory has described the nature of missions as follows (2020, p.6)[6]:

"We regard missions as always embedded in and in tension with the structures of different systems of provision and the science, technology and innovation systems. Missions emerge as a negotiated outcome between different interests, concerns and imperatives. This implies that in our view, they are neither apolitical in their formulation, nor neutral in their conduct. Moreover, they are not fixed but rather dynamic engagements, whose conduct is (desirably) adaptive and iterative, responsive to changing circumstances. Even if the headline goals remain unchanged, how they are interpreted, structured into intermediary goals, and evaluated is often up for (re)negotiation. In this respect it should be noted that missions interact with other approaches, structures and policies in complex ways, which may undermine their execution and have negative impacts elsewhere. Missions always address challenges partially, engaging some systems and sectors and publics but not others, and therefore always exclude particular paths, possibilities and concerns."

Building on this interpretation, Figure 1 positions missions in between the various systems they are influencing (and originating from). These are the *socio-economic system* relevant for a social domain dealing with a challenge (like traffic safety or clean industry), and the *innovation system* that may be mobilized for solving that challenge. While the socio-economic system entails the overall set of technologies, infrastructures, behaviours and values relevant for production and consumption patterns in a social domain, the innovation system consists of the actors and structures relevant for the acts of developing new knowledge and applying them in novel products, processes and services.

As the figure shows, missions may operate as an interface for aligning coordination and investment activities in both the aforementioned systems. Additionally, they can also help to establish a bridge between governments on the one hand, and markets parties and societal organisations (including firms, universities and citizen representatives) on the other hand. One can expect that the involvement of such actors might change over time, thereby also influencing which directions are being pursued and which actual changes this causes in the socio-economic and innovation system. Rather than static phenomena, missions are to be regarded as embedded and evolving.

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[4] Mazzucato, M. (2016). From market fixing to market-creating: a new framework for innovation policy. *Industry and Innovation, 23*(2), 140–156.
[5] Wanzenböck, I., Wesseling, J., Frenken, K., Hekkert, M., & Weber, M. (2020). A framework for mission-oriented innovation policy: Alternative pathways through the problem-solution space. *Science and Public Policy.*
[6] Janssen, M., Torrens, J., Wesseling, J., Wanzenböck, I. Patterson, J., Hekkert, M. (2020). Position paper 'Mission-oriented innovation policy observatory', v. 12-02-2020. Utrecht University.
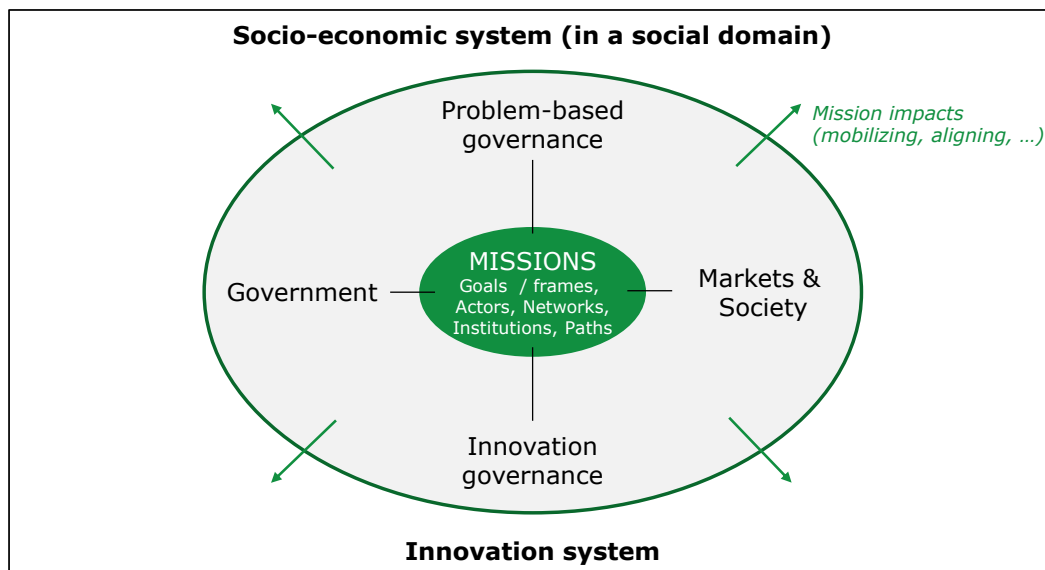
Figure 1: Missions as embedded and evolving phenomena (MIPO, 2020[6]).

2.2. Mission-oriented innovation policy

When it comes to concrete policy strategies for engaging actors in the pursuit of missions, the academic debate so far has proposed different approaches. Often implicitly, studies on MIPs tend to emphasize the importance of either scientific research, entrepreneurial experimentation by firms, or changes stemming from societal stakeholders themselves (like civil-society organisations). These focal topics are typically associated with policy approaches like, respectively, challenge-led R&D policy, industrial policy, and transformative innovation policy based on transition thinking. This is reflected in the figure below, plotting the three archetypical approaches against the axes of 'knowledge/technology push – demand pull' and 'innovation focused – diffusion focused'. Actual MIP strategies, including the processes for mission formulation as well as the specific governance arrangements and policy instruments deployed for pursuing missions, can be designed according to any of these archetypical approaches.

Figure 2: Different approaches to mission-oriented innovation policy (adapted from Janssen 2019[7])

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[7] Janssen, M. 2019. Legitimation and effects of mission-oriented innovation policies: A spillover perspective.

Figure 3 shows an alternative way of interpreting MIPs, based on the combination of the perspectives captured by the previous figures. MIPs consist in the first place of governance arrangements for organizing the task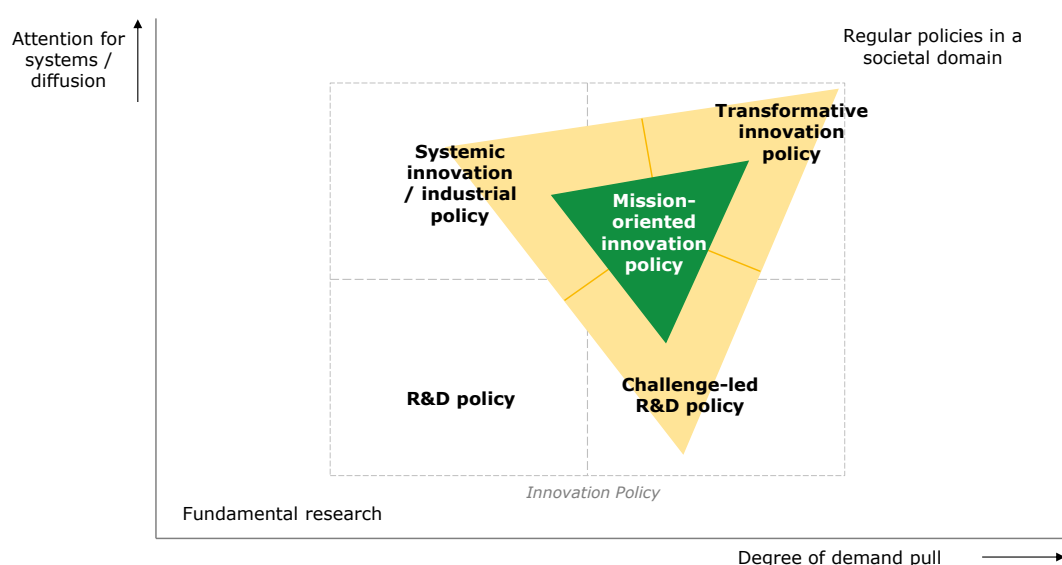s and responsibilities associated with prioritizing and pursuing a mission goal. Secondly, a government launching a mission and the MIP governance structure it puts in place will both have a role in creating a policy mix suitable for the creation and application of promising solutions. As MIPs by definition draw on driving changes by mobilizing innovative capacities, many of the policies they can build on will be related to some parts of the spectrum ranging from knowledge development to innovation and diffusion. It is possible to launch new policy instruments explicitly dedicated to supporting the pursuit of missions, or to adjust exiting instruments. Hybrid forms may be possible as well, in which some new instruments complement the ones that were already present.

It is unlikely that merely having well-balanced policies for different stages of innovation is already sufficient for completing a mission. Recent writings on MIPs emphasize that the policies and the mission itself should create the circumstances in which actors in the innovation system (researchers, innovators) and in the socio-economic system (those affected by a societal problem) are driven into each others arms, so that they can ensure that they properly inform each other and co-create when searching for suitable solutions.[6] This implies that MIPs are to be seen as coordination mechanisms just as much as 'policy packages'. Moreover, the actual uptake of resulting solutions is believed to be also a matter of initiatives not typically associated with innovation policies, including for example the modification of regulation or awareness campaigns informing people about the role they can play in dealing with a given societal challenge. Finally, completing a mission entails more than consistently nurturing the solution pathways that are being explored in so-called 'mission-oriented innovation systems'; it might also require active managing of which paths to pursue, combine, or drop.[8]
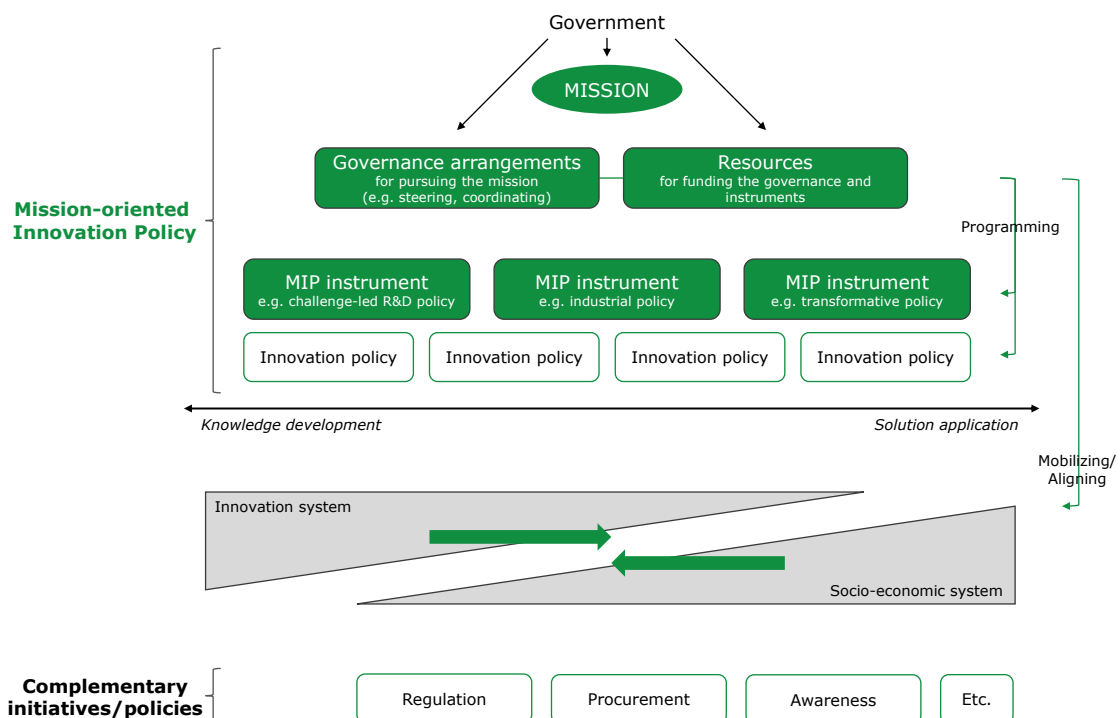
Figure 3: Conceptualization of what mission-oriented innovation policy is composed of.

The conceptualization presented here provides the MIP interpretation and vocabulary that will be used throughout this study. In line with the research questions listed in section 1.2, the empirical analysis focuses particularly on how the governance arrangements are designed, how they affect the mobilization of resources and the lining up of policy instruments, and how this is being monitored.

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[8] M. Hekkert, M. Janssen, J. Wesseling, S.O. Negro (2020). Mission oriented innovation systems. *Environmental Innovation & Social Transitions*, 34, pp. 76-79.

3. Mission-oriented innovation policy in the Netherlands

3.1. Evolution of Dutch innovation policy[9]

Already with the introduction of the Topsector approach, around 2012, the Dutch government (notably the Ministry of Economic Affairs and Ministry of Education, Science and Culture) started to develop **a research and innovation strategy focused on coordination and collaboration**. The nine Topsectors that were selected pertain to R&D and export-intensive domains like AgriFood Logistics, Life Sciences and Health, and High-Tech Systems and Materials. At least originally, the primary goal of Topsectors was to improve the match between the knowledge demands of innovative firms and the activities of research institutes.

Brief description of the Topsector approach

Each Topsector consists of a Topteam of high-level representatives from science, industry and policy. Additionally, the Topsectors have one or more TKI; the 'Topconsortia for Knowledge and Innovation'. Together, the Topteam and TKI are responsible for creating and implementing the Knowledge and Innovation Agendas (KIAs) in which stakeholders active in the respective Topsector domains articulate their visions on the directions in which they want to develop. Although important decisions are mostly taken by the Topteam members than The TKI have a staff of multiple people (usually also active still in their main jobs), which leaves them the capacity to engage with stakeholders and coordinate the writing of the KIAs. Moreover, they also organize networking activities and other supporting initiatives to help stakeholders in their domain with moving forward in developing and applying innovations. Taking a rather systemic perspective on innovation, the Topsectors deploy initiatives also for supporting human capital development (e.g. by regularly updating Human Capital Agendas reflecting skill demands), export activities, and reconsideration of regulatory barriers.

Importantly, the experimental way of engaging in 'modern' industrial policy involved relatively little funding. While financially the bulk of innovation support in the Netherlands is still allocated through fiscal schemes like the WBSO and the Innovatiebox (Patent Box), the Topsectors mostly operate by influencing the scope of other policy instruments. Two major exceptions are the TKI or PPP allowance and the MIT. The TKI allowance for subsidizing public-private R&D projects serves to identify which research domains were of high importance for firms, and to encourage firms to make private research investments as well. In order to ensure also the involvement of SMEs, the MIT instrument subsidizes activities like prototyping and feasibility studies. Finally, some ministries have devoted some of their own budgets to activities or instruments coordinated (programmed, not executed) by the Topsectors. This concerns for instance EZK for energy innovation, and the ministry of Infrastructure and Water management for the development and especially uptake of innovations in the field of logistics. Apart from also programming a substantial amount of earmarked funding from the National Science Foundation (NWO), the Topsectors have mobilized many other – often domain-specific – funding streams and policy initiatives in order to execute the plans laid out in the KIAs.

Over the years the Topsectors have become prominent coordination platforms in the Dutch research and innovation system. Despite their name, the Topsectors are hardly to be seen as purely sectoral structures. **The triple helix composition, and the focus on developing and realizing new innovation paths, implies that considerable attention is paid to engaging very diverse stakeholders in the recombination and application of knowledge**. For instance, as the networks in the various Topsectors were formed, priority gradually shifted to connecting also actors from different 'silos'. Generally, this would still mostly involve organisations relatively inclined to engage in R&D. Engaging also less innovative firms has remained a challenge for many of the Topsectors.

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[9] For an extensive description and assessment, see: Janssen (2019). What bangs for your buck?: Assessing the design and impact of Dutch transformative policy. *Technological Forecasting and Social Change* 138, 78–94.

On the positive side, a remarkable feature of the Topsector approach was that it provided a basis for involving also more public stakeholders in innovation processes. The overall impression is that by being represented in thematic Topsectors related to e.g. healthcare and mobility, **many line ministries steadily became more acquainted with interacting with industry and science**. Jointly exploring options to exploit promising innovations fits with the view that driving innovation is not so much a matter of economic policies, but rather also of accommodating a wide range of changes needed to make an innovation succeed (or to avert undesired effects).

At the time of the evaluation of the Topsector approach, in 2017, there were signals that the Topsector approach was ready to go beyond the initial goal of reinforcing innovation systems by encouraging private R&D. **With the governance structures, policies and (partially) reconfigured R&D networks in place, the moment came to respond to the internationally growing interest for targeting innovation policies at societal challenges**. In the Netherlands this ambition was not only sparked by the rising interest for an 'entrepreneurial state' and the promises of missions, but also by the line ministries that got on board of the ministries of EZK and OCW's Topsector approach in the preceding five years. Because those line ministries faced pressures to address difficult challenges, and because they became more deeply involved in steering innovation, momentum was building for increasingly sharing (or even shifting) the responsibility for driving innovation-based socio-economic change.

This momentum to transition towards pursuing missions also came from within the Ministry of EZK, as in 2017 the (then) Ministry of Economic Affairs obtained the Climate Policy dossier. Carrying responsibility over growth and innovation as well as climate policy implies the ministry was no longer only the architect of the overall Topsector (and now MTIP) strategy, but at the same time also one of the line ministries with responsibility for a particular societal domain: climate and energy. With this came also the obligation to formulate an answer to the challenges posed by the Paris Agreement (2015) and the Dutch Climate Act this resulted in (September 2019).[10] Note that even before EZK obtained the climate dossier, it was already the principle ministry involved in the Topsector Energy. Exceptional about this Topsector was that it did not have the objective to enhance the innovation system for actors concerned with energy topics, but that it also had a mandate to steer several policy instruments in order to improve energy innovation and sustainability. **In sum, there were many ways in which the shift towards a mission-orientation started long before it became official**.

In July 2018, the Dutch ministry of EZK announced that the Topsector approach would be continued, albeit with a different focus.[11] By upgrading it into the 'Mission-oriented Topsector and Innovation Policy' (MTIP) strategy, the ministry chose "to challenge the top sectors to produce concrete solutions, while also calling for a commitment from the government to create the right framework conditions for innovation" (EZK, 2019, p. 3). **The fact that this decision was endorsed by the entire cabinet in April 2019 effectively makes it a truly national policy, rather than just a departmental one**.

The missions featuring centrally in the MTIP were not developed by the ministry of EZK itself. Instead, it organized a process which invited also the line ministries to propose ambitious and measurable societal goals. In many cases extensive consultations took place to formulate those goals together with knowledge institutes, business, civil-society organisations and regional authorities. Some of these consultations were in fact already happening outside of the context of developing missions. For the mission theme 'Energy transition & Sustainability' (ET&S), for instance, the objectives set in the Climate Agreement were of major importance for switching to a challenge based

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[10] See: https://www.raadvanstate.nl/climate/.

[11] Ministry of EZK (13-07-2018). Kamerbrief over innovatiebeleid en de bevordering van innovatie: naar missiegedreven innovatiebeleid met impact.

innovation policy strategy (see box 1 in section 1.2). In the case of the ET&S mission on Circular Economy, (sub)goals for the mission were obtained directly from the Transition Agendas and associated Execution Agendas that quadruple helix consortia already developed on behalf of the Ministry of Infrastructure and Water management (I&W). **Generally, we see for many missions that both existing as well as new ideas and agendas fed into the process of setting ambitious but realistic mission goals.**

3.2. Overview of missions

In April 2019, the Ministry of EZK (on behalf of the entire cabinet) presented 25 missions grouped according to 4 mission themes.[12] An overview of these themes and missions is provided in table 1:

Table 1: Overview of missions (Ministry of EZK, 2019)[13].

Themes	Missions
Energy transition and sustainability	- 49% reduction of national greenhouse gas emissions by 2030, aiming for 95% lower emissions by 2050 compared to 1990. - An entirely carbon-free electricity system by 2050. - A carbon-free built environment by 2050. - Carbon-neutral industry with reuse of raw materials and products by 2050. - Zero-emission mobility of people and goods by 2050. - A sustainable and completely circular economy by 2050, with resource use halved by 2030.
Agriculture, water and food	- Reduction of the use of raw and auxiliary materials in agriculture and horticulture by 2030 and creating the maximum possible value from all end products and residuals by utilising them as fully as possible (circular agriculture). - By 2050, the agricultural and nature system will be net carbon-neutral. - The Netherlands will be climate-proof and water-resilient by 2050. - By 2030, we will produce and consume healthy, safe and sustainable food, while supply chain partners and farmers get a fair price for their produce. - A sustainable balance between ecological capacity and water management vs. renewable energy, food, fishing and other economic activities, where this balance must be achieved by 2030 for marine waters and by 2050 for rivers, lakes and estuaries. - The Netherlands is and will remain the best-protected and most viable delta in the world, with timely future-proof measures implemented at a manageable cost.
Health and health care	- By 2040, all Dutch citizens will live at least five years longer in good health, while the health inequalities between lowest and highest socio-economic groups will have decreased by 30%. - By 2040, the burden of disease resulting from an unhealthy lifestyle and living environment will have decreased by 30%. - By 2030, the extent of care provided to people within their own living environment (rather than in health-care institutions) will be 50% more than today or such care will be provided 50% more frequently than at present. - By 2030, the proportion of people with a chronic disease or lifelong disability who can play an active role in society according to their wishes and capabilities will have increased by 25%. - By 2030, quality of life for people with dementia will have improved by 25%.
Security	- By 2030, organised crime in the Netherlands will have become an excessively high-risk and low-return enterprise, thanks to a better insight into illegal activities and cash flows. - By 2035, the Netherlands will have a navy fit for the future, which will be able to respond flexibly to unpredictable and unforeseen developments. - By 2030, the Netherlands will have operationally deployable space-based capabilities for defence and security. - Cyber security: the Netherlands will be in a position to capitalise, in a secure manner, on the economic and social opportunities offered by digitisation. - By 2030, the armed forces will be fully networked with other services and through the integration of new technologies, so that they can act faster and more effectively than the opponent. - Supply and demand will come together more quickly to implement successful short-cycle innovations. - By 2030, security organisations will be capable of collecting new and better data, so that they are always one step ahead of the threat. - By 2030, the role of security professional will be among the 10 most attractive professions in the Netherlands.

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[12] Ministry of EZK (26-04-2019). Missies voor het topsectoren- en innovatiebeleid.

[13] Ministry of EZK (26-04-2019). Dutch missions for grand challenges: Mission-driven Top Sector and Innovation Policy.

To articulate on what accounts the missions rely on innovation, a 'Knowledge and Innovation Agenda' (**KIA**) was developed for each of the four mission themes. **While representatives from Topsectors occasionally had a role already in formulating the missions themselves, the Topsectors especially contributed to the KIAs (as they have been doing so since 2012).** The overview depicted in figure 4 shows which Topsectors are most clearly associated with the various mission themes. It also reveals that the missions themes were proposed by always at least one line ministry carrying responsibility for the societal domain in which one can find the problems addressed by the missions. Apart from the four mission themes, the MTIP has two more pillars. One of them is support for Key Enabling Technologies (KETs) and Key Enabling Methodologies (KEMs), the other one concerns building 'public earning capacity' in a regional context.

4 Themes x 5-8 Missions	KIAs	Ministries	Topsectors
Energy transition & Sustainability	(I)KIA	**EZK** I&W - BZK	Energy, Chemistry, Water, Creative industries, Horticulture, Agri-Food, High tech Systems & Materials, Logistics
Agriculture, Water and Food	KIA	**LNV** I&W - VWS	Agri-Food & Horticulture, HTSM/ICT, Life Sciences & Health, Chemistry, Energy, Water, Logistics, Creative Industries
Health and Health care	KIA	**VWS** LNV – OCW - SZW	Life Sciences & Health, Agri-Food, Horticulture, HTSM/ICT, Chemistry, Energy, Water, Logistics, Creative Ind.
Security	KIA	**DEF – J&V – I&W** EZK – BZK - OCW	Hightech Systems & Materials, Water, Logistics, Creative Industries
KIA: Key enabling technologies/methods		**EZK +**	Hightech Systems and Materials & all topsectors
KIA: Public earning capacity		**EZK +**	Creative Industries & all topsectors

Figure 4: Overview of Themes/Missions, KIAs, and the associated ministries and Topsectors (adapted from: ClickNL, 2020[14]).

As the KIAs are still fairly broad agendas, a few additional translation steps have been taken in order to guide actual innovation activities. This is depicted in Figure 5. For each KIA, the Topsectors and their partners have proposed several more specifically targeted 'multi-annual innovation programs' (**MMIPs**). In some cases these MMIPs are tied to sub-goals underling the overall mission goal. The MMIPs differ from previous KIA roadmaps in the sense that they are said to be more comprehensive; instead of only listing a set of technologies or topics research and innovation should be focus on, the multi-annual plans also articulate how these focal points link together in order to form a promising solution path. This also implies that besides presenting a research element, the MMIPs devote attention to issues like the integration of sub-solutions and institutional aspects with relevance for diffusion. **The observation that the MMIPs contain comprehensive strategies for combining various innovation-related developments, however, does not automatically imply they are also more *selective* in terms of the total number of technologies or innovation topics they address.** The main difference is that now these topics are clustered into coherent paths.

Theme with **Missions** → Knowledge & Innovation Agenda **(KIA)** → Multi-annual Mission-based Innovation Programs **(MMIPs)** → Programming of policies (e.g. NWO call, RVO tender) → Projects

Figure 5: Chain from Missions to research and innovation projects.

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[14] https://www.clicknl.nl/en/themes/mission-driven-innovation/

For the sake of illustration, the figure below shows which MMIPs correspond with the various Energy transition and Sustainability missions ('A-E') on reducing national greenhouse emissions. As noted in box 1 in section 1.2, this theme also contains a mission 'CE' on establishing a fully circular economy by 2050. This latter mission does not originate from the Integrated Knowledge and Innovation Agenda (IKIA) for the Energy transition and Sustainability theme, but from the five Transition Agendas that are tied to the so-called Raw Materials Agreement of 2017 (see also Figure 11 in section 4.1). The three MMIPs cutting across these five Transition Agendas, or Transition Domains, are: Design for Circularity, Circular material chains and processes, and Trust, behaviour and acceptance.

Missions	With the following interim target(s)	MMIPs	
A. An entirely carbon-free electricity system by 2050	By 2030: - a minimum amount of 35 TWh of electricity will be produced on land each year using wind energy and solar energy >15kW; - at least 49 TWh of electricity will be generated by offshore wind energy.	1. Offshore renewable electricity 2. Renewable electricity generation on land and in the built environment	13. A robust energy system supported by society
B. A carbon-free built environment by 2050	By 2030: - natural gas will be phased out of 200,000 existing homes per year; - 1.5 million homes and 15% of commercial buildings and public property will be natural gas free; - at least 20% of local energy consumption (incl. EV) within the built environment will be generated from renewable sources.	3. Acceleration of energy renovations in the built environment 4. Sustainable heating and cooling in the built environment (incl. glasshouse horticulture) 5. The new energy system in the balanced built environment	
C. By 2050, raw materials, products and processes in industry will be net climate neutral and at least 80% circular	By 2030: - 50% fewer primary feedstocks will be used; - greenhouse gas emissions from production processes and the waste sector will have been reduced to approx. 36 Mt of CO_2 equivalent; - sustainability improvement of the industrial heat system up to 300ºC will have been achieved; - electrification and reuse of CO/CO_2 will have been implemented; - CCS will be implemented in a cost-effective manner; - sustainable hydrogen production will be on the road to implementation; - bio-based raw materials will be seen as the norm.	6. Creating circular industrial chains 7. Carbon-free industrial heat system 8. Electrification and radically redesigned processes	
D. Zero-emission mobility of people and goods by 2050	By 2030: - there will be 1.9 million electric vehicles; - 1/3 of all energy consumption in mobility will be renewable; - we will have reduced business mileage by 8 billion kilometres; - the 32 largest municipalities, at minimum, will have zero-emission zones for city logistics.	9. Innovative propulsion and use of sustainable energy carriers for mobility 10. Efficient transport movements for people and goods	
E. By 2050, the agricultural and nature system will be net carbon-neutral	By 2030: - an additional reduction of at least 1 Mt CO eq for methane, 1 Mt CO_2 eq for energy consumption in glasshouse horticulture and 1.5 Mt CO_2 eq through smarter land use will have been achieved.	11. Climate-neutral production of food and non-food 12. Optimal carbon capture and utilisation on land and water	

Figure 6: MMIPs for the Energy transition and Sustainability missions 'A-E' on reducing national greenhouse emissions (Source: EZK, 2019).

3.3. Governance structure

3.3.1. Governance layers

When designing the governance structure for the MTIP, or at least the mission theme 'Energy transition and Sustainability' (ET&S), the following **principles** were leading[15]:
- The structure should be appropriate for optimally supporting the objectives/goals of the missions;
- Coordination and scoping of innovation activities is a triple helix responsibility;
- the governance is based on existing processes and mandates with respect to funding;
- the governance needs to be consistent with the Topsector approach;
- the governance should maximally build on existing and successful structures (TKIs and their ecosystems) as well as policy instruments.

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[15] Ministry of EZK (2019). Governance of the KIA and Innovation agendas of the societal theme 'Energy transition and Sustainability', version 085.

The governance structure devised for the MTIP in general contains a significant amount of layers. Figure 7 shows how these layers relate to the strategic elements discussed so far.
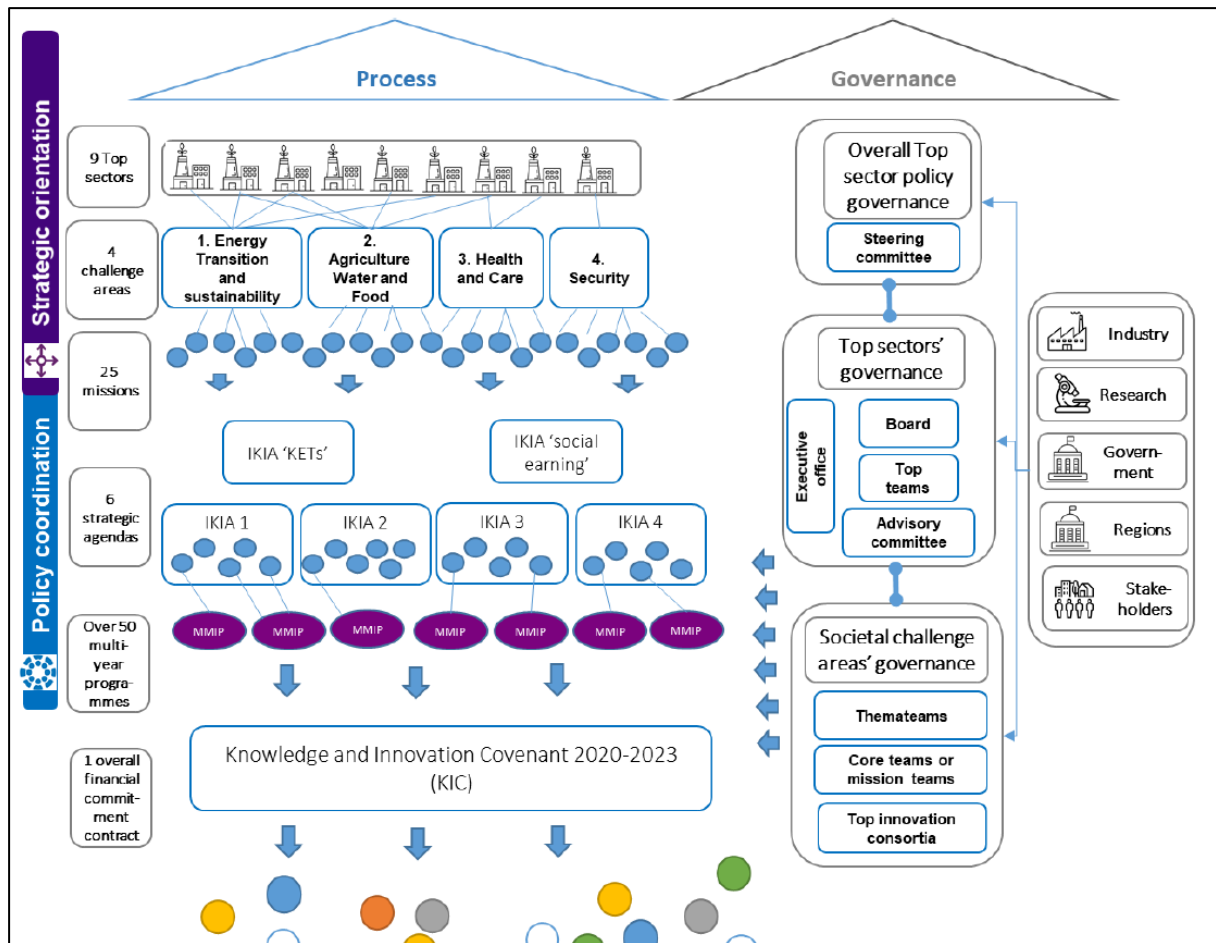

Figure 7: Layers and elements in the MTIP governance structure (Source: Larrue, 2020).

As discussed earlier, the Topsectors (Topteams and TKIs) have a large role in deciding on which topics are covered by the Knowledge and Innovation Agendas.[16] **With the shift to the MTIP, an extra governance structure was woven into the existing configuration of arrangements**. In figure 7 this has been labelled as Societal challenge areas' governance, made up by high level themateams (for making decisions at the level of the mission themes) and mission teams (operating at the level of missions and MMIPs). Mission teams are often also referred to as '**MI teams'**, for 'mission-oriented innovation teams'. The Topconsortia for innovation (TKIs) from the original Topsector approach have remained in place, but now also provide input to the mission teams. **Just like the Topsectors and TKI, the representatives active in the mission themes originate from all parts of the triple or even quadruple helix.**

An alternative way of interpreting how the MTIP is organized, is shown in figure 8. The overview focuses on the mission-part of the MTIP governance, which (as figure 8 already showed) blends in also the pre-existing Topsector structures. The overall outlines of the mission-part of the MTIP are directed in the 'Regieoverleg MTIP'; a high level executive meeting taking place twice per year. At this overarching level, high ranked policy officials, captains from Topteams and executives from 'knowledge partners' (NWO and TNO) agree on fundamental issues related to funding and governance. Additionally, there are also executive meetings at the level of themateams. These

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[16] Note that only the one for the theme 'Energy transition and sustainability' is referred to as an Integrated Knowledge and Innovation Agenda (IKIA); see chapter 4.

meetings, taking place roughly four times per year, are of a strategic nature and concern the planning and funding (e.g. targeted NWO calls) for specific themes. Also the mission teams unite several times per year, in their case to make decisions on programming issues related to the various MMIPs they oversee. The collecting of information for feeding into the programming activities and decision processes is mostly done by the 'program teams' associated with particular MMIPs. Often there is one program leader appointed for a MMIP. Additional support is provided by the TKIs.
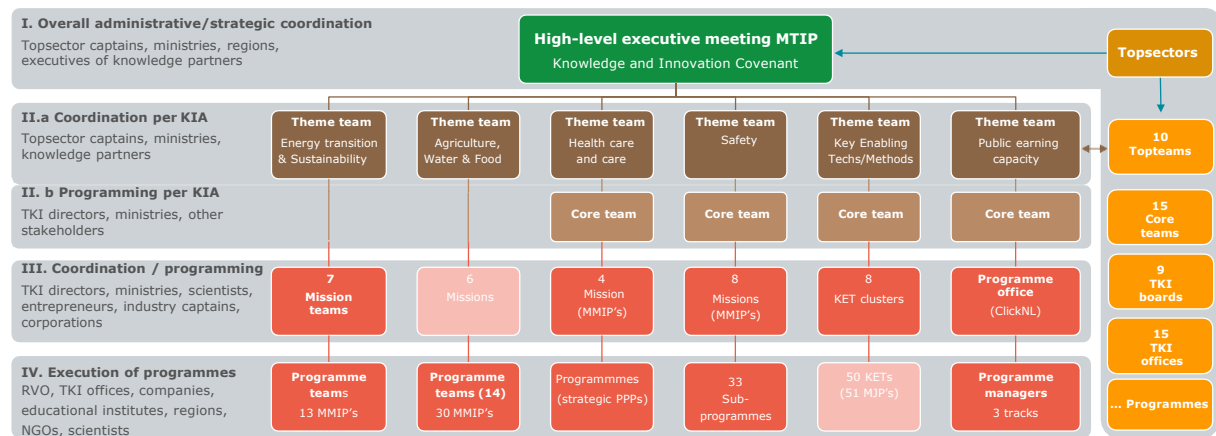

Figure 8: Layers and elements in the MTIP governance structure (adapted from: NWO, 2020).

Slight discrepancies between figures 7, 8 and other texts can be explained by the fact that some details may vary from one theme/mission to the other. Moreover, differences can emerge due to the evolving nature of the policy approach. The transition from Topsector approach to MTIP is regarded as a gradual process that might turn out to move through different phases, possibly also effecting to what extent either the Topsectors or the mission-part of the overall structure are in the lead (or integrated) when it comes to coordinating innovation activities. Governance structures that were so far put in place are intended to be for the middle-long term, but perhaps not definitive. Finally**, as the number of governance elements and involved stakeholders are both rather high, with some stakeholders participating in very distinct parts of the structure** (see e.g. the regional representatives at both the overall administrative level as well as the execution of programs)**, it is understandable that stakeholders have different interpretations of how the governance is designed exactly.**

3.3.2. The mission teams[17]

Probably the most MTIP-specific parts of the new (or rather: extended) governance structure are the mission teams. They are positioned as the engines for driving changes, **as formally their tasks include the developing, executing and organizing - through engaging various ecosystem actors - of both the Missions and the MMIPs**. This also includes ensuring consistency between the missions as well as the actual realisation of the final goals. Within MI teams, specific members are appointed as contact persons for cross-cutting themes like human capital or responsible and inclusive innovation. In case of the theme Energy and Innovation, there is also a MMIP that links to all the five missions (MMIP13 for 'a robust and societally accepted energy system'; see figure 6).

The actual programming of knowledge and innovation (e.g. in research calls) takes place in the programme teams tied to mission teams. These programme teams might be closely linked to a TKI. The structure around the mission teams belonging to a theme team also contains two additional governance elements, as shown in figure 9. One of them is the Innovation Advice Committee (IAC);

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[17] This entire section is based on: Ministry of EZK (2019). Governance of the KIA and Innovation agendas of the societal theme 'Energy transition and Sustainability', version 085.

a group of independent advisors overseeing the activities of the mission teams in order to ensure consistency and progress with respect to the long term goals as captured by the mission statements. With respect to developments on the shorter term, an independent Innovation Monitoring Unit (IMU) collects and analyses information on activities and output of the mission teams and the MMIPs. **It also monitors the 'maturity' of the ecosystems involved in pursuing a mission, and to what extent desired societal outcomes are achieved** (and can be attributed to innovation).
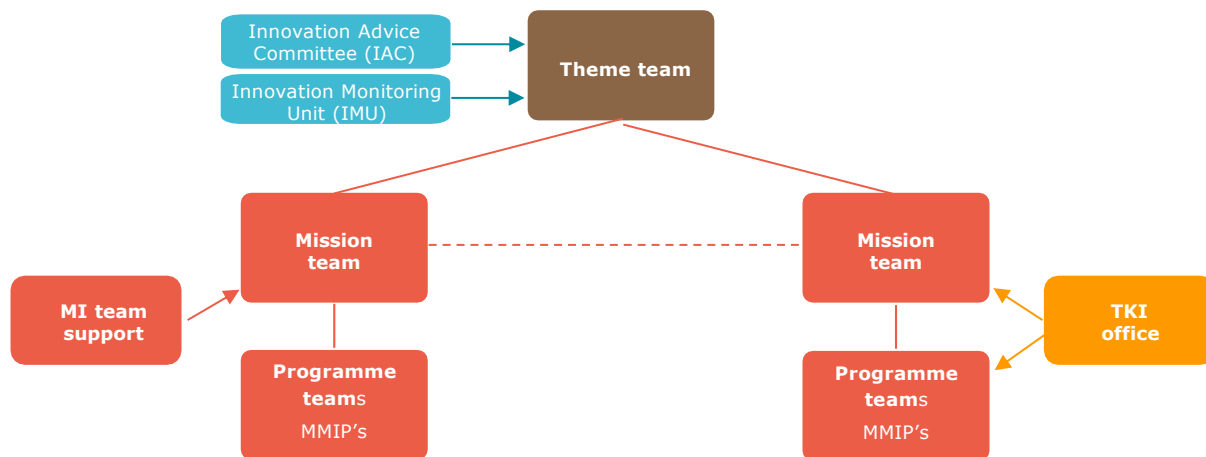

Figure 9: Governance structure around the mission teams and theme team.

The four main tasks of the MI-teams are:
1. **Learning and connecting.** This role of chairman is typically fulfilled by a representative of the Topteam belonging to the Topsector that is supporting a mission. He or she is the liaison towards executive meetings at theme level as well as to the Topsectors.
2. **Securing coordination** of the MMIPs and corresponding subprograms, and **alignment with other MI-teams**. This is mostly in the hands of triple helix representatives active in the supporting TKIs, line ministries, and research/educational institutes. The mandate of the MI teams concerns making decisions on the programming of research calls and tenders in a policy schemes, adjusting MMIP objectives (possibly informed by the input of the IAC or IMU), the annual plan of the MI team, and the balance of activities focused on various MMIPs.
3. **Organizing programme/agenda development activities**. This task is mostly executed by the TKIs and the program managers. Their assignment includes to develop and regularly update the MMIPs and subprograms, the formulation of Key Performance Indicators, engaging in community building to create ecosystems suitable for developing and diffusing innovative solutions, creating commitment from relevant partners and stakeholders, and other operational and advisory activities.
4. **Development and execution of initiatives and instruments** for delivering the support to research and innovation activities. The actual execution is likely to be mostly in the hands of funding organisations like NWO, policy execution agencies like RVO.nl, or regional authorities that contribute to the MMIPs as well. These organisations typically monitor their own activities, while the MI team itself is also responsible for collecting data and sharing it with the IMU and theme team.

3.4. Funding

After the 25 missions were formulated, a process emerged in which the ministries, knowledge partners (incl. NWO, the Royal Dutch Academy of Arts and Sciences KNAW, and representatives of universities and universities of applied sciences) and other organizations started negotiating about the financial aspect of the MTIP. This practice already existed in the Topsector approach, in the form of those stakeholders signing Knowledge and Innovation Contracts in which they committed a certain amount of funding for particular knowledge and innovation programs and/or instruments.

In November 2019, by signing the Knowledge and Innovation Covenant 2020-2023, 30 stakeholders pledged to spend a total of almost €4.9 billion per year.[18] Around 58% concerns funding from public sources, which is matched with the 42% invested by private companies as well as sources like charity funds (e.g. patient organizations). The columns in Figure 10 show the distribution of the amounts over the 4 missions themes, the KETs and the Societal Earning Capacity theme. The rows give an indication of the various sources of the budgets, which are grouped into private investments through the Topsectors and public investments from knowledge institutes and departments.

Knowledge and Innovation Covenant 2020-2023: envisaged budgets for 2020

budgets € x 1000 — MTIP themes

Partners	Agriculture / water/ food	Health and care	Safety	Energy transition & Sustainability				Key Enabling Tech-nologies	Societal Earning Capacity	T.b.d.	Total	
				Climate & energy	Circulair economy	Future proof Mobility	sub-total					
Private:												
1. T&U	75.100										75.100	
2. Water en Maritiem	68.700		2.000	700	1.933	3.450	6.083				76.783	
3. Agri&Food	108.200										108.200	
4. LSH		477.000									477.000	
5. Chemie incl. Bio-based economy		2.500		48.950	20.500		69.450	9.800	4.938		86.688	
6. Energie				82.400			82.400				82.400	
7. HTSM	5.000	39.000	31.000	2.000	2.000	14.000	18.000	498.000			591.000	
8. ICT								59.000			59.000	
9. Logistiek		1.300		9.500		8.500	18.000				19.300	
10. Creatieve industrie	3.000	6.000	2.000	3.000	5.000	2.000	10.000	1.000			22.000	
11. Private cofinanciering voor klimaatregelingen buiten de TS Energie regelingen				441.000	12.000		453.000				453.000	
Public:												
Knowledge partners												
12. TNO	4.232	10.045	7.600	32.677	1.263	6.322	40.262	46.701		27.531	136.371	
13. Wageningen Research	61.300									21.700	83.000	
14. NLR								2.507		10.120	12.627	
15. MARIN			500			1.000	1.000			5.380	6.880	
16. Deltares	4.000	250	250	2.250			2.250	1.250		6.988	14.988	
17. NWO-PPS	11.000	11.000	6.000				11.000	11.000	5.000	45.000	100.000	
18. NWO-alg										175.000	175.000	
19. NWO-SIA	1.400								5.000	13.000	19.400	
20. NWO-TTW								24.022			24.022	
21. KNAW		12.000						2.000			14.000	
22. ZonMw		168.624									168.624	
23. Universiteiten		74.380								104.400	178.780	
24. UMC's		80.000									80.000	
25. RIVM	18.500	54.000									72.500	
26. Hogescholen										32.000	32.000	
Departementen												
27. EZK Digitale Economie			5.500					4.000			9.500	
28. EZK Bedrijfsleven & Innovatie	4.000	13.282	5.378	15.465	4.640	7.470	27.575	8.000		275.000	333.235	
29. EZK Klimaat & Energie				200.800			200.800				200.800	
30. EZK Ruimtevaart										39.000	39.000	
31. Defensie			38.200								38.200	
32. VWS	4.270	82.920									87.190	
33. IenW	23.500			47.500	5.600	7.500	60.600		2.500		86.600	
34. OCW-Creat industrie									13.100		13.100	
35. BuZa-BHOS	28.446	17.000								21.000	66.446	
36. LNV	69.600										69.600	
37. SZW		11.300									11.300	
38. BZK				20.800			20.800				20.800	
39. J&V			23.500								23.500	
Other												
40. Provinces										250.000	250.000	
41. ROM's										80.000	80.000	
42. Expected contributions Horizon programme										400.000	400.000	
Total	490.248	1.060.601	121.928	907.042	52.936	50.242	1.021.220	667.280	30.538	1.506.119	4.897.934	
total private	260.000	525.800	35.000	587.550	41.433	27.950	656.933	567.800	4.938	0	2.050.471	41,9%
total public	230.248	534.801	86.928	319.492	11.503	22.292	364.287	99.480	25.600	1.506.119	2.847.463	58,1%

Figure 10: Overview of distribution and origin of KIC budgets for the year 2020 (Source: MinEZK[18])

[18] Ministry of EZK (12-11-2019). Kennis- en Innovatieconvenant 2020-2023.

The overview shown in Figure 10 reveals that the envisaged budgets for the various MTIP themes differ in orders of magnitude. For instance, the missions on Safety have a 2020 budget of only €122mln (in which public investments are more than twice as high as private investments), while the envisaged budget for the Health and Care mission is over €1bln. Also within the Energy transition and Sustainability mission there are stark contrasts.[19] The 'A-E' missions on reducing greenhouse gas emissions have a budget of over €900mln, while the CE mission stands at a budget of only €50mln. This difference is partially due to the €441mln of expected co-funding stemming from climate policies (other than the ones administrated through the Topsector Energy).

The budgets presented above are sometimes estimates, but not real commitments yet (hence the label 'covenant' instead 'contract' this time). Still, compared to the preceding four-year contracts for knowledge and innovation, the amount of almost €5 billion / year is roughly twice as high. This is mostly due to the fact that **the shift towards MTIP implies a greater role for an increased amount of partners**. Out of the 30 signatures, twelve stem from ministers and state secretaries, with a few more coming from local authorities. The fact that so many funding streams are being brought together in the KIC reflects the ambition to create both momentum and consistency in the MTIP approach towards supporting innovation for societal challenges. It also testifies of a strategy to do this systematically, as the funding streams do not just stem from an increasing range of public stakeholders but (almost automatically) also stretch over a broadening range of support measures. This would in particularly concern the line ministries' and regional authorities' policy initiatives regarding the implementation of innovative ways to address societal challenges. As indicated earlier, the MTIP governance structure contains various committees and activities for monitoring and periodically discussing how the budgets and deployed activities meet the overall goals.

3.5. Instruments

From the outset, the launch of the MTIP was not associated with the implementation of new MTIP-wide policy instruments. As a matter of fact, the strategy to change objectives while maintaining the same set of policies was one of the principles proposed when designing the MTIP governance structure (see section 3.3). **Rather than on adding more instruments to the policy mix, the emphasis in implementing a national MIP has been put on setting up the coordination mechanisms that allow organizations to make better use of available instruments**. In this case, 'better' would refer to innovation capacities being mobilized for contributing to solving societal challenges (as prioritized in missions) rather than for yielding innovative output per se.

Instruments that are of relevance for coordinating entities like the Topsectors, TKIs and now MI teams are for instance some NWO calls, the PPP allowance for collaborative R&D projects, and the MIT for SME's working on innovation projects fitting a KIA. Over the years the Topsectors have also broadened their reach by influencing the use of funding programs offered by the European Commission and Dutch regional authorities such as the regional development agencies ('ROMs').

Recently, the ministries of Finance and EZK launched two major policy initiatives targeted at economic growth. The national promotional bank InvestNL has a budget of €1.7 bln for risk capital investments in innovative scale-ups contributing to the energy transition (and in the future possibly other challenges).[20] Furthermore, the 'National Growth fund' announced in September 2020 aims to invest €20 bln (in the next 5 years) in education, infrastructure and R&D / innovation.[21] Also actors pursuing missions, including the MI teams, might formulate strategies for utilizing these new policies.

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[19] In this overview the ET&S theme also mentions a third subtheme; this is mission D ('Zero-emission mobility of people and goods by 2050') of the 'A-E' missions on reducing greenhouse gas emissions.

[20] https://www.government.nl/latest/news/2020/01/16/invest-nl-launches-with-focus-on-financing-the-energy-transition-and-innovative-scale-ups

[21] https://www.government.nl/government/the-government-s-plans-for-2021

4.   Mission 'Carbon-free built environment'

4.1. Origins and place in other agendas and structures

The statement and subgoals for the specific mission highlighted in this case study report is as follows:

- Missions statement: *"A carbon-free built environment in 2050".*
- Subgoals:
  - *Disconnecting 30.000-50.000 existing houses per year from the natural gas infrastructure by 2021, and 200.000 existing houses per year before 2030.*
  - *1,5 million houses and 15% of utility buildings and societal real estate natural gas free by 2030;*
  - *at least 20% of local energy consumption (incl. EV) within the built environment should concern sustainable energy production.*

The mission for a carbon-free built environment in 2050 is Mission B under the theme 'Energy transition and sustainability' (ET&S), which has the overall ambition of reducing national greenhouse gas emissions by 49% in 2030, increasing to 95% in 2050, as compared to emission levels in 1990. Like the other missions under this theme, it follows directly from the targets that were proposed in the Climate Agreement of 2017. This means that also the goals attached to this mission are quite literally adopted from the Climate Agreements concerning the built environment.

Figure 11 illustrates how the mission relates to underlying agendas and other ET&S missions. The mission is also linked to the 'Construction Agenda' for driving public and private investments needed for innovation and cost reduction in the construction sector.[22] This Construction Agenda, backed by the ministries of BZK and I&W, is the platform tasked with Circular Economy transition agenda on construction. Similar interlinkages exist also for e.g. mission CE on carbon-neutral industry and the Manufacturing Industry transition agenda. Indeed, distinct missions can touch upon each other in different ways.
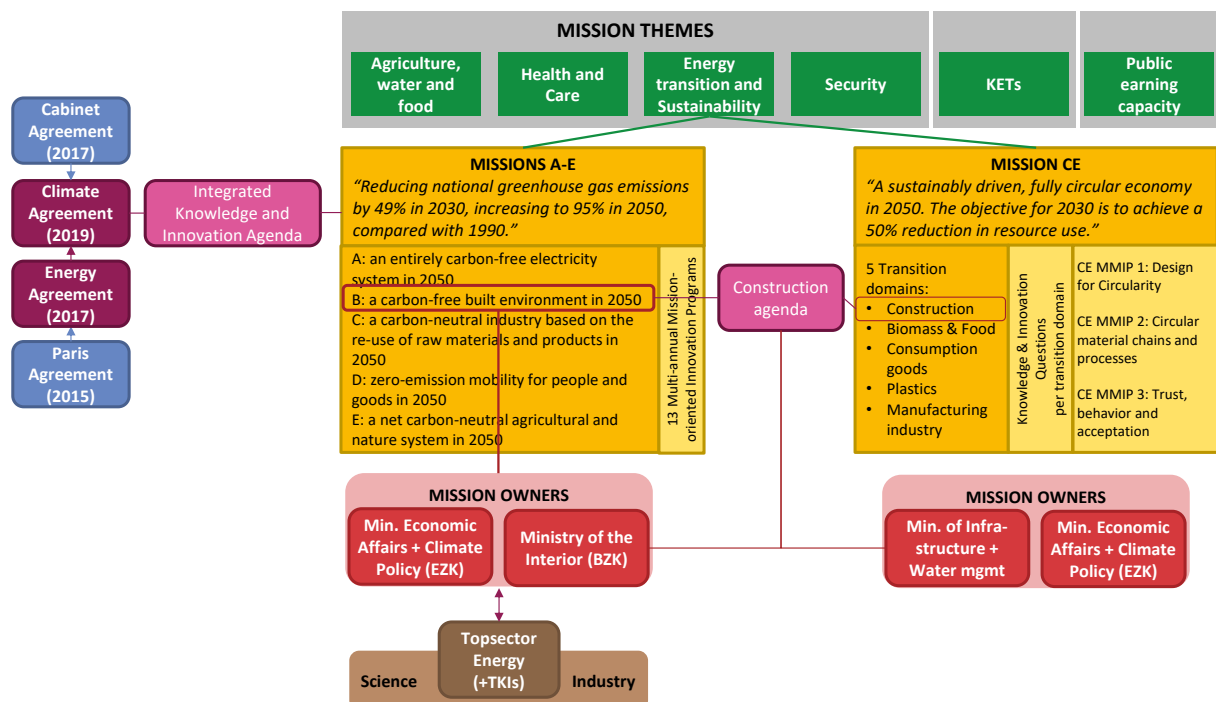

Figure 11: Positioning of the mission in the broader landscape of agendas and governance structures.

[22] https://www.debouwagenda.com/themas/nieuws+thema+circulair/1149542.aspx

4.1.1. The Climate Agreement

To understand how the mission has come about, it is essential to have some insight in the processes leading up to the Climate Agreement of 2019. The Climate Law of June 2017 provided a legal basis for the national government to make arrangements in order to succeed in achieving the targets set in the Paris Agreement of December 2015. In order to determine how these targets may best be met through a collective efforts of government, industry, science and society, the government organized talks around Sector Tables focused on a particular part the system of energy production and consumption (e.g. 'Industry', or 'Built environment'). The talks at these tables needed to result in plans for how to realize CO2 emission reductions. A starting point for these talks were the cost-effectiveness calculations by the Environmental Assessment Agency (PBL), which helped also to determine how much emission reductions should be achieved in each sector. Principles that guided the development of plans and agreements included: the focus on a single CO2 target (no sub-targets on renewables or energy efficiency), a preference for cost-efficient solutions (national costs limited to 0,5% GDP through tentative, cost-effective sectoral targets), a just transition (keeping energy bills for households in check), minimizing leakage for businesses (safeguarding a level playing field), and maximizing economic opportunities (new export products and innovation).[23]

Characteristic for the processes deployed to arrive at a Climate Agreement, and thus the goals now prioritized in the mission, was that it relied on broad and intense stakeholder involvement. During the roughly 1,5 years of consultations and negotiations, over 100 parties got involved. The process of organizing these talks was facilitated by the Social Economic Council and led by independent chairs. Stakeholders were engaged if they were in the position to reduce emissions or enhance societal support for the transition, if they possessed relevant knowledge regarding how to realize the transition, or if they had a mandate to express commitment and make deals.[23]

As it was realized that ambitious climate goals might require innovative solutions, the process for writing the Climate Agreement was paralleled by with the development of the 'Integrale Kennis- en Innovatie Agenda' (IKIA; comprehensive knowledge and innovation agenda). While the IKIA is sometimes presented as a derivative of the Climate Agreement (i.e. its goals would have been translated into innovation ambitions), some interviewees consulted for this report stress that the IKIA development took place relatively disconnected from the Climate Tables at which the Climate Agreement was written. That is, they perceive that it is not so much a derivative of the Climate Agreement but rather a agenda that was written simultaneously and iteratively (based also, but not exclusively, on debates taking place at the Sector Tables). The IKIA was created by a temporal project group involving representatives of, amongst others, the applied research institutes ECN and TNO, two TKI directors, and the dean of the TU Delft university.

In line with the logic presented in section 3.2, and especially figure 5, the IKIA served as a basis for developing MMIPs. For the overarching mission of cutting national greenhouse gas emissions by 49% in 2030, a total of 13 missions have been developed – see figure 6. The MMIPs specifically for the mission on the built environment are the following ones[24]:

- MMIP 3: Acceleration of energy renovations in the built environment. This MMIP stimulates technical, process and social innovations that can accelerate the energy transition in the built environment. It pursues the realization of integrated solutions by focusing on:
    - o development of integral renovation concepts;
    - o industrialization and digitization of the renovation process;
    - o building owners and users at the center of energy renovations.

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[23] This paragraph contains texts adapted from a presentation by Ed Buddenbaum (February 2020): "The Dutch climate agreement and mission oriented innovation". Presented at the 'Governance of missions' seminar organized by the Mission-oriented Innovation Policy Observatory (Utrecht University) and ISI Frauenhofer.

[24] See website of Topsector Energy for the detailed descriptions from which the summaries here were retrieved.

- MMIP 4: Sustainable heat and cold in the built environment (including greenhouse horticulture). The mission of this MMIP is aimed at developing an attractive alternative to natural gas, with the intermediate objectives in 2030 being:
  - o 1.5 million existing homes disconnected from fossil natural gas;
  - o 15% of non-residential and public buildings disconnected from fossil natural gas;
  - o making heat demand in greenhouse horticulture more sustainable through geothermal energy, seasonal storage and low temperature heat sources (1 Mton CO_2 savings in 2030).
- MMIP 5: Electrification of the energy system in the built environment. Focal areas here are:
  - o Smart energy usage in/between buildings by its users;
  - o Flexibility of/for the energy system (in the built environment);
  - o System design for the electricity system in the built environment;
  - o Local flexibility to the benefit of the entire electricity system.

Each of the MMIPs has its own sub-programs. Apart from the 3 MMIPs mentioned above, also the ET&S-wide MMIP 13 (a robust and socially supported energy system) is aimed at contributing to achieving the mission goal. As part of the Climate Agreement, the government reserved a budget of €250 million for those 3 MMIPs.[25]

4.2. Governance

Within the framework for the overall MTIP governance structure (see section 3.3), the aforementioned temporal 'IKIA guidance group' has refined the governance arrangements for the ET&S missions on greenhouse reduction.

MI teams for ET&S consist of the chairman (a Topteam captain), one or multiple TKI directors (to ensure the link to the TKI offices with capacity for programming and networking activities), one or multiple direction-level representatives of relevant line ministries, one science representative, and one industry representative. In the case of the mission for the Built Environment, it is the Ministry of the Interior (BZK) that is actively engaging in the MI team. As this ministry has committed itself to the goals like making large amounts of houses natural gas-free and sustainable already within a few years, the ministry is eager to support the search and application of novel solutions for renovating (e.g. insulating) houses and deploying sustainable heating. How exactly the ministry is pursuing the fulfilment of its goals is explained in the Letters to Parliament on 'Cost reduction and innovation in the construction sector'[25] and on 'Implementation of the Climate Agreements on the built environment'.[26]

In between the launch of the MTIP and September 2020, the MI team for the mission built environment mission had met three times. The first served for the members to get to know each other and discuss their assignment. The second was dedicated to deepening the mutual understanding of how the MI team is positioned with respect to the other elements in the MTIP governance structure. Allegedly this involved a fierce debate over the relative responsibilities and mandates of these other elements. The third meeting concerned a more focused debate on how the MI team relates to the policy execution agency RVO.nl.

The current state of developments implies that up till now much of the work to transition from the Topsector approach to the MTIP was in the hands of the TKI. In this case this concerns the TKI 'Urban Energy', which already for a few years has a scope very similar to the one of the Built environment mission. **The TKI office uses its network and capacity to obtain information from scientists, firms, and increasingly also civil society organisations. The programme managers**

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[25] Ministry of BZK (17-12-2019). Kamerbrief over kostenreductie en innovatie in de bouw;
[26] Ministry of BZK (17-12-2019). Kamerbrief over uitwerking Klimaatakkoord gebouwde omgeving.

responsible for developing and updating the MMIPs are employed by the TKIs. The TKIs receive the base funding for their organising, networking and agenda development activities from the Ministry of EZK. Actual programming takes place in so-called 'programme advice committees' (PACs). These PACs, supported by the program manager, gather information and prepare directions for the MMIPs and associated programs that are used for setting the scope and criteria for calls and funding programs. Decisions following on the advice prepared by the PAC are to be taken by the MI team, implying that the development of programs and deciding upon it is allocated in the separate part of the governance structure (in order to warrant a critical view). The latter is novel, as previously the TKI made more of the decisions by themselves. The cycle of preparing and deciding upon program proposals is designed to be repeated annually.

4.3. Relevant policy instruments

Existing innovation policy instruments

For all the ET&S missions, including the one on Built Environment, there is a wide set of relevant policy instruments. These include relatively generic innovation policies for low technological readiness levels (TRL), up to 'energy innovation' specific instruments for higher TRLs. Figure 12 provides an overview. The vast majority of these instruments is provided by the Ministry of EZK (and executed by RVO.nl), as it is in charge of both innovation as well as energy and climate. The NWO instruments targeted at the lowest TRL belong to the domain of the Ministry of Education, Culture and Science.
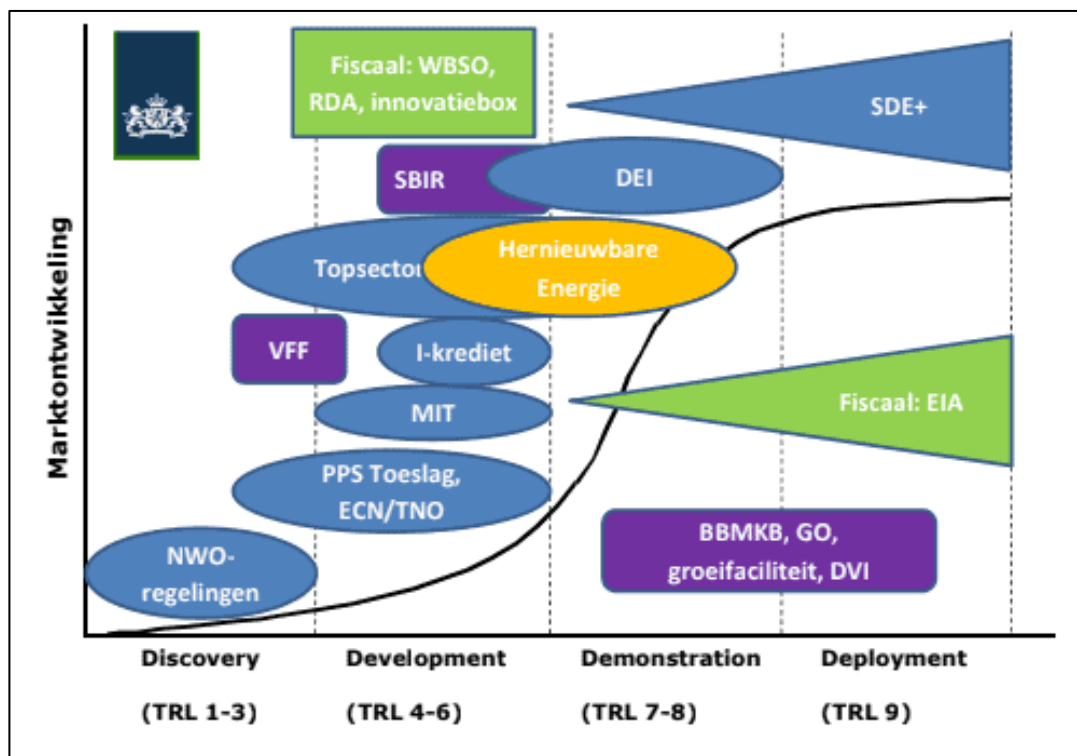
Figure 12: Overview of policy instruments with relevance for energy innovation (Source: see footnote 18).

Across the board of all E&S missions, the shift from Topsector approach to the MTIP at this stage primarily holds implications for how these existing measures are targeted and implemented. The influence of the governance structures discussed earlier primarily concerns setting the scoping and criteria project proposals should adhere to.

Raising the bar on performance requirements for e.g. heating solutions or insulation is a common way of challenging the field. One concern is to make sure this involves functional specifications.

Currently there are indications that some programs and tenders exclude technologies and materials that might actually offer better performance perspectives. This might be due to the ambition of making the tenders as clear as possible, in order to maintain focus and help the field with understanding what types of solutions are looked for in the MMIPs.

Another issue is to make sure criteria are informed by proper development scenarios. A technology like heat pumps might appear attractive at this point in time, but one can doubt whether it is likely that investing more in this technology truly has the potential to make prices drop significantly in the near future. It has been argued that prices might even rise due to regulation imposing citizens to adopt this particular solution, which potentially might undermine societal willingness to move along in realizing a carbon-free environment.

With the shift towards the MTIP, the programming bodies (so far mostly TKI/PAC) have started to extend their attempts for also **including non-technical issues in tender criteria and key performance indicators.** This would for instance concern topics related to the societal acceptation of technologies. While some features can be expressed in technical terms (e.g. the noise level of heat pumps), features related to e.g. aesthetics or usability are harder to measure. As a consequence, some calls challenge proposal writers to articulate how they expect to address certain KPI, without attaching strict criteria to it. Besides that this still allows juries to award extra points for plans with convincing arguments regarding their probabilities of having an actual impact, this practice also gives insight in the types of dynamics and indicators that proposal writers deem relevant for the success of their projects.

A recurrent topic of debate concerns alignment in the scoping and working mechanisms of relevant instruments in the policy mix the mission teams can work with. Parties trying to take their solutions from low to high stages of development and deployment typically need to make use of a series of instruments all targeted to some specific development level. While the budgets of many of these instruments were counted into funding amounts for which the KIC 2020-2023 was signed, **the existence of a comprehensive covenant does by no means guarantee that all the instruments work well together**. Interviewees have expressed mixed views on this account, which partially has to do with differences for various linkages along the spectrum between discovery and deployment:

- When it comes to the link between the NWO and the MMIP plans and priorities, consulted stakeholders generally are content with the possibilities to use NWO's earmarked budgets for setting up calls that correspond with the MMIP. As it is still very early stage, and progress is hampered due to the COVID crisis, not much experience has been gained with how these calls are working out. One interviewee stresses that NWO appeared a bit hesitant in the use of sandpit models. In sandpit models organisations with an interest for a call are invited to form large consortia submitting one or a few integrated plans, instead of NWO running a competition in which many alternative proposals are being submitted. Allegedly, **sandpits fit rather well with ensuring that researchers look for synergies between their competences, and with the idea of mobilizing research and innovation capacities around shared societal goals**.
- For the range of instruments concerning TRLs 4-6, i.e. the various generic and targeted innovation policy schemes, it is mostly the PPP allowance that matters when it comes to the capacity of the mission teams to provide guidance. Ideally creating an ecosystem around promising solution paths also results in individual business using firm-level instruments like the WBSO for innovations fitting with those solution paths, but this is not something the MI teams can directly influence (e.g. in terms of targeting the WBSO). Thus, in the eyes of interviewees active in a MI team or TKI it mostly comes down to utilizing the PPP allowance when trying to accommodate innovation activities fitting the MMIPs. Here the impression is that the experience gained during the Topsector approach period is very helpful as now

routines have been established that the field can work with. As it took many organisations some years to work with the allowance scheme, **having the PPP allowance scheme continues to be a suitable way for setting up collective R&D projects that are consistent with an agenda (in this case the MMIPs).** This also involves the possibilities for the public research organisations to adjust their research agendas based on what has been outlined in the MMIPs.

- Finally, for the link between demonstration and deployment, several new initiatives have been deployed (see later on in this section). While some of them are an extension of the activities of the TKI, there are also initiatives coming from organisations with deep involvement in the domain of the built environment. The question whether actors can easily participate in initiatives from both the demonstration and deployment stage is hard to answer, as interviewees mainly feel it are very different organisations that would be interested in those initiatives. They deem it welcome that **there are increasing possibilities for less-innovative actors to also explore how they can use novel solutions, precisely because e.g. in the construction context there are many firms that wouldn't participate in the innovation policy schemes**. At this point little is known about possibilities for innovative firms to make steps towards policies supporting experimentation. However, there are some concerns over the possibility of the MI team to actually ensure alignment. More on this is discussed in section 4.5, under 'Layering of coordination structures and mandates'.

New innovation policy instrument: MOOI

Special about the mission for Built Environment is that the shift to MTIP has also led to the creation of a new policy instrument: the MOOI (mission-oriented research, development and innovation). Distinctive is that it asks consortia of minimally 3 organisations to submit plans proposing integrated solutions rather than individual technologies. So far, in many (energy) innovation schemes it was common practice that projects would focus on individual technologies or diffusion elements. **The MOOI encourages multidisciplinary consortia to create proposals in which various technological and non-technological sub-solutions are combined, including also activities concerning the commercialisation and societal acceptance of the projects.** Project partners should therefore also include SMEs and stakeholders concerned with (or affected by) usage of the solution. Research organisations can only account for 65% of the subsidized costs. With a minimum of €2 million of subsidized costs, the projects are substantially bigger than the regular energy innovation projects of about €200k-€300k. As usual, the percentage of projects costs eligible for subsidies depends on the nature of the innovation activities associated with these costs; R&D can be subsidized for 80%, industrial research for 50%, and experimental development for 25%. The percentages are higher when the activities are conducted by medium or small firms.

The initial version of the MOOI, not yet called as such, was dedicated to MMIP 3 and 4 only. A budget of €39m was provided by the ministry of BZK, with the help of the Ministry of EZK. For this novel policy scheme it was mostly the Ministry of BZK that acted as an important driver. Despite some parties being reluctant about the idea of demanding organisations to team up in pretty large projects, the ministry of BZK and RVO.nl continued their attempt to realize an instrument very much in keeping with the goal of supporting projects with a clear outlook on implementation and upscaling. Funding just a few projects, but with a large amount of stakeholders, has been received remarkably well. For firms, the projects are appealing because they have to contribute relatively small parts to be part of projects with considerable budgets (combining private funding from different firms increases the amount of public funding that can be allocated to the projects). The positive ratio between own contributions and total project volume make it also appealing for smaller firms to participate. Another advantage is that the MOOI really supports various actors to explore how they can complement each other, and to ensure all pieces of knowledge, technology etc. are available for realizing a solution.

After the successful pilot, the first official call of the MOOI (now for MMIP 3-5) took place in 2020. Originally there was a budget of €68 million for the respective tracks on various MMIPs. In the pre-registration phase of the two-stage call, however, the subsidy budget of €30 million for the track on Built Environment attracted over 70 proposals with a project volume of €4m-7m each. This amounts to a subsidy request for €193 million. In response, the ministry of BZK recently added €27m to the track for Built Environment, raising this track's share to €57 million out of the total €95m budget.[27]

Interviewees remark that the high number of proposals for the MOOI-track on Built Environment might be seen as a success indicator, in particular because the MMIP do not necessarily just reflect business interests. After all, the governance structure contains various checks and balances (in the form of e.g. advisory committees) to ensure that the programs are in line with the societal challenges that has been leading for the mission formulation. Secondly, the large number of applicants renders the possibility (for the selection committee appointed by RVO.nl) to be selective when it comes to which proposals to award. **The oversubscription thus implies that it is possible to use the MMIPs for truly providing guidance**. In case only a few proposals were submitted, there would have been less possibilities to pick the ones best in line with the MMIPs.

The scarce critical remarks on the MOOI mostly point at the fact that the policy instrument and its budget were tied so strictly to just MMIP 3-5, and that it was hard for consortia working on other types of energy innovation to make use of it. This underlines that apparently there is more demand for this type of policy scheme, which is also mentioned explicitly by several interviewees from the mission on Circular Economy.

Other policy initiatives (examples)

Besides the introduction of the MOOI, also several other new initiatives have been created in order to enhance the likelihood of suitable innovative solutions to emerge (and to be applied). A small yet relevant initiative for making the step towards implementation of new findings is the Uptempo! Program.[28] The program consists of a multidisciplinary research team's investigation, based on learning-by-doing, into how to accelerate the upscaling of energy innovations for the built environment. The program is funded by BZK, and executed by the TKI Urban Energy and the Topsector Creative Industries' TKI ClickNL. As the TKIs are deeply embedded in networks of scientists and firms working on relevant innovations, they are in the position to scan which ones are promising but might not make it through the 'valley of death'. The TKI bring innovators and possible users together in order to explore whether a first demonstration can be realized, in order to pave the way for further market introduction. Moreover, to overcome the valley of death, the TKIs of the Topsector Energy run a Financing Desk that offers assistance to particularly SME entrepreneurs in search of grants or equity capital.[29] The provided activities include masterclasses, matchmaking events with investors, 1-on-1 consultation, and innovation broker subsidies for hiring specialist support.

To really boost the transformation of existing housing, the national government reserved €500mln (2019-2023) of the so-called 'Climate Envelope' for a programme called 'Startmotor'.[30] The program, administered by BZK, aims to disconnect at least 100.000 housing corporation dwellings from the natural gas grid before the end of 2022. **The combination of this time-bound goal and the significant amount of funding serves to kick-start changes by providing promising market perspectives to the construction sector**. Creating demand might entice innovation, scaling and standardization, which could in turn lead to cost reductions needed to reach the overall mission goal.

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[27] https://www.rvo.nl/subsidie-en-financieringswijzer/mooi
[28] https://www.topsectorenergie.nl/urban-energy/innovatieprogramma/uptempo
[29] https://www.topsectorenergie.nl/en/financing-desk
[30] https://www.klimaatakkoord.nl/gebouwde-omgeving

One specific action line within Startmotor is the 'Renovation accelerator' program for uniting housing corporations and firms specialized in improving the sustainability of buildings.[31] The program is an initiative from BZK, RVO.nl and several other societal partners. It builds on a subsidy scheme with a budget of €100m for four years, while it also contains a program for offering process support. This support program, running for six years, is designed to spread knowledge and finding originating from innovation programs (e.g. the results of the Uptempo! Program). As such, **it presents a clear link between the innovation domain and the built environment ecosystem.**

Links like these are also being forged via the BTIC (Building and Technology Innovation Centre), an initiative that brings together the Dutch ministries EZK, BZK en IenW as well as various knowledge partners, industry organisations from the construction sector, the TKI Urban Energy, and a housing corporation.[32] The BTIC, originating from the Construction Agenda, aims to act as **an initiator and connector** driving the application of novel solutions in the design, construction and engineering sector. This domain is considered to be relatively conservative and, also because it lacks the 'organizational capacity' of a Topsector, rather fragmented. The BTIC supports the creation of consortia that run research projects on comprehensive renovation concepts, covering topics like energy transition, digitalisation, circularity, infrastructure replacement and climate adaptation. The BTIC also focuses on involving educational institutes, to ensure that sufficient suitably trained students enter the labour market.

Highly relevant for the success of new solutions is not just the support of innovation, but also the existence of actual demands for change. Amongst the relevant policy initiatives in this respect we can find several developments targeting both the financial aspect of market creation as well as the legal aspect. For instance, the SEEH scheme RVO.nl runs has a budget of €90m for encouraging people to apply energy saving solutions in their houses.[33] Another €93m program for providing advise on which solutions to pick is currently on its way. **When it comes to legal interventions supporting the energy transition in the built environment, the recent regulations prohibiting new buildings to be connected to the natural gas distribution network are of major importance**. It is perceived to operate as a strong driver as it gives market parties a clear signal that new solutions are needed. This, in turn, adds to the willingness of firms to collaborate and seek for new approaches. In order to further drive the potential of solutions that help to meet the mission, the ministry of BZK and EZK also engage with the TKIs for collecting information regarding which regulations are hampering promising developments. One study concerns for instance the bottlenecks associated with flexible energy consumption (combining different renewable energy sources, like solar and wind). Although the issue of regulatory barriers was an element of the Topsector approach already, the closer involvement of BZK is perceived to be important for the magnitude and impact of TKIs' activities with respect to studying the market potential and legal restrictions for innovation.

The various examples of relevant policy instruments mentioned above are far from exhaustive. Besides other national policies on topics like e.g. sustainability, circularity and digitisation in the construction sector, there are also plenty of regional initiatives that contribute to the mission goal of realizing a carbon-free built environment. Important in this respect are the initiatives deployed as part of the 'Regional Energy Strategies' (RES) through which Dutch regions experiment with combinations of innovative solutions for sustainable housing. At the moment the regional plans are being translated to more concrete visions at the municipality and even district level, which is leading to the Transition Vision Heating foreseen for the end of 2021.[34] Meanwhile, **extensive learning and local experimentation activities have started already** as part of the Programme Natural Gas

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[31] https://derenovatieversneller.nl/

[32] https://www.tudelft.nl/en/2019/citg/btic-combines-knowledge-and-innovation-strengths-for-building-sector/

[33] https://www.klimaatakkoord.nl/gebouwde-omgeving/vraag-en-antwoord/subsidieregelingen

[34] https://www.rvo.nl/onderwerpen/duurzaam-ondernemen/duurzame-energie-opwekken/aardgasvrij/aan-de-slag-met-aardgasvrij/transitievisie-warmte-en-wijkuitvoeringsplan

Free Districts (Programma Aardgasvrije Wijken; PAW).[35] Through this programme, the ministries of BZK and EZK as well as sub-national structures like the Association of Dutch Municipalities (VNG) support municipalities and other stakeholders with their respective assignments in the realizing districts with sustainable heating. Of key importance are the now 46 local testing grounds for implementing potentially scalable solutions. Also via the associated knowledge and learning program, the PAW contributes to the implementation of practices fitting the Built Environment mission.[36]

4.4. Monitoring and learning

In the context of many of the energy innovation policy instruments shown in figure 12, the TKIs (responsible for programming, based on the Topsector Energy's KIA) and RVO.nl (executing the actual policy programs) have gained extensive experience with keeping track of what is being done in subsidized projects. While the shift towards the MTIP has led to changes in the governance and policy setup, much of the available experience and mechanisms appears to remain relevant for learning and monitoring.

Monitoring of project information at RVO.nl

As for RVO.nl, the information it discloses stems from the administration of policy schemes it offers. Apart from units that execute the policy instruments, RVO.nl has a unit concerned with monitoring and evaluation. This unit gathers project data in a dashboard and periodic reports providing aggregate accounts of which actors are working on which topics, and with whom.

The figure below shows the various angles that are used for studying project data associated with the KIA and policy instruments for the Topsector Energy. The upper part of the figure concerns the sphere of policy and administration, while the lower part reflects activities and outcomes in relevant socio-economic systems (i.e. in industries and society). **Concrete innovation projects, positioned in the centre of the figure, are the vehicles through which policies impact those systems**.
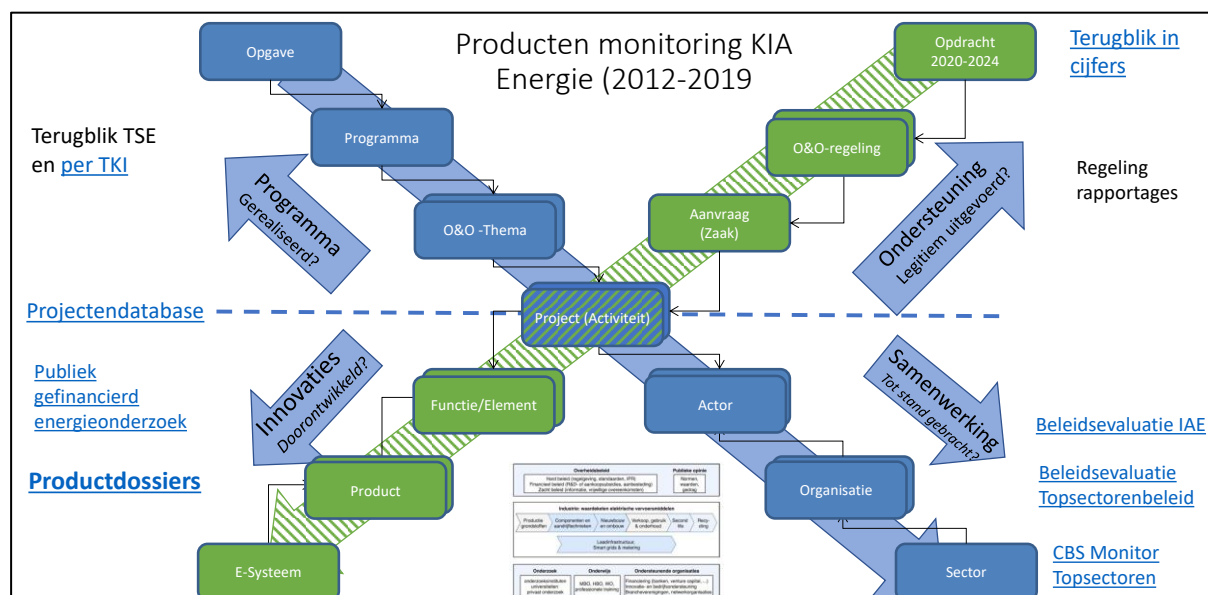
Figure 13: Dimensions and levels on which (I)KIA monitoring takes place at RVO.nl (RVO.nl, 2020).

The blue axis is the one for the perspective of innovation policy. Starting in the left upper corner, there is a societal objective that provides guidance to innovation policy instruments. In this case that

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[35] https://www.aardgasvrijewijken.nl/default.aspx

[36] Van Wijk (2020). Experimentation in Mission-oriented Innovation policy: natural gas free districts. Utrecht University / Dialogic.

would be the mission. As discussed earlier, this mission has been translated into programs like the MMIPs with their respective subprograms. Within these programs we find certain research topics associated with, in this case, ET&S-related innovation for the built environment. These topics are addressed by projects, executed by actors with a certain organisation type (large firm, SME, research institute, NGO, …) and belonging to a certain sector, place, etcetera. Monitoring along this axis involves checking to what extent granted projects are consistent with the innovation programs and objectives to which they should contribute, as well as following to what extent these projects are associated with desirable innovation and collaboration patterns (e.g. more links between universities and industries, more SME involvement, cross-sectoral collaboration, interregional collaboration).

The green axis reflects the logic of following the actual changes that should be brought about (regardless of whether this involves innovation). Here those changes would have the form of new or better solutions for the built environment. In the case of the theme ET&S, it is possible to map which part of the energy system the project would affect (e.g. energy production, storage, transport, usage), or which kind of technology the project is associated with (e.g. PV, grids, heat pumps, insulation). Indeed, this part of the framework is highly domain specific.

The sketched approach to monitoring deviates on one important account from a very linear view on the chain of inputs, throughputs, outputs and outcomes: it recognizes that there are multiple axis or dimensions along which such a logical framework could be constructed. **The essence of mission-oriented innovation policies is that they bring together innovation governance and problem-based governance (see figure 1), each of them having their own logic when it comes to driving changes. The monitoring approach developed by RVO.nl reports on both these logics**, as indicated by the various monitoring 'products' (documents and websites) depicted at the end of the axes in Figure 13. Together, these products provide a basis for evaluating the process as well as the impact of the deployed policies. Process questions typically concern the upper part of the figure (were the procedures for programming properly organised, e.g. in terms of transparency, openness and clarity), while impact questions would address the lower part of the figure (have collaboration patterns changed; did the targeted impetus to innovation projects contribute to increased application of novel technologies?).

This approach to monitoring remains relevant for the ET&S MTIP strategy, as it largely builds on existing instruments (with possibly an adjusted scope) and the MOOI instrument also executed by RVO.nl. Note, however, that RVO.nl does not monitor all of the policy initiatives deployed by the line ministries responsible for a mission. For the mission on Built Environment the ministry of BZK has designed initiatives involving the TKI Urban Energy and RVO, just the TKI, just RVO, or none of them at all. **This poses a challenge with respect to creating a comprehensive view on all innovation activities associated with pursuing the mission, especially when it comes to linking development activities to deployment activities**. See section 5.5 for more discussion on this challenge.

Monitoring and learning activities at the TKI

In order to inform and update their programs, the TKIs engage in monitoring (and learning) activities as well. Besides collecting and analysing data from RVO.nl, the TKI develop or commission their own reports. This involves for instance portfolio analyses to study the composition and outputs of granted projects. Those studies aim to give insights into how the projects relate to the programs, and what actual progress is being made (e.g.: are heat pumps really getting more silent?). Besides reporting on technological issues, the reports also contain information on other type of key performance indicators (see section 4.3). To track what is being achieved on the recently established MMIPs, the TKI plans to publish **annual portfolio analyses (reporting on new projects) as well as a 'permanent' monitor for giving a cumulative account of all projects granted so far (including new, ongoing and completed projects)**. The first annual portfolio analysis, looking back on 2019, is intended to serve as a **baseline measurement**.

Having ongoing monitoring practices in place feeds into the demand for more reflexivity regarding what was needed, what is being done, and what is being achieved. **For running a subsequent series of calls for tender addressing the same MMIP, it is crucial to have sufficient continuous feedback loops.** This starts with the information regarding how many projects are being submitted. If the appeal for a given call is very high, this might have implications for a future call (that could either support neglected projects or focus on further development of granted projects). At a more refined level**, detailed information on the content and progress of the portfolio of granted projects provides a basis to identify common needs or 'knowledge gaps'** that are being overlooked in the existing projects. Importantly, learning-oriented efforts should also search for explanations why some calls are more successful than others; this might be due to the topic and timing, or to design parameters in the call for tender (e.g. the time for writing and submitting proposals, the minimum and maximum project size).

Coming from a policy approach focused on competitive bidding, it is relatively natural to focus programming and monitoring mostly on the scoping and criteria of tenders, and less on how awarded (and rejected) projects evolve over time. However, many interviewees stress **the desire to move even more towards using policy instruments that offer room to support a few large multi-annual projects rather than many smaller projects**. The MOOI scheme discussed in section 4.3 is one example of such a 'programmatic' approach, while some stakeholders would prefer instruments that are even less competitive (see next section). **An essential part of adhering to a programmatic approach, in line with the multi-annual and targeted MMIPs, is to be able to terminate trajectories that turn out to be less successful. Obviously, such decisions require detailed up-to-date info on project progress** (as well as insights into why projects have failed to deliver on their promises).

At this moment, part of the learning on what happens in projects or what intentions possible submitters have occurs informally. As the TKIs are deeply imbedded in the networks from which projects emerge, they are in the position to directly collect input from firms and institutes working on promising developments fitting the MMIPs. Because legally RVO.nl can not just share project data with the TKIs, parties submitting a proposal are given the possibility to grant RVO.nl permission to share information with the TKIs. This features helps to ensure that the TKIs have detailed information when advising on programming activities.

Link between innovation development and adoption

Overall, there are several ways in which signals about knowledge and innovation developments also reach actors operating at the 'problem governance' side of the system the mission aims to link (in this case the part of the Climate Agreement concerned with the built environment). Beyond the TKIs, that formally only support the PACs that in turn advise the MI-teams, there are various other governance structure elements that reflect and base decisions on innovation project progress information. This would include for instance the 'Execution tables' for realizing the Climate Agreement, as they are involved in discussing topics like what solutions to integrate at the level of neighbourhoods. Information about ET&S innovation projects is also an important input for the 'progress meetings' of the Climate Agreement, as well as the Climate Monitor. It is acknowledged that **information feeding into processes related to coordinating the mission as such is still relatively static.** Consistent time series showing a trend on topics related to performance, price and adoption would be more helpful. Moreover, **much of the available information is mostly focused on the 'input' aspect of monitoring**, indicating for instance how many investments and actors were involved in setting up projects. While such descriptions are helpful already for programming future calls for innovation projects, it is regarded to be of limited value for decision processes concerned with achieving mission goals on the short term. **At this point, also the ministry of BZK is not entirely certain about how much they will learn about the potential of innovative solutions, and when these can be implemented.** Clearly, this is also due to the fact that the joint governance approach (and its monitoring procedures) are still in development.

4.5. Impressions so far

The previous sections occasionally already contained some remarks obtained from interviewees. Additionally there are also a couple of additional issues that emerged, often repeatedly, from conversations with stakeholders closely involved in running parts of the MTIP governance and policies. These are discussed below.

Involvement of different partners and stakeholders

So far, stakeholders perceive positive developments regarding the level of involvement of authorities with a stake in completing the mission. Allegedly, **the amount and depth of interaction between the ministries of EZK and BZK has improved** with the shift from the Topsector approach (already containing action lines and even an entire TKI for the built environment). EZK has laid the foundations for new collaborations, while BZK has stepped up in terms of being closely involved and taking responsibility for ensuring the diffusion of innovations. **BZK appears to take the potential of innovative solutions seriously, as evidenced by the range of policy initiatives implemented as part of the MMIP**. Some of them are integrated into the existing structures (like the MOOI scheme and the Uptempo! Programme), while other activities focus on the uptake of novel solutions emerging from the innovation system (e.g. the Renovation Accelerator). **Highly important are also demand side policy interventions like regulation and subsidies for households, which are generally believed to be consistent with the activities prioritized in the MMIPs** (probably also because these MMIPs might simply still cover many topics; see below).

One possible tension that might occur in the inter-departmental mission strategy relates to the acclaimed preference of the ministry of BZK to focus on improving the cost efficiency of mission-related solutions already on a very short term (ready for commercialisation within a few years). A reason for doing so is, besides showing actual progress in completing the mission, is that it would allow the ministry to save on subsidies for energy saving in neighbourhoods. **Prioritizing short term gains might be at odds with supporting solution paths that on the longer term might be more beneficial**. Generally, however, the ministry of BZK seems increasingly acquainted with thinking in terms of nurturing many early stage innovation projects in order to later have the possibility to scale up the ones that turn out to be most promising. Moreover, **for the overall balance in the MTIP governance structure it important that the ministry ensures that innovation is truly targeted at completing the mission**.

A second warning issued in the interviews is that establishing close links between various ministries as well as regional authorities does not only have upsides. **The risk of bringing so many different parts of the government on board is that there is an illusion of a common goal, while each individual government then sticks close to its own objectives.** This wouldn't pose a problem for projects clearly fitting in just one national/regional innovation policy instrument, or an accelerator program. For projects that cut across policy spheres, for instance when they progress from innovation to local deployment (or when experimental projects yield questions for more basic R&D), the differences between various governments and their policies might be more complex. Combining agendas could lead to more consistency in jointly pursuing a mission goal, but also in more fragmentation due to every government still adhering to its own logics and routines. Important is therefore also how the MTIP strategy continues to evolve; will ever closer involvement of different authorities lead to a larger set of policy instruments that may better serve but also confuse the field, or will it lead to more resources being combined in a few main instruments? It is not evident what is more desirable, as for e.g. small firms **a scattered set of smaller instruments might be just as hard to navigate in as a landscape with fewer but more complex instruments**. Especially research institutes and large firms have learned how to participate in the PPPs allowance scheme for collaborative R&D projects, whereas for SMEs this remains either challenging or sufficiently attractive. Streamlining of policy instruments is regarded to be an issue of major concern.

In line with the previous point, there are also some doubts regarding the observation that occasionally missions have been 'adopted' by multiple rather than one Topsector. When supporting the search for original cross-sectoral and multidisciplinary solutions this setup might be beneficial, but again **it could also cause coordination difficulties and protection of vested interests**. This risk appears to be not much of an issue for the mission on the built environment, as here one single Topsector (for Energy) and TKI (Urban Energy) are clearly best positioned for steering innovation towards mission goals. In fact, it is hypothesized that this starting point creates more possibilities for the MI-team to neutrally compare and weigh different solution paths, as for other missions there might be a risk that the various influential Topteams of different Topsectors would all try to push their own solutions. Obviously, the fact that the mission for the Built Environment is so closely linked to the scope of one TKI also introduces other challenges. It is often emphasized that **the availability of existing structures and networks is valuable for quicky making speed in running projects fitting the MMIPs (and therefore mission), while actual adoption of these projects is likely to demand other initiatives and perhaps even the involvement of very different ecosystems**. This would concern e.g. the construction sector and housing organisations, typically no so widely active in innovation activities. New initiatives like the BTIC are regarded as important for creating channels to link up with parties and consortia more closely involved in adopting the solutions the innovation system is bringing forward.

Ownership of the mission

When it comes to missions being the interface between the innovation system and the built environment socio-economic system (including industries and users), **a question is who is really in charge of ensuring that productive two-way interactions emerge**. Within the ET&S theme the TKIs seem to take a lot of responsibility for making sure the mission goals are met. This might be a positive finding when it comes to question how seriously the innovation field is really responding to the shift towards societal challenges. However**, it also obscures the task distribution within the governance and policy framework that was established**. Formally the TKIs should primarily focus on generating the right sets of knowledge and innovations (and facilitating their diffusion), while the MI teams carry more responsibility over indeed making sure the resulting novelty gets adopted and creates an impact. This discrepancy in perceived mandates does not create major inconsistencies (and might even have benefits in terms of alignment), but interviewees note it leads the TKIs to prioritize discussions about 'how to solve a mission' over 'what knowledge is needed'. **Leaving the debate on finding solutions very much in the hands of TKIs might result in technocratic approaches, focusing on uncertain innovative solutions that are still in development, whereas potentially more impact can be achieved by altering the behaviour of a broad set of non-innovation oriented actors**. An ensuing fear is that these other actors (like construction companies, installers, and engineering firms) might perceive they are not so much part of the mission, and therefore also refrain from investing and engaging in processes related to determining how to make progress. That having said, it is clear to many that there are merits in at least having science and industry representatives actively involved in comparing solution directions. According to parties closely involved in programming activities for the Built Environment mission, the checks and balances for getting different perspectives on what to prioritize seem to work well. One remark is that more attention now should be paid to **ensuring that the various solution paths in MMIP 4-6 converge further**. This integration is believed to be a matter of time, as it requires insights in which development within the individual MMIPs really take off.

Layering of coordination structures and mandates

Taking a closer look at the issue of responsibilities and mandates, concerns have raised over the complexity and sheer size of the coordination structures that have been put in place. Developing coordination and alignment mechanisms lies at the very core of the Dutch approach to mission-oriented innovation policy, but there are some worries that it is currently overdone. **The amount of structures, processes, meetings etc. for advising what to focus on seem disproportionate to the energy spent on actually working on promising projects**. Although there are probably

good reasons for the governance structure to be so extensive (e.g. the challenge is urgent and massive, there are many stakeholders involved, and especially when increasing the directionality of innovation activities it is important many perspectives are heard before making sharp decisions), it might be wise not to ignore the sentiment that there are too many layers and governance elements. After all, this might result in important stakeholders to drop out if they don't see what contributions they can make.

The question that automatically follows is to what extent the structures can be simplified. Relevant answers might be found by looking at where there is most confusion over who does what. In the case of the Built Environment mission this appears to concern the role of the MI team, which is supposed to have a central role in driving the mission. To what extent the MI team is truly in the position is at this point unclear. While formally everyone in the MI team is equal, there are concerns that representatives of the authorities that provide funding can overrule the MI team. This might cause difficulties for issues like the aforementioned tension between investing in very novel solution directions versus experimenting with the ones that are already further developed (but that might have less potential). Also the relation between the MI team and the Topteam and TKI is not entirely obvious for many of the stakeholders active in one of these governance elements. The MI teams seem in charge of making decisions based on advices by the PACs (that were supported by the TKI), but because the existing mandates of the Topteams has not been altered now there appear to be two structures that exert influence on what is included in the MMIPs. **So far the MI team for the Built Environment mission has not been able to fulfil a very decisive role in providing guidance to innovation activities.** The outlines of the MOOI scheme were already written before the MI team became active, and for other decisions the influence of parallel governance structures was experienced to be limiting the freedom for making own choices. As a result, it remains to be seen to what extent the MI team is truly the hub from which effective coordination takes place, or rather a (another) advising body.

Apart from worries over how the MI teams are positioned with respect to the Topsectors and the ministries providing funding, there are also internal dynamics that could hamper the effectiveness of the MI teams. This mostly relates to the balancing of interests, in particular when it comes to the influence of research institutes. While there are sound reasons for giving research institutes a strong voice in reflecting on possible solution directions, a governance setup based on connecting innovation-push and demand-pull would typically put research institutes in the innovation part of the dialogue (here: the TKIs rather than the MI-teams). How the research institutes position themselves evidently also has to do with other factors, like how they obtain their funding. Due to necessities of obtaining co-funding, for instance for NWO goals, they have a larger incentive to exert control on the directions that are being selected as promising solution paths in need of support. An adverse effect of the need for co-funding is that also when it comes to submitting project proposals, research institutes might take a competitive stance rather than a cooperative one that promotes desirable knowledge diffusion throughout the innovation system.

Level of guidance provided by the MMIPs

An important question to reflect upon when considering the Dutch MTIP strategy, encompassing so many governance structures and stakeholders, really lends itself to provide guidance to knowledge and innovation activities. **The A-E missions for the theme ET&S, including the one for the built environment, are generally regarded as clear, to the point, and legitimate (due to originating from the Climate Agreement).** However, in the translation from IKIA to MMIP, which was mostly in the hands of established structures for innovation governance - the MI teams didn't exist yet -, the amount of focal topics has grown considerably. Stakeholders with in-depth knowledge of the MMIPs and earlier programs are critical of how selective these topics really are. **The impression is that with drawing up the MMIPs existing priority topics are regrouped into more coherent paths, without becoming more selective.**

The claim that MMIPs are not so new is not necessarily problematic, as long as it would be because there were already longer attempts to make comprehensive knowledge and innovation agendas targeting societal goals like a sustainable built environment. Nevertheless, several interviewees make a plea for more critical analysis of how promising competing alternatives really are, e.g. in terms of scalability and export chances. From an innovation perspective it is preferred if Dutch solutions are not simply in line with where are other leading countries are going, but truly leverage unique local capabilities and knowledge. On the other hand, from a challenge perspective, alternative criteria (like cost-effectiveness and time to market) may matter more - which is probably one of the reasons why the MMIPs still stretch over so many topics. **Engaging end users and departments responsible for a mission might safeguard technocratic push of solutions society might dislike, but at the same time it could prevent systemic and long term thinking needed to support those innovative solutions that also have economic importance** (thereby potentially making it possible to obtain resources needed to invest in other welfare issues). This debate underlines that apart from strategic and operational dimensions for aligning innovation and adoption, **there is also a political economy and ideological dimension that should be acknowledged** when considering how innovation and mission goals can be interlinked.

Leadership, choices and solution directionality

Directionality for what solutions to focus on does not only emerge from the scoping of the MMIPs. Also governments can take a strong role in leading the way. For the built environment mission, the ministries of EZK and BZK are observed to deploy a broad range of initiatives for mobilizing the innovation system and facilitating the development and diffusion of novelty. However, by acting as a partner and facilitator, **the ministries are not demonstrating the leadership some stakeholders deem necessary to make substantial progress in completing the mission**. The reported risk, as noted above, is that **(too) many solution directions are being pursued simultaneously, while actually there might already be signals regarding which directions are more promising then others**. For instance, in comparison to heat networks, a solution like infrared heating offers better perspectives (in terms of efficiency gains and cost reductions, due to scalability and learning effects). As stakeholders closely involved in the programming activities of the TKI perceive that such considerations do not seem to be part of how TKIs reason, they occasionally argue for the ministries responsible for the mission to install more clarity. At this point, they claim, **too few real choices are being made when it comes to 'solution directionality'**. The societal problem is clear, but as long as there is no consensus which solution directions and applications to focus on, many investments and synergies might remain out of reach. Often mentioned examples of countries showing the desired level of leadership are Denmark and Germany; there the government did not only set a goal and provide resources (in this case in relation to renewable energy sources), but also indicated what kind of developments they would like to see. For the mission on a carbon-neutral built environment this would entail a clear choice for particular renovation approaches or sustainable heating solutions. The impression is that attention is still distributed over too many competing solutions, thereby also lacking a strategic view on what kind of knowledge is still missing. For the mission and MTIP to make a difference, it is argued that joint efforts should focus precisely on the innovations with the highest potential, and the bottlenecks that keep them from flourishing. The apparent preference for nurturing diversity might spawn new solutions, but it is at odds with creating a strategic focus when uniting innovation capabilities for addressing an urgent challenge.

The tension outlined above is obviously a consequence of the choice to rely on solutions to prove themselves in the market. Both EZK and BZK have reasons for refraining from taking a strong leadership role when there are market mechanisms that can automatically point out which innovations have a large potential. An important assumption there is that there are markets for all solutions. This is not always the case in the short run, which is the reason why market creation is considered to be one of the fundamental aspects of mission-oriented innovation policies.[4] In the context of the mission for the built environment, market creation is so far occurring mostly in a

technology/solution neutral way, e.g. by promoting diffusion of innovative and sustainable solutions in general. One observed problem signalled by one interviewee is that **the market is going in many different directions, without achieving the convergence needed to unleash complementarities between various kinds of investments** (in knowledge, infrastructures, production activities, value chains, etc.). When the interests of different stakeholders are too far apart, this limits the ability to follow a joint strategy. The interviewee compares this with the Netherlands having good musicians, but no director that ensures the musicians play in harmony.

The heavily debated question here is to what extent 'the government' should and can be the director. It is acknowledged that the EZK and BZK ministries are increasingly knowledgeable about the built environment field (including the potential inflow of innovations), which is a prerequisite for leadership. However, this wouldn't automatically imply the government itself should therefore also this knowledge for pointing the way. **Giving governments the task of making sharp decisions would also make it sensitive to politics. This could lead to a lack of stability (due to political changes) as well as a lack of responsiveness (as it can be politically difficult to change strategy).** Both events are problematic. Learning from advancements is precisely the point of asking the MI teams and the TKIs to report on the latest insights regarding possible solutions for societal problems, while for market parties it can be undesirable if strong choices would be made and then revised. As the issue of choices and clarity is very much about creating promising perspectives for various stakeholders, it is obvious that variability or inconsistencies in policy strategies can be detrimental. In that sense **the MTIP strategy might also be understood as an 'arms length approach', laying decision making in the hands of public-private structures (formally the MI-teams) that would respect the interests of different quadruple helix stakeholders.** It has also been pointed out that the governance structure for at least the built environment mission is not designed to give one governance element or even stakeholder the power to make sharp decisions. In line with the Dutch tradition of 'polderen', the philosophy behind the layered and comprehensive governance structure is that it would gradually lead to widely backed MMIPs.

To what extent to use or create markets remains a rather fundamental issue when it comes to governing MIP. A slightly more practical issue concerns the use of comparative analyses that would be needed for leadership decisions on what directions to pursue. Even if national authorities like BZK would stick to relatively technology neutral strategies for driving solutions, other stakeholders might benefit from a better understanding of which solution to rely on under which circumstances. Comprehensive overviews of what different solutions have to offer might help for instance the local policy makers charged with regional energy strategies. At this point interviewees have some doubts regarding the information that has been used when deciding upon solutions for meeting regional energy production goals. Apart from boosting new innovative solutions, substantial impact might be realized simply by ensuring that 'low hanging fruit' in the form of available techniques (e.g. for insultation) are being used. The impression so far is that **the combination of a well-embedded governance structure and initiatives like the Renovator accelerator offer good chances of identifying and communicating which solutions can be considered to be low hanging fruit**.

5.   Discussion (Synthesis)

This post-commencement analysis provides a first scan of how the Dutch MTIP is currently unfolding. Since to date there are only very few empirical studies giving a detailed account of a fully fledged MIP strategy, the findings presented here should be regarded as a first step towards more extensive documentation (and assessment) of possible ways to design and embed such policies, as well as of the tensions that may occur. The current report pretends by no means to be exhaustive in terms of highlighting all the dynamics that have come into play, e.g. all the initiatives that are being mobilized and aligned for ensuring the supply and uptake of suitable innovative solutions. Instead, it merely offers a tentative description and characterization of the main setup of the MTIP. Rather than already providing strong statements regarding the quality and potential of the emerging governance design, this report aims to sketch how the MTIP strategy should be understood in the first place.

As has become clear, the MTIP is building on both the preceding Topsector-based innovation strategy as well as major developments regarding societal challenges like the energy transition. This underlines that the policy strategy consists predominantly of installing coordination mechanisms for interlinking a wide range of agendas, networks, governance structures and policy instruments, belonging to both the innovation system as well as the sphere of socio-economic systems. Taking a first glance at how all of these structures and developments are being brought together serves, in turn, to enable more in-depth reflections on both the overall setup as well as particular features of the policy design.

5.1. Governance

The Dutch approach to MIP consists of the MTIP for driving innovations, as well as many other mission/ministry-specific initiatives concerned with the challenges that are to be solved. Figure 14 maps the main components of the overall policy setup on the generic template of section 2.2. The coloured boxes are the ones that are relatively new.
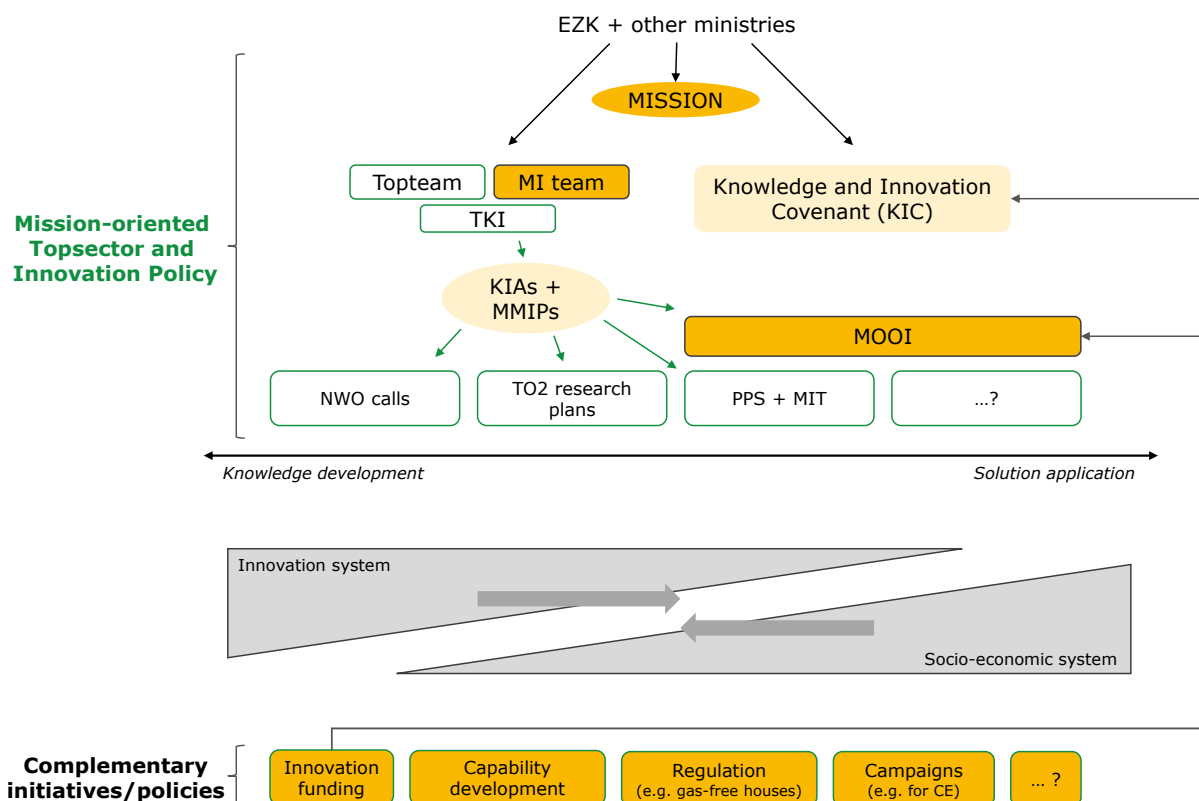

Figure 14: Main elements of the Dutch MTIP strategy and complementary initiatives / policies.

Origins of the missions and governance structures

What might be striking is that, **although the 25 missions feature centrally in the ministry of EZK's MTIP strategy, they have in fact been developed outside the MTIP approach**. As their origins lie in extensive consultation and negation processes facilitated but not managed by EZK, nor any other individual line ministry, the mission statements appear to be relatively uncontested. At least for the missions studied in this report, **the starting point of the MTIP is not to set missions but to see how the innovation system (and beyond) can be mobilized for completing them**. The Dutch way of using missions as an interface between innovation governance and problem-based governance (see chapter 2) relies heavily on coordination activities – principally the KIAs/MMIPs and KIC – for making a variety of mostly existing policy instruments work in tandem with each other.

As the MTIP name already suggest, the 'new' mission-oriented innovation policy is closely wedded to the pre-existing Topsector approach. Diving into the peculiarities of two missions has revealed the importance of recognizing that this Topsector approach consists of several elements, each of them having a different place in the MTIP that has succeeded it. Next to the Topteam we now find a MI team, with both these teams formally having a mandate over deciding over the content of the MMIPs and therefore the programming of calls for tenders in actual policy instruments. **This combination of teams with similar mandates has raised some concerns, and doesn't seem to match with the status of MI teams as central engines of the MTIP** – see also section 4.5. The function of TKIs has remained relatively unaltered, as these offices still serve to engage the field (science, industry, and increasingly also societal stakeholders) in processes yielding information on what innovation directions would be feasible when pursuing a shared agenda. Previously the TKI would also make programming decisions. In the new setup, they support the Program Advisory Committee (PAC) that in turn advices the MI team on which topics and criteria to prioritize in new programs and tender calls. Strategic decisions on funding are taken at the level of the theme team.

Variety between missions

Before going into more detail, it should be noted that **the MTIP strategy is heavily nested**. While there are overall outlines of how it is designed and operates, idiosyncrasies start to emerge when descending towards the levels of theme teams, mission teams, and MMIPs. This study attempts to make some generic statements on the Dutch MTIP, but many of the observations might be specific for the mission theme Energy transition and Sustainability. Within that theme, already major differences exist between the missions A-E for reducing greenhouse emissions (all belonging to the 'IKIA' associated with the Climate Agreement) and mission 'CE' on Circular Economy (having a KIA based very much on the five Transition Agendas linked to the Raw Materials Agreement). **Sources of differences are not just variety in the agendas for driving changes, but also the fact that the ministry of EZK invited stakeholders participating in governance structures to be involved in the experimental design of organisational arrangements and distribution of task and responsibilities**. Within the boundaries of working with KIAs and the KIC, triple helix representatives in e.g. the MI teams had freedom to arrange governance details amongst themselves. Whereas the MI team for Built Environment receives abundant support from one single existing TKI and its PAC, the MI team for Circular Economy (which was studied for this report as well, but not documented in detail) relies more on a newly installed support group closely tied to the MI team itself. **As there was no clear blueprint available, some governance structures seem to serve as an example for missions in which actors started out later with configuring their own arrangements.** Also in those cases, building on existing coordination structures seems to be a prerequisite for having an impact.

Variance in governance approaches also emerges from how the line ministries 'owning' the mission participate in the MTIP and associated endeavours to steer and leverage innovation activities. **Compared to BZK's mission on the Built Environment, I&W's mission for Circular Economy appears to rely somewhat less on innovation as an important basis for achieving the mission goals. The possible contributions of the MTIP are recognized, but more as just one**

of many action lines that may be of importance. In the Built Environment context also many non-innovation specific initiatives have been launched, but overall the possibilities to accelerate promising novel solutions seem to be more woven into BZK's strategy for realizing the goals to which it committed itself.

Commitment of different 'problem-owning' ministries

Despite these slight differences, the fact that line ministries carry ownership over the missions appears to contribute to their general inclination to deploy initiatives geared towards the actual uptake of innovative solutions. **The BZK and I&W ministries are not just lining up agendas on how to make use of research and innovation, but both also commit themselves to deploying activities to actually support this**. Some of these initiatives are organized as part of the MTIP strategy, testifying that the innovation domain and the 'problem' domain are not managed in parallel. Illustrative is for instance how the ministry of BZK was involved in the creation and funding of the MOOI scheme for large collective and integrated innovation projects, but also the Uptempo! Program (run by two TKIs) for boosting the demonstration of actual solutions and the Renovation Program for spreading innovations towards the use context of construction companies and housing corporations. This range of initiatives complements EZK's existing policy mix for the stages from knowledge development to innovation. Apart from new policy initiatives in the form of support measures, there are also examples of new structures that help to bridge the gap between the innovation system and the socio-economic systems they should impact upon. **The BTIC, for instance, is an enrichment for the mission ecosystem as it complements the TKIs in uniting actors typically not operating in the innovation networks in which the TKIs are embedded**. While the founding of the BTIC can hardly be attributed to coordination activities explicitly belonging to MTIP, receiving funding from the MOOI instrument might have been helpful for spurring interactions between innovation developers, innovation appliers, and innovation users.

To what extent the initiatives from the 'innovation system' and from the line ministries truly match and leverage each other is likely to become clearer in the near feature, once stakeholders have had sufficient opportunity to identify which gaps exist in attempts of innovators to move from development to deployment (and reversely: in efforts to address adoption challenges in the programming of the MMIPs). Interviews conducted with stakeholders closely involved in coordinating innovation activities indicate that at least **in terms of mindsets some convergence is on its way; the knowledge and innovation agendas and MMIPs are increasingly structured according to more coherent solution paths also addressing commercialisation and societal acceptance, whereas line ministries acknowledge the promises of interacting more closely with the innovation system.** The latter might also due to the fact that the ministry of EZK hopes to provide additional innovation support by tapping into the resources of line ministries (dedicated to e.g. opening market perspectives), while the line ministries in turn intend to extend their reach by linking innovation policy instruments to their own agendas. In that sense, the model of signing a KIC in an early stage is likely to help ministries and knowledge partners understand on what accounts they can benefit from (and support) each other in terms of synchronizing policy instruments and funding. A clear indication for some early success of the MTIP is that the ministry of BZK has recently announced to invest another €30 million in a round of the MOOI scheme for R&D projects tied to several ET&S MMIPs. As it would also have been possible to invest this amount in BZK's 'own' initiatives for achieving mission goals, one could interpret this joined up funding an indication that there is confidence in the potential of the MTIP to make meaningful contributions to solving societal challenges.

5.2. Guidance

Structures and instruments for steering

The MTIP contribution to completing missions still relies very much on guiding knowledge and innovation projects. Apart from (modest) changes in the scoping of programmes on which subsidy

tenders and research calls are based, however, also new additional policy initiatives are being deployed. **The MOOI scheme is a rare example of an actual policy instrument complementing the already existing set of policies for research innovation, but there are already many other initiatives (mainly coming from line ministries) for also covering higher stages of innovation development and deployment.** According to some interviewees, the overall focus on contributing to missions via a package of project-based instruments conflicts with the logics of line ministries concerned with achieving the goals to which they committed themselves. Others emphasize that the MTIP is in its very nature about bringing such potential conflicts to the surface, in order to see where communalities between policy objectives can be found. In their eyes, **the MTIP should blur boundaries between policy domains in order to be able to exploit complementarities**.

Generally speaking, there is confidence that the MTIP setup allows for redirecting policy instruments – and thereby the content of actual innovation activities. Relying on embedded platforms like TKI is a way to ensure that topics covered by MMIPs can at the same time contribute to a mission while also resonating with parties that are supposed to invest in projects fitting these MMIPs. A merit of the current approach is that the design enables momentum building in individual solution paths, due to stakeholders understanding better how they can complement each other and due to the government having more information of the state of the art and challenges in these respective paths. **Actual guidance and alignment should then mostly come from the MI teams, acting as 'engines' operating at the centre of the MTIP governance structures**. However, so far the MI team for Circular Economy has just begun, while the one for the built environment spent its first three meetings on figuring out its own position in the overall landscape. The latter highlights that it is a rather ambitious endeavour to orchestrate so many activities taking place in the innovation and socio-economic systems relevant for a mission. While this is precisely what missions and MIPs supposedly should be about, **the available post-commencement observations urge for some patience with respect to how quickly and smoothly new coordination mechanisms can be introduced**.

Specificity of the missions and agendas

What can already be discussed at this point is the overall impression regarding how selective and binding the MMIPs for completing the missions are. This guidance is perceived to be relatively 'open'. One reason is that the total of 25 missions implies that still many directionalities co-exist. **Each mission individually might help to align stakeholders, and perhaps even to streamline support instruments, but together they might also raise confusion**. For instance, there are different missions for circular economy, sustainable agriculture and energy reduction, while these topics interrelate in many respects. See for instance also the position of the Construction Agenda as a driver for changes in both the Built Environment and Circular Economy missions (figure 11). The established structures try to cope with this by appointing contact persons and ensuring interaction, but it remains to be seen how this affects actors in the field. Another reason to cast doubt on how much guidance is provided concerns the specificity of guidance at the mission level. This is sometimes believed to be somewhat limited; in the context of Built Environment **there are allegedly clear and coherent directions, but they still 'focus' on a high number of topics**. For Circular Economy, steering activities seem to have an even broader scope as they are mostly targeted at promoting the topic as such (rather than on choosing particular paths).

In principle it is imaginable to have a MIP approach encouraging parties to pursue a mission by focusing more intensively on fewer paths, which then would be supported throughout various phases of development. In the MTIP case, however, the dominant approach is to let the innovation system generate different (competing) paths. As discussed extensively in section 4.5, there is currently a fierce debate regarding how much of the guidance can be left to the market (industry and science, as also represented in Topsectors) and how much to the government. **The MI teams and the TKI might be seen as an 'arms length' extension of the government, but many conversations**

point at a demand for the government to provide clearer visions - and market perspectives - herself. Besides noting that this introduces several risks with respect to stability, other interviewees have pointed out that it might be easier for governments to 'step in' once particular solution paths have sufficiently proven themselves. This would imply that **the level of guidance and directionality within the MTIP is not a given, but could evolve over time.** Note that this level is not just necessarily a matter of choosing which paths to 'select'; it can also come down to aborting the support for paths not progressing sufficiently well. Also, managing a mission is not necessarily about preferring one solution over the other; it sometimes is also matter of implementing an intelligent approach to knowing when to deploy a particular solution. Using solutions strategically requires higher order systems analysis, which is typically something the layered structure of theme teams, mission teams and their support offices (incl. TKI) should be able to accomplish.

5.3. Instruments

The brief conceptual reflections provided in chapter 2 indicated that in theory there are quite distinct ways of targeting a MIP strategy. Remarkable about the Dutch MITP approach is that it is not relying on one major policy scheme belonging to one of the outlined archetypical approaches. Instead, **the novel way of coordinating knowledge and innovation dynamics builds largely on existing instruments and, importantly, the new domain-specific initiatives a particular mission can mobilize**. It effectively acts as a boundary object for evoking convergence in governance and support initiatives related to research (e.g. NWO's KIC calls), entrepreneurial experimentation (e.g. public-private R&D projects) and transformative deployment activities (e.g. in neighbourhoods exploring how to disconnect themselves from the natural gas grid by applying various new solutions).

Continuous policy support through competitive policies

The figure below illustrates the range of policies that is being tweaked for providing a continuum of support to the mission on the Built Environment.
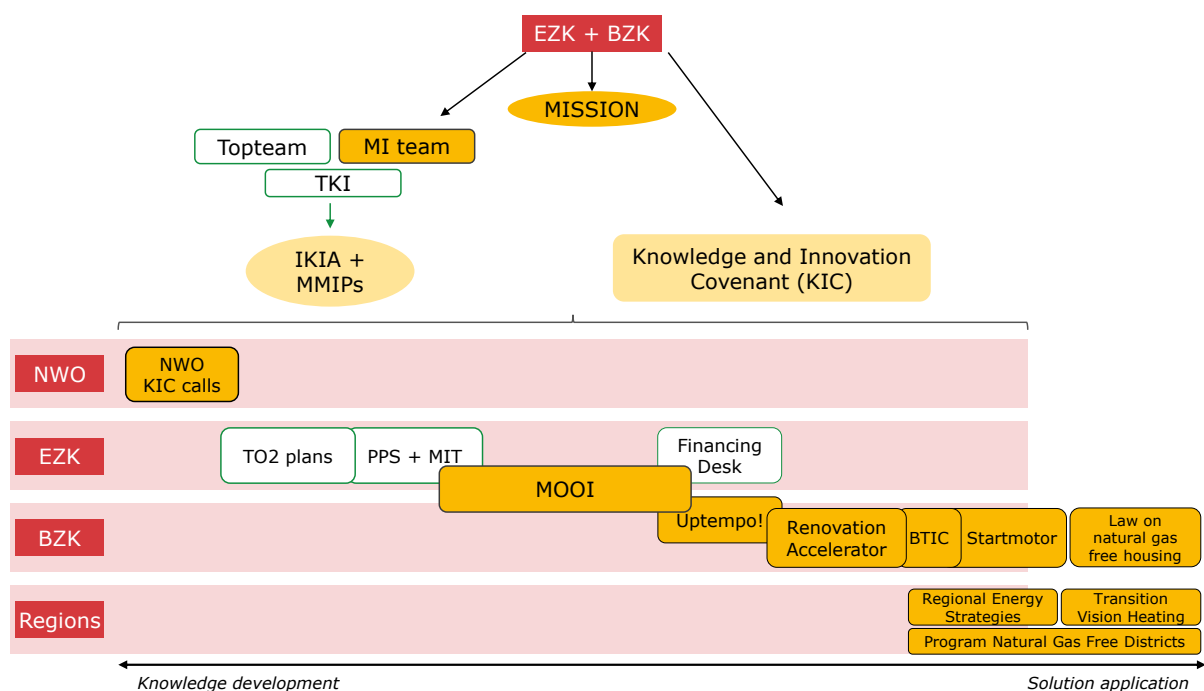

Figure 15: Some of the relevant policy support measures for the Built Environment mission.

As noted, one major change in the policy mix is the introduction of the MOOI. Because it stretches over a range of development stages at the (for innovation policy) relatively high end of the TRL ladder, it appears to be a valuable complement to the existing set of instruments. Interviewees are

quite unanimously pleased about the availability of a scheme that, also due to its relatively high project sizes, invites for value chain and end user involvement as well as knowledge dissemination. At this point, EZK and BZK's collaboration in establishing this joint policy initiative seems the best illustration of policy support getting more continues. Additionally, interviewees praise the range of BZK's subsequent initiatives for ensuring relevant innovations get picked up and applied. This includes not just support for (local) experimentation, but also crucial complementary interventions like legally preventing newly constructed houses to have a natural gas connection.

The current impression for the Circular Economy mission is that the 'hand-over'-point from knowledge and innovation to deployment (and thereby from EZK to I&W) occurs in earlier development stages. Possibly it is also less substantially supported with instruments explicitly following up on each other, as is the case for the chain devised for Built Environment innovations. Evidently, stronger statements on how seamless the support measures really are would require consultation of researchers and innovators themselves. It should be noted that **what ultimately matters is not how easily the innovators can walk through all stages, but rather how easy it is for particular innovation paths to get traction**. After all, it will not always be the same parties that work on different stages of innovation development and deployment.

A consortium-based alternative

Despite the above indications that there is already progress in creating a conducive policy mix, ensuring continuous support remains a major issue in the interviews. This is perhaps not surprising, as many of the interviewees were actively involved in developing coherent programs like the MMIPs. From that perspective, there is obviously a strong preference for preventing that teams working on a certain trajectory need to move from one instrument to another as their innovation evolves. As the policy setup does not allow programming entities to merely 'select' projects and project teams, they perceive it as very challenging to be so dependent on what proposals are submitted to competitive tenders. Some even fear that the lack of possibilities to drive a coherent portfolio of changes (also due to limitations in tendering procedures and unclear mandates) might undermine the willingness of high-level stakeholders to engage in the MTIP. On a more constructive note, ideas have been proposed for better embodying the programmatic aspect of boosting mission-oriented innovations. **One approach would be to focus more on continuously supporting large multi- or even trans-disciplinary consortia** (also involving parties applying or 'consuming' innovations). This model would draw on these consortia, or centres, as hubs charged with pushing a particular action line (sub program) for a couple of years, thereby also having the possibility to engage different stakeholders over time. Getting other parties to invest after a project was started is often difficult in regular subsidy projects, while it would fit with being responsive to the interest of market parties willing to experiment with promising solutions. Whereas a model based on competitive bidding is associated with either making small fragmented steps not necessarily adding up (due to project teams working independently from each other) or big risky steps, the consortia model would allegedly allow to more carefully build a coherent development path. This would work especially when having **discipline principles that also allow for terminating consortia support whenever it becomes clear that the targets of the consortia can not be met**. Note that the BTIC, partially funded via the MOOI scheme, is a concrete example of a centre with an ongoing program and dynamic involvement of stakeholders.

As with any policy design, both the competitive and the collaborative models have their respective advantages and disadvantages. One way of going about would be to consider how these can best be matched. **A possible approach is to stick to tenders for lower TRLs, and consider moving to consortium support for projects and project teams concerned with higher TRLs.** Important is also the question how to respond to the collective knowledge or technology demands encountered in the more applied stages of solution development, e.g. when it comes to topics like digitalisation. Right now it is unclear to what extent there are already sufficient **possibilities for MI teams to link demands from high TRL activities back to lower ones**. The TKI Urban Energy is currently

exploring how incorporate demands from the diffusion side (including SMEs) to programs targeted at mobilizing the research capacities of the innovation system. As previously highly innovative (and often larger) firms and research institutes had a big say in programming activities, integrating specific demand-side issues is regarded to be a substantial shift. The impression is **that the more those demands can be bundled (e.g. because of many firms collaborating in large consortia), the easier it will be for research institutes to identify how they can contribute.**

5.4. Directions for improvement

The MTIP is an evolving policy approach. **In various ways the design and implementation of the governance structures and policies are the results of an experimental process, in which some steps need to be made first before there is room for other steps**. Based on the discussions so far, the following deliberations and directions for improvement stand out:

1. Streamline the governance
There are serious concerns that the coordination arena is getting too crowded. To a certain extent it is understandable that the MTIP has a multitude of ways to engage stakeholders, simply because there are so many of them to deal with when covering both the development and deployment of innovation. Having different layers for making different types of decisions is generally appreciated as a way to ensure all entities within the governance structures know what mandates they have and how that relates to the tasks and responsibilities of others. However, for the MI teams right at the middle of the MTIP governance structure, this is less clear. As noted in section 4.5, at least for the Built Environment mission interviewees have the impression that **the MI team might currently be more of an advisory body rather than the central place in which innovation dynamics (coordinated by e.g. the TKIs) get connected to the mission objectives of line ministries**. Much has to do with confusion over the role of the Topteam, which suggest that attempts to streamline the governance should look in particular into the respective role of these two teams. From the perspective of solving missions it might be opportune to phase out the Topteam's influence in mission coordination, and perhaps keep them more in the lead for coordination issues related to the Key Enabling Technologies pillar of the MTIP strategy.

To add some nuance, note that it is hard to immediately take this as a very generic advise. The situation for the Built Environment mission is hardly comparable with the Circular Economy mission, as there the MI team has not gathered much and faces multiple Topteams (with the one for Chemistry in the lead). Designing an appropriate governance structure seems to be a matter of crafting, more than of offering a generic recipe. The complex field of stakeholders and relevant institutional landscape differs per mission, but probably it is always a challenge to get actors to represent a certain part of society (which is inherent to this 'network' approach) while also being able to look beyond their own interests. Checks and balances like a set of boards and committees might help, but it often is also just a matter of the personalities of people sitting in the various governance teams. The context specificity of governance tensions might explain why the ministry of EZK has laid out the overall architecture, while leaving implementation up to the field. **Getting buy-in from different stakeholders is important, but as the first observations now show, it might go at the costs of transparency and leadership required for setting clear directions**. In this respect, interviewees differ in the type of coordination mechanisms they would like to see. Some promote a model in which there is one specific place in which decisions on preferential solution directions are made (e.g. the MI-team), while others regard the entire configuration of governance structures as a 'web' that can exert pressures coming from many places. Still, based on current information, it seems wise to critically consider streamlining options related to the multitude of advisors and decision makers.

2. Re-orient the TKIs

The fact that the Dutch MIP is rooted in the Topsector approach has positive and negative consequences. **As for the role of the TKIs, it might still be useful to have this type of office (and capacity) for engaging with the field that is to be guided and facilitated in their attempts to contribute to a mission**. Especially now that they have an even more supportive rather than decisive role, they appear to have a natural function in the governance structure. At least, as long as there is a counter-force representing the stakes of the mission owner and the society on which possible solutions will impact. **A suggestion that has risen is to align the TKI even more with missions, and less with the Topsectors they were originally associated with.** The fact that TKIs previously served very distinct communities should not be an argument to maintain silo's; instead, in order to spur cross-sectoral, multidisciplinary and integrated solutions, it seems relevant to tie the (government funded) TKIs to missions and thereby position them more at the intersection of the networks that have been established with the Topsector approach. **Re-orienting them might be consistent with the ambition to engage different types of actors or even ecosystems in innovation trajectories, in particular the ones more concerned with deploying and using solutions**. Perhaps it is not efficient to expect the TKIs to maintain deep relations with both researcher/innovator networks as well as the communities organized around a certain problem; in that case it might be more feasible to complement the TKIs with counterparts that can inform the TKIs (and MI teams) about proceedings in implementation and experimentation efforts. Relevant for future policy deliberations in this respect is also the finding that right now it is not obvious how TKI can respond to common knowledge demands emerging from experimentation with new solutions. Here it might help if at least the TKI are more aware of challenges encountered by an extended range of actors (also including non-innovators).

3. Intensify guidance

On the other end of the spectrum between innovation supply and innovation demand, we find the line ministries with responsibility for a mission. Balancing to what extent solution push or challenge pull is leading for the MMIPs and policy initiatives implies a delicate managing of powers and interests. Currently there are fears that the 'pull' force might still be underdeveloped, giving much room to the innovation force. It is hard to verify such perceptions, but in any case **it is recommendable to ensure sufficient guidance from the side of mission owners. This goes back to the issues of MMIPs possibly lacking directionality specificity and the (contested) urge for government leadership**. Generally it is understood that creating structures for making societal challenges truly leading for innovation policy is more difficult than redirecting innovation structures and policies. The basic recommendation following from these views is that it seems wise for EZK to continue the approach of handing over some innovation responsibilities to line ministries. In the case of the Built Environment and also Circular Economy missions this seems to be working out well, in terms of getting commitment for driving the uptake of promising solutions. To what extent the same holds for other missions is less clear, hence the advice to at least highlight good practices.

4. Extend the 'programmatic' consortium model

Looking at policy instruments, there are a few more substantial directions for improvement. A relatively contested one is the suggestion **to work more with continuous support for large consortia, focusing on a certain program or use context**. As noted, this can offer a possibility to move away from running a pragmatic approach through competitive bidding processes, which might result in fragmented project portfolios. Another typical problem of competitive bidding is that the diffusion of knowledge may be limited due to research institutes and firms becoming very exclusive in their partnerships. Challenging about the suggested alternative, however, is that it would require not only the selection or creation of consortia, but also a process for determining when to discontinue financial support. Designing a stage-gate process usually not easy, especially in an innovation context. Uncertainties inherent to experimenting with novel solutions make it hard to say

when something is a failure or a success. Still, **moving towards consortia is primarily suggested for higher development stages, in which adoption and therefore success of innovations can be measured** (acknowledging that this will seldomly follow linear curves). It would therefore be relevant to inspect what kind of criteria and procedures could be used for determining realistic performance levels. A possible fear of suddenly having to make sharp choices is not entirely justified. **Also in a consortium-based model it is possible to include market mechanisms that will help to identify the true potential of some innovations**. For instance, if it is assumed that more market parties will join as innovations mature, this would quite readily present indicators for stage-gate decisions (e.g. the amount of actors that joined, and the amount of investments they brought).

5. Extend the MOOI scheme

An often mentioned example of a transdisciplinary centre dynamically uniting different innovation developers and users is the BTIC. Interestingly, this centre was one of the few consortia that got (substantial) financial support through the first round of the MOOI scheme. This directly points at the second – and less contested - policy instrument recommendation. The MOOI scheme is broadly praised for having a design consistent with MIP philosophy. **Particularly lauded are the focus on fewer but larger subsidies for heterogenous project teams, also involving the value chain and end users relevant for an innovation trajectory**. The criteria of the MOOI encourage the combination of innovation development and application, with special attention for the integration of complementary sub-solutions (rather than focusing on individual technologies). In a way, the MOOI presents a way to avoid discrepancies between instruments as it stretches over a broad range of TRLs already. Moreover, **because the MOOI scheme still has a competitive element, it seems to sit in between a market-based model and a programmatic model.** The scheme could therefore be a nice answer to the bigger question of how to balance freedom and guidance. In sum, the various advantageous properties make it worthwhile to assess to what extent also ministries other than BZK (and EZK) are willing to deploy it.

5.5. Monitoring

As the preceding sections have shown, the MTIP comprises various layers of activities. Consequently, monitoring practices can be deployed at the level of projects belonging to MMIPs, as well as at the level of the MTIP strategy as such. There are several lessons regarding the proper use of monitoring:

1. Enhance consistency between monitoring procedures for innovation and deployment policies

Section 4.4 described which monitoring practices are currently being conducted for the Built Environment mission. A large part of this is related to monitoring arrangements for the energy innovation policy instruments that continue to be of relevance, in fact for all the ET&S missions (A-E) for reducing carbon emissions. Over the years RVO.nl, the policy execution agency, has devised an approach for consistently tracking which actors and topics feature in projects that enjoy policy support. The framework shown in figure 13 indicates **that the project database can be utilized for monitoring exercises on various dimensions and levels.** These include analyses on the innovation dynamics of projects (are new collaborations emerging, e.g. cross-sectoral and interregional?) as well as on the match between the content of the projects and the parts of the energy system they should be impacting upon.

Overall it is believed that **the resulting reports are useful for understanding in particular the input side of the logical framework one could draw up for monitoring MMIP progress. Less information is available on what is being achieved, although this is essential for regularly updating the programming activities of the TKIs/PACs and MI teams**. It seems worthwhile to expand ongoing efforts to extend data collection (e.g. via project proposal forms) on key performance indicators regarding, for instance, the societal acceptance and commercialization potential of projects. Even if such information is not always entirely valid, due to uncertainties inherent to innovation, it would help advisors and decision makers in the MTIP governance structures

to understand better where innovation developments are going. To establish meaningful feedback loops, it would also help if progress on the project level is recorded and shared regularly. Currently the impression is that, perhaps in order not to put too much of a burden on project partners, the information on project outputs is somewhat thin.

In order to later make assessments of how the MTIP strategy is contributing to the fulfilment of missions, it also seems relevant to improve the consistency and compatibility of monitoring activities concerning te crucial link between development and deployment. One baseline criterium for consistent monitoring is usually the availability of uniform information on the organisations participating in projects. When addressing a societal challenge, however, it is not required that the organisations inventing a novel solution are also the ones ultimately applying it. What matters is that the innovation system as such is sufficiently tied to the socio-economic system (in which adoption takes place) for solutions to make it to the other side – and for demands and knowledge about problems to reach the innovation system. Ideally, the MTIP monitoring system thus also allows for tracking the process of the solutions themselves, i.e. the topics (technological and non-technological) organisations are working on. **This would require a careful link between existing monitoring practices by RVO.nl and the TKIs on the one hand, and monitoring of line ministries' 'own' innovation diffusion policies (and goal progress) on the other hand**. Because the spectrum of relevant policies is so broad, it will be challenging to utilize existing policy administration data for constructing overviews of how innovations reach applications linked to mission goals. This is also illustrated in the stylistic figure shown below. One the one hand it is very informative to study how the budgets and scopes of different types of policies (here: research, development, deployment) of various authorities are being combined. For the MTIP this would concern in-depth analysis of how the KIC is unfolding. On the other hand, it seems crucial to follow how actors and projects are 'flowing' between policy instruments. While one authority can try to synchronize the monitoring procedures for its own policies, it is probably more difficult to synchronize the labelling of topics and identification of actors throughout different policy spheres. In the case of the MTIP it is still difficult to make the step from connecting innovation policies to deployment policies.
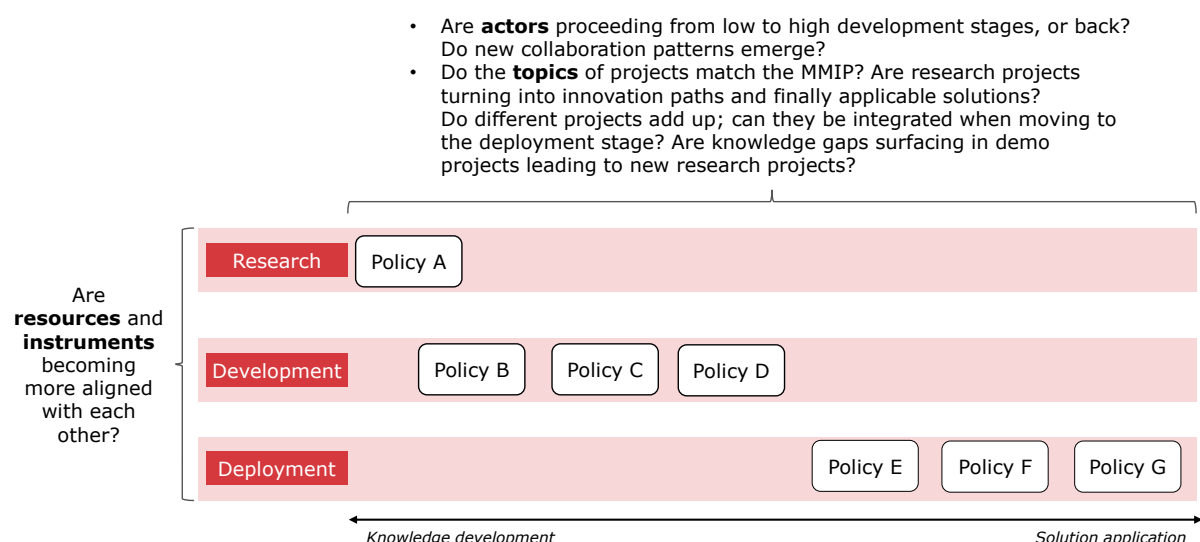

Figure 16: Examples of questions requiring integrated monitoring procedures.

2. Move from producing overviews to actual learning

A practical issue emerging from the interviews is how to utilize monitoring data for learning activities. As the current approach is very much based on building datasets with overviews of which projects are initiated and by whom, the most readily available information concerns the content and intended goals of subsidized projects. **Actual learning involves sensemaking, as well as dissemination of information, knowledge and lessons.** A plea has been made to turn monitoring practices more into 'learning systems' providing e.g. early warnings or information prepared for decision processes.

This approach could build very much on the already existing close links between RVO.nl and the offices that are in close touch with both the innovation system as well as the governance layers ultimately making decisions on programming and funding (like the TKIs or MI team's own support offices). Learning systems may work well if there is capacity of field experts to engage sufficiently with project partners, both to keep track of project developments and to issue feedback. The foundations of such an integrated approach to producing and interpreting information are already present. Helpful is also the recent practice of asking parties submitting a project proposal whether RVO.nl can share the information with a support office like the TKI. This prevents duplication of efforts and ensures programming entities like the PACs have at least a basic information set to work with when engaging the field for further interpretation of relevant developments.

Regarding the sharing of information, some interviewees relate this to the importance of focusing more on support for consortia rather than projects (see previous section). While projects often need to be executed by the team that originally submitted a proposal, consortia might better be able to continue engaging stakeholders as their activities (innovations) mature and other parties an gain interest. Continued openness with respect to which parties contribute to the development and adoption of innovation would appear to be one way of ensuring knowledge spreads and cumulates.

3. Be cautious and detailed when disentangling progress and additionality

While perhaps less of an immediate concern, ultimately there will also be concerns on what the MTIP approach as such is achieving. Crucial is again the notion that the MTIP is to a large extent leveraging existing initiatives, and complementing with new ones where possible. In the case of the mission on Built Environment there were already many instruments to build on, making it perhaps less clear what is new on the 'innovation side' of the mission (as compared to the diffusion part accelerated by BZK; note that **involving and developing this part further might in fact be one of the biggest achievements at the overall strategy level**). Since the mission on Circular Economy is not so closely linked to specific pre-existing structures and instruments, the difference of now having a mission are likely to be more obvious. Still, it might be very hard to tell in which of the two scenarios (altering/updating existing practices vs. establishing a new 'mission-oriented innovation system; see section 2.2) the actual impact will be biggest.

Reasoning from the mission statement itself, one point of departure for following desired impacts is by **conducting attribution-based analyses**. This starts with looking at the main development visible so far, primarily at the outcome level of mission objectives like disconnecting houses from the natural gas grid. Taking such 'real progress' information, the next step would be to determine causal relations with deployed activities. Doing so would require rather detailed information about the actual actions that were undertaken. Following a more **contribution-based perspective**, an assessment would start reversely, with tracking what range of investments an actions was deployed and how these might have led to circumstances from which desirable outcomes can emerge. In both cases, conducting a proper assessment quickly leads to an immense myriad of activities that need to be investigated in order to understand what difference the MTIP or even a specific mission has been making. Indeed, rather than driving change via one major policy instrument with clearly circumscribed boundaries, the MTIP is fundamentally an effort to alter - sometimes even very lightly - the way distinct policy initiatives complement each other in creating a coherent policy mix, geared towards supporting innovative solutions throughout a long range of development stages.

Analysist need to be aware that disentangling the relative influence of the MTIP can be a daunting task, given that it is lies in the very nature of the strategy to involve so many parts of the innovation and socio-economic systems that matter for completing a mission. **Determining what was mobilized or engaged is even only the first step, which should be followed by an assessment of how all the various structures and policies were engaged, and what this had led to**. In sum, this type of analysis requires careful deliberation of how abstract or detailed the to-be investigated mechanisms need to be.

It appears recommendable **to focus on the main orders of results and effects** listed below. Based on the first findings presented in this report, there are also already a few more specific sub-questions that have surfaced. These are included, by means of illustration of the type of dynamics and mechanisms that deserve particular attention. Several of those illustrative sub-questions have been addressed to some (minor) extent already in earlier sections. However, given that this study sets out to characterize the MTIP rather than to assess it, all of the provided reflections should be regarded as preliminary propositions that are still to be scrutinized in more depth.

- "Has the MTIP led to the emergence of governance structures suitable for aligning innovation and deployment initiatives?" This question requires a process analysis rather than an impact analysis. It is best to be answered by first defining the principles that are important for determining what suitable governance structures would look like. Relevant sub-questions:
    - Does the structure involve elements equipped for collecting information with respect to emerging innovation opportunities and mission-related problems?
    - Does the structure involve elements able to combine this information and make decisions on what directionalities to follow? How selective are the programs (e.g. MMIPs) that arise?
    - Does the structure contain well-functioning checks and balances for preventing an overly strong capture of interests?
    - …
- "Is there evidence that the MTIP is getting traction in terms of mobilizing partners?" This would concern the actual buy-in of line ministries, regional authorities, knowledge partners, etcetera. By signing the KIC, many parties already promised to devote resources to the mission.
    - To what extent have those parties listed existing budgets that are deployed relatively independently of the MTIP and MMIPS? Are there indications that different partners are truly willing to blend their budgets into a comprehensive and consistent MIP approach (e.g. as in jointly financed policy schemes like the MOOI?). Are the annual budgets increasing?
    - Do line ministries actively monitor MMIP developments, as part of a formalized policy cycle?
    - …
- "Does the 'extended' MTIP strategy (also involving initiatives from line ministries) rest on a policy mix and funding streams suitable for supporting the entire spectrum of innovation development and deployment?".
    - Is the programming of scientific research grants in line with the knowledge needed in (PPP) R&D projects concerned with particular innovations? Similarly, are innovation policies for the middle TRLs synchronized with initiatives for supporting deployment?
    - To what extent is it problematic if discrepancies exist; does it hamper continuity, and/or does it ensure critical re-evaluation of the innovation trajectories that are being pursued?
    - Are there indications (e.g. from programming and project portfolio data) that the policy mix also allows to adjust low-TRL instruments in response to bottlenecks experienced in high-TRL innovation activities?
    - …
- "Are activities by actors engaged in the 'mission-oriented innovation systems' (more) in line with the mission objectives?"
    - Are there any relevant changes in the composition of actors and collaborations found in those systems, e.g. in relation to the type of stakeholders involved?
    - Are actors showing an (enhanced) willingness to invest in mission-related topics? Note that a high interest for e.g. MMIP-related subsidy calls is especially telling if the MMIPs truly focus on mission completion rather than only driving innovation per se.
    - …
- "Are the results of innovation activities being adopted in initiatives targeted at deploying them"?
- "Are the innovations being applied, and do they actually contribute to the mission objective (rather than only 'being in line' with it)

6. Conclusions

Based on what was found in the desk research and interviews so far, at this stage the research questions introduced in section 1.2 can be answered as discussed below:

What is the current form of governance?

1. The MTIP strategy consists of installing coordination mechanisms for interlinking a wide range of agendas, networks, governance structures and policy instruments, belonging to (and targeting) both the innovation system as well as the socio-economic systems in need of transformation. The coordination mechanisms rest on a multi-layered governance configuration, wedding the pre-existing triple helix Topsector structures to the newly introduced Theme teams, MI teams and the offices (including extant TKIs) that support them.

2. The main task of this configuration is to mobilize and direct policy initiatives in order to engage highly diverse stakeholders in innovation activities corresponding with the 25 missions (belonging to 4 mission themes) that were launched by various ministries. The missions are based on extensive consultation rounds preceding implementation of the MTIP. The uncertainties arising when pursuing the ambitious, specific and time-bound goals prioritized in these missions form the basis for Knowledge and Innovation Agendas (KIAs). These have been translated into Multi-annual Mission-oriented Innovation Programs (MMIPs) now used for programming policy instruments and thereby steering innovation projects.

3. By signing the Knowledge and Innovation Covenant (KIC) 2020-2023, 30 stakeholders pledged to spend a total of almost €4.9 billion per year on executing the KIAs and MMIPs. This substantial increase with respect to earlier Topsector KICs testifies of a greater role for an increased amount of public partners, both at the national and regional level. As the amounts are merely estimates, mostly based on existing budgets, it still remains to be seen how eager the signees are to pool their resources into joint or carefully aligned initiatives.

4. In the new governance setup, the MI teams are positioned as the 'engines' for driving and aligning change-oriented activities required for completing the missions. Their support offices use their networks and capacity to obtain information from (and engage) scientists, firms, and increasingly also civil society organisations. Various checks and balances in the form of boards and committees are in place to ensure objectivity in setting directions (e.g. for writing MMIPs or programming calls).

5. Details of the chosen governance setup vary per mission; not just because of differences in the KIAs and relevant sectors and institutional landscape, but also due to variance in the style and involvement level of the ministry 'owning' a mission. Moreover, parties participating in the governance structures had some freedom in shaping the distribution of mandates and organizational arrangements. As there was no clear blueprint available, some governance structures serve as an example for missions in which actors started out later with configuring their own setup. Besides being varied and experimental, the chosen governance is also likely to be evolving over time.

Does the mission actually guide the various activities?

6. The missions themselves are relatively uncontested societal goals, and serve as reference point for all actors involved in the extensive governance structures (and beyond). However, confusion emerges due to the high number of missions sometimes being interrelated (e.g. circular construction fits in both the Built Environment and Circular Economy mission). Each mission individually might help to align stakeholders and support instruments, but complexities arise from the missions and associated governance structures (and ecosystems) occasionally overlapping each other.

7. A limitation of guidance provided by the current MTIP governance is also that the central MI teams, in as far has they have become operational, experience restrictions in asserting their mandate. This is mostly due to the mandate of the Topteams still being preserved, and due to the risk of being overruled by ministries responsible for the mission and providing essential funding. Furthermore, the MMIPs the MI teams rely on for steering research and innovations are criticized for lacking selectivity. At the same time, despite still containing many topics, these MMIPs are at least structured according to coherent solution paths also addressing commercialisation and societal acceptance. Accordingly, with the shift towards the MTIP, the MI teams' programming bodies have started to extend their attempts for also including non-technical issues in tender criteria and key performance indicators.

8. The line ministries carrying responsibility over a mission are increasingly committed (but still to very different extents) to incorporating innovation in their strategies for addressing societal challenges. For instance, The BZK and I&W ministries are not just lining up agendas on how to make use of research and experimentation, but both also deploy activities to actually support this. This also raises some tensions, e.g. when they prioritize short term gains that are at odds with supporting more promising solutions requiring more time. On the other hand, leaving the search for solutions very much in the hands of the TKIs supporting the MI teams (and the Topteams) might result in technocratic approaches focusing on uncertain innovative solutions that are still in development – and perhaps never move beyond that phase.

9. Getting buy-in from different parties is important, especially when uniting innovation and diffusion, but it goes at the cost of transparency and leadership required for setting clear directions. By acting primarily as a partner and facilitator, the line ministries with a mission are not demonstrating the leadership deemed necessary to make substantial progress. This points at a still insufficiently fulfilled demand for the government to provide clearer visions and market perspectives herself. At the moment it seems that the 'push' of new technologies remains dominant (in the pursuit of missions), while the pull for new solutions is so open that it fails to unite innovators around the MMIP pathways. Regrettably, specificity of solution directionality decreases when approaching application stages.

Do the governing arrangements offer a suitable range of instruments for researchers and innovators? Does it offer a seamless and efficient continuum of support, covering all TRLs and the investment stages, and including also supporting policies like helpful regulation and procurement?

10. The existence of the comprehensive KIC covenant does by no means guarantee that all available resources and instruments work well together. Characteristic for the MTIP is that, instead of adding more instruments to the policy mix, it focuses on coordination mechanisms allowing organizations to make better use of available instruments. This concerns in the first place several policies that have been used already, under the Topsector regime, for programming innovation agendas. Examples are calls by the National Science Foundation NWO, EZK's PPP allowance for supporting public-private R&D projects, or various energy innovation policies administered by the Topsector Energy and RVO.nl. These instruments continue to be of relevance for realizing the MMIPs by (together) offering continuity for developments on the lower side of the *technology readiness level* (TRL) spectrum.

11. An EZK-BZK policy instrument introduced originally for just the mission on the Carbon-free Built Environment is the MOOI scheme. This scheme offers relatively large subsidies for heterogenous project teams, also involving the value chain and end users relevant for an innovation trajectory. The widely praised scheme presents a way to avoid discrepancies between instruments, as it stretches over a broad range of middle to high TRLs.

12. At least in the case of the mission on the Carbon-free Built Environment, the responsible line ministry (BZK) has implemented many additional policy initiatives for ensuring the actual uptake of promising innovations. This concerns a plethora of policies and structures for either experimenting with novel solutions, or diffusing them through communication, advise, and spurring interaction between the organisations adopting innovations (e.g. constructors) and their clients (e.g. housing corporations). The policy initiatives of BZK also include substantial financial schemes (e.g. the Startmotor) for creating market perspectives, in order to kick-start experimentation and elicit further investments in innovation development and application. Moreover, recent regulatory changes require potential innovation adopters and local players to find solutions for sustainable heating of houses disconnected from the natural gas grid. This presents a clear demand for integrated and market ready solutions.

13. In sum, the MTIP effectively acts as a junction for evoking convergence in governance and support initiatives related to research, entrepreneurial experimentation, and transformative deployment activities. More detailed information on how seamless policy support really is requires consultation of the actors overseeing innovation activities moving through different development stages. In any case, it is likely that between missions variance exists for especially the higher TRLs. The Built Environment mission might perhaps be a good example for a comprehensive array of instruments, but it also risks resulting in an overly complex patchwork of initiatives.

What could be next steps for further improvement?

The five steps for further improvement that were identified in this post-commencement analysis are:

14. Streamline the governance structure by reducing the overlap between Topteams and MI teams. The current setup allows for effectively tapping into Dutch innovation capacities, but has resulted in a complex and extensive configuration of advising and guiding bodies. Reconsider (strengthen) and clarify the mandate of the MI team so that it can deliver on its objective of driving change and completing the mission.

15. Reorient the TKIs more towards missions instead of Topsectors. Make sure to leverage their capacities to engage with especially the science and industry side of solution development, but give them the position to neutrally compare and nurture development paths. Consider to either equip them to interact more intensively with also the application side of mission completion, or to complement them with counterparts overseeing such proceedings.

16. Continue the intensified involvement and perhaps leadership of problem-owning ministries. When doing so, be aware that enhancing the role of ministries might safeguard technocratic push of solutions society might dislike, but can prevent systemic and long term thinking needed to support those innovative solutions that also have economic importance.

17. Consider to experiment more with continuous support for large practice-oriented consortia, focusing on development and deployment activities (high TRLs) associated with a certain program or use context. Be sure to allow for participation of new challengers, and design procedures for terminating consortia not meeting their performance promises.

18. Extend the MOOI scheme to more missions and MMIPs. The instrument lends itself for large projects integrating partial solutions and covering commercialisation and acceptance issues.

What are the (planned) arrangements to monitor inputs, activities, outputs and impacts? What would be next steps to improve monitoring?

19. Both the policy execution agency RVO.nl and the TKI offices deploy efforts to regularly report on the progress of MMIPs. They primarily focus on the administrative data of mobilized policies, thereby shedding light on the content, development stage and participants involved in projects fitting the agendas.

20. While RVO.nl and the TKIs are increasing feedback loops and extending the range of indicators that are being tracked (also covering impact-related issues like societal acceptance), there is not much systemic monitoring of project outcomes and how they add up. Their reports thereby give insight into how innovation inputs and activities are advancing, but they provide mission owners limited perspectives on how close certain innovation pathways are to scalable solutions. Improving this crucial link requires more consistency between not just monitoring procedures of various innovation policies, but also between those policies and the many initiatives deployed (sometimes by other administrators) for supporting the uptake of solutions.

Appendix: List of interviewees

Name	Organization(s)
Blok, Kornelis	TU Delft
Bokhoven, Teun	TKI Urban Energy; NVDE
Buddenbaum, Ed	Min. EZK
Dortmans, Ardi	TNO
Heideveld, Antoine	Het Groene Brein
Kirch, Michiel	TKI Urban Energy; Univ. Groningen
Kleiboer, Jos	Metaalunie
Koch, Joost	RVO.nl
Kreiter, Rob	TKI Energie & Industrie
Kroon, Machteld de	TNO
Leede, Gerard de	Solarge; TU/e
Meijer, Emmo	Friesland Campina; TS Chemie
Nelissen, Elphi	TU/e (now Fontys)
Roos, Murk de	Min. IenW
Spijkerboer, Marieke	Min. IenW
Van den Brink, Oscar	COAST, TKI Chemie
Van der Woude, David	Min. BZK
Verbree, Richard	Inventum Technologies
Warmenhoven, Bas	Min. EZK
Wyfker, Gerard	Metaalunie
[Kick-off event KIA-CE]	[Diverse]