Collaborative governance in mission-oriented innovation policy:

Lessons learned from the German High-Tech Strategy 2025

A comparative case study of transformer missions in the German High-Tech Strategy 2025

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ABSTRACT

The 21st century is characterized by grand environmental and societal challenges, such as climate change or public health, stimulating national governments to revise their innovation policies by implementing missions. A mission is a well-defined goal that connects and enables stakeholders on the shared objective. With mission-oriented innovation policies (MOIP), policymakers attempt to intentionally generate a shared direction for innovation activities and guide various actors around a common goal. Therefore, a significant aim of MOIP is to enable cross-disciplinary collaboration by including actors of various groups of interest, such as civil society, industry, and local governments.

The following research question is addressed: "How can collaborative governance be implemented in transformer missions?" Additionally, two sub-questions are posed to address hampering and facilitating factors of collaborative governance and the differences among the missions regarding the collaboration process.

In this context, Germany has formulated twelve missions in the High-Tech Strategy 2025 (HTS) which have already been characterized. For this study, the transformer missions were analyzed because of their broad scope and complex socio-technical system that they comprehensively aim to target. A comparative case study analyzed two transformer missions, namely 'Creating sustainable circular economies' and 'Substantially reducing plastic discharged into the environment'. This aim was to better understand the MOIP processes with collaborative governance. Therefore, fifteen semi-structured interviews with stakeholders connected to the two transformer missions were conducted.

The results showed that collaborative governance in transformer missions is essential. For a better understanding, the HTS was divided into three levels: the HTS, mission, and program level. Variances among all of them were observed. While the HTS and the program levels were well structured, the mission level hardly received coordination resources. Another overall finding on mission collaboration indicated the importance of time commitment for a multi-stakeholder collaboration process. The collaborative process factors are therefore essential to maintain and not negligible.

On the basis of these findings, the following two implications are recommended. First, the formulation phase of the mission already determines crucial factors such as scope, participation, and uptake. Therefore, early inclusion of the target groups is crucial to create MOIP. Second, each mission needs coordinative governance structures to connect stakeholders – public and private – for collaboration, leading to the aimed knowledge transmission among them and consequently spurs the endeavoured innovation.

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1.INTRODUCTION

The 21st century is characterized by grand environmental and societal challenges, stimulating national governments and international organizations, such as the UN or the EU, to revise their innovation policies and strategies to tackle these challenges. Former innovation processes and policies focused primarily on technological and economic growth, whereas grand challenges of today's society, such as climate change, famine, or public health, can only be targeted by structural transformation, including societal and systemic transformation (Mazzucato, 2018a; Wanzenböck et al., 2020). Therefore, as emphasized in recent innovation policy literature, the next generation of innovation and innovation policies should support societal change towards future proof developments in the socio-economic system. Hence, the new governance model integrates and coordinates a plurality of actors within the system (Wanzenböck et al., 2020; Schot & Steinmüller, 2018; Boon & Elder, 2018).

Moreover, the complexity, interconnectedness, and urgency of today's societal challenges indicate attributes of so-called wicked problems. They can be defined as open-ended, intractable, and ill-defined, and among other features, are characterized by the impossibility of finding a one-size-fits-all strategy for policymakers to target the challenges (Rittel & Webber, 1937). Given that societal problems and grand challenges involve a highly complex environment of actors and groups of interest, current innovation policy literature considers new mission-orientated innovation policy (MOIP) approaches a new way of innovation policymaking for addressing these wicked societal problems (Mazzucato, 2018a; Mazzucato et al. 2020; Koski et al., 2018). MOIP is bringing together multiple stakeholders on a common goal to target challenges.

These scholars generally describe a mission as a well-defined goal to connect and enable stakeholders on the shared objective (Mazzucato, 2020). By implementing missions, policymakers attempt to generate a shared direction for innovation activities and guide various actors around a common goal. This shared direction, so the assumption can mobilize stakeholders and actors to search for innovative solutions to a societal problem that is of both technological and institutional nature. Compared to previous policy strategies, the advantage of its premise is that the approach is no single sector-based industrial policy but requires a system-wide transformation (Mazzucato, 2017). Therefore, a significant focus of MOIP is to enable cross-disciplinary collaboration by including actors of various groups of interest, from civil society, over private companies, to local governments to generate new and more integrated ways to target wicked problems (Schot & Steinmüller, 2018; Mazzucato, Kattel, & Ryan-Collins, 2020).

Some mission targets are more 'wicked' than others, leading Wittmann et al. (2020a) to distinguish between accelerator and transformer missions. Accelerator missions are more clearly defined and refer directly to the domains of technology or science, thus are one-directional and potentially less contested. An example of such a mission is the aim of curing cancer. On the other hand, transformer missions are

more open and broader concerning the wickedness of the addressed problems as they target systemic societal change (Wanzenböck et al., 2020). This systemic change requires a more fundamental shift in public and private organizations' behaviors and citizens. Accordingly, transformer missions need to engage various sectors, actors, and disciplines; and aim to interlink them to generate innovation that requires suitable governing and coordination (Head, 2019; Daviter, 2017).

The literature on the governance of wicked problems argues that they more likely demand a collaborative governance strategy than clear, uncontested, or less complex policy goals (Roberts, 2000; Head 2019). Collaborative governance can be defined as a process that opens boundaries to enable policymakers to integrate and engage stakeholders from different backgrounds to achieve otherwise unattainable goals (Emerson et al., 2011; Roberts, 2000). Such collaborative governance strategies are, however, less explored in a mission-oriented innovation policy context. Nevertheless, former research on collaborative governance emphasized multi-actor collaboration in fields such as fish industry or transportation economics as well as policy administration (Flye et al., 2021; Marcucci et al., 2017; Emerson et al., 2012). Therefore, it was decided to study mission-oriented innovation policies by means of collaborative governance to understand policy processes that include, e.g., decision making and stakeholder inclusion and provide deeper insights.

As missions –especially transformer missions – need interaction and integration of a comprehensive stakeholder variety (Wittmann et al., 2020a), a governance model on how to process and manage the ambitious goals collectively can be instructive. This research sees in the collaborative governance model of Ansell and Gash (2008) a good foundation for researching how societal challenges in the format of missions are being tackled in an integrative and effective way. This model has been researched before in multiple cases as it gives a firm basis on factors to consider in collaborative governance (Torfing et al., 2020; Koski et al., 2018; Torfing & Ansell, 2017). Then The model consists of two main elements. First, the so-called structural influences are external conditions that set the framework for collaboration. These factors are decided on beforehand and clarify, e.g., whom to include. Second, for the collaborative process, five factors, such as trust-building, face-to-face dialogue, and commitment, were specified that interconnectedly reinforce each other. Both elements interact with each other and designate eventual collaborative outcomes (Ansell & Gash, 2006).

Investigating current MOIP's allows for revealing uncertain and/or missing governance structures. Therefore, applying this model to an empirical case reflects realities on mission-oriented innovation policies. This view also reflects the call of various authors, who stress the need for a deeper understanding of collaborative governance and suitable governance models that can spur both innovation and societal change in the context of transformer missions (Wittmann et al., 2020a; Janssen et al., 2020; Mazzucato, 2018a; Edler & Fagerberg, 2017). Nevertheless, analyzing collaborative governance in mission-oriented innovation policies has not been investigated yet. This study addresses

these gaps and aims to gain insights into the role of collaborative governance processes for mission-oriented innovation policymaking. The following research question is subject of this research:

How can collaborative governance be implemented in transformer missions?

To answer this research question, this study first introduces the collaborative governance model of Ansell and Gash (2008) in the context of mission-oriented innovation policies. The German High-Tech Strategy 2025 serves as an empirical case to analyze the course of the strategy, processes, and how collaborative governance is already implemented. Considering that scholars already identified various types of missions in connection to the High-Tech Strategy, this research focuses on two distinct transformer missions as characterized for HTS (Wittmann et al., 2020a), namely, Type 1 (T1) and Type 2 (T2) missions. Overall, transformer missions target sweeping change of a complex system of interdependencies, multiple stakeholders, and the urge for external and internal policy coordination. T1 can be characterized as goal-oriented, while T2 missions follow a problem-oriented approach and directly address the end-consumers by targeting behavioral change. By looking through the lens of the collaborative governance model, this thesis aims to identify factors that can either facilitate or hamper mission-oriented innovation policies for the specific mission type. To guide the empirical study, two additional sub-questions are formulated:

What are facilitating and hampering factors of collaborative governance in mission-oriented innovation policies?
To what extent do T1 and T2 missions differ in the collaborative governance process with respect to the suggested collaborative governance model?

This research aims to identify best-practice approaches in collaborative processes to realize missions and mission-oriented innovation policies in the future. Analyzing how Ansell and Gash's (2008) model is applied in a mission policy context has not been done before. Therefore, this thesis aims to close this research gap and identify both weaknesses and strengths of collaborative governance thinking and the integration of different actors and sectors governing transformer missions. Thereby, this study addresses predefined possible obstacles, such as coordination of transformation, long-term orientation, and translation efforts between science and application (Wittmann et al., 2020a), to provide implications for implementation. Furthermore, the study contributes to a deeper understanding of transformer mission governance, which is of scientific relevance. Concluding, the outcomes of this thesis should provide recommendations for policymakers for future planning, implementation, and execution of mission-oriented innovation policies that aim for societal and transformative change. Moreover, this study provides societal relevance by pointing out the importance of integrating multiple stakeholders from different backgrounds in the mission-orientation processes and possibly providing an integrative approach towards sustainably addressing grand challenges and wicked problems that threaten our society.

2. THEORY

This chapter gives an overview of current scientific literature on the wickedness of societal challenges and mission-oriented innovation policies. The typology of transformer missions follows this. Then, collaborative governance as a possible governance approach to deal with wicked problems in mission-oriented innovation policies is introduced. Finally, the collaborative governance model is conceptualized, which provides the basis for a framework for this research.

2.1 The wickedness of societal challenges

Societal challenges of interconnected, complex, and urgent nature can be defined as wicked problems (Alford & Head, 2017). Rittel and Webber (1973) introduced the concept of 'wicked' problems in the context of general planning, with ten characteristics describing the nature of wicked problems: They indicate primarily complex, enduring, intractable, open-ended, and unforeseen issues (Daviter, 2017, Head & Alford, 2017). Additionally, they are regarded as ill-defined', inter-linked and intractable. (Head, 2008; Brown, 2020). Head (2008) identified situations as most wicked when neither the problem nor a solution is apparent, and additionally, multiple parties with conflicting values and interests are involved.

Addressing and counteracting such wicked problems is exceptionally difficult for policy. There is one right solution to a wicked problem, and it indicates that different actors can develop distinct solution approaches depending on their perception of the issue (Wanzenböck et al.,2020). Furthermore, scholars recognize that a 'one-size-fits-all solution does not exist because every case varies marginally (Head & Alford, 2017; Wanzenböck et al., 2020). Therefore, governments and public organizations have developed strategies that provide mainly partial or provisional responses only (Roberts, 2000; Head 2019). One of the paths introduced as a coping strategy to deal with wicked problems is the collaborative strategy (Roberts, 2000). This path enables one to join forces to accomplish more than only with one stakeholder acting independently. Here, connecting stakeholders for the policy process on the same problem can contribute to innovative solutions, as it allows for the interaction of multiple disciplines and stakeholders to achieve more impact (Søresen & Torfing, 2017). Also, mission-oriented innovation policies follow an approach where a mission addresses multiple stakeholders who work collaboratively.

2.2 Mission-oriented innovation policies

Innovation activities are fundamental for socio-economic development (Janssen, 2019). Therefore, science, technology, and innovation policies should aim at meeting social needs and therefore contribute to building up a sustainable and inclusive society for the future (Schot & Steinmüller, 2018). Since expectations and conception for innovation progress are constantly evolving, innovation policies developed and adapted in the past decades. Schot and Steinmüller (2018) defined current innovation

policies focusing on more transformative change, focusing on environmental and societal challenges instead of encouraging competition or solely targeting technological innovations. Such transformative system policies aim to bring together actors and create new cooperation connections to stimulate socio-technical system change (Boon & Edler 2018; Mazzucato 2018b; Weber & Rohrarcher, 2012).

With the increasing interest in societally more relevant and valuable innovation policies, policymakers resurrected the interest in innovation missions. Initially, missions pursued a well-defined, solely technological end goal, such as the 'man-on-the-moon mission' (Boon & Elder, 2018). However, missions can support complex societal problems by providing guidance and direction in formulating needs to reach a common goal. Therefore, missions are used in innovation policies that target societal transformation, emphasizing non-technological innovation (Fagerberg, 2018). Furthermore, they are aiming to steer innovation from a focus on quantity or rate (e.g., number of patents, jobs) towards quality and direction (e.g., whether innovations help alleviate climate change) (Kattel & Mazzucatto, 2018). Hence, a 'new' generation of mission-oriented innovation policies has been proposed as one way to better address societal challenges and transformation by policy (Mazzucato 2017, 2018a; Edler & Boon 2018; Kuhlmann & Rip 2018, Hekkert et al., 2018; Fisher et al., 2018).

Missions that target societal and environmental challenges are embedded in a complex and unstructured environment (Wanzenböck et al., 2020), which can impede progress incrementally. The characteristics of a mission are the following: First, solutions and goals of the challenges can be initially unclear, which leads to a complex operationalization of the problem at the beginning (Brown, 2020). Second, the problem's roots can often not be targeted by a single actor or even sector (Boon & Elder, 2018). Third, proposed policy tools range from regulations, research, and innovation to a fundamental transition in the socio-technical regime (Mazzucato et al., 2020). Therefore, solution paths go beyond solely technological advantages. Fourth, behavioral change with or without technological innovation is relevant for societal missions (Wanzenböck et al., 2020).

For this study, the following is proposed as the definition for societal missions. *"A societal challenge-led mission can be seen as a strategic goal that targets important societal problems and/or future societal needs, and requires the development, diffusion, and embedding of technological and/or institutional solutions to accomplish it."* (Wanzenböck et al. 2020, p.1) By focusing on a common goal, societal missions target to achieve transformative change by engaging stakeholders among various fields. Hence, mission implementation and execution does not stop at one discipline's border but asks a wide variety of sectors, actors, and organizations to meet predefined goals (Mazzucato et al., 2020). Ideally, a diverse group of interconnected actors can yield new forms of innovation. At the same time, governing diverse actors with different standpoints implies skills and effective measures in coordination.

2.3 Typology of transformer missions

For realizing a mission, a common understanding of the problem and the goal is needed. To facilitate this, a typology with categorization to detach the complexity can be helpful. An example is Wittmann et al.'s (2020a) classification on missions is based on Germany's HTS. The scholars devised a distinction for transformer missions that were analyzed in this study. Moreover, two subtypes that show further differentiations, based on characteristics such as the type of problem, solution, or the demand of governance, exist. Table 1 summarizes the similarities and differences of distinct transformer mission types based on Wittmann et al. (2020a).

Table 1: Characteristics of transformer missions based on Wittmann et al. (2020a)

	Type 1 (T1)	**Type 2 (T2)**
Type of problem	Transformational system failure	Transformational system failure
Type of solution	Transformation of system	Transformation of the system (+behavior)
Problem vs. goal-oriented	Goal-oriented	Problem-oriented
Demand for governance	High	Very high

Transformer missions are missions that aim for a fundamental systematic conversion. The authors (Wittmann et al., 2020a) distinguish between two different transformer missions categorized by their scope of reach and orientation. Generally, due to their comprehensive, transformative change intention, these missions include a wide variety of actors, levels, and disciplines. Furthermore, transformation requires a broad cohesive system change that is applied and tested on multiple levels. Consequently, higher demand for governance structures is needed to administer these transformer missions, which indicates internal and external policy coordination. (Grillitsch et al., 2019). In this context, external coordination means the interplay between public and private actors, while internal coordination targets, for instance, interministerial work culture, forms of administration, and responsibilities (Wittmann et al., 2020a). This requires a structured multi-actor governance model. Therefore, this research focuses on transformer missions and their essential governance.

2.3.1. Transformer Type 1 (T1)

Transformer Type 1 missions are characterized as goal-oriented. This means that in their mission statement, the solution is already mentioned. In the example of Wittmann et al. (2020a), the T1 missions target the goal of creating sustainable circular economies and finding new sources for new knowledge. Pivotal for a T1 is then the direction and path of implementation. However, the complex system that the transformer missions target affects actors on a broad basis that are interconnected.

Nevertheless, a T1 mission usually does not include the end consumer in their system and therefore targets a confined level of the innovation chain such as research, regulatory, and industry. Initially, the innovation is developed by a smaller group of actors and later applied to end-consumers. Additionally, an extensive cross-collaboration between fields and levels is asked, but civil society is not included. Considering these attributes, the T1 missions differ from a Type 2, and therefore, also the governance demand deviates. (Wittmann et al., 2020a).

2.3.2. Transformer Type 2 (T2)

The transformer missions Type T2 are characterized by technological and behavioral innovation complexity and are considered the most complex mission type. T2 missions do not provide one plausible solution to a complex problem but are leading to several possible pathways for solutions. However, their mission statement is also problem-orientated because no solution concept is provided. A comprehensive systematic transformation includes public and private stakeholders from various academic, industry, and regulatory backgrounds. Additionally, T2 missions directly include the consumer or civil society side to achieve behavioral change and desired uptake. That requires a fair distribution of resources as well as effective changes in existing policies. This comprehensive inclusion of multiple actors needs resources for coordination and administration. Furthermore, due to the problem-orientation, some paths taken to tackle the missions might end in deadlocks. To keep the experimentation risk still in place, effective guiding is vital to consider (Wittmann et al., 2020a).

2.3.3. Possible obstacles of transformer missions

As identified by Wittmann et al. (2020a), missions have certain obstacles or possible issues. The obstacles vary among the different mission types. However, the basis on potential issues for transformer missions is equal, but two more potential barriers were identified for transformer missions type 2. While for T1 missions, three obstacles are identified, T2 covers five. Understanding these obstacles better can facilitate an adapted implementation of the missions (Wittmann et al.,2020a). Table 2 shows the identified impediments that the possible mission's governance can take measures and counteract.

For T1 and T2 missions, ‘Coordination of transformation process and policy mix’, ‘Long-term orientation and strategic planning’, and ‘Translation efforts between different areas and from science to application’ are determined as potential issues for targeting a comprehensive system transformation. The socio-technical system is approached with the missions needs to consider a governance and coordination system that coordinates the current process for stakeholders and can untangle the mission's complexity. Long-term goals are crucial because governmental legislation periods in Germany are limited by four years, whereas the missions require more time. Identifying bridges between disciplines displays a crucial part of accelerating mission-oriented innovation processes (Wittmann et al., 2020a).

For T2 missions, 'Moderation transformation processes and changes in societal behavior' and 'Compensation of potential losers of transformation' can additionally outline barriers. Because a T2 addresses behavioral change, the missions encounter more stakeholder groups, where moderation and communication are required. Furthermore, the problem-oriented attribute of the mission type requires riskier approaches to find solutions (Wittmann et al., 2020a).

Table 2: Potential barrier and issues of transformer missions based on Wittmann et al. (2020a)

TRANSFORMER MISSIONS	
T1 & T2	**T2**
• Coordination of transformation process and policy mix • Long-term orientation and strategic planning • Translation efforts between different areas and from science to application	• Moderation transformation processes and changes in societal behavior • Compensation of potential losers of transformation

2.4. Collaborative Governance

The quest for suitable governance models is pressing, especially for the transformer type of missions (Daviter, 2017; Wittmann et al., 2020a). However, addressing such wicked problems indicates addressing a large group of different stakeholders targeted by the challenge (Alford & Head, 2017). This complexity prevails, especially when collaboration between public, private, and non-profit organizations is strived for (Ansell & Gash, 2008). On the other hand, managing wicked problems can bring forward new or different partnerships that drive innovation (Kuhlmann & Rip, 2018). Taking everything under consideration, the aimed outcome is to foster new forms of innovation paths – societal and/or technological – by stimulating and guiding interaction between disciplines, actors, and levels (Mazzucato et al., 2020).

One of the paths introduced as a coping strategy to deal with wicked problems is the collaborative strategy (Roberts, 2000). Collaboration then is understood as the merger between different parties to work together, where it is expected to have a more fruitful outcome than working in isolation (Roberts, 2000). Advantages like sharing costs, risks, and knowledge, can lead to a 'win-win' situation. Additionally, disadvantages can emerge (Roberts, 2000; Ansell et al., 2020). The process can be costly, affect the quality of deliberation and increase the risk of negotiations (Ansell et al., 2020). Hence, the adequate handling and management of the collaboration are crucial to become successful (Emerson et al., 2011).

A collaborative governance model can help facilitate collaboration and foster innovation adequately to all unique circumstances. Collaborative governance can be defined as a process that opens up boundaries of public policy decision-making to engage people of various functionalities and result in achievements that would otherwise not be accomplished (Emerson et al., 2011). At the same time, this process aims to be formal, consensus-oriented, and deliberative (Ansell & Gash, 2008). Ansell and Gash (2008) analyzed this promising governance form and introduced a model which provides a foundation for public affairs operations. It represents a framework, which illustrates the collaboration process of different actors in public policymaking. The concept has emerged as a popular alternative to conventional governance because it is deemed an effective strategy for dealing with wicked problems (Koski et al., 2018).

Various scholars have analyzed collaborative governance and connected factors in case studies (Trofing & Ansell,2017; Koski et al., 2018; Ansell et al., 2020; Douglas et al., 2020). These studies show, for instance, that collaborative governance can lead to strengthening policy leadership because politicians are commonly poorly positioned and insulated from fresh ideas (Torfing & Ansell 2017). Enhancing collaboration in policy- and decision-making can spur policy innovation (Torfing & Ansell, 2017). Moreover, representation (Koski et al., 2018) and inclusion (Ansell et al., 2020) have been highlighted as significant factors in the outcome, influencing the outcome by power structures. Others state that mission clarity is decisive for the success of collaborative governance arrangements (Bryson, Crosby, & Stone, 2015). Nonetheless, hands-on leadership, such as clear facilitation ownership of stewardship and catalyzing roles, can contribute to the success of collaborative innovation outcomes crucially (Torfing et al., 2020). The stewardship role aims to secure the process from external influences, whereas the catalyst's role helps to integrate new actors and knowledge to spur innovation while respecting risk management. However, risk aversion, political competition internally and externally, and ideological purity can impede political opportunities (Torfing & Ansell, 2017).

Therefore, the complexity of governing and coordinating wicked problems within existing policy systems should not be underestimated (Brown, 2020). Advantages and disadvantages of collaborative strategies are known, like establishing new partnerships or bringing actors to a consensus (Roberts, 2000; Torfing & Ansell, 2017; Ansell et al., 2020). However, it also bears more effort, time, and risk for actors to collaborate (Ansell et al., 2020). In order to outweigh impediments and consequently benefit from the advantages, a collaboration process needs to be defined and developed, which is the subject of this research.

Previous insights on positive and negative aspects of collaborative governance are displayed in Table 3. They motivate this thesis to gain a deeper understanding of the collaborative governance process in the context of current mission-oriented innovation policy designs. The indications of previous research in this field mainly focus on the surrounding factors of collaboration. This research focuses additionally

on the collaboration process per se and how collaborative governance can spur innovation regarding transformer missions concerning the differences of T1 and T2.

Table 3: Positive and negative aspects of collaborative governance

Collaborative governance	
Positive	Establishing new partnerships
	Bringing actors to a consensus
	Strengthening political leadership
Negative	Additional effort
	Time commitment
	Risks for actors to collaborate

2.5. Conceptual Framework

This thesis is interested in exploring differences in the governance of mission-oriented innovation policies by looking at if and how the model of collaborative governance can be applied differently, depending on the mission type. The results should give insights into how governments can address collaborative governance on mission-oriented innovation policies to formulate and implement transformer missions.

The model of Ansell and Gash (2008) focusing on collaborative governance provides the basis for this research. The model suggests upfront facilitates, which are expected to be complicated implementation processes for policymakers. Figure 1 displays the basic model, which contains structural influences on the collaborative process, such as starting conditions, leadership, institutional design, and the collaborative process itself with its reinforcing circle consisting of face-to-face dialogue, trust-building, commitment to the process, shared understanding, and intermediate outcomes. The process builds the model's heart to what is potentially crucial for the collaboration. For this research, the model is slightly adapted due to the scope of the research.

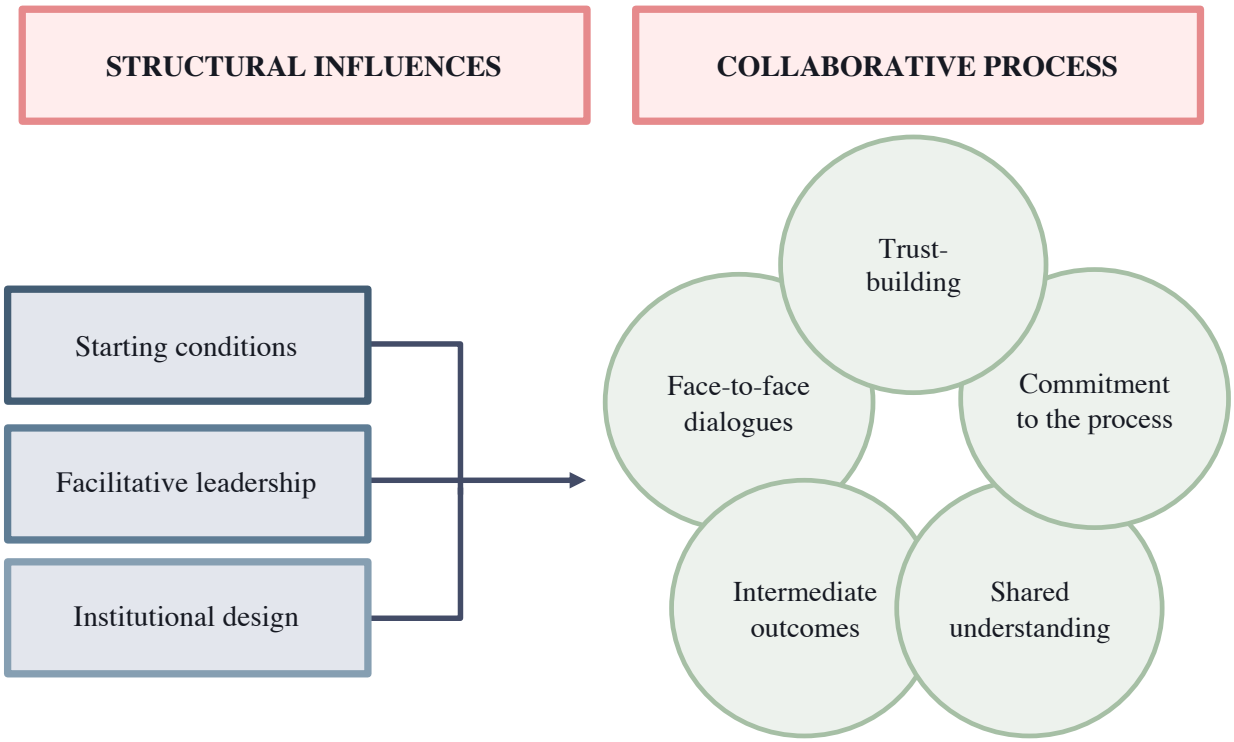

Figure 1: Collaborative Governance model based on Ansell & Gash (2008)

2.5.1. Structural influences

Starting Conditions. Before the collaboration process, power and resource imbalance and previous contacts between actors can determine upfront who participates and how the actors are being perceived. This indicates that actors who do not have the same capacities as others might be excluded or not represented equally enough (Head & Alford, 2017).

Institutional Design. Institutional design can help set an operating framework related to, e.g., basic ground rules, such as protocols and process transparency. Fixed ground rules can simplify processes and collaboration between actors, who have probably various working styles. Furthermore, deadlines can be of use but should be set realistically. (Emerson et al., 2011; Ansell et al., 2020)

Facilitative Leadership. Certain factors determine if strong leadership is necessary and the role of this leader. Regardless of collaboration being focused, but conflicts can still arise and bring up alternatives. However, suitable mediation is necessary to consolidate. (Torfing & Ansell, 2017)

2.5.2. Collaborative process

Face-to-Face Dialogue. Direct communication is an essential prerequisite that is necessary, however not sufficient. Especially tacit knowledge about innovative solutions can be transmitted face-to-face (Søresen & Torfing, 2017). Assertive communication can reinforce the benefits of the collaboration by building up trust and opening to commitment (Head & Alford, 2015)

Trust-Building. Trust is an important attribute adding to the quality of collaboration and therefore preventing manipulation, especially for antagonistic actors (Søresen & Torfing, 2017). With an enhanced feeling of trust, actors are more likely to discard their risk aversion and disclose sensitive information (Head & Alford, 2015). However, it is time-intense to establish and requires a long-term commitment.

Commitment to process. Committing implies that actors foresee a positive outcome and up-front willingness to admit to compromises that do not necessarily support the actor's position. In a public case, the government dispenses its 'ownership' of decision-making. A committed team can unite attributes needed to achieve the overall goal (Søresen & Torfing, 2017).

Shared understanding. It is essential to come to the same terms on necessary knowledge and expectations to follow the same goal. It lies within the nature of a mission to work towards a shared goal (Mazzucato & Pena, 2016). A mission's purpose is to provide a shared direction for innovation activities (Wanzenböck et al., 2020)

Intermediate Outcomes. Tangible milestones are enhancing motivation to continue with processes and can reinforce other factors. For this purpose, small wins can be considered a governance strategy, contributing to results (Termeer et al., 2015). In addition, strategic plans with realistic deadlines help with planning and incentivizing.

It is essential to conceptually understand how collaborative policymaking works to indicate if a governance model can help overcome the wickedness of problems targeted by missions and lead to successful policy implementation and innovation in the end. As multiple scholars researched upon collaborative governance, the individual factors are identified. Nevertheless, it is vital for this study to observe the factors first to then analyze if the collaborative strategy can benefit transformer missions in its implementation.

In Appendix A, all these factors were operationalized to understand the underlying concepts and investigate them based on literature.

3. METHODOLOGIES

3.1 Research Design

This study aims to understand mission-oriented processes better by analyzing them according to a collaborative governance model. Thereby, a qualitative research strategy explores how the collaborative governance processes function in the selected missions. To address the research aim, two transformer missions related to the German HTS were chosen. One was classified as a T1 mission with a goal-oriented mission strategy, and another case as a T2 obtaining problem-oriented attribute, entailing a broader scope and covering a wider variety of stakeholders (Wittmann et al., 2020a). A comparative case study was performed to analyze variances and/or similarities of governance structures within and between these missions (i.e., cases) (Yin, 2003). Since the two selected cases have been analyzed before and showed differences and similarities, in theory, a further in-depth comparison of the governance structures is fascinating. For this research, a case study was suitable for answering an explorative question by considering the context and the influences the phenomenon was situated in (Baxter & Jack, 2008). Deeper insights into the case were acquired by conducting interviewees to capture the stakeholder perceptions on policy processes. Additionally, reports and government documents were used as data sources to put the findings into context.

The thesis was based on a deductive research design, where primary data was used to test a conceptual framework (Bryman, 2012, Holloway, 1997). For this thesis, Ansell and Gash's model on collaborative governance provided the foundation for research and was further added with data collected for this research. The research process consisted of the following stages. First, the researcher gained insights and an understanding of the environment of the cases and the theory to explain a phenomenon. This was done by conducting interviews and gaining insights into governmental documents. Second, empirical data was collected and analyzed to add to existing knowledge. Finally, this method can suggest additional implications to the phenomenon.

3.2 Case selection

At the beginning of the study, the case selection has been conducted according to the following criteria. First, the research for the case selection concentrated on missions on a national level. Many governments adapted mission-oriented approaches into their innovation policies. However, their strategies vary in structure, implementation scope, and focus areas (OECD; 2020), which implicates demand for research on the federal government level. Second, the mission should already be formulated. Hence, the mission could already be analyzed in its implantation phase and when including and incentivizing all stakeholder groups is essential. Third, each mission should be characterized as a transformer mission with a high or very high demand for governance structures. In order to make them comparable on the governance

demand, one T1 and one T2 mission were selected. Following these criteria, transparency and replicability will be provided (Baxter & Jack, 2008). Finally, selected boundaries indicate the scope of the research (Baxter & Jack, 2008). Eventually, two missions of Germany's High-Tech Strategy 2025 were chosen for an in-depth comparative case study.

The High-Tech Strategy originated in 2006. At this time, it did not have the same format as it has today. Until 2018, the strategy had the goal to combine public and private activities (Kuhlman & Rip, 2019). Since then, the approach has changed to a more problem-orientated mission strategy with a high emphasis on social innovation and interdisciplinary R&D. By adapting this, new actors became involved in policy development. The strategy moved their focus from purely technological driven to including societal needs. 'Participation and transparency' became one of their core elements (Kuhlman & Rip, 2019, Federal Ministry of Education and Research (BMBF), 2019). This indicates that actors from different backgrounds and branches should be included in every further step of the strategy (Wittmann et al., 2020a). Twelve missions were formulated and implemented, whereas seven were classified as transformer missions. Of which two were transformer mission type 1 and five transformer mission type 2. For transparency in the case selection, primary research yielded that in transformer mission 'Substantially reducing plastic discharged into the environment', 'Creating sustainable circular economies 'and 'Developing safe, networked and clean mobility', a mission dialogue amongst responsible stakeholders was organized. Eventually, Circular Economy and Plastic Waste were selected according to the reasons given in the chapter before. A more in-depth description of the case follows in section 4, which elaborates further on the High-Tech Strategy (4.1) and the selected missions with their objectives (4.2 and 4.3).

- Case 1: Creating sustainable circular economies (T1)
- Case 2: Substantially reducing plastic discharged into the environment (T2)

3.3 Data collection

For this study, primary as well as secondary data were used. Primary data were generated from interviewees to understand the governance processes of the HTS, the missions, and programs that are occupied with complex challenges related to the selected mission topis. The focus, therefore, was put on the informal elements of collaboration and processes, which cannot be found in reports or formalized documents. This data was simultaneously complemented through a content analysis of policy documents. She was carrying out multiple interviews (15 in total) and using data from official documents concerning the cases secured internal validity (Leung, 2015).

Interviews

Interview partners were be identified accordingly. An interview partner is an actor who represents either an entity – public or private – or a single person or someone representing a particular group of interest that is or has been involved in a collaboration process with multiple other stakeholders from different backgrounds. For this thesis, 15 interviewees were conducted in a semi-structured way. In addition, all interview partners received a short interview guide in advance to prepare for the questions. Eventually, the researcher could reach four interviewees with a broader view on the High-Tech Strategy and the overall view on mission-orientated innovation policies. Another four interviews were connected on the plastics mission, and seven people answered questions regarding the topic of circular economy. Hence, governing complex situations with multiple views from stakeholders was one of the criteria for selecting an interview partner. The interviewees were all chosen from projects connected to the High-Tech Strategy as mentioned in the Progress report, which was released in 2019, focusing on the respected two missions (BMBF, 2019). Multiple interviewees were in a management role with an overview of the process. Interviewees were also asked to assess the current situation and how they are handling such a complex topic. For a more precise structure, this study divides the strategy into three levels: the HTS, the mission, and the program level, as further explained and elaborated in Table 5.

Initially, an already existing point of contact working for the administration office of the German High-Tech Forum was reached for further contacts and potential interview partners. Further on, a snowballing technique, where interview partners can recommend further partners, was strived for. Finally, however, most of the contacts were established by the researcher herself. Another criterion was to receive interviews associated with both selected cases to gain data on each case. Additionally, interviews with stakeholders connected to the overall strategy and the High-Tech Forum were conducted. Table 4 shows an overview of stakeholder groups that were interviewed for this study. Public stakeholders representing the group of policymakers working in the ministries were chosen because they are directly connected with the implementation of the missions or programs. Because most interview partners were found on the program level, governance processes connected to plastics and circular economy were focused. As visible in Table 4, no interviews were conducted directly on the mission level. However, interviewees gave insightful information on the mission level, which was later used for the analysis.

Table 4: Interviewees per sector and level

	HTS- HTF	Public	Projektträger	Science	industry association	**Interviewees**
HTS	2	1		1		**I1-4**
Program		3 (CE)	5 (3 CE/2 PW)	1 (PW)	2 (1 CE/1 PW)	**I 5-15**
TOTAL	**2**	**4**	**5**	**2**	**2**	

The interview guideline consisted of three parts. First, opening questions provided general information from the actor's viewpoint. Then, the structural factors of the collaborations were elaborated on further, and finally, the collaboration process was in focus. In most interviews, the latter part was the most dominant. The question guide for all interviewees followed the same structure for uniformity, but various questions were more emphasized depending on their position and expertise. Constant interview questions as guidelines ensure internal reliability and consistency (Leung, 2015). The primary interview guide can be found in Appendix B.

By carrying out multiple interviews per case and using data from official documents concerning the cases secured internal validity (Leung, 2015). Furthermore, leading semi-structured interviews with selected actors generated qualitative data. This format enabled the researcher to a deeper understanding of primarily unidentified fields by official documents (Miles & Gilbert, 2011). The interviews created room for open-ended discussions when pursuing unexpected information for a deeper understanding (Bryman, 2012). This provided the ideal basis for actors to express their perceptions.

Documents

For the documents, the following approach was chosen. First, desk research on the internet was conducted. By searching through official homepages of the ministries, the HTS, and the associated programs, documents were found. Second, a request at the portal "FragDenStaat" was filed (https://fragdenstaat.de). This initiative supports the law of freedom of wisdom in Germany and provides a platform to file requests for anyone interested in or investigating certain policy decisions. The responsible department then processed the filed issue within the BMBF. In total, 21 documents composed of research reports, policy documents were provided. The documents were used to put the findings into context.

3.4 Operationalization

In this part of the research, indicators are derived from the respected collaborative governance model to see to which extent factors of the model were present in the case studies. In advance, a clear operationalization to enhance reliability and replicability was conducted (Bryman, 2012). In Appendix A, the operationalization of the factors is displayed. The basic concepts are derived from academic literature, and further explained in the theory chapter (Ansell & Gash, 2008). The model includes structural influences with the categories' starting conditions', 'institutional design' and 'facilitative leadership' and the collaborative process including 'commitment to process', 'trust building', 'face-to-face communication', 'intermediate outcomes' and 'shared understanding' as discussed in Section 2.5 Conceptual framework.

These conceptual factors were further divided into sub-categories, for which several indicators were defined based on literature. A clear operationalization increases the external reliability and replicability of the study (Bryman, 2012). The sub-categories and indicators then built the basis for the interview questions. The interview questions derived from the indicators of the operationalization table can be found in Appendix B. The guide varied slightly among the interviewees due to different expertise, and in some interviews, more specific questions were added depending on the interviewee's experience with the HTS and missions.

3.5 Data analysis

For the data analysis, multiple steps were of importance. First, the proposed framework, structural influences factors (starting conditions, facilitative leadership, and institutional design) were analyzed based on interviewees and policy documents data. Then, the collaboration process analysis (face-to-face dialogue, trust-building, intermediate outcome, shared understanding, and commitment to process) was substantiated only on the interviewees' perception and insights. This distinction can be made because the structural influences were seen as framework conditions, which lay the basis for the process, and which are typically observable from documents as they are less open for interpretation.

The researcher conducted all interviews online via a videoconference. Then, to analyze the data, all interviews were recorded, transcribed, and eventually coded. For the two interviews which did not approve being recorded, additional notes were taken during the interview. Next, the author transcribed the interviews by herself and coded them. Therefore, data were obtained by using the coding software NVivo 12 to facilitate organizing the collected information. A coding scheme based on the operationalization was applied, which derived from theory. Such a coding scheme guarantees replicable and systemic research (Bryman, 2012). The coding scheme was applied to both cases in the same way, to make them comparable. A consistent system ensures the coding process and therefore was developed to lead to valid results. Each mission was coded separately and only compared later. Additional information that targeted the overarching HTS, e.g., the High-Tech Forum, was also analyzed according to the same codes and categories to provide equal interpretation.

During the analysis, three different levels of the High-Tech Strategy were identified for this study. This identification clarifies the different operational levels. To not confound between them, a definition of each level and which stakeholder group is involved is provided in Table 5.

Table 5: Identified levels of the HTS

Level	Description	Stakeholder groups
HTS	Level with the overarching strategic goal.	• State secretary round • High-Tech Forum • BMBF
Mission	Level of the mission coordination.	• BMBF as a facilitator role.
Program	level of programs that are all connected to one of the selected missions. The programs are all included in the progress report (BMBF; 2019)	• Projektträger • Policymakers • Program managers of industry alliances/platforms

First, the results were compared in a comparative case study using the collaborative governance framework to answer the research questions. A comparative case analysis can disclose commonalities and differences between the cases (Bryman, 2012). Furthermore, in addition to this comparison, the interpretation provided information on facilitating and hampering factors of collaborative governance structures. Thus, analysis and interpretation can provide conclusive information and insights into the processes of mission governance. Moreover, contributions to theory and practice can be indicated after this study.

4. CASE DESCRIPTION

This chapter overviews first, information into overarching HTS and its affiliated organizations is provided. Then, two in-depth case descriptions of Circular Economy and Plastic Waste follow to understand the background and the importance of targeting these wicked problems.

4.1. High-Tech Strategy (HTS):

The HTS works as an overarching umbrella strategy for the German government. Its main goal is to foster innovation to tackle grand challenges that concern Germany's innovation policies. With this aim, multiple ministries and organizations are included to achieve the formulated goals. Hence, a general overview of the strategy is essential for this study to understand its origin, its current components, and how they are governed (BMBF, 2018a).

The German High-Tech Strategy was first released in 2006 as a framework for research and innovation policies to guide the German research and innovation landscape towards joint milestones (OECD, 2020). Since then, every new legislation period of the federal government, the government adapted the strategy according to relevant topics. Since 2018 the fourth edition – High-Tech Strategy 2025 (HTS) – is in place. The HTS is an overarching strategy that aims to align research and innovation objectives of various ministries from a top-down governmental approach (OECD, 2020). This means that the strategy is directed from the federal government to the ministries. The primary responsibility for implementation lies within the federal ministry of Research and Education (BMBF), while almost all other ministries are interconnected and contribute to the selected topics, such as healthcare or mobility. Additionally, the strategy receives scientific, consultative, and administrative support (BMBF, 2019).

The initial intention of the HTS was to set a framework to promote research and innovation, which has stayed unaltered since 2006. However, the specific strategic objectives transformed from initially solely technological ambitions to a more holistic approach that addresses societal needs. First, in 2006 its intention to target 'key technologies', developed in 2018 to 'grand challenges', with integrated missions. The latest edition's main objective is to increase Germany's GDP on R&D to 3,5% (from 3,13% in 2018) by focusing on (1) tackling the grand challenges, (2) developing future competencies, and (3) establishing an open innovation and venture culture (BMBF, 2018a). By establishing an overarching strategy, the intention is to guide multiple stakeholder groups such as industries, science, civil society, and policymakers from other ministries around cross-disciplinary topics.

The HTS has set six focus areas ('grand challenges') as crucial for the future development of the German economy*: 'Health and Care', 'Sustainability, Climate Protection, and Energy', 'Mobility', 'Urban and Rural Areas', 'Safety and Security and 'Economy and work 4.0*') (BMBF, 2019). The HTS 2025 is the first edition of the High-Tech Strategy, building explicitly on a mission-oriented innovation policy

approach to address these focus areas. Twelve missions were formulated, targeting a wicked problem that can be addressed with technological and social innovation. For reaching these missions, enabling innovation through an emphasis on the participation of and collaboration amongst stakeholders is required. Therefore, the German federal government aims to integrate various stakeholders such as industry, science, and civil society (Kuhlmann & Rip, 2018, BMBF, 2018a).

This approach, especially the formulation of missions, determines direction, scope, and possible outcomes and plays an essential role in subsequently implementing them. Within formulating missions, the council of ministries structured the following criteria for determining the HTS missions' characteristics (BMBF, 2017). First, the HTS missions should require pilot projects that are not mainstream yet. Second, the objectives indicated that funding and network activities in the fields of the missions are not sufficient. However, relevant stakeholders should be reached with overarching access to data, technology, and knowledge. Third, the criteria of developing an intelligent and integrative system such as digital medicine, intelligent mobility, or circular economy) was decided on. Finally, a collaboration of actors in science, industry, and society should be necessary (BMBF, 2017). According to these standards, the missions were formulated in 2018.

The HTS missions' formulation was conducted in a political consortium of ministries without an external consultation process (I4, I3). Although multiple ministries were included in the formulation process of the missions to retain a holistic policy approach, it was solely led by policy stakeholders, such as ministers and policy experts. Only in later phases, external expert consultation was claimed for the missions. Consequently, the missions for the HTS are not uniform but differ in scope and goals. For example, while some missions focus more on technological change, such as 'Combating cancer', others emphasize a holistic system change that includes multiple dimensions of problems, like 'Preserving biological diversity' (Wittmann et al. 2020). Moreover, some missions have clear targets like 'Building up battery cell production in Germany', whereas, e.g., 'Shaping technology for the people' is an example of a broadly defined statement (BMBF, 2018a). Hence, how to pursue the set goals and enable innovation can differ among every mission. For this purpose, enabling governance structures on the missions' levels is of high importance for implementing the missions of the HTS (Wittmann et al., 2020a)

Regarding the HTS and the overarching goals of the strategy, the following bodies and actors assist in achieving the strategy's aim. First, a 'round table of state secretaries', considered as an 'intra-governmental coordination mechanism' (BMBF, 2019), meets twice a year to assure coordination with the respected ministries. As proposed by the umbrella strategy, this board aligns the direction, shape, and definition of innovation policies according to HTS focus areas.

Second, the High-Tech Forum (HTF) works as an interdisciplinary advisory council. Twenty-one high-level experts from science, various industries, and NGOs provide independent advice about further

innovational development steps for policies (I2). The HTF established smaller working rounds that focused on prescribed subtopics such as agility in the innovation sector and social innovation. Their work is published in short so-called impulse papers. The HTF also acts as an essential source of information for the state secretaries by consulting on mission orientation. Ultimately, the results of the impulse papers are presented in state secretary rounds to advise on possible developments and implementation possibilities of their findings (I1).

Third, Fraunhofer ISI (Institute for systems and innovation research), an independent research organization, set up a team of researchers to monitor and advise the strategy from a scientific perspective. Implications of the Fraunhofer ISI are explicitly directed to the HTS. By scientifically assessing the HTS missions, designated scientists assist in implementing these within the policy landscape and fulfilling formulated goals. As the HTS's missions are highly complex, the institute scientifically guides the implementation process by trying to address wicked challenges (Fraunhofer ISI, 2021). One particular task was to classify and map the missions according to external and internal coordination levels and type of problem. As a result, the typology of transformer and accelerator missions emerged (Wittmann et al. 2020).

As already indicated, this study focuses on two of the missions that require a high level of governance. Therefore, this study analyzed closely the missions of 'Creating sustainable circular economies' (CE) and 'Substantially reducing plastic discharged into the environment' (PW). Thereby, detailed descriptions of the selected cases and their backgrounds follow in the successive section.

4.2. Case 1: Creating sustainable circular economies (CE) – T1 mission

The first case of this study is the mission to create a circular economy system and enhance resource efficiency. This section gives a better understanding of the underlying grand challenge and the related wicked problems. Moreover, the complexity of this mission regarding involved stakeholders and governance structures are displayed to demonstrate the characteristics of a transformer type one mission.

According to Wittmann et al.'s (2020a) mission categorization, this represents a transformer mission type 1. By pursuing a systematic transformation, a broad range of stakeholders needs to be included and affected by the consequences. Therefore, the German government follows a broad range of programs to support this mission and target multiple areas in this complex and interwoven system. Initiatives such as targeting battery cell systems and the construction industry can all be related to circular economy or resource efficiency.

For the HTS, Sustainability, Climate Protection, and Energy are some of the main challenges that it wants to address. For future generations, resources scarcity and pollution with waste constitute a significant threat. For this purpose, one of the HTS missions aims to create sustainable circular

economies and decouple economic growth from resource consumption (Kuhlman & Rip, 2019). According to the mission statement, this is targeted by increasing the total raw material productivity to 30% by 2030 compared to 2010 (BMBF, 2018a). Material efficiency is in focus much on creating innovative business models in combination with digitalization. Eventually, this should contribute to Germany's climate goals and result *"in a significant reduction of greenhouse gases, waste, and environmental pollution and less dependence on imported raw material"* (BMBF, 2019, p.33). According to the typology, the specific goal orientation of this mission is one characteristic of a T1 mission. By targeting the goal of establishing a circular economy, the mission's direction is prescribed.

The mission aims to target national activities and contributions of science and industries to establish a resource-efficient and circular economy. The federal government and ministries support initiatives such as funding programs, policy consultation, and setting policy framework conditions to promote the objective of this mission. The following ministries are involved with programs: BMBF (Education and Research), BMU (Environment), BMWi (Economic Affairs and Energy), and BMEL (Food and Agriculture). An exciting example of the programs supporting this mission is the national strategy of ProgRess III can be mentioned. This policy initiative has been launched in the third edition in 2019 and incorporates resource efficiency with measures for various fields, such as efficiency in mobility, education for resource efficiency, and green finance. Another one is the BMBF concept of 'resource-efficient circular economy', which includes multiple measures that separate the impact focus slightly under its umbrella. Moreover, an initiative supported by the BMBF for circular economy has been established by acatech. In this consortium, a strategic consultation with various stakeholder groups such as industry, academia, and politicians has been conducted on reusing batteries and reusable packaging. Acatech presents the results to policy bodies for possible implementation (BMBF, 2019, Wittmann et al., 2020b).

Further stakeholder integration in the mission has happened indirectly through the policy programs mentioned above. Changing towards a circular economy would indicate a broad, systemic transformation of policy, science, industry, and civil society. Specific stakeholder inclusion, such as mandatory industry participation in some funding programs, shows the primary target group (I9). The goals formulations in the mission mainly target industry and research, whereas the consumer behavioral side is not directly addressed (BMBF, 2018a). This reduction in the scope towards a more technical identifies this mission as a T1 and not T2 type (Wittmann et al. 2020a). Nevertheless, one program stood out by actively including civil society in their decision-making process, which was ProgRess III by the federal ministry of environment (BMU) (BMBF, 2019).

4.3. Case 2: Substantially reducing plastic discharged into the environment (PW)– T2 mission

The second case of this research is targeting plastic waste in the environment. By being categorized as a transformer type 2 mission, this mission targets a systematic transformation including behavioral change of stakeholders all along the value chain (Wittmann et al. 2020a). Germany has set various goals on decreasing plastic litter in a systematic way. Multiple fields, such as academia and industries, within diverse disciplines are occupied in finding solutions for reducing litter, finding substitutes, developing a fundamental rethink in society, and cleaning polluted areas are challenged with this topic. The roots of the plastic intake problem need to be seen more holistically. Therefore, it is of high importance to unite knowledge and insights on the impacts of plastics (BMBF, 2018a; BMBF, 2018b).

To tackle this wicked problem, this mission follows various objectives to identify significant points of discharge and find strategies to reduce and avoid discharge. To achieve this, policymakers aim to incentivize development towards ecological friendly replacements for plastics, such as bio-based raw materials. The mission should enhance improvements in the biodegradability of certain plastics. Additionally, it should raise awareness in a broader population and educate on plastic pollution from the bottom-up. Interestingly, one of the aims mentioned is to improve circular economy (including recycling-friendly design, development of new recycling technologies and processes, high-quality recycling products) (BMBF, 2018a). Technological, as well as broad behavioral system change, is expected for modification of the current problem.

Therefore, the HTS builds mainly upon the BMBF program of ‘plastics in the environment’ that promotes initiatives that avoid plastics intake. The program was already developed before the mission was formulated. Nonetheless, the program focuses on a holistic approach by integrating various stakeholder groups and looking beyond contamination. This program approaches ‘green economy’, ‘consumerism’, ‘recycling’ and ‘water systems’ (BMBF, 2018b). Therefore, an integrated strategy for multiple areas across the value chain. In Germany, this topic is addressed in programs of six ministries (BMBF (Education and Research), BMU (Environment), BMEL Eco (Food and Agriculture), BMJV (Justice and Consumer Protection), BMWi (Economic Affairs and Energy), BMZ (Economic Cooperation and Development)) (BMBF, 2018a). Within those, an intricate system of multiple stakeholder groups, such as research, end-customers, industry, regulatory and further, is targeted to change processes and behaviors.

Following these critical issues and the broad scope, the PW mission can be classified as a case of a transformer mission type 2 (Wittmann et al., 2020a). Another indicator that can be detected is the problem orientation of this mission. Because the focus is on reducing plastic waste, it highlights the focused problem but cannot provide directionally towards an immediate solution.

5. RESULTS

Chapter 5 describes the results of this study, which are analyzed based on Ansel and Gash's (2008) model on collaborative governance and is divided into two parts. First, the structural influences of the missions are touched upon, followed by the collaboration process with a focus on the selected T1 and T2 missions. The results are drawn from the interviewees' insights concerning the HTS in general, 'Circular Economy' or 'Plastic Waste'.

5.1. Structural influences

The structural influences are the factors that set the framework for collaboration and are decided on before the collaborative process. In this chapter, the structural influences represent starting conditions, facilitative leadership, and institutional design. The structural influences are divided into three levels within these categories to identify and structure the different findings better. Therefore, the HTS, the mission, and the program levels are presented. At the end of each chapter, the results representing a collaborative governance category are summarized in a table.

5.1.1. Starting conditions

The HTS, the mission, and the program levels were analyzed according to the categories of power and resources imbalances, incentives and constraints for participation, and prehistory of cooperation or conflict. Results concerning starting conditions are targeted in the following chapter. Table 6 displays all the main results at the end of this sub-chapter.

<u>HTS level</u>

In the initial phase of the HTS, the strategy remained under mainly policy influences, and stakeholder inclusion cannot be found. Limited time and a limited number of people were dedicated to a holistic understanding of innovation and missions. When policymakers drew up the strategy, external experts were excluded from this process. Therefore, the strategy's missions and goals are derived solely from a ministry council (I2, I3). *"It was the case that we defined them on the government side first, i.e., without the involvement of external parties in this phase, and this must, of course, be recorded and certainly also discussed and evaluated as to whether it is good or bad."* (I3). In this formulation phase, the strategic orientation of the missions and, eventually, the direction for aimed results were decided. This study shows that the inclusion and collaboration of other stakeholder groups in the initial phase of the HTS development were missing. Therefore, solely policy decision-making power was detected in the primary phase of outlining the strategy.

However, over time different institutes supported the strategy. The HTF, scientific analysis by Fraunhofer ISI, the state secretary round and an administrative office, worked on and with the HTS. All the institutions represented multiple stakeholder groups, and therefore the strategy profited from a more holistic and inclusive approach. As the HTF is one of the central bodies on this level, the consortium represents stakeholders from various backgrounds, private and public. Furthermore, according to one member, no stakeholder group was overrepresented in this consortium. *"There was also no dominant group, who could somehow dominate the discourse, but always in such a way that we had perhaps one representative from a certain group." (I1)*. Therefore, conditions for collaboration on further neutral ground were established. For the HTF, participation in this consortium remained unremunerated, and the main incentive to participate was to collaborate in a high-level consortium and indirectly advise the German government.

Mission level

One level below, the missions are characterized by policy implementation through various ministries. Therefore, the results show that the German federal ministry has a strong hierarchical structure outlined in multiple organigrams of individual ministries and is strongly emphasized by interview partners (I2, I3, I4). "*So it was more like that that the others felt it was fishing in foreign waters" (I11)*. Nevertheless, the missions aimed to spread over multiple ministries or even departments of ministries with their goals (I3). However, results on this mission level show that the operative responsibilities of experts are well structured and influenced by the hierarchical system around them. Therefore, the system builds up barriers for policy advisors to communicate across one department and outside to another ministry (I11, I3, I4, I12). Findings display that, for those cross-sectoral challenges, hardly any cross-sectoral policy structures exist (I2). *"If at some point you realize that it would be good for the missions for this or that activity, to act across ministries and thereby, then perhaps that is also no longer a free space for them at that point." (I3)* With the missions' aim of combining several ministries in working together on societal pressing topics, current structures can be seen as constraints for collaboration.

According to HTS's intention, the inclusion of many different stakeholders, public and private, should spur new collaborations and innovation (I1, I3, I4). Even though the strategy was laid out with an overarching top-down commitment from the federal government and the aim to collaborate between ministries, labor and tasks were still strictly divided on an operational level following the resort principle (I3). *"You must say that they have a certain competence and responsibilities because normally they always work in this hierarchy, everything across is really difficult" (I3)*. This means that competencies and responsibilities are strictly divided among the ministries. Moreover, incentives to break apart those well-established habits have not been found on this level. Consequently, ministries did not feel responsible for contributing to a strategy because that responsibility lies within another ministry. Eventually, constraints on shared accountability hampered participation.

In order to counteract, on the mission level, attempts for incentivizing stakeholders for participation, including policymakers from various ministries, so-called mission dialogues have been carried out. For three out of twelve missions, a conference was organized by the independent HTF organization (I4, I11). However, these meetings were only organized once and hardly had any immediate success or implementation was surveilled. For some participants, the direct aim of the meeting was also not precise. *"We did not know what was actually expected." (I11).*

Referring to the starting conditions on the mission level, resource imbalance could be detected regarding allocating financial resources. While the overarching level of the strategy was supported with monetary resources, the mission coordination did not receive additional resources for governing the missions and the underlying programs. Additional budget for missions' implementation from ministries was not released. *"We never had a budget for the high-tech strategy. We never had a budget for the missions, but neither did we before." (I3).* Consequently, ministries referred to their running programs rather than a joint appearance within the HTS or a specific mission. All programs were either established earlier, within the individual ministries' boundaries or only later connected to the HTS mission goals. Policy advisors from the BMBF went 'hunting' for present and planned projects that suited the missions (I3l).

Program level

Lastly, on the program level, implementation lies within the responsibility of each ministry that leads its programs. For the vast majority, these programs are funding projects conducted according to the criteria and frameworks of the responsible ministry. Furthermore, the execution is often conducted by the same independent program managers, so-called 'Projektträger'. This continuous work is based on high-quality collaborations for many years (I9, I11, I12). Some funding programs assume to include industry in each project as an exclusion criterion if not fulfilled. Those could get coevally neglected by prioritizing industry, mobilization, and no active integration of other stakeholder groups (I4). Depending on the topics of the programs, the participation incentives differ in each program (I9). Direct citizen's inclusion was only found in the 'ProgRess III' strategy, connected to CE (I6, I7). In general, the participation conditions among the programs vary widely, and no standardized inclusion policy is existing.

Table 6 Observations on starting conditions

Factor	Observation
Starting conditions	
Power and resources imbalances	**HTS level:** Influenced by political stakeholders, no external (public or private) actors involved in mission formulation
	Mission level: Decision-making power at the policy level, external stakeholders have limited influence on mission implementation

	Program level: Industry bias; focus on supporting societal actors (e.g., NGOs, academia, citizens) limited
Incentives and constraints for participation	**HTS level:** Inter-ministerial group of state secretaries formed to coordinate at a high policy level
	Mission level: Resort principle leading, limited incentives to coordinate
	Program level: Coordination guided by topics and driven by individual actors
Prehistory of cooperation or conflict	**HTS level**: No data
	Mission level: Rivalry of recognition amongst the ministries, historical interests provide discrepancies
	Program level: Continuous work with high-quality 'Projektträger'

5.1.2. Facilitative leadership

Leadership builds the foundation for essential factors in the collaborative process, such as trust, dialogues, exploring mutual benefits, and maintaining initial ground rules (Ansell & Gash, 2008). This chapter elaborates on the bodies that took over leadership roles on HTS, mission, and program level and how they facilitated collaboration processes. Those results are displayed in Table 7.

HTS level

As the study shows, on the HTS level, an administrative office facilitating and preparing meetings, workshops and publications were established to guide the HTS's goals. This coordinating body contributed to the overarching strategy. By aligning the HTF with the state secretary rounds, this administrative facilitator provided continuity and guidance for all participants (I1, I2). Through the organization and regularity of meetings, the participants felt connected. *"The HTF is also characterized by the fact that they choose a somewhat more participatory and open approach." (I2)*. Also, they encouraged everyone to contribute. *"So, there was no one who actually just sat there silently." (I1).*

Mission level

Additionally, this administrative body contributed to the missions' development by organizing the mission dialogues on the mission level to spur the mission's implementation and connect stakeholders. Eventually, this committee organized three mission dialogues with multiple stakeholders to evaluate the mission and encourage a more integrated collaboration.

However, direct facilitation beyond the mission dialogue has not been detected on a mission level. The liability of the missions is positioned within the BMBF. For the coordination of the missions, no separate budget for facilitating every mission was provided (I3). "*Then you need the capacities for it and then*

you also need your own budget." (I3). Aligning the policymakers on a mission, however, requires more facilitation. *"It is only important to me that the capacities are increased." (I3)*. The collaboration between ministries was found to be insufficient to build up a collaborative mission. Possible antagonism between ministries, that was detected due to historical development (I4) or hierarchical structures (I7, I11, I12), prevented to find common ground in complex missions and hindered a possible win-win situation for every participant on the mission level.

Program level

Nevertheless, on the program level, the execution of the programs is often conducted by independent organizations with experts, 'Projektträger', who are trusted with performing the guidance and moderation of policy programs. *"We are neutral moderators who have this neutral platform, the convening power, so to speak, to bring together the different actors and to guarantee that these processes are managed neutrally and transparently by us." (I8)*. Other interviewees reported how stakeholders used the opportunity to collaborate. *"Yes, so there are several possibilities, so there are also project meetings (…) We cannot force anyone to take part, but they participated very well." (I9)*. Moreover, policy collaboration between ministries and Projektträger is often reoccurring after a successful collaboration with those organizations (I11). This shows that former collaboration with them provides an initial trust level and affirms further collaboration (I11, I9, I12).

Table 7: Observations on Facilitative leadership

Factor	Observations
Facilitative leadership	**HTS level:** Well organized and professional Administration of HTF with support to HTS bodies
	Mission level: BMBF as the leading facilitator but limited impact due to resort principle leading, missing resources to coordinate
	Program level: Often, 'Projektträger' provide facilitation of programs with expertise and

5.1.3. Institutional design

In the following sub-chapter, the results of the institutional design are displayed. This consists of the factors Clear ground rules and process transparency which are then presented in Table 8. Following institutional design factors can encourage stakeholders to engage in a good-faith collaboration (Ansell & Gash, 2008)

HTS level

According to the highest level of analysis in this study, the HTS level, a straightforward design for collaboration was found in responsible organizations, such as the administrative office, the state secretary round, and the HTF. The administrator office that functioned in guiding the strategy also established working rules (I2). The strategy was structured by frameworks with regular meetings. Moreover, responsibilities and accordingly agendas were specified on this level. As an example, the HTF, as a consulting body of the HTS, was regularly meeting within the consortium to provide input for the ministerial state secretary rounds. Thereby they were preparing and eventually publishing policy impulse papers. This structured design of collaboration contributed to fulfilling the HTF's purpose (I1, I2).

Moreover, regarding ground rules, a set timeframe was indirectly provided for the overarching strategy and consequently also for the mission level because they were limited to the legislation period. This strict time restriction narrowed the impact of the work automatically (I12). Especially with the complexity of grand challenges, tackling them goes far beyond the duration of a legislation period (I4). *"If we now speak of a legislative period that short-term thinking has a lot to do with the fact of listening and understanding the reality." (I4)*. Furthermore, since the strategy was limited until 2021, it is uncertain how the HTS and the associated missions continue.

Mission level

However, on the mission level, the analysis shows implementation omissions. Explicit ground rules can determine the collaboration process, especially when many organizations and people encounter a cross-actor collaboration. "The core issue with this interdepartmental cooperation is, of course, an original problem of how politics is organized, not only in Germany but in general." (I4) Because the overarching strategy spreads over multiple ministries and organizations different expectations and working methods are met. However, these differences were not solved beforehand and remained throughout the duration of the HTS. *"They have to build bridges within their own departments and to the external partners. And yes, there were some really practical difficulties in the implementation." (I3)*

Program level

Furthermore, results displayed that building connections between the missions and the associated programs were often missing. Some programs did not know that they counted as part of the HTS. Even though they were mentioned in the HTS Progress Report (BMBF, 2019), they were not informed of their contribution (I13, I15). Others then again saw a lack of active communication with responsible programs. Furthermore, homepages were not kept up to date (I5). Another interviewee considers the interconnectedness of each program to the missions as evident but could not detect their program's direct input (I9). Transparency of mission implementation with the regarded programs was therefore neglected.

Table 8: Observations on Institutional design

Factor	Observation
Institutional Design	
Clear ground rules	**HTS level**: Administrative and structured working procedures of regular meetings and defined deadlines, overarching time limit due to link to legislation period
	Mission level: No standard defined ground rules
	Program level: Each program with different ground rules, depending on program type and ministry/resort
Process transparency	**HTS level**: HTF publications available and transparent
	Mission level: Influenced by policy stakeholders, no external (public or private) actors involved in mission formulation
	Program level: Program guidelines and resort frameworks available

5.2. Collaborative process

In the framework, the factors – face-to-face dialogue, trust-building, commitment to the process, intermediate outcome, and shared understanding – are not static, nor can they be seen alone. Within the collaborative process, the factors are interconnected and reinforcing each other. Hence, they act complementary and cannot only be seen individually for collaboration. The following chapter shows the findings for both missions and compares the collaborative process and significant divergences where it is possible. The level of analysis in this section is based on program and mission level and aims to be generalized and then transferred to mission level governance activities. Here, the HTS level is not included because not enough data was collected providing relevant results that show generalizable outcomes.

5.2.1. Face-to-face dialogue

Communication sets the basis for other factors within the collaborative process. Therefore, interviewees from both cases confirm that face-to-face dialogues among participants in a collaborative process are necessary (Ansell & Gash, 2008). The following findings show criteria for establishing open and personal communication culture, summarized at the end of the chapter in Table 9.

Mission level

In both cases on the mission level, a direct face-to-face dialogue where exchange and knowledge transmission among the initiatives and stakeholders can connect each mission regularly was not found.

One of the primary goals to be reached by HTS and the mission-oriented approach was to transfer knowledge between stakeholders by establishing horizontal communication among programs. "*I think that these hierarchical structures can be a real hindrance …, it is much more conducive and successful if you can actually discuss the matter at hand with the people" (I11)*. However, hierarchical structures and disagreements on areas of responsibility are currently hindering open communication (I11). In the PW case, an interviewee stressed that "it was helpful but *after the mission dialogue… Wir wussten auch häufig nicht, was eigentlich erwartet wird."* (I11). Especially in ministerial settings, interviewees stressed that information gets lost in the vertical system (I11, I12, I6). Furthermore, vertical collaboration is not usual in the ministerial departments that are connected to the HTS.

Program level

First, in both cases, time was mentioned as one of the most relevant elements for establishing a proper communication foundation (I10, I11, I12, I13). In collaboration on complex topics, one interviewee stressed out that *"the first 2 to 3 meetings are in any case also there simply to provide orientation"*. (I8). This established a first relationship basis to build a strong collaboration upon. Moreover, face-to-face dialogues were improved by sharing time commitment to the collaboration process. *"You might also have to invest a few more sessions to simply meet them and that ultimately also in person -ultimately it always depends on people." (I12)*. Having a personal meeting usually takes more time, which actors need to commit. Hence, for establishing a communication basis, participants need to commit their time to the process.

Second, personalized messages and conversations are significant for a multi-actor collaboration. It can benefit in the long term to directly contact other participants, as this interviewee stresses. One interviewee brought up the example of the impact of her calling colleagues regarding the project rather than sending them an e-mail by saying, *"the frustration and anger you save yourself by talking more and not just writing an email to everyone is worth it." (I12)*. Another one emphasized the initial phase of a collaboration where the first workshops are about a cautious approach without specific goals but a dialogue and talks among all stakeholders (I8). This phase of getting to know other actors and their interests can be essential to identify points where they share the same opinion. Furthermore, the individual component was emphasized by indicating, *"you do need a bit of contact also beyond the very strict work context, then it actually works"* (I11). In general, organizing in-person meetings or workshops influences the atmosphere for further meetings and enhances the willingness to collaborate.

Controversially, a face-to-face dialogue can also be misused and backfire when for example, participants feel overruled in a conversation. This could indicate a refusal for further collaboration because no benefit from one party is seen. Collaboration dialogues should therefore be guided and prepared (I2, I7, I8). Thereby, similar knowledge on a topic and discussion skills are of high importance. With the example of having an association's representative and citizens in a discussion, one employee pointed out that

"they are working on two different levels, while the association represents compromises, the citizen has his or her freedom of speech" (I7). This argument can reinforce the concept of facilitative leadership and the starting conditions on power and resource imbalance.

The dialogue focuses on stakeholders from more and different fields in programs connected to the PW mission. By setting up the original strategy on plastics in the environment, the goal was to build a holistic approach and find an end-of-pipe solution. Therefore, the complexity of dialogues lies within the scope of the mission because the material plastic has its positive and negative sides. *"So, I think plastics in the health system. In many respects it is certainly not so wrong. But if you look at the food sector and the packaging sector, I would say that it is certainly important to rethink how we actually want to consume."* (I13). Nevertheless, plastic waste in the environment possesses considerable media coverage, partly because it is regarded as a visible problem (I13). "*when you see all these littered beaches, that is of course simply different from the invisible consequences of climate change." (I13)*. Therefore, addressing civil society for contribution and participation is facilitated.

On the program level in Circular Economy, the dominance of industry involvement overshadows the inclusion of other stakeholders in the overall process and the dialogue part. Multiple interviewees mentioned that the alignment with industry is of high importance (I8, I9, I13), which is why communication is facilitated because they know each other (I14). "*This approach of wanting to work on concrete products and with this strong industry focus, which we all have shared." (I8)*. However, the program ProgRess III actively invited civil society for dialogues on that strategy (I6, I7). It showed that participants had difficulties directly identifying some topics in the strategy paper because of its strong industry focus. Only after understanding some challenges, interest and enthusiasm for resource efficiency arose (I6, I7).

Conclusion

In general, the factor face-to-face dialogues showed significant results. Unfortunately, only one face-to-face dialogue was found for each case on the mission level. However, the participating interviewees mentioned the positive potential of communication with other stakeholders on the mission's goals. Nevertheless, findings in a multi-stakeholder setting showed, time commitment and direct and personalized messages essentially contribute to collaboration.

Table 9: Observations on Face-to-face dialogue

Factor	Observation
Face-to-face dialogue	**Mission level:** resort principle inhibiting interministerial communication, each ministry and department have different protocols
	Program level: time commitment for collaboration, personalized and direct messages, preparation before the process (finding a common language), guidance, equal distribution of actor groups • **CE**: Industries in focus – being profitable, industry community exchange, identification after comprehending a system • **P:** Communication depending on each branch – medicine vs. retail, media coverage of the topic enhances communication

5.2.2. Trust building

Another essential criterion for collaborative governance in the missions is trust-building, which can be established in various ways. Observations in this chapter only refer to program-level since no data could be found on mission level on this factor. The findings are summarized in Table 10.

Program level

Some participants in programs share information as soon as they feel it is beneficial for them, and then they are open to disclosing it (I5, I8, I9). *"We cannot force anyone to take part, but they actually participated very well" (I9)*. This was experienced by participants, for instance, in the CE mission. In funding programs that promote innovative business models, sharing information in a protected environment with like-minded people, like other entrepreneurs who face similar challenges, will evoke trust (I9). People can openly talk about their barriers when they feel that others can mutually help each other. Only by sharing information others can empathize and potentially contribute with guidance (I9). Indeed, an open and transparent exchange of what other group members are working on was mentioned to enhance trust (I13).

For processes where stakeholders already established antagonism in advance, this factor is of even higher importance. In general, building up a trust for collaboration requires time and resources, which also can be consolidated through communication exchange (I8, I10). *"This joint I mean that which is of course already madness, what this swallow up for capacities, so this whole building of trust and this rather once more often." (I8)*. A common ground should be established before collaboration starts (I2).

"From my point of view, it requires trust, and this, in turn, needs time to grow." (I10). Therefore, time to build up this initial trust should be provided.

Trust can also be reached with the size of working groups. Interviewees endorse that smaller group sizes help speak openly (I6, I7, I8, I9, I13, I14). Perceptions of appropriate group size varied from eight (I7) to max. 25 brings people to participate actively and share (I8). For specific preparations, groups can also be divided into smaller focus groups. *"You would actually have sub-groups with a focus, and in my opinion, they should already be balanced, so science provides the facts and basics." (I11)*. Integrating civil society, groups of six to eight people meet at one table to discuss the proposed challenges (I6, I7).

Another way is to integrate a neutral moderator in the discussion (I9, I2). First, a moderator can help to listen to all participants without losing focus on the topic (I2, I9*). "That good moderation, i.e., creating a sensitive setting, actually gives people a protected space." (I2)*. As the interviewee pointed out, in a protected space, trust among the stakeholders can be established. Second, a facilitator who does not represent one side can make stakeholders find the least common denominator (I2). Hence, the alleged participants to be of weaker representation skills do not feel overruled (I8). Otherwise, overruling can lead to mistrust, which is one of the critical barriers to collaboration.

In the case of programs connected to CE, discussions among actors were hedged with a legal contract that entails a non-disclosure agreement to provide a secure setting to discuss freely (I5, I8, I10). Sometimes those contracts are even required by, e.g., competition law when actors meet that stand in competition against each other (I10). In this setting, it should be prevented that stakeholders copy each other or form illegal arrangements. However, collaboration with groups of one stakeholder group, especially technical innovation, can be sparked. (I8, I9). Hence, building up trust in the competing industry sector and recognizing the interdependency of all actors integrated within the supply chain is crucial (I9). A regulative, such as a binding contract, can be the initial impulse that conveys trust. "The projects internally also have confidentiality agreements, of course, but we have now worked across projects, there is no such thing, but you have to say, it is still spoken about relatively openly" (I10). This shows that initially, contracts can help to build up the trust needed for further collaboration.

In general, interviewees on the program level provided multiple insights on the importance of trust in multi-stakeholder collaboration. By providing small groups and a neutral moderator, it facilitates establish trust among the participating stakeholders. For more delicate topics connected to, e.g., competition among the stakeholders, legal contracts can provide a basis to build upon.

Table 10: Observations on Trust building

Factor	Observation
Trust Building	**Mission level:** no data was found
	Program level: small groups, neutral moderator for focus and not neglecting anyone, process transparency • **CE:** Legal contracts; stakeholders in industries are competitors, learning from each other, understanding the interdependency – long supply chain • **P:** Understand what the others are doing – holistic approach, not all plastics are harmful, not pointing the finger at one industry

5.2.3. Intermediate outcomes

Intermediate outcomes, such as interim reports, temporary results, and significant milestones, are part of a collaboration that can create a vital momentum to engage the working group (Ansell & Gash, 2008). Sharing and showing progress within a group or even publicly can enhance commitment and create thought-provoking impulses (I1, I7). Observations on this factor are collectively displayed in Table 11.

Mission level

On the mission level, especially the formulation phase was targeted not to show any interim outcomes before determining the missions. The learnings show that the missions' top-down formulation did not include multiple stakeholders to roll out strategic goals. Furthermore, by not including them, they do not feel addressed with the missions' goals (I3, I2, I11). Also, the missions technically differed in scope and orientation, which resulted in the highly complex categorization to facilitate the implementation of the missions (I4). Because of the selection on the topics, stakeholders – public and private – were not included any ownership to the missions built-up (I5, I11). "*Of course, agreeing on concrete reduction targets is always a huge issue, but people have recognized the added value of getting involved in such processes in order to at least help shape all the targets, interim targets, etc. and measures, and I think that is the crucial point." (I3)* Pointing out this reinforces the importance of integrating multiple stakeholders from the first phase onwards to facilitate then reaching goals.

Nevertheless, interim results were published in a progress report in 2019 (BMBF, 2019). A strategic plan was to promote knowledge transfer among stakeholders. While the progress of each program was published by the BMBF (BMBF, 2019), connections amongst the programs were not shared collaboratively. While this was the intention stated publicly to engage in mission-orientation, the results

were not beneficial amongst other programs in other ministries, or resorts and joint learning activities did not occur as strived for (I3).

Program level

On the program level, according to one interviewee, it was essential for the CE mission to break down the overarching goal into more tangible clusters that actors feel responsible for, such as the mineral industry and construction (I9). In this mission, a high industry focus is already present. Consequently, sharing the topics addresses more specific stakeholders with a narrowed scope. Importantly, this separation is on the basis of expert discussions ensures legitimacy for each topic. *"The result of the expert discussions, so to speak, and this is now being successively implemented with separated funding announcements." (I9)*. However, these programs prepare for more concrete outcomes, which later can provide a better understanding of specific technologies and business models. *"Otherwise, many good ideas will be lost." (I9)*.

Whereas in other programs, interviewees urged for a joint co-creation of shaping goals, interim objectives, and measures with integrating stakeholders from the start onwards (I3, I5, I8). One program was co-created by multiple stakeholder groups, which created a feeling of belonging and ownership to them (I5). The highest achievement to the interviewee was to hear stakeholders call it 'their' program (I5). *"The involvement of the target group, yes. Yes, that is totally important" (I5)*. Thereby implementation facilitation and take-up were created for all stakeholders involved. Results showed that a joint setup of intermediate goals could pave to way for systematic transformation.

Conclusion

In brief, interim outcomes are as crucial as attainable goals for all groups of stakeholders, private and public, to narrow down the scope of wicked problems. Interestingly, the goal of the plastic mission is creating a circular economy, which could reinforce the circular economy mission. Nevertheless, other goals are additionally connected to that mission. This overlap was already seen when formulating the missions (BMBF, 2017). Regardless, no direct collaboration amongst the missions could be detected or stood out. However, interviewees working in this field recognized the connection of topics, which was perceived as beneficial if they would have been interconnected (I13, I15). While both missions primarily build upon existing goals, the amendment of concrete goals was requested (I11, I15).

Table 11: Observations on Intermediate outcome

Factor	Observation
Intermediate Outcome	**Mission level:** recognition of program outcomes in progress report amendment of concrete goals important
	Program level: regular progress meetings, creating thought-provoking impulses, small wins (communicate and present, implementing innovative solutions), **CE:** niche innovations **P:** One 'solution' is CE

5.2.4. Commitment to process

This factor shows the motivation of participants to contribute to a collaborative process. The overall findings of this factor are displayed in Table 12. Beforehand, all participating stakeholders should be aware of their power and role and commit to a possible shift from their initial targeted idea. (Ansell & Gash, 2006).

Mission level

Particularly due to the broad scope of transformer missions, targeting the entire socio-economic background, *recognition of interdependency* was stressed out by interviewees of both missions necessary. *"Everyone has to contribute" (I14). "So, I think, and this has become really clear to us in this plastic issue one more time, it only works if everyone goes along with it."* (I13). Due to the complexity of the missions, stakeholders from multiple backgrounds such as politics, civil society, industry, and science are essential for a systematic transformation. In academia, e.g., increased importance is put on inter- and transdisciplinary research to find synergies between disciplines (I13). Likewise, ministries can align their agendas to be able to incentivize stakeholders to contribute. Mainly the industry was targeted in this context. *"Without industry, it will not work"* (I9). Moreover, interviewees stress that this recognition of interdependency should come from different sides, both bottom-up and top-down (I1, I3, I13).

Results on the mission level show that policy actors from other ministries than the BMBF did not feel shared ownership regarding the missions. However, they contributed with their individual programs to the missions, but collaboration among the missions on the operative level was not found. Nevertheless, interviewees pointed out the importance of commitment when working on an overarching mission that targets multiple actors and programs. Therefore, creating space for exploring and opportunities can

provide collaborative strategies and open new perspectives (I13). Another interviewee noticed that knowledgeable people are present (I11) and willing to contribute, but only new approaches among ministries could connect them. Therefore, the mission level shows strong potential for further mission implementation.

Program level

First, the circumstance of a collaboration should be openly communicated to make people understand their significant part within the process (I11). This can either be executed by neutral moderators or administrators (I8, I15). However, the results show that the motivation to collaborate should be determined first from all addressed stakeholders (I8, I15). *"I think this goal is clear, it must be clear that we know that we are now working together towards it and that we have a common basic understanding as a group, and then this next step is like this." (I8)* Therefore, their acknowledgment of being part of the challenge is crucial (I5). Without this commitment, openness and willingness for change will not be given (I5, I9). One interviewee pointed out the consensus principle, which indicates that everyone participating commits to the process openly. *"So, these are already consensus processes in the sense, …, that already has to be there from the start, otherwise of course one has no basis for cooperation, that is clear." (I8)*. This commitment to a process is crucial, especially with substantial transformation processes, because it can potentially disadvantage some stakeholders while others will benefit from the change. Accordingly, collaboration with convinced stakeholders brings further successful collaborations.

For the purpose of commitment, stakeholders should feel connected to their work. Since the legitimacy of a program is of high importance, interviewees affirm the importance of co-created goals with stakeholders and connect measures (I5). This can contribute to creating intermediate outcomes with an essential contribution of the working group. Preserving the interest of every stakeholder is an aim of a collaborative process, while no participant should feel disregarded. As an outcome, affected actors respected the strategy, and the ultimate confirmation was when people refer to their strategy because of their sense of shared ownership and ability to contribute (I5, I6, I7). This is similar to the observations connected to the factor of intermediate outcomes.

Conclusion

In general, the mission-oriented approach was not entirely introduced at the mission level, which provides considerable potential for future implementation. With complex mission topics, such as CE or PW that already target multiple ministries, policy experts and other stakeholders can benefit from a collaboration. Because a commitment of 'everyone' is required, connecting shared visions, and understanding other stakeholders' positions can create stronger cohesion.

Table 12: Observation on Commitment to the process

Factor	Observation
Commitment to the process	
Mutual recognition of interdependence	**Mission level:** Complexity provides commitment, only works when everyone commits
	Program level: policy bottom-up up pressure to commit **CE:** everyone has to commit **P**: Plastics in environment strategy, long time consumer responsibility, Not only sea research
Shared ownership	**Mission level:** Only works when everyone commits, (Including industry, science, NGOs), New approached with multiple resorts,
	Program level: End-user helpless, Including social sciences, **CE:** Development of understanding to positions, Connecting Shared vision **P:** Finding synergies in different organizations, Inter- and transdisciplinary approach
Openness of exploring	**Mission level:** Provide space for exploring and opportunities, Preserve the interest of everyone, connect everyone and see what is happening, Knowledgeable people are around, Share risks
	Program level: After regulations that work as impulses, new energy will be set free to develop openness **CE:** Including innovative start-ups, Difference established systems vs. new challenges, Easier with new topics because no established structures **P:** Provide not only end-of-pipe solutions, experimental approaches necessary

5.2.5. Shared understanding

A shared understanding of the mission and the underlying problem is one of the factors influencing collaboration. Table 13 presents the main results for the factor of shared understanding.

Mission level

On mission level for CE, as much as for PW, this common understanding between the ministries has not been fully established. However, initially, the missions were regarded as self-sustaining, suggesting that

other goals and development would automatically happen. While hardly any additional and measurable goals were formulated (I3). Both have experienced that the strategy has not conveyed clear messages to the connected programs (I5, I9, I11). Due to a lack of resources, this shared understanding could not have been established in the overarching strategy. Interviewees pointed out that for maintaining the common goal and transferring messages to other separately working ministries, an additional department to guide and include them more could benefit (I11).

Program level

For programs, all interviewees emphasized how important it is to find a *common language* to gain a shared understanding. Collaboration with multiple stakeholders means that a different comprehension of technical terms and expressions meet. *"There are always processes in such multi-stakeholder consortia. Consortia, that you have to find a common language" (I8)*. A standard language should be in place so that every participant understands what is going on (I7, I8, I10, I13, I14). "*Speaking with the common language with the common terminology" (I14)*. One interviewee observed that in a panel for circular economy connected to battery cells, participants established their standardization and definition of terms (I8). A second one pointed out the challenge of including a cross-section of citizens in a participation program that is not common with technical terms and processes. Hence, an essential preparation is translating scientific and policy papers into a common language with understandable fundamental information (I7). Additionally, even among one field but different disciplines in academia, a common understanding was established before collaborating (I13).

Conclusion

One of the foundations of collaboration is a shared understanding, which was also emphasized in interviews. Working with multiple stakeholders from various backgrounds, especially a common language, was pointed out to establish a common ground on terms from which stakeholders can build upon. In particular, with the missions' aim to connect a wide variety of actors, the interviewees stressed this factor. No distinction between the two missions was found on this factor because common terminologies and problem definitions were considered highly important in both cases.

Table 13: Observations on Shared understanding

Factor	Observation
Shared understanding	**Mission level:** Holistic approach, Acting transparently
	Program level: Setting a common basis on terms and definitions, Identification of common values Common problem definition

6. CONCLUSION

In this section, answers to the research questions are provided by analyzing two of Germany's transformer missions. This study investigated how collaborative governance can assist in implementing mission-oriented invocation policies to accelerate the transition towards tackling wicked problems.

The selected model consists of two main components. On the one hand, the structural influences, which are considered as the external framework conditions, and on the other hand, the collaborative process, which entails factors from the course of the collaboration. The overall findings of this study show the importance of a suitable governance model for mission-oriented innovation policies. Moreover, the results answer the main research question:

How can collaborative governance be implemented in transformer missions?

According to the results, it shows that collaborative governance was given little consideration in the HTS context. This study shows that the mission framework and structural conditions need to change to pursue collaborative governance for the following reasons.

First, the institutional design and its starting conditions on participation were not respected on the HTS and mission level because the missions were elaborated in a solely inter-ministerial council. Which indicated that only one, namely the policy stakeholder group, was represented. Therefore, the findings show that a participatory approach and holistic view of collaborative governance would necessitate particularly for a wicked problem, which was neglected in the design of the HTS missions. Enabling the targeted stakeholders for participation creates motivation and ownership, which facilitate collaboration. To this purpose, standardized guidelines such as which stakeholder group to include and when can provide equal inclusion for all related processes.

Second, a facilitative leadership role has not been integrated at the mission level. Although this factor was found at HTS and program level, it was mainly neglected at the mission level. On the mission level, resources to establish an empowering facilitator role that coordinates and administers the mission was missing. The missions did not receive additional resources (monetary, human, and time) to coordinate the transformative process. Providing an empowering facilitator role for coordinating and maintaining the goals can lie a foundation on implementing collaborative governance, as the program and HTS levels show. Nevertheless, first attempts with so-called mission dialogues were organized to establish collaboration on the mission level. Unfortunately, this promising format to collaborate in a workshop to shape further goals only took place once for CE and PW. It can be indicated that this is a result of allocating limited resources in governing the missions.

Third, according to the results, starting conditions did not entirely comply with the collaborative governance model. Especially power imbalances were visible with all three levels as policy power was overrepresented. At the HTS level, although the HTF committee was composed of multi-actors, the final decision power was laid at the ministerial council. Similar circumstances happened with the scientific guidance by Fraunhofer ISI. Next, the ministry of education and research (BMBF) is the main responsible body for implementation at the mission level. Finally, policy power was visible at the program level. Even though most programs were executed by independent 'Projektträger', the final decisiveness lay at each responsible ministry. When required to implement collaborative governance for MOIP, ideally, a neutral organization could guide implementation. Then, policy actors can be represented as one stakeholder group.

Additionally, the study addresses two sub-questions. The first one refers to *facilitating and hampering factors* of collaborative governance. Based on the comparative case study of two transformer missions of the German HTS, the following factors were identified as facilitators of collaborative governance in MOIP. Since the HTS promotes multi-actor collaboration, the collaborative governance model by Ansell and Gash (2006) can support coordinating these criteria. Possible structured stakeholder participation from multiple backgrounds can be achieved by applying the model in the setting of the HTS. Furthermore, the results show that a focus on collaboration processes itself should not be neglected. Emphasizing these factors of the collaboration process, such as trust-building, face-to-face dialogues, or commitment to the process, influences the collaboration process significantly. Therefore, integrating a model which proposes essential criteria can facilitate collaborative governance in mission-oriented innovation policies.

However, hampering factors were also identified. On the one hand, instituting a new governance model proves to be more complicated, as the policy processes are well established and structured. The hierarchical systems with an entrenched resort principle impede collaborative governance. Moreover, the integration of this model is time-consuming, and the limitation to one legislative term may provide enough time to implement.

Furthermore, the second sub-question asked for the differences between the two transformer mission types to clarify whether and how collaborative processes among a T1 and a T2 mission can differ in practice. When comparing the selected case studies along with the collaboration process factors on the mission level, differences were hardly detectable. This is likely to be because collaborative governance of the missions did not occur. The collaboration processes were inhibited by hierarchical structures that did not leave space for horizontal collaboration on operative civil servants between resorts. Nevertheless, on a program level, differences were found amongst the cases and notably amongst the programs themselves. No unified framework has been established to govern the programs connected to the missions. However, the programs that were analyzed in the study followed the given protocol of the responsible ministry in terms of collaboration. Furthermore, the program's core purposes varied as most

were funding programs, while two were stakeholder platforms and one was a research program. In conclusion, it is now possible to generalize that the governance of the two analyzed missions does not show significant differences.

A better understanding of governance procedures in mission-oriented innovation policies could be achieved by using the collaborative governance model. The analysis of Germany's HTS and the two transformer missions provided clarity on many necessities for further mission-oriented innovation policy implementation. Overall results implicated the importance of actively maintaining and coordinating missions in order to fulfill their purpose.

7. DISCUSSION

The purpose of this research was to understand HTS's governance by analyzing it according to the collaborative governance morel. With the High-Tech Strategy 2025 formulating twelve ambitious missions in 2018, of which seven are categorized as transformer missions, the governance structures were fascinating to investigate. Previous research by Wittmann et al. (2020a) showed the necessity for internal and external coordination on transformer missions. Following this implication, this study focused on understanding the governance structures in Germany. However, results show that, in general, a mission-oriented approach has not been fully implemented yet. As the CE and PW mission examples indicated, integration throughout policies and a shared vision amongst stakeholders were still missing.

7.1. THEORETICAL IMPLICATIONS

With a better understanding of the current governance structures of the missions connected to the German HTS, theoretical implications can be made. The study can help overcome the potential obstacles identified for transformer missions in recent literature (Wittmann et al., 2020a) in the following ways. First, as the governance model focuses on implementing shared understanding for the collaboration processes, 'translation efforts between areas and from science to application' can be addressed. A common language and a mutual comprehension are the basis for communication among stakeholders, as much as a critical component for trust or commitment. By focusing on a shared understanding in the collaboration process, translating key findings and outcomes into practice can be facilitated. Not only can a shared understanding facilitate the procedure from science to application, but it can already emphasize the directionality of further research. Hence, applying collaborative governance can contribute to overcoming this issue for a transformer mission.

Second, this model can partly target the issue of 'coordination the process and policy mix'. For the first part of coordinating the transformation process, the model suggests facilitative leadership as a structural influence. An independent and empowering moderation role providing thorough coordination should be established for every transformer mission. By institutionalizing a coordinating organization, the aims of the mission can be governed in the intended direction. Hence, an amendment to this structural factor can be recommended. Currently, in the starting conditions, previous relationships and possible antagonism are touched upon. However, neither the collaborative governance model nor transformer missions take former policies into account. This study proposes to add another starting condition by reflecting all former policies in this field. Only then contradicting and disturbing policies can be detected. Like former relationships, this can influence collaboration significantly because implementing missions might still be a challenge when former policies are still valid. This can hamper the progress of the mission implementation.

Third, for 'long-term orientation and strategic planning', the model does not explicitly target these constraints. However, the interviews and literature results emphasize the importance of time commitment and are concerned regarding the duration restrictions of a legislation period. According to the results, the researcher suggests adapting the model and integrate this factor into secure collaborative mission governance as suggested in Figure 2.

While the collaborative governance model does not directly address the issues of 'long-term orientation and strategic planning', 'coordination the process and policy mix', a collaborative governance model that touches upon these obstacles could provide further facilitation of mission integration. According to the results, the researcher suggests adapting the model and integrate this factor to secure collaborative mission governance, as suggested in Figure 2.

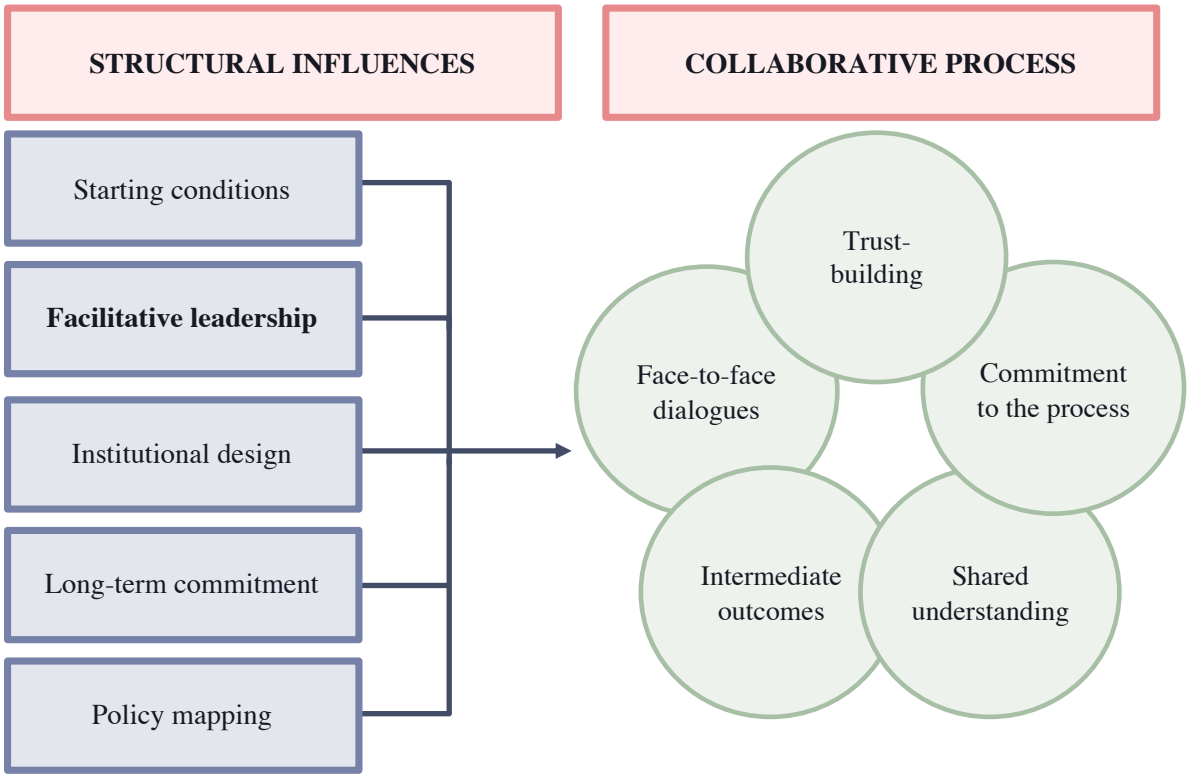

Figure 2: Proposed model for collaborative mission governance

7.2. POLICY IMPLICATIONS

After delving deeper into collaborative governance in mission-oriented innovation policies, the following suggestions to facilitate transformer missions and accelerate the transition towards tackling wicked problems are proposed. As the case of Germany and the HTS shows, the federal government is at the start of implementing a mission-orientated approach. While the holistic strategy included most of the ministries, an embedding of the missions within the operative structures of the ministries was not found. Thereby, each ministry was responsible for administrating the mission individually with their programs. Consequently, these programs did not share a uniform policy framework or any common

approach for implementation. Additionally, the strived for knowledge exchange among the programs and stakeholders did not occur. Three policy implications stem from this case study.

First, the results of this study indicate that on the mission level, a centralized approach should be implemented. Currently, the hierarchical structures of the federal ministries hinder a comprehensive integration of the programs into a transformer mission approach. Therefore, an independent organization that provides administration and coordination of the missions should be realized to overcome the resort principle.

Second, it is essential to integrate the targeted stakeholders from the beginning onwards. As results show, co-creating strategies encourage stakeholders to contribute. This motivation is especially essential for targeting wicked problems, where a broad involvement of several stakeholder groups, such the policy, science, industry, and society, have to contribute. Strategic dialogues between these groups can draw up mission goals, where everyone can commit and contribute.

Third, the perspective of time needs to be included in this strategy. Currently, a legislation period with a four-year timeframe determines the duration of such a strategy, while it takes longer to target a wicked problem. For the next period, a new strategy is developed, which is hampering the progress on societal and environmental challenges. From the beginning onwards, due to the pressing timeframe, little focus was given to a systemic understanding before formulating the missions. Therefore, little stakeholder engagement was provided and resulted in the current missions. For a realistic prospect to utilize the full potential of mission-oriented innovation policies, an extended time commitment for the process should be regarded. Ideally, the duration of missions is released from legislation periods in the future.

In brief, mission-oriented innovation policies and their approach seem to be highly promising after fully understanding the implementation of a governance structure. By following a framework, such as the collaborative governance model of Ansell and Gash (2006), the strategy's aim to tackle the wicked problems can be facilitated.

7.3. LIMITATIONS

For this research, empirical, methodological, and theoretical limitations were identified. Regarding the sample, five limitations can be stated that the reader should keep in mind. First, the case selection eventually resulted in missions that can be seen as similar topic-wise. The missions complement each other because CE can be one solution within the PW challenge. For this study, however, the ultimate case selection was based on if a mission dialogue was conducted. Nevertheless, for a third case, a mission dialogue was organized as well, but this mission was not integrated, which narrows the generalizability of this study on this criterion.

Second, the actors interviewed on mission and program level are narrowed to policy experts, 'Projektträger', and one interviewee from an academic background. Hence, this study provides a sample that does not precisely reflect the total population. This could bring one-sided results, which affects the generalizability to other missions, especially since collaborative governance targets stakeholders with multiple backgrounds. For collaborative governance, more comprehensive insights with all potentially participating stakeholders are of high importance. Only with an integration of various stakeholders, all perspectives can be considered and possible paths to address the missions explored. For further research, stakeholder groups from NGOs, civil society, industry (also in different sizes from startups to corporations), and more academia can be included.

Third, the interviewees generally recognize collaboration among various stakeholders as positive. This image is partly caused by the research strategy of approaching programs with successful collaboration outcomes. The fact that primarily affirmative experiences have been shared could contribute to a distorted impression of the overall results. Opposite perspectives could bring different insights and focus more on the negative experiences of collaborative governance in missions, but it was beyond the scope of this study. This would shed further light on why collaborations might founder and consequently prevent unprepared situations. Nevertheless, by researching the hampering factors of collaborative governance in missions, it was intended to partly cover this. However, no in-depth analysis of individual factors was conducted. Therefore, further research could engage in failed multi-actor collaborations to provide a comprehensive view and increase the probabilities for a successful collaboration setting.

Furthermore, not all targeted key stakeholders did participate in interviews. Due to reasons such as time limitations, the global pandemic of Covid-19 or political discretion, actors were unavailable for interviews. Hence, a restrain is the limited number of interviewees per case. With this burden, eventually, the number of interviews per case differs as Circular Economy exceeds those for the Plastic Waste mission. Initially, it was intended to reach the same number of interviews per case to provide comparability.

Lastly, the researcher's bias could be detected in the data analysis part and interpretation of the interviews due to several reasons. The primary source of data in this qualitative study is based on interviews. Therefore, the researcher might privilege some information to others while interpreting and coding, such as information on collaboration that has already been mentioned in the scientific research before. Additionally, a language barrier could build constraints because all interviews were conducted in German. Due to the translation of codes and quotes, a particular nuance can be influenced by the researcher's interpretation. Hence, a bias of the research cannot be entirely excluded. However, for transparency, exemplary quotations can be found in Appendix C.

In sum, the findings contribute to theory as well as to practice. Theoretical contributions provide how predefined possible obstacles can be targeted by implementing a collaborative governance model.

Moreover, regarding practical contributions, this study offers policy implications that specifically target the German governmental structure but can be generalized for multi-actor collaborations on wicked problems. Despite the limitations on stakeholder interviews, a clear picture of collaboration factors can be drawn from this study. Further research is needed to integrate missions into a well-established system and find facilitation on cross-cutting interministerial collaboration on a common target, such as a mission.

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APPENDIX

Appendix A: Operationalization

Table 14: Operationalization

Characteristic	FactorFactor	Sub-category	Indicator
Structural influences	Starting conditions	Power/resource imbalance	Level of power/resource imbalance between actors
			e.g. power → lobby, more actors that have one opinion, resource → money, infrastructure, human capital
		Incentives for and constraints on participation	Level on incentives
			Levels of constraints
		Prehistory of cooperation or conflict (initial trust level)	Level with number of other actors
	Institutional design	Clear ground rules	Timeframe, commitment
		Process transparency	Protocol
	Facilitative leadership	(Including empowerment)	Role of external mediator in stewardship role and catalyzing roles represented
Collaboration Process	Trust building		Did you feel like you could share secrete data
	Commitment to process	Mutual recognition of interdependence	Network, broadness
		Shared ownership of the process	Acting collectively shared responsibility
		Openness of exploring	Experimental paths
	Shared understanding	Clear mission	Understanding the goal/problem
		Common problem definition	Problem written
		Identification of common values	Share the same objective
	Intermediate outcomes	'Small wins'	Visible results
		Strategic plans	Tangible goals
		Joint Fact-Finding	Joint exploration
	Face-to-face dialogue	Good faith negotiation	Platform for communication

Appendix B: Interview guide

Opener:

- How are you involved with the HTS/ Mission X?
- What experiences do you have with the mission?
- What do you think about the development of mission-oriented policies?

Structural influences:

- How did you get involved/invited to mission? And how did the process start for you? Can you briefly describe this for me?
- Do you feel that there were incentives to participate in the program?
- Have you been given clear objectives and working rules of the mission (at the beginning)?
    - How many different partners are you in regular contact with?
    - Who facilitates this process?
- How do you feel about the diversity of the composition of the groups? Are there many different groups from politics, science, civil society, and academia?
    - Do you think it would be useful to include even more different actors/groups?

Collaborative process:

- Can you briefly describe how your collaboration in Mission X/ in program X looks like?
- Was there collaboration with other participants before?
    - Do you like to work with partners you have worked with before?
- To what extent do you benefit from this exchange? network?
- Do you feel comfortable sharing internal data?
    - Do you feel that other partners are also so open?
- Do you like to have your own responsibility/ liability for the implementation of the mission?
- How are the objectives of the different partners coordinated with each other?
- If there are recognizable intermediate results, how are these communicated?
- If you want to go down a very experimental path, do you think it will be welcomed openly?
    - Do you feel that the organizers are open to taking risks for this?

Appendix C: Power quotes

STRUCTURAL INFLUENCES

Table 15: Quotes Structural Influences

Factor	Sub-subcategories	Level	Quotes
Starting conditions	Power & Resource imbalances	HTS	- They have to build bridges between their own departments and the external ones. And yes, there were some really practical difficulties in the implementation. So it's an incredibly time-consuming process that requires a lot of capacity, because all the people usually have their days well filled with the normal funding programs, legislative procedures, whatever they do, and now they have to take care of such a mission across the board, and they also have to do that with many other people involved. (I3) - The High-Tech Strategy is characterized by the fact that in principle all departments of the Federal Government are involved (I3).
		Mission	- that they didn't say at the beginning that they wanted to bring it together, so it was more like that, that the others felt it was fishing in foreign waters (I11). - What is also very important is that if these coordination capacities are horizontal, then it is also something where the ministries, at least the government part, must really say that they have a certain competence and responsibilities, because normally they always work in this hierarchy, everything across is really difficult and the people sit there, even if the small groups are well staffed, there can be people with so much experience and knowledge, with such a great external network. (I3) - These are also the hierarchical structures, they make sense, you need them for long-term work for well-balanced planning. (I3) - In short, we didn't have our own budget for this story, and we also didn't have constructions like the mission boards, which are also interesting in that they directly involve external parties. (I3)
		Program	- I believe that after many decades and now also a discourse, we have reached the point where we say that everything must take place in an integrated way. No target group should be lost from sight. (I14)
	Incentives and constraints	HTS	- The HTF was one of the most interesting experiences because it was very diverse, but at the same time it was always discussed at a very high level. (I1) - The second incentive is that in such rounds you always get to know very interesting people that you would otherwise not have met so easily, and because HTF is also very interdisciplinary and also intersectoral, i.e. it really is science, NGOs, business, politics. All of them are really represented and. (I1) - That is a very positive image of innovation. Of course, that is one-sided and there is always the other side of the coin, but I would say that the committee or in Germany in general or in German innovation policy is naturally pro-research and pro-innovation. (I2) - There was also no dominant group, we didn't have a group of 5 engineers or 5 AI experts who could somehow dominate the discourse, but always in such a way that we had perhaps one representative from a certain group (I1).
		Mission	- and there is this snide word: If I know more, set up a working group. You can look at it that way, but I think that this. These opinion finding processes are totally important, especially for such complex issues, (I8) - If at some point you realize that it would be good for the missions for this or that activity, to act across ministries (also very difficult to offer money), and thereby set certain behavioral incentives, then perhaps that is also no longer a free space for them at that point. (I3) - But that is even more complex and difficult. Therefore, it really is a complex environmental problem, and it is a good opportunity to show that we all have to try to work together. (I11) - We often didn't know what was actually expected. (I11)

		Program	- In the end, it won't work without the economy. (I9) - But an even greater challI2e is when we really go into civil society and really try to involve citizens. (I3) - Yes, this is a process for society, companies must be involved, but it is quite clear that science must be involved, politics must be involved, and civil society must be involved (I8).
	Prehistory of cooperation or conflict (initial trust level)	HTS	- What can also arise in such processes is precisely that, i.e., that we do not move from defending our own position to how we can perhaps reposition ourselves in a changing market. That is exciting and challenging at the same time, of course, and that is why the work was very, very different at the same time. (I8) - There is an organizational chart with one strand and another strand. And in these strands, work is done hierarchically upwards, yes. Our two work units are in different strands. And that the strands speak directly with each other, that it is first of all still a development that occurs in recent times. (I7) - You have these different parties, you have a plurality of what has to happen manifested in voters' favor or disfavor, which then leads to this party color in certain houses. (I4)
		Mission	- So, if this keyword of agile policy design is to have any relevance for me, and if you say A in that way then you also have to say B, then you need the capacities for it and then you also need your own budget. (I3) - So, the problem or the core issue with this interdepartmental cooperation is of course an original problem of how politics is organized, not only in Germany, but in general. (I4) - There are established ways how governments can do that, how to involve experts. (I3.)
		Program	- In the past, the discourse often took place at precisely these points of discontinuity, where it was said that it was the consumers' responsibility to pay attention to this. And from the other side it was said, but the industry has to lead the way, it has to offer products first and then it is later, yes, but politics has to set the framework conditions. (I13)
Facilitative leadership		HTS	- The office is now an external actor that can coordinate the enabling and the processes a little bit, exactly that, so to speak, 2 fields of work, but with a lot of overlaps (I2). - However, the committee was also able to raise issues that were considered relevant, so to speak. (I2) - In my opinion, the HTF is also characterized by the fact that they choose a somewhat more participatory and open approach. After the papers are published, they are also published on the website and commented on, and we also process these comments, so to speak, and then it goes on, which is always about three or four weeks after our HTF meeting, there is a meeting of the state secretaries, which is interdepartmental, i.e., from the Chancellery to all the ministries. (I2) - There was also no dominant group, we didn't have a group of 5 engineers or 5 AI experts who could somehow dominate the discourse, but always in such a way that we had maybe one representative from a certain group, (I1)
		Missions	- In short, we didn't have our own budget for this story, and we also didn't have constructions like the mission boards, which are also interesting in that they directly involve external parties. (I3) - So, the problem or the core issue with this interdepartmental cooperation is, of course, an original problem of how politics is organized, not only in Germany, but in general. You have these different parties, you have a plurality of what has to happen manifested in voters' favor or disfavor, which then leads to this party color in certain houses. (I4) - They only ever accepted our invitations, of course, when we somehow had to do something, but you have to be the driving force yourself and otherwise not much happens, and in my opinion, this is also due to the fact that it was simply not communicated properly, what you want to achieve with it and that is actually also aimed at cooperation between the ministries (I11).
		Program	- We as the project executing agency are, let's say, the technical substructure of the responsible department in the value, i.e. of the specialist department, which is then resources, circular economy, geo research. (I9) - Exactly that is our role practically in the sense that we are neutral moderators who have this neutral platform, the conveying power, so to speak, to bring together the different actors and to guarantee that these processes are managed neutrally and transparently by us (I8).
Structural influences	Transparency	HTS	- And especially with participatory processes, the accusation is made those beautiful papers are produced on whether the events that were held were all great, but these feedback loops into the political process are missing (I3).

			- That is exactly the complex, the most difficult challenge. So, because of the diversity, to simply do justice to everyone and to still work out recommendations, so to speak, but to work out papers or statements that are supported but that are just as soft-washed, so that you can still get things going progressively, so to speak, without always having to accept the small common denominators, and that is of course also the big, task and our work at the office is precisely this coordination. (I2)
		Mission	- Sometimes the communication and information flows were not completely transparent, you made it very difficult to actually implement that and that was a bit of a pity in my opinion (I11). - I would therefore like to see, and this is my personal idea, that we don't go to the cabinet with a finished strategy paper, but that we perhaps have the courage to really define the cornerstones and say, based on the experiences with the mission orientation of the previous electoral period, we have now evaluated them. (I3) - Goals were actually formulated in the workshop, but they were of course very much oriented towards what was already going on. (I11)
		Program	- At this expert workshop, we were invited to provide impulses for this and for the discussion. And everything was then also recorded and precisely (I12). - Where are the sensitivities of the others or that one has not simply made a decision silently because one happens to be the coordinator but has also sent an agenda to the team beforehand for this meeting, for example, saying that I would like to talk to you next time about this and that and the other. Anything else? There are a lot of little things that play a role in building up this trust slowly (I12). - It's not easy to find someone who discusses things and allows transparency to prevail, and that's time-consuming. It's simple and of course it can be a deterrent, but yes, on the whole it's worth it. (I12) - There were slides with only red crosses on them and that led to a bit of frustration and when they showed us the slides, we really thought about whether we wanted to do that, because then we got into trouble explaining, but we did it that way because that was the plan. It was simply an honest process. We then had to admit that we didn't manage to push it through (I7). - That's why the Internet portal was added because that means that all people were involved. The 230 will then prioritize the opportunities again, yes, and then there were just these ambassadors as a small subset, then we have again prepared these results further. (I6)
	Clear ground rules	HTS	- Definitely, especially in this interministerial cooperation, it only works if you really come into contact with the people somewhere, i.e. at the working level (I11).
		Mission	- but I think we should actually take a look and also see which policy instruments pay, which goals and so on, and then immediately, yes, there is already a lot of friction here. (I4) - Then, of course, there is always the question of what does that mean and who is involved in developing these things? (I2.) - They have to build bridges within their own departments to external partners. And yes, there were some really practical difficulties in the implementation. (I3)
		Program	- And of course it is precisely the challenge to set up such processes in an integrative way, to manage them transparently, to create clear guidelines in the sense of who can participate and how, maybe to think into the matter a bit more, too? (I8) - More than 25 people can no longer be involved (I8). - If we now speak of a legislative period. I think that the short-term phase has a lot to do with the fact that listening and understanding the reality (I4) - Or rather, we always find that time is unbelievably short to find each other in the first place, to come to an understanding in terms of language, to bring ourselves to a level of knowledge, to a common level of perspective, even if this does not mean that there is now consensus, but that it is simply clear how we want to implement what? (I13) - Exactly, we have, we are an academy and again briefly, we are practically set up with these 2 pillars and we have senate companies that support us in our work and these are of course the companies that we approach first, there are, so to speak, formal circles (I8).

COLLABORATIVE PROCESS

Table 16: Quotes Collaborative Process

Factor	Sub-subcategories	Quotes
Face-to-face dialogue	Time	- You may have had to invest a few more meetings in order to simply meet them and that ultimately it depends on people (I12). - We had regular project meetings and at some point we introduced a system in which one person reports on the current status of the work at each meeting and we worked together on publications. (I13) - Or just discussing things and allowing transparency to prevail and so on, that is, that is already time-consuming. (I12) - Roughly speaking, the first 3 meetings or the first 2 meetings are in any case also there simply to provide orientation. (I8) - It's time-consuming to talk to someone who discusses things and allows transparency to prevail and so on. It's simple and of course it can be a deterrent, but yes, overall, it's worth it. (I12) - But you do need a bit of contact and beyond the very strict work context, then it actually works (I11). - The discussion is kind of stagnant and that, unfortunately, is not just sending emails from A to B, but you really have to be able to talk to people at eye level and that's the hold up in this breadth of topics, (I2)
	Guided and prepared	- That is, for example, that the different stakeholder extremes really clash. (I7.) - There is the round table. I think you have to try, with a lot of dialogue, if you talk to each other, you might get further. (I6) - So, it was like this that we organized and coordinated these meetings and that at the beginning, the departments were involved and were present at these meetings and partly coordinated them ourselves (I12)
	Hierarchy	- Yes, I think that these hierarchical structures are a real hindrance and this jurisdictional wrangling, which is much more conducive and successful if you can actually discuss the matter at hand with the people (I11).
	Personal	- Where all people can also look at each other and share their experiences on a personal level, that of course also makes a big difference (I2)
Trust building		- You would actually have sub-groups with a focus, and in my opinion, they should already be balanced, so science provides the facts and basics. (I11) - From my point of view, definitely. It's more exchange between actors or between actors who perhaps haven't necessarily been in such an exchange so far and therefore exchange of information and from my point of view it requires trust and this in turn needs time to grow. (I10). - Yes, so it is always very important for this work that these processes are very transparent, so sometimes we torture our members. (I8) - Then you first have to find a consensus before it can finally be poured into a report (I8).
	Small groups	- At this venue at that time it was still possible, but sitting down at the tables, even a bit of a world coffee format, which they also discussed at a table of 6 8 approx. in different rounds. That is the first stage, so to speak. (I6) - More than 25 people can no longer be involved (I8).
	Moderator	- Yes, so there are several possibilities, so there are also project meetings, so I am also invited to the meeting of the projects I supervise from time to time and then of course I also report quite honestly what the problems are and where they have difficulties and then there is just what I said, these cluster group meetings where many projects sit together, it is up to everyone how openly they report or not? We can't force anyone to take part, but they actually participated very well (I9).
	Legal contracts	- At every meeting we had, we always read out all these things relevant to antitrust law, there are very strict rules, so if someone. (I8) - The projects internally also have confidentiality agreements, of course, but we have now worked at the level of. Where we work across projects, there is no such thing, but you have to say, it is still spoken about relatively openly. (I10)
	Understand plastics	- Plastic is very broad and I would also say that plastic is used in so many fields and I don't think it has to be changed in all fields. (I13) - So, I think plastics in the health system. In many respects it is certainly not so wrong. But if you look at the food sector and the packaging sector, because that is also something that has been discussed a lot in our country, I will say that it is certainly important to rethink how we actually want to consume. (I13)

Commitment to process	everyone commits	- Of course, agreeing on concrete reduction targets is always a huge issue, but people have recognized the added value of getting involved in such processes in order to at least help shape all the targets, interim targets, etc. and measures, and I think that's the crucial point (I3). - I had the feeling that all the people who were involved simply understood that the topic is bigger than the piece of cake that they themselves are working on, but that their own piece of cake is an essential part of a beautiful overall cake, so that is what we all need in order to actually be able to bake the cake, to remain in the image? (I12.) - So, I think, and this has become really clear to us in this plastic issue one more time, it only works if everyone goes along with it. (I13). - It's just something like that, you have to have a little openness then. (I14) - It is precisely this holistic thinking. (I5) - Everyone has to make a contribution. (I14) - You should include perspectives in order to find something that is sustainable. (I11) - We have always said that we don't want to reinvent the wheel, but of course we want to build up all the expertise that has accumulated over decades here in Germany, but at the same time we want to broaden our view and simply say that we now want to address the entire product life cycle and not always think in terms of recycling at the end. (I8)
	feel connected to their work.	- The approach was to concretize these goals again and to define them a little more precisely and then to operationalize them, so to speak, to formulate them in a way that is verifiable. (I11) - So something like that always needs people, people in the background who seriously want it and who are in the position of saying that I want it to be like that. (I12) - I believe that if there hadn't been this will in the background, we wouldn't have been able to do it, so without this will to create something together, it wouldn't work. So there must be a will from above. (I12) - But there is also a certain kind of ownership, so to speak, a sense of belonging in my opinion, that one wants to do this up to now, that one wants to do this together, corporate ident. Here it is, after all, or ultimately, that one can identify this together. As if one would also identify oneself. (I5) - And do you also think that this cooperation will also have an effect on the future, that these projects will then know that they are also dependent on other projects or that this exchange. Together, yes, it motivates people to work together. (I10)
Shared understanding	Language	- There are always processes in such multi-stakeholder consortia. Consortia, that you have to find a common language. In any case, so I have done that now.(I8) - On this basis, on these definitions that you have given yourself, you can then work together (I8). - Then you first have to find a consensus before it can finally be poured into a report. (I8) - Keyword: resource efficiency cycle, circular economy. Speaking with the common language with the common terminology perhaps (I14) - They have to understand what I'm talking about, and of course there have always been processes like this in the individual working groups, where people have agreed on a common terminology, and in some cases the working groups have even gone so far as to write their own definitions. (I8) - The text is also comprehensible, and we have tried to smooth out these special terms accordingly, because we have that too. (I7) - Bringing events together, sometimes the challenge is to find a common language, so to speak. Yes. Everybody so say your own field is, there are certain key terms, then everybody understands the same underneath, and everybody knows what is meant, but when you act across um and then sometimes things will not agree, or same terms were different. (I10) - I bring people together from this random selection to discuss a topic then of course I have to bring them to the same level, they can be very difficult for me to do that because the level of people is quite different, but nevertheless I have to try. You usually do that by creating input materials. (I7) - It is always processing in such multi-stakeholder consortia that you find a common language like that (I8) - or is it sometimes really necessary to first create a common language basis, so to speak, in order to really understand each other (I10) - So, there was no one who actually just sat there silently, so it was clear that we had to find a language, but it actually worked very well. (I1)
	Transparency	- so, I think plastic in the health system. It is certainly not so wrong in many respects. But if we now aim at the food sector and the packaging sector, because that is also something that was strongly discussed here, I would say that it is certainly important to rethink how we actually want to consume. (I13)

	Common value identification	- No one person can solve this alone. (I11) - And also, as I said, this approach of wanting to work on concrete products and with this strong industry focus, which have shared this. (I8) - Yes, I think it's not too broad, that's important, if it gets too broad then it doesn't make sense. So, if you do the whole topic in one funding program, it doesn't do anybody any good. (I9)
	Find synergies	- The work was good and there were also conflicts in the form of compromises, simple negotiations and so on. That's a fine thing (I12). - That's why I started with this goal picture, no, so it's important, I think, that the working group deals with it, so that there is a common understanding in the working group, we would like to have. (I8) - And that also works very positively across camps, so to speak. Environmental associations, business associations, chambers, consumer centers, trade unions, all the offices of the Bundestag, the most diverse participants their and. There is a level of trust, yes, (I14) - I think it is totally important and interesting, especially with such big issues that we deal with. To go through such processes because it is always a joint learning. It's developing an understanding of each other's positions. (I8)
Intermediate outcomes	Small wins	- Recommendations for action to develop options for action also for different actors, i.e., politics on the one hand, of course, but also What changes need to take place in industry, for example, what white spots are there that science still has to answer, so we then also try to name our target group accordingly. (I8) - The result of the expert discussions, so to speak, and this is now being successively implemented with separated funding announcements. (I9) - Otherwise, many good ideas will be lost, because you can only have a forum on plastics, a forum on recycling and calling for something. (I9). - Yes, I think it's not too broad, that's important, if it's too broad then it doesn't make sense. So, if you do the whole topic in one funding program, it doesn't do anyone any good. (I9)
	Recognition of others	- But that is worth it to us and that is the strength of the process, that we can really say with our heads held high, that what we have worked out, the BMU has dealt with, and we have also said that we have done with it, even if it did not work out, that some things come in and I think that is the difference. (I6) - But there are also in some projects. Now, in the socio-scientific field, the implementation of new circular models is simply a matter of acceptance, which is extremely important for the consumer, because he or she also has a considerable share in the process, so to speak. To succeed or not (I10) - That's the second thing. What always plays a role at the European level is the nexus idea, that you also have to look at the circular economy policy, resource-efficient policy, yes climate policy and that all this is coordinated with each other (I14). - A lot of things are transnational, yes, so also the cycles supply chains, you actually have to take place transnationally, as you can see just now with the Covid 19 crisis. (I9.) - It belongs to us together and we shape it together and that's cool so that's really nice. I think that's good as exactly yes, that's definitely in the map, that works great. (I5)
	Co-creation	- Of course, agreeing on concrete reduction targets is always a huge issue, but people have recognized the added value of getting involved in such processes in order to at least help shape all the targets, interim targets, etc. and measures, and I think that is the crucial point. (I3) - The involvement of the target group, yes. Yes, that is totally important. And I think that's also the case and even if you bring opposing sides to the table, they discuss it and sometimes things develop, so from my point of view, yes, at some point it's clear, but we still have the lowest common denominator, so to speak. (I5) - I think this goal is clear, it must be clear that we know that we are now working together towards it and that we have a common basic understanding as a group, and then this next step is like this. (I8)