Master's Thesis – master Innovation Sciences

Accelerating the Transition to Organic Farming

A Mission-oriented Innovation System analysis on the mission to 15% organic agricultural land in the province of Noord-Brabant in 2030.

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Abstract

Modern society is facing an increasing number of societal problems. There is a growing consensus that innovation and its policies should focus on solving concrete and pressing societal problems. In order to initiate this kind of transformative change, clearly defined missions are formulated, labelled as Mission-oriented Innovation Policy (MIP). Although promising, missions remain understudied in practice. Therefore scholar introduced the Mission-oriented Innovation System (MIS) framework. The mission addressed in this thesis is the mission initiated by the province of Noord-Brabant to have 15% organic agricultural land by 2030 in Noord-Brabant. Since there are different forms of agriculture, each with their own problems and challenges, this study is demarcated on organic horticulture and arable farming. In order to analyse this mission, the five-step structural-functional approach as introduced by Wesseling & Mijerhof (2021) for studying a MIS has been applied. A combination of desk research, expert consultation, and 24 semi-structured expert interviews provided data for these five steps.

The analysis resulted in a multitude of identified barriers related to weakly fulfilled system functions. From these barriers, two networks of interrelated barriers were identified with the most pressing systemic problems. These revolve around the low demand for organic products and the low number of farmers transitioning to organic farming. Thereafter the ongoing or planned mission governance actions were identified that aim to address (some) of these barriers. As for the low demand for organic products, the (planned) mission governance actions do not seem sufficient to overcome the barriers. Therefore, given that resources of the mission arena are limited, various governance actions have been proposed to overcome the identified barriers. One of those recommendations is to draw up a covenant with leading parties in the retail sector to make them jointly responsible and the problem owner for increasing the sales of organic products. In such a covenant, agreements can also be made to partially tackle other identified problems. Regarding the low number of farmers that transition to organic, many of the planned actions seem sufficient for now and should only be reconsidered when the demand for organic products increases. For example, one of the planned actions is a transition fund to help farmers finance the transition. However, it is important to examine whether there is sufficient demand for the products in the markets in which these farmers operate. Otherwise, there is a risk that farmers will be encouraged to grow crops for markets for which there is no demand.

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1 Introduction

For decades, the core objective of innovation policy was to fix market and system failures by investing in research and development and strengthening national innovation systems (Schot & Steinmueller, 2018). However, modern society is facing an increasing number of societal problems, also labelled as grand challenges, such as climate change. These problems are complex, systemic, interconnected, urgent, and require insights from many perspectives (Mazzucato, 2018). Economic growth is therefore no longer the only rational for stimulating innovation policy. Instead, there is a growing consensus that innovation and its policies should focus on solving concrete and pressing societal problems (Wanzenböck et al., 2020; Janssen et al., 2020). In response, Weber and Rohracher (2012) coined the term transformation failures, which, along with the market and system failures rational, legitimizes government intervention aimed at influencing the directionality of innovation systems to address societal problems (Boon & Edler, 2018; Kattel & Mazzucato, 2018; Wesseling & Edquist, 2018; Wanzenböck et al., 2019). Consequently, we are now entering a third-generation innovation policy, aimed at overcoming societal challenges (Schot & Steinmueller, 2018). In order to initiate this kind of transformative innovation policy, clearly defined missions are formulated labelled as Mission-oriented Innovation Policy (MIP) (Mazzucato, 2016; Kattel & Mazzucato, 2018). MIP explicitly focusses on providing directionality through ambitious, actionable, measurable, and time-bound goals (Wanzenböck et al., 2020). These missions require socio-technical transformation, substantial governance and the involvement of stakeholders other than just government (Larrue, 2021).

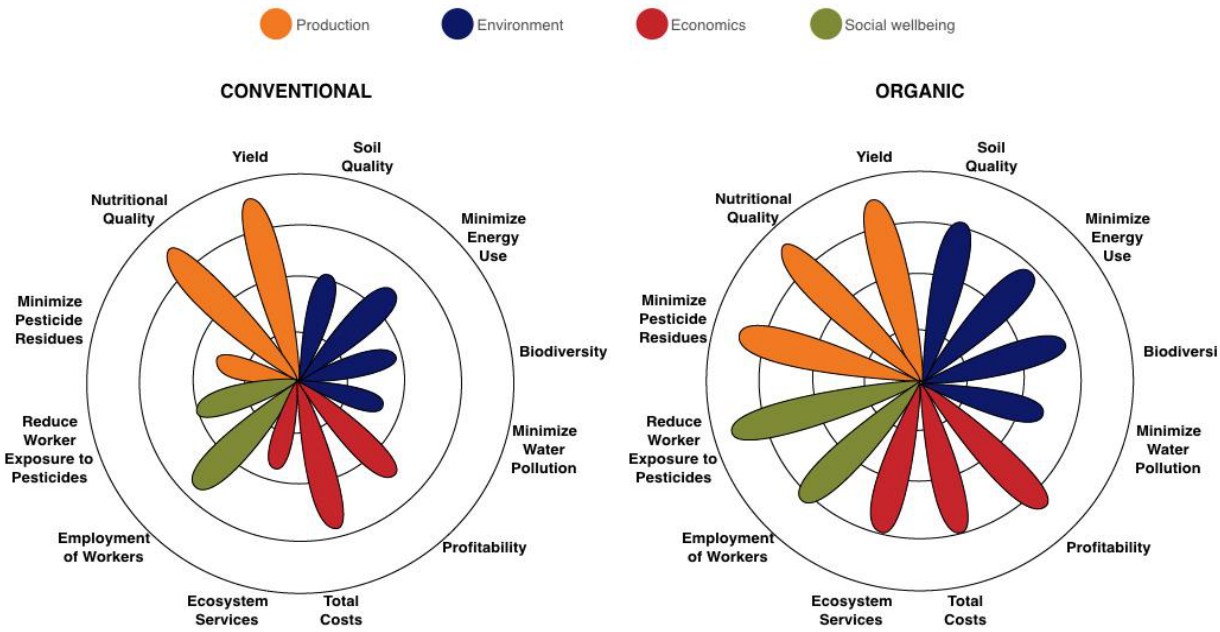
Although promising, missions remain understudied in practice. A lack of understanding of the innovation system dynamics in terms of formulation, pursuit, and completion of societal challenges, poses an immense challenge to policy makers on how to compose and assess effective policy. A deeper understanding of the innovation dynamics produced by missions and supportive governance actions is needed (Hekkert et al., 2020; Janssen et al., 2021). Over the past decades, different innovation system perspectives have emerged to cope with market and system failures rationales, however, these perspectives are often aimed at pushing innovations and unable to address, understand, and systematically assess the impact of missions and transformation failures (Hekkert et al., 2020; Wesseling & Meijerhof, 2021). Therefore, scholars signalled the need for a framework that maps and evaluates innovation dynamics that contribute to completing a societal mission and designs appropriate intervention strategies (Hekkert et al., 2020). In response, Hekkert et al. (2020) proposed a new framework within the innovation systems perspective literature: the Mission-oriented Innovation System (MIS) framework, which they define as: *"the network of agents and set of institutions that contribute to the development and diffusion of innovative solutions with the aim to define, pursue and complete a societal mission"* (p. 77). Through a MIS, underlying barriers are identified that inhibit the diffusion and development of both technological and social innovative solutions within a mission (Hekkert et al., 2020; Wesseling & Meijerhof, 2021).

An interesting case to study using the MIS framework is that of organic farming in Noord-Brabant. The Province of Noord-Brabant (PNB) recently formulated the mission to have 15% organic agricultural land in 2030 in Noord-Brabant (Province of Noord-Brabant, 2022). This is in line with the European Union that has formulated the mission to have 25% organic agricultural land by 2030 in Europe (European Union, 2020). These goals warrant a shift from what Duru et al. (2015) define as a *"productivist paradigm"*. After the Second World War, agricultural policy was primarily aimed at securing Europe's internal food production and market. Driven by technological innovations (Grin et al., 2004) and increasing farm sizes, productivity has doubled (de Wit et al., 2011). European agriculture can therefore be characterized by a productivist paradigm (Duru et al., 2015; Wanzenböck et al., 2019). This paradigm also materialized in Noord-Brabant, which is responsible for 17.5% of total Dutch agri-food export and 20% of Dutch agri-food production (Vellinga et al., 2021). However, this productivist paradigm has also led to a wide range of major negative social and environmental impacts (Henle et al., 2008; Stoate et al., 2009).

Examples are land use intensity, soil compaction, soil diseases and pests, a strong decline of insects and birds, high nitrogen deposition levels, high impact on climate change, low animal welfare, and low or negative income for farmers (Vellinga et al., 2021; Bobbink et al., 2010; Sanderson et al., 2013). Accelerated action and radical changes in production and consumption, transitions, are needed to halt further environmental degradation, meet internationally agreed targets, while also improving the economic sustainability of the agricultural food system (Vellinga et al., 2021). Therefore, a redesign of the food system is warranted. A way to facilitate this transition is through organic farming (Skinner et al., 2019). The Food and Agriculture Organization (FAO) of the United Nations define organic farming as: *"a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasises the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system."* (Food and Agriculture Organization of the United Nations, 1999). Consider **Figure 1** for an illustration of the impact of conventional vis-á-vis organic farming on production, environment, economics, and social wellbeing (Reganold & Wachter, 2016).

Figure 1

Assessment of organic farming relative to conventional farming in four areas of sustainability.



Note. Reprinted from Regnald & Wachter (2016).

As previously stipulated, PNB has set out the mission to have 15% organic agricultural land by 2030 in Noord-Brabant. Through this mission, PNB is aiming to improve water and soil quality of Noord-Brabant's agricultural lands (Provincie Noord-Brabant, 2022). In 2020, approximately 2% of farmers (183) in Noord-Brabant were certified organic or in conversion. With a used area of cultivated land of 6,125 ha., approximately 2.5% of the total cultivated land (Provincie Noord-Brabant, 2021). This is below the Dutch average, which amounted to 3.7% of agricultural land in 2019. Moreover, compared to other European countries (in 2019: Austria - 25.3 percent, Estonia - 22.3 percent, Sweden - 20.4 percent, Italy - 15.2 percent, Czech Republic - 15.2 percent), the organic farming sector in Noord-Brabant is small (Eurostat, 2021a). The discrepancy between the Netherlands and other European countries therefore suggests that elements of the innovation system in Noord-Brabant are stagnating. As such, the following research question is stated:

Which aspects of the organic horticulture and arable farming innovation system currently hamper the transition to 15% organic agriculture in the province of Noord-Brabant and do the ongoing or planned Mission Governance Actions adequately target these barriers?

The scope of this research is limited to open field horticulture and arable farming that produce crops for human consumption. The reason for this demarcation is fourfold. First, the structure of livestock farming differs from horticulture and arable farming, therefore it is expected that both systems have different problems which complicates a more holistic study. Second, conventional farmers in these sectors often use (synthetic) fertilizers, pesticides, and heavy machinery to grow their crops, which deteriorate soil and water quality, which are underlying reasons for PNB to opt for more organic farming. Third, the share of farms that are plant-related in Noord-Brabant increased from 37% to 45% between 2010 and 2020 and is expected to continue to do so (Provincie Noord-Brabant, 2022). Fourth, while there have been some studies that have analysed transition dynamics in Dutch dairy farming (Verburg et al., 2022; Vermunt et al., 2020, 2022), literature on transition dynamics for (Dutch) horticulture and arable farming remain understudied.

The contribution of this paper is fourfold. First, it aims to gain insights into key barriers hindering the uptake of organic agriculture and open field horticulture in Noord-Brabant. By unravelling interlinkages between these barriers, this paper identifies intervention points to help accelerate the transition towards organic agriculture and horticulture. Second, while literature on more mature innovation system perspectives is extensive, the current body of literature on MIS is in its infancy. Thus, there is a need to conduct more deductive research, while concomitantly applying and testing the MIS framework on different types of missions to build theory in order to assert how different missions impact the MIS dynamics (Wesseling & Meijerhof, 2021). In doing so, this thesis aims to contribute to the current body of MIP literature by testing the MIS framework in a completely new case. This opens new research pathways by providing insights on understudied components of MIS theory. Third, literature on how MIS relates to its geographic scope and the resulting coordination issues is currently underdeveloped (Wanzenböck & Frenken, 2020). Existing MIS analyses have focused on national or supranational missions. However, this mission is regionally orientated and initiated by a regional authority. Therefore, this thesis aims to contribute empirically to the understanding of challenges involved in mobilizing the structures of a MIS in a regional context. Fourth, deviating from Wesseling & Meijerhof (2021) and in line with Hekkert et al. (2020) two system functions (coordination and change of regime practices) are included to the functional analysis as proposed by Wesseling & Meijerhof (2021). These functions are deemed to be important when studying this mission.

2 Theory

2.1 Innovation Policy

In the face of climate change, population growth, ecosystem degradation, increasing resource scarcity, and the challenge of achieving sustainable food security the global agri-food system is in need of a sustainability transition (el Bilali et al., 2018). Agro-food sustainability transitions refer to transformation processes necessary to move towards sustainable agriculture and food systems. Innovation, and the policies that support it, play a key role in steering transitions for sustainability. Traditionally, however, innovation policies have focused primarily on innovation for growth, exploiting the potential of science and technology for prosperity, and nurturing socio-technical systems aimed at mass production and consumption. (Schot & Steinmueller, 2018). This first framing of innovation policy was complemented by a second framing focussing on the competitiveness of individual nations vis-à-vis other countries, better known as national systems of innovation (Schot & Steinmueller, 2018). However, modern society is increasingly facing grand societal challenges and the first two framings are unable to cope with transformation of socio-technical system. Therefore Schot & Steinmueller (2018) articulate a third framing for transformative change. This framing addresses the question of how science and technology policy can be used to meet social needs and addresses the issues of sustainable and inclusive societies at a more fundamental level than previous framings. Scholars have labelled this third generation as Mission-oriented Innovation Policy (MIP) (Mazzucato, 2018). Such transitions require the development and diffusion of a wide range of social and technological innovations in the form of new technologies, changes in social behaviour of different actors, and the development of new institutions (Geels et al., 2008). A wide range of theoretical and conceptual frameworks have been developed to understand and promote sustainability transitions. One of the conceptual and theoretical frameworks to study sustainability transitions is the innovation systems (IS) approaches (el Bilali, 2020).

2.2 Innovation Systems

In order to describe, understand, explain, and influence processes of innovation, it is essential to take all important factors shaping and influencing innovations into account. The IS approach, in its various forms, is designed to capture such dynamics (Edquist, 1997). The IS approach finds its origins in the domain of economic thinking and was introduced in a response to the shortcomings of the neoclassical attempts to explain innovation and technological change (Lundvall, 1992). An IS consists of all important economic, social, political, organizational, institutional, and other factors that influence the development, diffusion, and use of innovations (Edquist, 1997). There are different demarcations within IS. When a geo space is the unit of analysis the IS can either be National (NIS) (Lundvall, 1992; Nelson, 1993) or Regional (RIS) (Doloreux, 2002). Other demarcations that are not confined to a geo space are Sectoral (SIS) (Malerba, 2002) and Technological (TIS) (Carlsson & Stankiewicz, 1995). However, the aforementioned IS approaches are unable to cope with the system dynamics revolving around a certain mission. Despite progress in conceptualizing the new roles and modes of governance needed to address societal problems in the sense of MIP, the innovation policy literature lacks approaches to address the heterogeneity of societal challenges. (Wanzenböck et al., 2019). In response, Hekkert et al. (2020) introduced the Mission-oriented Innovation System (MIS) analysis.

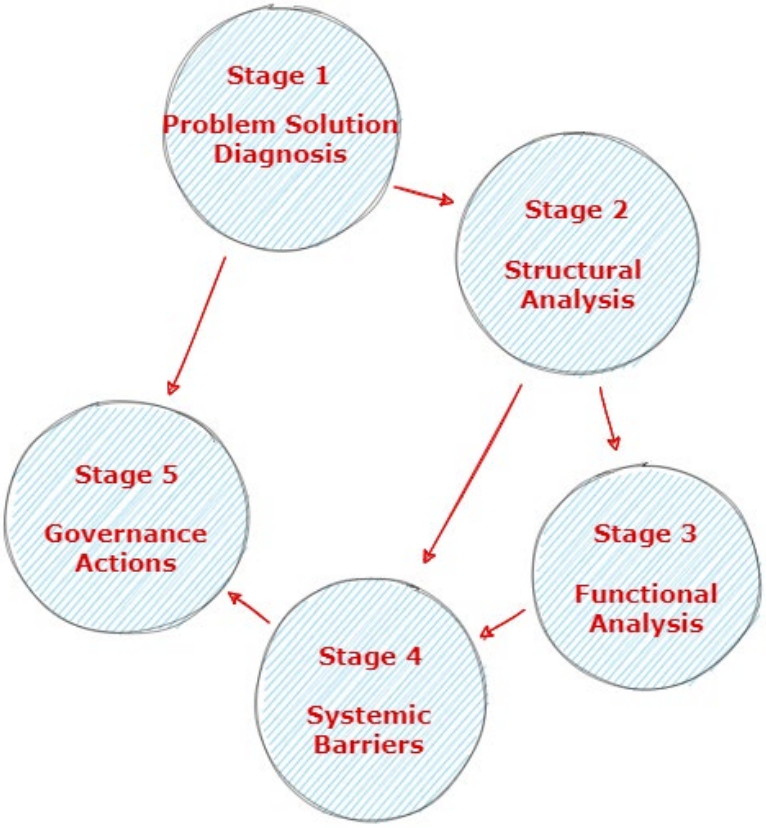
2.3 Mission-oriented Innovation System

Hekkert et al. (2020) define a MIS as: "*the network of agents and set of institutions that contribute to the development and diffusion of innovative solutions with the aim to define, pursue and complete a societal mission*" (p. 77). A MIS should not only include technologically innovative solutions, but also socially innovative solutions. After all, social problems such as climate change cannot be solved with technological solutions alone (IPCC, 2018; Levin et al., 2012). Examples of social innovations are sustainable consumption and the sharing economy (Rehfeld et al., 2015). Additionally, issues such as

the increased wickedness and transformative nature, temporality, systems embedding, and the centrality of problem and solution directionality pose challenges that MISs must address (Wesseling & Meijerhof, 2021). In line with these challenges, Wesseling & Meijerhof (2021) define a MIS as: *"a temporary semi-coherent configuration of different innovation system structures that affect the development and diffusion of solutions to a mission that is defined and governed by a mission arena of different stakeholders"* (p. 3). To structure and operationalize a MIS, Wesseling & Meijerhof (2021) distinguish five analytical steps to studying a MIS. These are related to the structural-functional approach to studying a TIS (Bergek et al., 2015;Hekkert et al., 2007). Consider **Figure 2** for a schematic overview of the analytical steps in analysing a MIS which are outlined in more detail below.

Figure 2

Schematic representation of the five steps in analysing a Mission-oriented Innovation System for policy analysis.



Note. Insights from Wesseling & Meijerhof (2021)

2.3.1 Problem-solution diagnosis

A first step to studying a MIS is mapping the full scope and complexity of the mission. Although missions usually focus on a single societal problem (Mazzucato, 2018; Wanzenböck et al., 2020), multiple problems and solutions are often involved in a mission (Wesseling & Meijerhof, 2021). Wesseling & Meijerhof (2021) differentiate between a *problem-directionality* and *solution-directionality.* The former alludes to the way different problems are included and prioritized in the mission, which effects what solutions are relevant for the mission. The latter refers to how stakeholders search and invest in solutions they consider promising for fulfilling the mission.

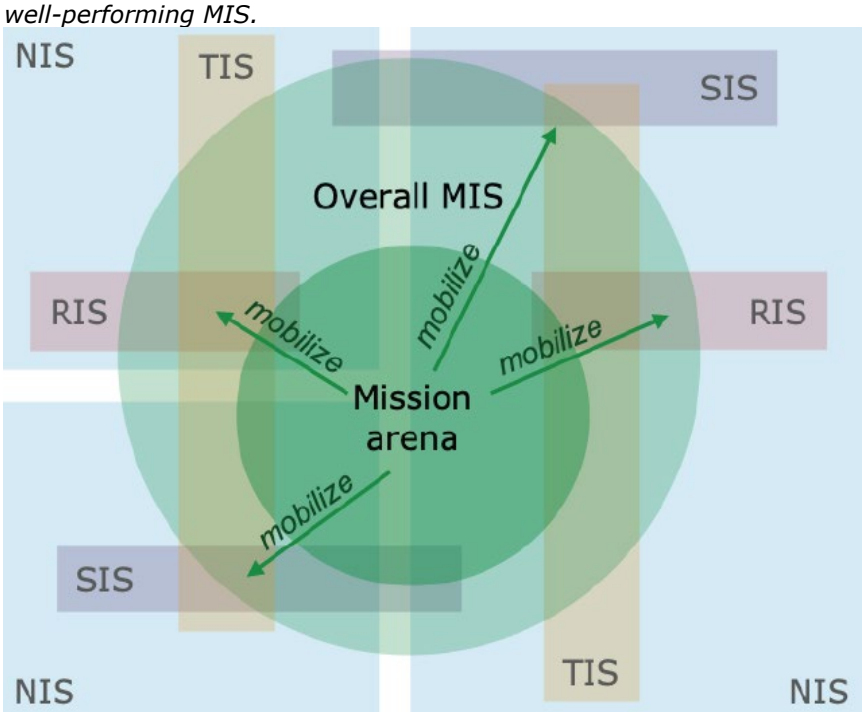
2.3.2 Structural analysis

The second step to studying a MIS is mapping all relevant structural elements. Wesseling & Meijerhof (2021) differentiate between the structural elements of the mission arena and the overall MIS. Wesseling & Meijerhof (2021) define the mission arena as: *"the*

actors that are engaged in the highly political and often heavily contested process of mission governance". Involved in: *"1) setting up the mission arena, 2) formulating the mission, 3) mobilizing the MIS components via mission governance actions (MGAs), and 4) reflexive mission governance"* (p. 7). The mission arena plays a pivotal role in the system building and directionality of the MIS. Nevertheless, the success of the mission is contingent on mobilizing a larger group in the overall MIS (**Figure 3**). Therefore, the mission arena aims to mobilize the structural dimensions of existing innovation systems through MGAs. These governance actions for example include MIP instruments implemented by governmental organizations, as well as measures to mobilize components undertaken by other stakeholders in the mission arena (Wesseling & Meijerhof, 2021).The overall MIS consists of actors, networks, institutions, and infrastructures (**Table 1**) impacting the speed and direction of both technologically and socially innovative mission solutions, including both supportive and opposing forces of change (Wesseling & Meijerhof, 2021).

Figure 3

The mission arena aiming to mobilize other, existing innovation systems structured into an overall, well-performing MIS.



Note. Reprinted from Wesseling & Meijerhof (2021).

Table 1

Definition of the structural components in an innovation system.

Structural components	Definition
Actors	Actors involve organizations contributing to a technology, as a developer or adopter, or indirectly as a regulator, financer, etc. It is the actors of an IS that, through choices and actions, actually generate, diffuse and utilize technologies. The potential variety of relevant actors is enormous, ranging from private actors to public actors, and from technology developers to technology adopters. The development of an IS will depend on the interrelations between all these actors. Five actor categories can be differentiated: Knowledge institutes, Educational organizations, Industry, Market actors, Government bodies, Supportive organizations.
Institutions	Institutional structures are at the core of the innovation system concept. It is common to consider institutions as 'the rules of the game in a society, or, more

	formally as the humanly devised constraints that shape human interaction. A distinction can be made between formal institutions and informal institutions, with formal institutions being the rules that are codified and enforced by some authority, and informal institutions being more tacit and organically shaped by the collective interaction of actors. Even though informal institutions have a strong influence on the speed and direction of innovation, they are impossible to map systematically.
Networks	The central idea of the innovation system framework is that actors and institutions play a role in the development, diffusion and implementation of technology. The different actors interact with each other in networks that develop or diffuse the technology.
Infrastructures	Physical infrastructure (artefacts, instruments, machines, buildings), knowledge (expertise, know-how) and financial (grants, subsidies).

Note. Insight from the work of Hekkert et al. (2011); Wieczorek & Hekkert (2012); Wesseling & Meijerhorf (2021).

2.3.3 Functional analysis

The activities within, and between, structural dimensions contributing to the goal of an IS are conceptually referred to as *key innovative activities* or *system functions* (Hekkert & Negro, 2009). The TIS literature describes seven system functions (Bergek et al., 2008; (Hekkert et al., 2007). While some of these functions are generalizable enough to be applicable to a MIS as well, some cannot be adopted one-to-one and some MIS specific challenges must be incorporated into the system functions. For example, the TIS Function *Guidance of the Search* is replaced by three sub-functions; *problem directionality*, *solution directionality* and *reflexive governance*. In addition and in line with Hekkert et al. (2020), two novel system functions are added to the analysis, namely *coordination* and *change in regime practices* (Wesseling & Meijerhof, 2021; Elzinga et al., 2021; Hekkert et al., 2020). **Table 2** describes all the system functions that are analysed. For each system function, the (M)IS literature describes a set of diagnostic questions (**Appendix A**) to assess whether system functions are positively or negatively fulfilled (Wieczorek & Hekkert, 2012; Wesseling & Meijerhof, 2021). Positive fulfilment indicates activities that support the missions goals, solutions, and the phase-out of 'harmful practices'. Conversely, negative fulfilment suggests activities that hinder system development (Suurs & Hekkert, 2009).

Table 2

Description of system functions for a MIS analysis.

System Function	Description
SF1: Entrepreneurial activities	Experiments with (clusters of) solutions to enable learning; entering markets for new solutions; engaging in business model innovations to foster the diffusion of solutions.
SF2: Knowledge development	Learning by searching and by 'doing', resulting in development and better understanding of new technical and social knowledge on problems and solutions, through R&D, social research and behavioural science research.
SF3: Knowledge diffusion	Stakeholder meetings, conferences, governance structures, public consultations, mission progress reports and other forms of disseminating technical and social knowledge for the mission's solutions and societal problems.
SF4: Providing directionality	Besides pre-existing institutional structures in the context of the mission arena, the mission arena is central to providing direction and mobilizing support from the existing innovation system structures that comprise the overall MIS.
4A: Problem directionality	The direction provided to stakeholders' societal problem conceptions and the level of priority they give it.

4B: Solution directionality	The direction given, both by existing system structures and the mission arena, to the search for new and further development of existing technological and social solutions, as well as the coordination efforts needed to identify, select, and exploit synergetic sets of solutions to the mission.
4C: Reflexive governance	Reflexive deliberation, monitoring, anticipation, evaluation and impact assessment procedures; these provide the analytical and forward-looking basis for redirecting the system's problem framing and search for solutions based on lessons learned and changing context. Reflexive governance can be seen as second-order directionality, and it can be initiated by the mission arena or by critical outsiders.
SF5: Market formation	Creating a niche market and upscaling support for technical and social solutions.
SF6: Resources allocation	Mobilization of human, financial and material resources to enable all other system functions.
SF7: Creation of legitimacy	Creating legitimacy for prioritizing (a) the problem and (b) the development and diffusion of the solutions, at the cost of harmful practices and technologies.
SF8: Coordination	Alignment of activities by a wide variety of actors through coordination processes.
SF9: Change in regime practices	Next to the creation and diffusion of novelty it is important that the existing production and consumption systems, in which rules and practices have become deeply engrained, change their routines and practices in line with the mission objective. three dimensions of change: 1) Increasing awareness that change is necessary 2) Experimentation with novel technologies, business models, new modes of governance in line with mission objective 3) Abandoning practices that are not in line with mission objective.

Note. Combination of insights from the work of Wesseling & Meijerhof (2021), Elzinga et al. (2021); Hekkert et al. (2020), building on previous work on TIS-related system functions including Bergek et al. (2008); Hekkert et al. (2007); Suurs (2009); Wieczorek & Hekkert (2012).

2.3.4 Systemic barriers analysis

The coupled functional-structural analysis subsequently allows for uncovering the systemic problems that hinder the progress of a mission. According to Wieczorek & Hekkert (2012), exposure of a weakly fulfilled configuration of system functions reveals persistent system problems. In essence, weakly fulfilled system functions are a feature of troublesome structural dimensions. Consider **Table 3** for an overview of systemic problems and how they relate to structural dimensions. Moreover, the origin of these systemic problems can typically be traced back to the regime (Wesseling & van der Vooren, 2017) and interrelated systemic barriers may result in systemic lock-in (Wesseling & Meijerhof, 2021).

Table 3

Description of systemic problems.

Type of systemic problem	Description
The presence or capabilities of actors	Actor's problems are reflected by a lack of capacity to learn or utilise available resources; to identify and articulate their needs; or/and to develop visions and strategies.
The presence or quality of the institutional set up	Institutional problems originate from stringent regulations and laws causing a so-called appropriability trap by favouring incumbents. Furthermore, institutional problems may hinder innovation by insufficiently supporting new technologies.

The presence or quality of the networks	Network problems emerge in the face of cognitive distance between actors, relating to a discrepancy between objectives, assumptions, capacities. Additionally, dominance by a set of actors due to asset specificity may hinder constructive networks as well.
The presence or quality of the infrastructure	Infrastructural problems allude to physical, knowledge and financial infrastructure that may be absent or malfunctioning.

Note. Insights from Hekkert et al. (2011); Wieczorek & Hekkert (2012).

2.3.5 Reflection on the impact of the planned governance actions on the MIS

In the literature on IS, reference is made to systemic instruments as policy or governance actions that aim to tackle the aforementioned systemic barriers (Smits & Kuhlmann, 2004). Effective governance actions should target the root causes of barriers that hinder the development of an IS (Wesseling & van der Vooren, 2017). Within context of MIS, systemic tools are construed as MGAs committed by the participants in the mission arena, in support of the pursuit of the mission (Wesseling & Meijerhof, 2021). The recommendations for these instruments are formative recommendations to address the MIS barriers that are currently not addressed, or that are inadvertently reinforced by ongoing or planned governance actions (Wesseling & Meijerhof, 2021).

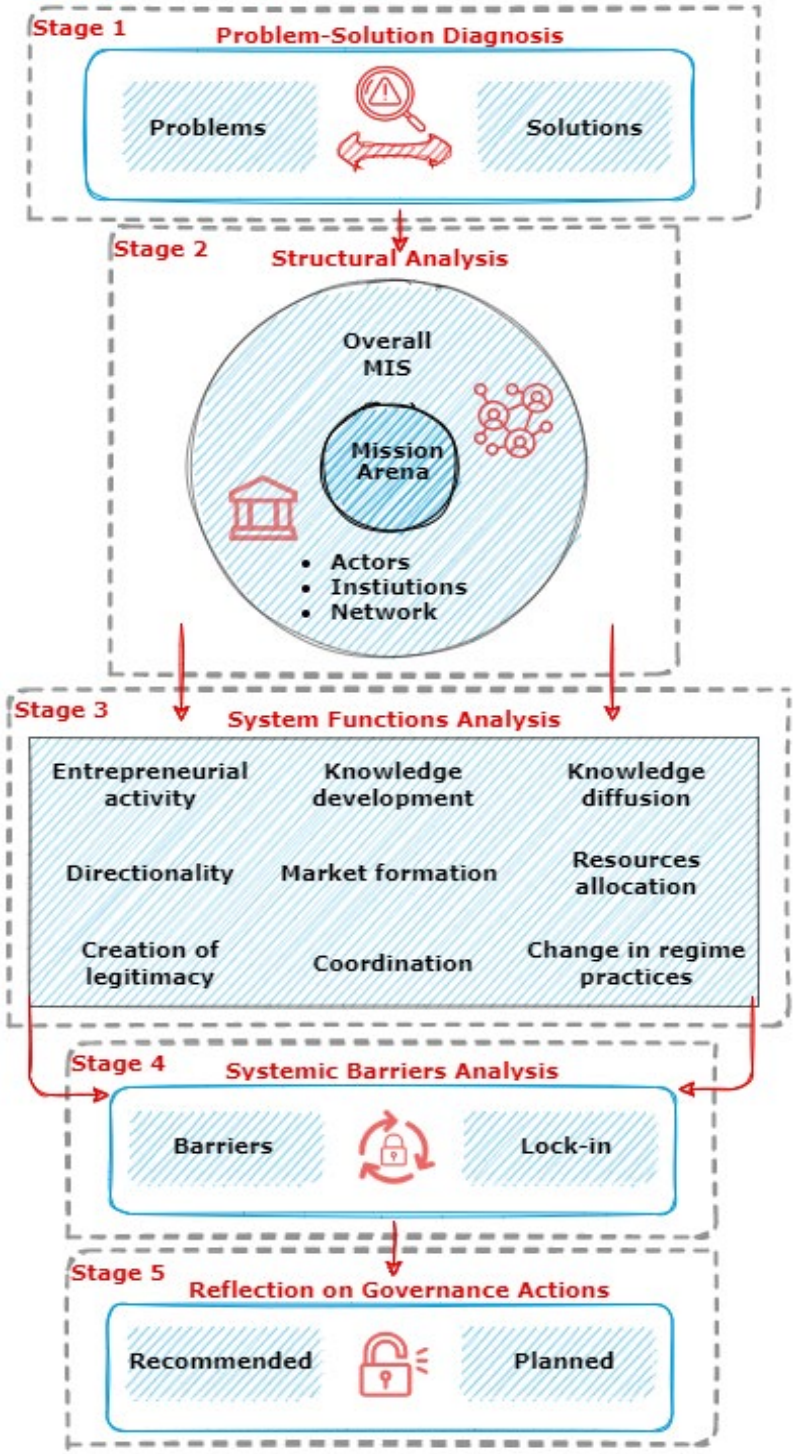
3 Methodology

3.1 Research design and data collection

The sections below covers the methodological approach underlining the MIS analysis, which is based on the structural-functional approach introduced by Wesseling & Meijerhof (2021) consisting of five descriptive sub-analyses. The upcoming section demonstrates how the step-by-step process unfolds, along with requisite data and corresponding data collection techniques applied. **Figure 4** gives a schematic overview of this process. Although **Figure 4** indicates that the process is sequential, in practice it is more iterative.

Figure 4

Schematic overview of the research design steps.



3.1.1 Stage 1: Problem-solution diagnosis

In order to identify the societal problems and solutions relevant to the mission, both desk research and expert consultation have been used. Desk research consists of grey and scientific literature. Grey literature ranges from conference proceedings, theses, websites, articles, to reports from businesses, associations, governments, NGO's, and academia (Adams et al., 2017). **Table 4** indicates the keywords used in desk research. Concerning the solution diagnosis, it deviates from previous MIS studies as this case pursues a clear solution direction, namely organic farming. However, there are other solutions to the problems underlying the formulation of the mission. It therefore remains interesting to investigate whether these solutions can create synergies or conflict.

Table 4

Key words used in desk research in both the problem-solution diagnosis, structural analysis, and system function analysis.

Language	Keywords
English	(Organic) agriculture, (organic) horticulture, (organic) farming, agriculture transition, horticulture transition, farming transition, sustainable agriculture, sustainable farming, agriculture innovation, *names of companies*, *names of NGOs*, *names of industry associations*, *names of governmental organizations*, *names of research institutes*, *names of technological solutions*, *names of social solutions*
Dutch	(Biologische) landbouw, (biologische) tuinbouw, (biologische) akkerbouw, landbouw transitie, akkerbouw transitie, landbouw innovatie, duurzame landbouw, *namen van bedrijven*, *namen van NGO's*, *namen van brancheorganisaties*, *namen van overheidsinstanties*, *namen van onderzoeksinstellingen*, *namen van technologische oplossingen*, *namen van sociale oplossingen*

3.1.2 Stage 2: Structural analysis

In this stage of the analysis, the mission arena and overall MIS were mapped. For the mission arena, the actors were identified that are involved in setting up the arena, mission formulation, mobilization of MIS components through MGAs, and reflexive mission governance (Wesseling & Meijerhof, 2021). For the overall MIS, a larger group of actors was identified who legitimize, develop, disseminate and adopt the solution of the mission (Wesseling & Meijerhof, 2021). The different actors, supported by institutions and infrastructure, interact with each other in networks that develop or disseminate the mission. Together, the four pillars (actors, networks, institutions and infrastructures) form the structural components of the innovation system.

3.1.2.1 Actors

Documentation, reports, websites and experts consultation were examined to untangle the relevant actors based on whether their contributions are conducive to the emergence of the innovation system. This selection approach represents a heuristic for identifying key figures and organizations. For example, trade associations representing the interests of organic farmers arguably play a crucial role in disseminating knowledge and information among constituents, thus representing a structural element of the MIS that directly contributes to the system function of 'knowledge diffusion'. Furthermore, reports from already identified key actors were further inspected as a way to identify other key actors (snowball sampling).

3.1.2.2 Institutions

As described in 2.3.2, Hekkert et al. (2011) argue that informal institutions are impossible to map systematically. Therefore, they recommend focussing on the formal policies that are in place that are likely to affect the development. Nevertheless, informal institutions were partially mapped on the basis of expert interviews. Formal institutions were identified through reports and documents that can be found on the websites of

governmental organisations and expert consultation. As many regional ambitions are derived from (supra)nationally formulated targets, Dutch and EU legislations constitute a part of the structural dimensions of the MIS.

3.1.2.3 Networks

As an innovation system can consists of ample networks, only the most defining networks are mentioned. This was assessed by retrieving data on conferences, consortia, branch organisations, public collaborations, etc. through desk research (grey and academic) and expert consultation.

3.1.2.4 Infrastructure

The infrastructure has an effect on the performance of innovation systems by establishing the dominance of technologies and in shaping the technological trajectories by physical, financial and knowledge components. However, as it is virtually impossible to map the physical infrastructure systematically, this study omits the operationalisation of physical infrastructures, while maintaining that non-tangible infrastructures (knowledge and financial) are implicitly inherent to specific system functions (e.g., knowledge diffusion, resource allocation).

3.1.3 Stage 3: Functional analysis

After mapping the structural dimensions, stage 3 comprises the system function analysis in which the relative absence of system functions becomes apparent. The data required for the system function analysis comprises a combination of desk research and qualitative data (expert interviews). Regarding desk research, in addition to the grey and academic literature partly collected in the previous steps, the Lexis Nexis search engine was used to gain a better understanding of the public debates and discourses on organic farming in the Netherlands and Noord-Brabant. All articles published between 2017 and 2022 were retrieved using the search terms 'Biologisch* AND landbouw OR akkerbouw OR tuinbouw'. This yields 7200 newspaper articles. Due to time constraints, the scope is reduced by selecting only two local newspapers and one national newspaper. Based on relevant article headings and the removal of duplicates, a corpus of 250 papers was retrieved and analysed. With regard to expert interviews, in order to arrive at a holistic picture of the MIS, semi-structured interviews (**Appendix B**) were conducted with multiple experts in the value chain of (organic) farming. A representative sample of actors is composed on the basis of the structural analysis. A generic purposeful sampling strategy was used, as the sampling is a priori created and involves answering the research questions (Bryman, 2016). Furthermore, interviewees were also consulted whether other experts are deemed important to interview (snowball sampling). In total 24 experts from actor types as identified in **Figure 5** were interviewed. Consider **Table 5** for an overview of the type of actors that were interviewed based on their expertise within the innovation system.

Table 5

Interviewees categorized based on their expertise within the organic innovation system.

Actor type	Amount
Government	4
Farmers	4
Industry association	2
University	2
Wholesale	2
Research/knowledge Institute	2
Vocational education	2
Consultant	2
Pesticides	1
Supermarket	1
Land owning organisation	1
Financial	1

The interview guide (**Appendix B**) consists of mostly open and some closed questions. The open questions are in line with the diagnostic questions from Wesseling & Meijerhof (2021). After some introductory questions, the interviewees were asked what they consider the three biggest barriers that hinder the transition to 15% organic horticulture and arable farming in Noord-Brabant. As a result, some system functions were already mentioned. The functions that had not been covered by that question were then touched on to determine whether they may also cause problems, even though they were not seen as the biggest barriers. The interview ended with a reflection on the top three biggest barriers that interviewees indicated at the start, to see whether they had gained new insights and want to adjust the top three.

After completing and transcribing the interviews they were analysed through a thematic analysis (Bryman, 2016). The analysis allows for identifying common or overarching themes, ideas, and patterns. This analysis consists of six successive steps: familiarizing, coding, searching for themes, reviewing themes, definition and naming themes, and reporting (Braun & Clarke, 2006). The themes were established deductively and are based on the system functions as described in **Table 2**. In addition, the top three largest barriers were quantified, with the largest barrier being given the heaviest weighting (3), followed by the second largest barrier (2), and the third largest barrier (1). The barriers that do not fall within this top three were also collected, but are presented separately and were therefore not included in the quantification described above.

3.1.4 Stage 4: Systemic barriers analysis

The system functions that were considered barriers to system development in the previous stage are analysed in more detail in the systemic barriers analysis. This allows to deduce which barriers hinder their functioning and how weak points are connected. A weakly fulfilled system function does not mean that the root cause arises from this specific function. Other system functions may also be related to the identified barriers. Each barrier was further analysed to find the underlying causes and possible reason for a systemic lock-in of the weakly fulfilled system functions. The most pressing systemic problems are clustered and presented in flowcharts. To further substantiate, confirm and validate the findings, experts were consulted and additional literature was used.

3.1.5 Stage 5: Reflection on the impact of the planned governance actions on the MIS

Lastly, it was evaluated whether the planned MGAs were adequate to address the identified barriers. If the planned MGAs adequately address the current barriers, the mission is likely to be successful and no further actions are required. If the MGAs do not adequately address the barriers, recommendations and/or (policy) interventions are needed. These then focused on improving mission policies to overcome the adverse effects of barriers that hinder mission diffusion and development (Janssen et al., 2020). These may concern politically or socially sensitive recommendations, so experts were consulted and literature was used to reflect on the feasibility of the recommendations.

3.2 Ethical issues

Because the research involves sensitive data and organizational information and documentation, it is important to ensure proper data collection, handling and storage. To guarantee this a number of measures are taken. First, interview participants are asked to sign an informed consent agreement so that their data can be part of this study. Second, prior to an interview, each interviewee was explicitly asked for permission to start an audio or video recording. Third, the limits of sharing results, for example whether the data is processed personally or anonymously, were explicitly made clear. Fourth, if a participant decides to withdraw from the research and wants to discontinue the collaboration, this decision was adhered to. Fifth, unpublished and confidential documentation, media and other data is treated with the utmost care and restraint. Sixth, information used during the

research is processed in consultation with the regulator(s) before being shared or made public in order to avoid disputes over confidentiality or intellectual property rights.

4 Results

4.1 Problem-Solution Diagnosis

This section describes the problem-solution diagnosis as highlighted in 2.3.1 and 3.1.1. As for the problems, ample exist concerning conventional farming. Therefore, the section start by describing the problems that conventional farming causes, and how organic farming mitigates these. However, the solution diagnosis deviates from what scholars usually describe in a MIS. Where in most MIS no solution direction is chosen from the outset, e.g. the mission from the Paris climate agreement to be carbon neutral by 2050, this MIS offers a clear solution direction, namely organic farming. Nevertheless, there are also other initiatives that could potentially be a solution to the problems outlined in the problem diagnosis. These are briefly discussed in the solution diagnosis.

4.1.1 Problem diagnosis

Society is increasingly aware of the negative externalities caused by conventional farming. This is also increasingly recognized by governments. With the *Green Deal* and the *Farm to Fork Strategy*, the European Union in particular aspires to the need to move towards a more sustainable agricultural system. With these strategies, the EU aims, among other things, to solve some of the problems caused by conventional farming. The PNB is also increasingly aware of these problems and have therefore drawn up the *Beleidskader Landbouw en Voedsel 2030* in which they state that water quality and soil vitality in the agricultural lands in Brabant have deteriorated in recent decades due to the intensification of agriculture. In many places, the soil has been compacted by heavy agricultural machinery, which means that drought and heavy precipitation lead to yield risks. Compaction continues due to little soil life and intensively worked soil. Due to a decrease in soil vitality, fertilizers are not retained and as a result leach into ground and surface water, making crops vulnerable to diseases. In many places in Brabant, the water quality does not comply with the EU Water and Nitrate Framework Directive. The EU states that the standards must be met by 2027. In addition, due to water management (including drainage) geared to agricultural land use groundwater supplies are insufficiently replenished and the nature network (Natura 2000) is therefore affected by desiccation. The desiccation affects biodiversity and the weakened nature makes it more sensitive to nitrogen deposition. Biodiversity outside the nature network also suffers from desiccation and from the use of chemical crop protection products, which leads to fewer insects, plants, meadow birds, etc. (Provincie Noord-Brabant, 2022). This illustrates the major challenges facing the agricultural sector in Noord-Brabant. The following paragraphs go deeper into these problems and reflects whether organic farming is able to help mitigate these problems.

Monocropping

Monocropping is when farmers grow the same crop year after year. This reduces nutrients in the soil, which over time makes soil less productive, can cause significant erosion, and reduces soil organic matter (Magdoff & van Es, 2021). Additionally, it can create multiple problems, requiring the use of synthetic fertilizers (because the soil is depleted) and the use of pesticides to control pests such as soil fungi, insects and other pests (University of California - Davis, 2016). Since organic farmers are required to rotate crops, they are less prone to the aforementioned problems caused by monocropping. However, organic systems have a lower land use efficiency than conventional systems as crop yields are on average lower than conventional yields. Furthermore, organic crop rotation usually includes crops that are not fit for human consumption (Kirchmann, 2019).

Synthetic Fertilizers

For healthy growth and productivity, plants need nitrogen, phosphorus and potassium. These macronutrients form the basis of healthy soils and plant growth (Foodprint, 2021). In soils lacking these nutrients, fertilizers — synthetic or from organic materials — must be applied to allow plants to grow optimally. As industrial crop production increased, so did the application of synthetic fertilizers (often made from fossil fuels) to increase plant

productivity (Rodríguez Eugenio et al., 2018). Studies have shown that some nitrogen fertilizers can cause soil acidification, which affects plant growth. Moreover, the application of synthetic nitrogen fertilizers can reduce the microbiological diversity of the soil (i.e. bacteria, fungi, etc.) or alter the natural microbiological composition in favour of more pathological strains. Furthermore, excessive use of fertilizers can also lead to the accumulation of salts in the soil, contamination with heavy metals and the accumulation of nitrate, contribute to climate change (use of fossil fuels in production), and water pollution (release of N2O, which causes algal blooms) (Rodríguez Eugenio et al., 2018). Therefore, the European Commission outlined the goal to reduce fertilizer use by at least 20% by 2030. In addition, the PNB emphasizes in their policy framework that food production must become less dependent on synthetic fertilizers (Provincie Noord-Brabant, 2022).

Since organic farmers are restricted from using synthetic fertilizers and rely on organic materials, their plots are less susceptible to the above mentioned problems. Although all nutrients (nitrogen, phosphorus, and potassium) can essentially also be supplied via organic manure, nutrient management is more challenging in organic systems (Niggli, 2015). Therefore, providing the right mix of nutrients to optimally support plant growth is complicated because the nutrient ratio of organic inputs can only be influenced to a very limited extent (Seufert & Ramankutty, 2017). Organic systems are therefore often limited in nitrogen and phosphorus (Berry et al., 2002; Oehl et al., 2003).

Pesticides

Pesticides are used in food production to control insects (insecticides), weeds (herbicides), and fungi (fungicides) (Foodprint, 2021). However, pesticides can cause harmful environmental effects if they are not sufficiently broken down or washed out. Pesticide residues in the soil, and their persistence in the soil over time, are strongly influenced by the soil type and composition as well as the type of pesticide (Natural Resources Conservation Service, 1998). Depending on the pesticide type, amount applied, soil quality, and environment, some pesticides can be degraded by microbial action in the soil or by other chemical reactions, while others can build up in the soil (Natural Resources Conservation Service, 1998). An example of a pesticide that causes adverse effects is glyphosate (RoundUp). It reduces soil microbial biodiversity and other studies show the adverse effects of glyphosate on earthworms (Soil Association, 2016). Other types of pesticides may have similar effects on soil microbiology and affect nitrogen-fixing microbes important for soil health and fertility (Hussain et al., 2009). The use of pesticides in agriculture therefore contributes to pollution of soil, water and air. Consequently, the European Commission aims to reduce the use and risk of chemical pesticides by 50% in 2030 (European Union, 2020). The PNB also aims to further reduce the use of pesticides in arable farming and horticulture (Provincie Noord-Brabant, 2022).

While organic farmers are allowed to use organic fertilizers, which can also have harmful effects on the environment and soil, they are not allowed to use synthetic pesticides. Therefore, some of the described effects of (synthetic) pesticides are mitigated. However, because these inputs are not allowed in organic farming it has a higher production risk because it is more susceptible to pest outbreaks, which can lead to yield losses and increased yield variability (Seufert & Ramankutty, 2017). Furthermore, the ban on chemical pesticides and GMOs in organic farming limits the resources available to farmers to plant diseases, weeds, and pests. Therefore, in environments with high pest pressure and where pests and diseases are encountered that are difficult to control with organic methods, the yield deficits of organic farming are greater than in environments with low pest pressure (Kirchmann, 2019).

Tillage, Soil Compaction and Erosion

Mechanical tillage and the use of heavy agricultural machinery can cause both soil compaction and soil erosion if the soil is not effectively managed (Foodprint, 2021). Soil compaction is caused by tillage when the soil is too wet and the use of heavy agricultural machinery (Duiker, 2004; Magdoff & van Es, 2021). Compaction leads to poor water uptake

and poor aeration, further leading to stunted plant root growth and reduced yields (Duiker, 2004). Soil erosion refers to soil particles that are worn away by wind, water and agricultural activities (such as tillage). Erosion is caused by many different factors, but poor soil management, including tillage, can cause significant erosion over time (Magdoff & van Es, 2021). Soil erosion can cause both wind and water erosion and is a problem for several reasons (Magdoff & van Es, 2021). When topsoil is lost, soil fertility is lost. This eroded soil can be drained and washed away in local watercourses, carrying along not only soil particles, but also any contaminants present in the soil (such as fertilizers and pesticides) (Ritter & Eng, 2012). Erosion can also be a cause of flooding, because eroded soil cannot absorb as much water as healthy soil (Ritter & Eng, 2012). Since in most cases organic farmers also use heavy agricultural machinery they too have a risk of soil compaction and soil erosion but the dangers of leaching substances that are bad for the environment are lower, because organic farmers do not use synthetic fertilizers and pesticides (Foodprint, 2021).

Biodiversity

Intensification of agriculture and homogenization of landscapes (monocropping) has contributed significantly to the loss of biodiversity (Bengtsson et al., 2005; Halberg, 2012). There is broad agreement that organic farms are more biodiverse (Hole et al., 2005; Maeder et al., 2002; Tuck et al., 2014), due to a lower use of pesticides, more semi-natural landscape features, and longer crop rotations (Niggli, 2015).

4.1.2 Solution diagnosis

As the case for this MIS prescribes a clear solution direction, the paragraph below provides a brief overview of other solutions that also contribute to reducing the problems described in the previous section and which are on national and regional political agendas.

Circular agriculture

One of those other perspectives is circular agriculture. For example, the Dutch government aims to close cycles of raw materials and resources at the lowest possible level – national or international – by 2030, and wants to ensure that the Netherlands is a frontrunner in circular agriculture (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2018). In the vision for circular agriculture from the Dutch Ministry of Agriculture, Nature and Food Quality *Nederland als koploper in kringlooplandbouw*, circular agriculture is defined as a system in which arable farming, livestock farming and horticulture primarily use raw materials from each other's chains and residual flows from the food industry and food chains. These circular chains can be structured differently: within a company, a region, the Netherlands or across borders. Furthermore, local where possible, regional or international where necessary. Residues from the agricultural sector and the food chain (crop residues, food residues, process waste, manure, compost) are reused or processed into new (auxiliary) products. Circular companies consume as little energy as possible and use renewable energy as much as possible (Ministerie van Landbouw Natuur en Voedselkwaliteit, 2018).

Nature inclusive agriculture

Aside from the target of 15% organic agriculture by 2030, the PNB also aspires to have 500 nature-inclusive farmers by 2030. The PNB defines nature-inclusive agriculture as a land-based agricultural system that produces food and crops, minimizes external input, is in balance with the natural environment (soil and water), integrates natural resources into business operations and takes care of the landscape and biodiversity on and around the company. This somewhat broad description has been used to enable farmers to tailor the interpretation of nature-inclusive agriculture to their own farm situation and thus utilize their specific possibilities. A stricter definition of conditions deprives farmers of flexibility, but it is also difficult to define conditions unambiguously, since the impact of the various conditions on the quality of soil, water, biodiversity and landscape depends on local conditions (such as soil type and soil type, water management, location in relation to the nature network) (Provincie Noord-Brabant, 2022).

4.2 Structural analysis

In this section the both the structural elements of the mission arena and the overall MIS are mapped. In addition, the mission governance actions that are initiated or planned by the mission are also described.

4.2.1 Mission Arena

The mission formulation started during a meeting (2021) between eight organic farmers with the deputy of Agriculture and Food of PNB. The farmers were dissatisfied with how organic farming was positioned in policy at the time. The deputy challenged the farmers to come up with a vision for the organic sector. In consultation with 80 organic companies in Noord-Brabant and a representative of the Zuidelijke Land- en Tuinbouworganisatie (ZLTO) the core group submitted the document *Visiedocument bio-boeren Brabant: Naar een duurzame landbouw en natuur in 2030 in Brabant* in the summer of 2021 to the deputy in which the ambition of 15% organic agricultural in 2030 was first stated. This ambition was taken over by the province in their policy framework *Beleidskader Lanbouw en Voedsel 2030* which was excepted by the Provincial Council in April of 2022.
Although the European Union has also set targets for organic farming in the *Farm to Fork Strategy* for 2030, in which they ask the Member States to come up with their own national plan and targets, the Dutch government has not yet adhered to this call. The province is therefore ahead of expected national targets and plans. Therefore, to ensure that the mission is successful, the responsibility lies with the agriculture and food program within the province. About 45-50 people work within this program, with one policy officer that specializes in organic agriculture. Although collaboration is being sought with other parties through the planned MGAs to link them to the mission, it is currently only the province that is active in the mission arena.

4.2.2 (Planned) Mission Governance Actions

The PNB recently drafted an action plan specifically aimed at stimulating organic agriculture. The province is (planning to) initiating the following MGAs:

Addressing barriers around land:

- Organic farmers have a preferential position on the basis of their Skal certification when issuing leases for provincial land.
- Stimulate cooperation between organic farmers and land management organisations. The aim of this collaboration is to increase the amount of land available for organic farming by entering into multi-year lease agreements and a lease price that is in line with the business model.

Bridging transition period:

- The deployment of a provincial transition fund for sustainable agriculture for the transition to organic agriculture or another form of income guarantee during the transition period (Planned).
- Farmers are actively reminded on the subsidies from the Ministry of Agriculture, Nature and Food Quality with which they can get funding for the transition ('Economisch Herstelfonds' and 'Investeringsfonds Duurzame Landbouw')

Stimulating organic production:

- Offering advisors who hold advisory discussions with dairy and beef farmers and arable farmers/vegetable growers who are considering the switch to organic. The steps to be taken are mapped out at company level. Farmers who want to continue can participate in an orientation course together (Planned).

Stimulating the demand for organic products:

- In the company restaurant, the Province of Noord-Brabant will increase the share of organic products in the coming years. In order to set a good example for other governments, it makes organic purchasing easier for the caterers. The province,

together with the 'Brabantse Milieu Federatie', invites other governments and companies to also opt for organic catering (Planned).
- Support of a pilot on the consumption of organic fruit and vegetables in two supermarkets in Brabant. Moreover, a training course is organized for the supermarkets to bring organic products better to the attention of the consumer (Planned).
- A public campaign in the form of an organic market to introduce more consumers to organic products and their benefits (Planned).

Stimulating organic education:
- Explore how various agricultural educational institutions in Noord-Brabant apply organic farming in their educational activities. Educational institutions indicate that they particularly need resources to be able to deploy more capacity in the development of organic education, for organizing excursions, knowledge days, guest lectures, and so on (Planned).
- Support the development of organic education modules. This is preceded by an exploration of existing learning pathways in the field of organic agriculture. It is important that the learning track is made available to students of agricultural education as well as to former students and other persons in the sector who want to develop in the field of organic farming (Planned).

Other:
- Six inspirational companies for organic agriculture. On these farms, conventional colleagues can get acquainted with the practice of organic farming and exchange experiences.

4.2.3 Overall MIS

4.2.3.1 Actors

Organic farming is highly institutionalized because it has existed in the Netherlands for decades. The overall MIS therefore consists of a wide range of actors. The types of actors present in the overall MIS are briefly summarized in **Figure 5** and a more detailed overview of actors can be found in **Appendix C**. As indicated in **Figure 5**, actors are categorized based on their role in the system consisting of government, research and education, supply side, demand side, and support organisations.

As for government, a handful of governmental actors have been identified that are related to organic farming. For example, the European Union exerts influence through, among other things, the CAP and sets targets that Member States must adhere to. The Dutch government also influences organic agriculture from various ministries by, among other things, drawing up laws and regulations that, for example, farmers must comply with. It is then up to the provinces, in collaboration with the national government and other organisations, to implement these policies. Provinces, such as in Noord-Brabant, can also set their own laws, regulations and targets. Furthermore, the municipality and regional water boards also influence organic farming, although to a lesser extent.

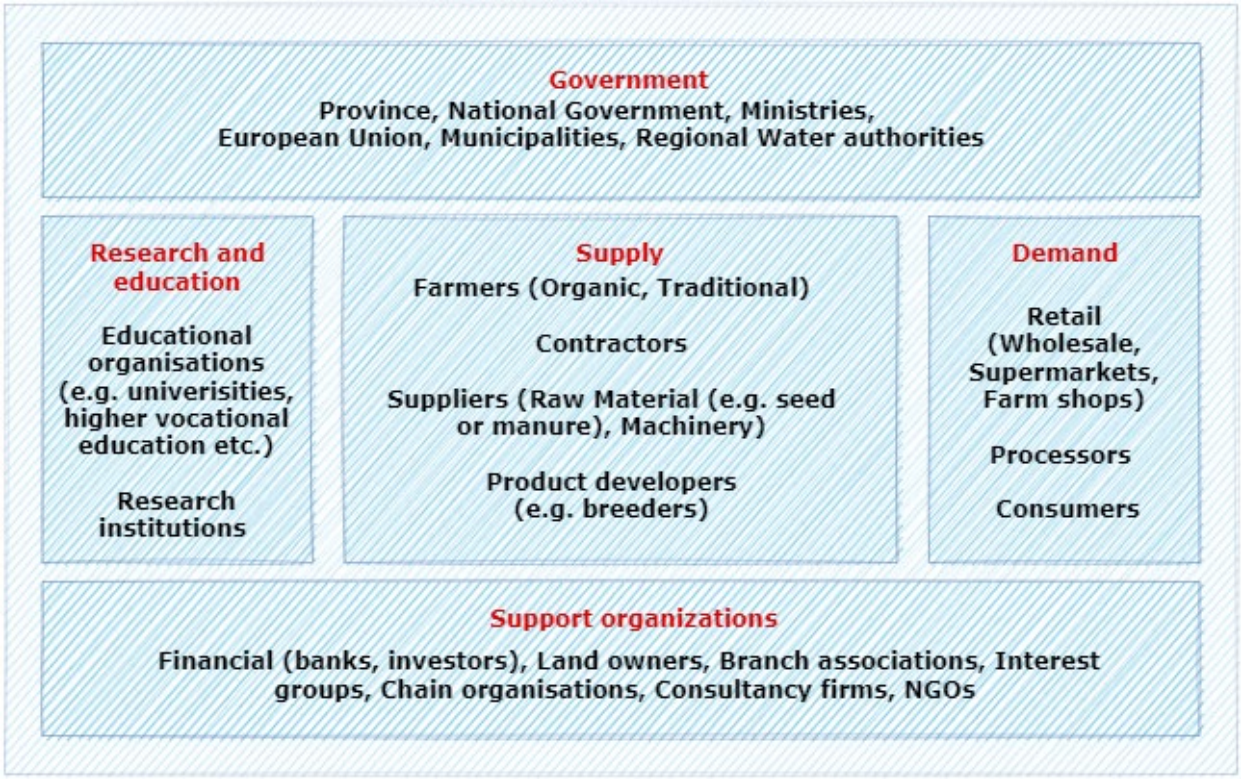
With regard to research and education, the Netherlands is strongly represented in agriculture, although to a (much) lesser extent in organic farming. In Noord-Brabant there is the university of applied sciences HAS in 's-Hertogenbosch and a number of MBO's (post-secondary vocational education) that focus on agriculture. Nationally there is also the University of Wageningen (WUR) which is leading in research and education in the agricultural sector. However, most hardly offer courses that focus on organic farming. The same applies for research institutes. Many institutes that conduct research in agriculture do little on organic, or only a very small part of their total portfolio. For example, the Louis Bolk Institute, that was founded to specifically conduct research into organic agriculture, is increasingly conducting research into other forms of (sustainable) agriculture.

Concerning actors on the supply side, these mainly consist of suppliers of seeds and manure. Since both need to be organic the latter in particular is often difficult to obtain. In addition, organic farmers depend on machine suppliers, although these mainly consist of one-off purchases.

As for the demand side, the actors vary widely. Organics are sold through various sales channels. For example, there is demand from supermarkets and specialty stores that offer unprocessed organic crops, the processing industry makes organic products that are usually sold through supermarkets and specialty stores, some catering establishments have organic dishes on the menu, and the animal feed industry offers organic animal feed.

Finally, the support organizations are very diverse and include banks, landowners, industry associations, consultancies, and NGOs. The first two in particular are important, because (organic) farmers generally do not have a strong financial position, so they are highly dependent on banks when making investments. As for landowners, (organic) farmers need large tracts of land to grow their crops and are therefore often dependent on leasing land from landowners.

Figure 5
Schematic overview of the actor types and structural elements identified for the (organic) farming sector for food crops in Noord-Brabant.



4.2.3.2 Institutions

Certification

The term organic is protected and may only be used for controlled organic foods, animal food, plants and floriculture. These products are recognizable by the organic EU quality mark. The European Regulation gives Member States the choice in the structure of the control regime. The Netherlands has opted for a structure with one controlling authority that is responsible for all statutory control tasks within organic production. The Ministry of Agriculture, Nature and Food Quality has designated the Skal Biocontrole Foundation as the controlling authority for the performance of these statutory tasks, resulting from the European regulations for organic production. Skal monitors the organic sector through registration, certification and supervision (Skal Biocontrole, n.d.).

Supranational institutions pertaining to organic farming

In the *Farm to Fork Strategy* and the *Biodiversity Strategy*, the European Commission has outlined the objective to have at least 25% of the EU's agricultural land under organic farming in 2030 (European Union, 2020). To realize this ambition, the European Commission has drawn up *an action plan for the development of organic production*. The action plan is organized along three axes that accommodate the structure of the food supply chain (production, processing, retail and consumers). To support continued growth and maintain a profitable market for organic operators (axis 1), the Commission will take measures aimed at:

- Promotion of organic farming and the EU logo.
- Promotion of organic canteens and increased use of green public procurement.
- Reinforce organic school schemes.
- Prevent food fraud and strengthen consumer confidence.
- Improve traceability.
- Facilitate the contribution of the private sector.

To continue progress in production and processing (axis 2), the Commission has planned to:

- Stimulate conversion, investment and exchange of best practices.
- Develop sector analyses to increase market transparency.
- Support the organization of the food chain.
- Strengthen local and small-scale processing and promote short circuits.

The Commission will further improve the organic sector's contribution to sustainability and environmental challenges (axis 3) through actions aimed at:

- Reduction of the climate and ecological footprint.
- Increasing genetic biodiversity and increasing yields.
- Develop alternatives to controversial inputs and other crop protection products.
- More efficient use of resources.

Moreover, the Commission intends to increase the share of research and innovation (R&I) and to devote at least 30% of the budget for research and innovation in agriculture, forestry and rural areas to topics specific or relevant to the organic sector. The research covers, among other things, changing farmer and consumer behaviour, higher crop yields, genetic biodiversity and alternatives to controversial products. In this context, the Commission will strengthen the coordination of national R&I programs for organic food and provide new opportunities, through the proposed Horizon Europe mission on soil health and food, and through partnerships, in particular those on agri- ecology and food systems. The dissemination of R&I results will be promoted through the European Innovation Partnership AGRI and the Agricultural Knowledge and Innovation System (AKIS) to promote an overall increase in organic products in all Member States (European Union, 2020).

Lastly, the Commission believes it is crucial for each Member State to develop its own national strategy for organic farming as soon as possible. All Member States should explain how they intend to contribute to the EU-wide target by establishing a national value for the share of organic agricultural land by 2030, taking into account their different assumptions.

National institutions

Since 2018 the vision and policy of the Dutch government has shifted to circular agriculture and organic farming no longer occurs in policy. However, there are a number of subsidies (although not specifically aimed at organic) available to organic farmers. Furthermore, organic farmers are expected to get more funds through the new Common Agricultural Policy (CAP) (The National Strategic Plan (NSP) still has to be approved by the EU). As for the subsidies, there are a number of subsidies and funds available through the Netherlands Enterprise Agency (RVO) and The Dutch National Fund for Green Investments

that support organic farming. **Appendix D** gives an overview of these subsidies and how they relate to organic farming.

Some of the subsidies in **Appendix D** come from the CAP. However, a new CAP will come into effect in 2023. The Dutch interpretation of the new CAP is outlined in the NSP, but this is yet to be accepted by the EU. The main changes for organic farmers in the new CAP are explained below. Within this new cap The Netherlands wants to focus less on direct income support for farmers and more on stimulating sustainability and innovation (Ministerie van Landbouw, Natuur en Voedselkwaliteit 2021). The core of the NSP is visualized in **Figure 6**.

Figure 6

Schematic overview of the Dutch Nationaal Strategisch Plan for the new Common Agricultural Policy

Note. Reprinted from Ministerie van Landbouw, Natuur en Voedselkwaliteit (2021).

The inner circle in **Figure 6** represents the basic premium, the core of the CAP. Farmers are entitled to the basic premium if they meet certain sustainability conditionalities. The second circle represents eco-schemes, which are measures that farmers may take that contribute to either of these five goals: soil, water, climate, landscape and biodiversity. Farmers are free to choose what eco-schemes suit their company best. Each scheme yields points, more points usually means more subsidy. What percentage of the total budget will be eco-schemes is yet to be determined but it is expected to be between 20% and 40%. The pay-out percentages depend on the use of the scheme and takes place at levels bronze, silver and gold with corresponding unit amounts. Organic farming automatically gets the gold level for the agricultural land that is part of the SKAL certificate. In the third circle (ANLb), farmers work together on nature management in a certain area. In the outer circle are the non-ground-bound instruments, aimed at specific problems that go beyond one specific plot or company. This also includes subsidies for young farmers, investments and knowledge development.

4.2.3.3 Networks

As for the networks, they variate between local, regional and (inter)national networks. Some specifically aimed at organic farming, but most on sustainability and innovation in the food sector in general. The most defining network for organic farming is the network that Bionext facilitates. It does this for primary producers, processors, and retailers in the Netherland. In addition, on a more local scale, there are organic farmers who unite in so-called study groups in which they discuss problems they encounter in their day-to-day

business operations. The organic sector is also united in Europe through IFOAM Organics Europe, the European umbrella organization for organic food and agriculture.

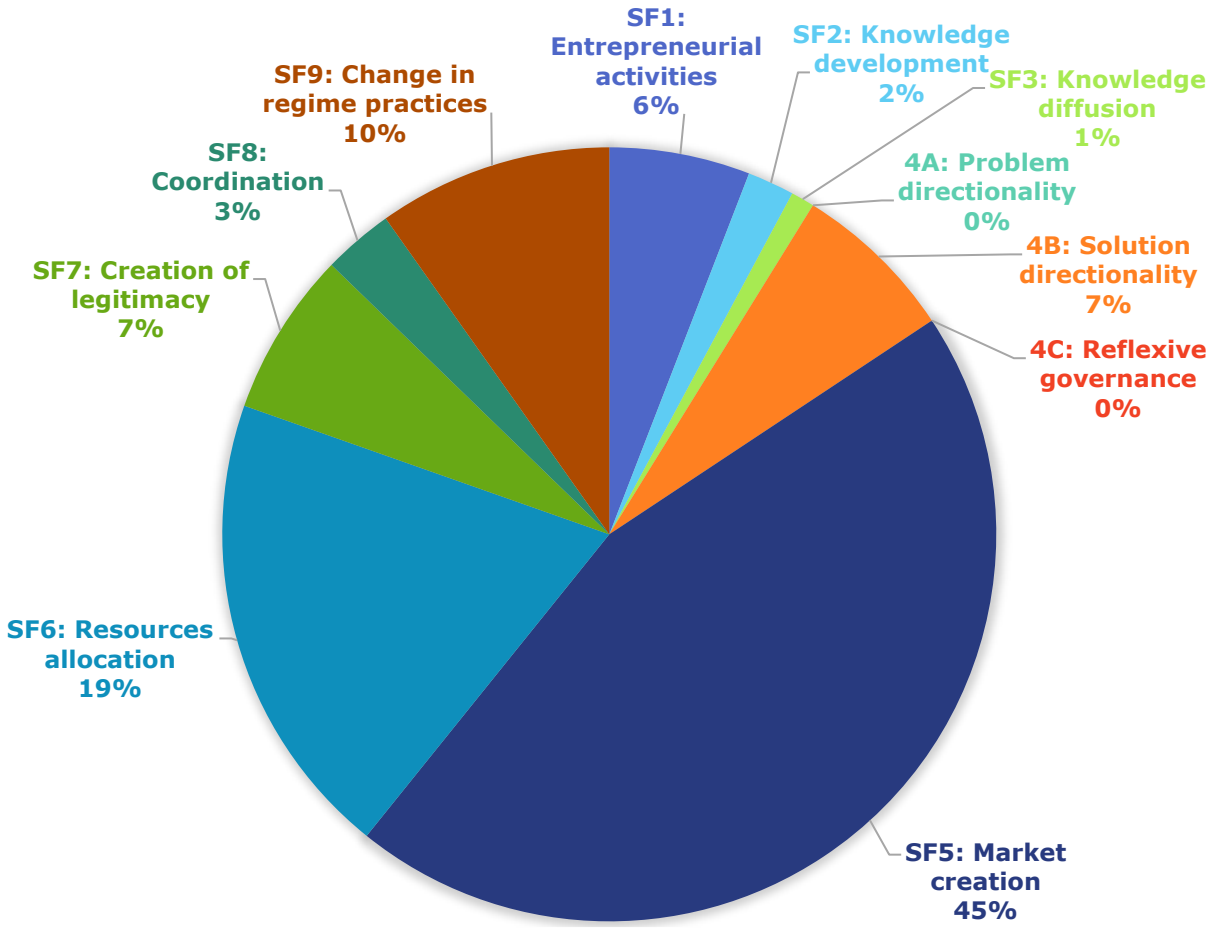
There are also numerous regional and national networks that focus more generally on sustainability and innovation in the food sector, such as regional; Foodtechbrainport, Agroproeftuin de Peel, and Goedboeren network and nationally; Topsector Agri&Food, Seed Valley, and Mineral Valley.

4.3 Functional analysis

The previous paragraphs show that there is an extensive structure of all kinds of actors, networks and institutions in the organic agricultural system. However, the system does not function in such a way that it has resulted in a much higher diffusion rate, which suggests that elements of the innovation system in Noord-Brabant are stagnating. Therefore the functional analysis is used to analyse were system functions (**Table 2**) might stagnate and expose bottlenecks that hinder system development. Based on 24 expert interviews, the pie chart in **Figure 7** gives an overview of what system function are considered the largest barriers when asked what the three largest barriers that hinder the transition to organic farming in Noord-Brabant are. This indicates that market creation is considered by far the largest barrier, followed by resource allocation, after which the differences are small between change in regime practices, creation of legitimacy, solution directionality, and entrepreneurial activity. Coordination, knowledge development, knowledge diffusion, problem directionality, and reflexive governance are hardly to never considered a major barrier.

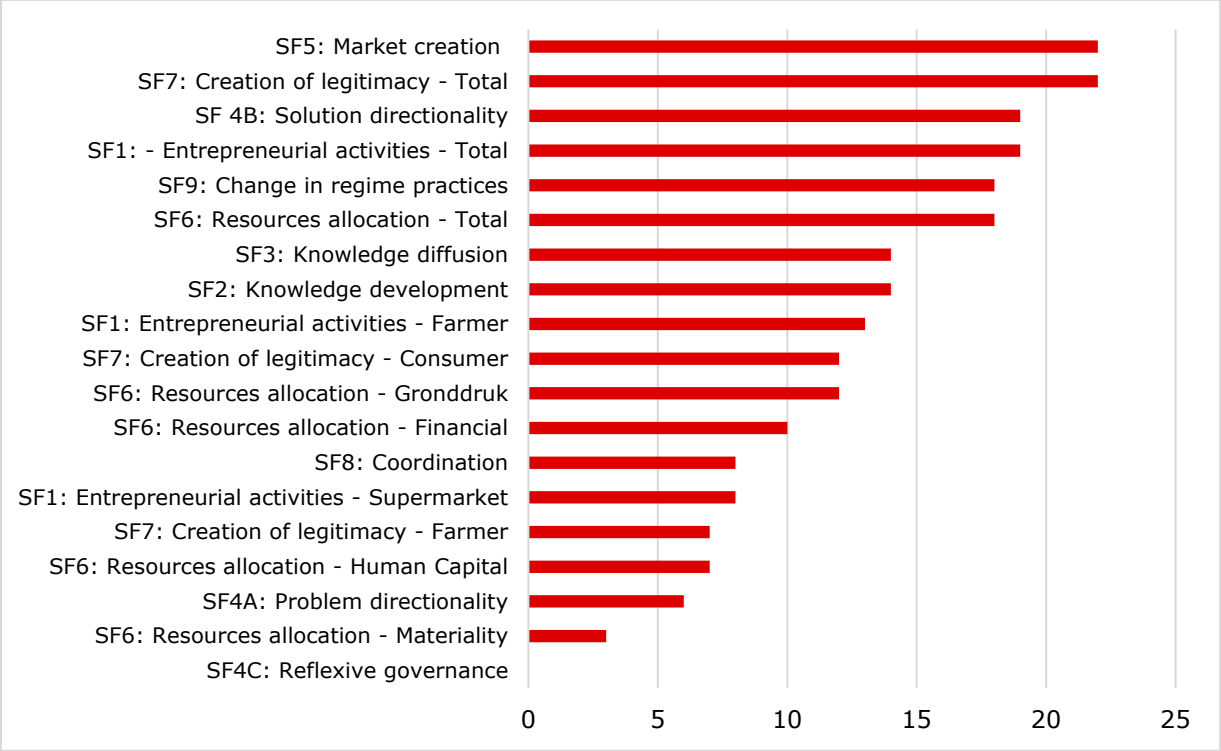
Figure 7

Biggest system function barriers that hinder the transition to organic farming in Noord-Brabant (N=24).



Aside from **Figure 7**, **Figure 8** indicates how often references is made to system functions as some kind of barrier without necessarily being one of the three largest barriers. It is striking that some system functions that are considered by most respondents as a barriers of some kind (**Figure 8**) hardly fall within the top three largest barriers (**Figure 7**). The most pressing problems can therefore easily be distinguished through **Figure 7**.

Figure 8
Reference made to a system function as being some kind of barrier (N=24).



4.3.1 Market creation

On average, market creation is by far considered the largest barrier (45%) hindering the transition to organic agriculture. In addition, an analysis of local and Dutch newspaper articles between 2017-2022 on organic farming shows that the low demand for organic products is the most often mentioned problem when compared to other problems that are mentioned.

Organic food is sold through various channels. The largest (traditional) channels are through supermarkets, specialty stores, and foodservice. During the market introduced of organics in the '90s, only specialized stores sold organics. Later the large supermarkets started selling organic products and are now the largest sales channel, both in terms of cash flow and volume (Bionext, 2020). For instance, 73.8% of all organic purchases take place in supermarkets. The remaining 26.2% of organic purchases are largely made in organic specialty stores (Bionext, 2020). Although organic products are currently widely available to consumers and the organic market is still growing, the share remains relatively low compared to other countries and the market share of organic in supermarkets has remained around 3 percent for years (Bionext, 2020). An additional challenge, shared by some respondents, is the increase in the organic acreage in other EU countries. In total, approximately 50% of Dutch organic arable crops and vegetables are exported. This indicates that domestic demand is lagging behind production, so further expansion is being held back by this fact (Dekking et al., 2020). It is expected that when the organic acreage in other EU countries increases, the demand for Dutch organic products will decrease (Koopmans et al., 2021). As a result, the growth of domestic sales is necessary for further growth and development of organic horticulture arable farming.

Three reasons why this domestic share is low can be distinguished. First, as previously mentioned, most organic products are bought in supermarkets (Bionext, 2020) and are therefore crucial in the upscaling of organics. However, according to most respondents supermarkets mostly focus on price, as acknowledged by a sustainability consultant in the Dutch retail sector: *"But of course the entire Dutch supermarket sector has always been extremely fixated on the price factor"*. As a result, organic products, which are often more expensive than conventional products, are rarely brought to the attention of consumers. For example, recent research indicates that Dutch supermarkets do little to promote organic food and drinks in their weekly brochures. Researchers looked at all the food and drinks that had been in the brochures of four large supermarkets over the past six months. Organic only took up about one to two percent of the space (Pointer, 2022). Therefore the general consensus is that supermarkets do not consciously hinder the market development of organics, but certainly also do not actively contribute to increasing organic sales. This is also confirmed by a sustainability consultant in the Dutch retail sector: *"Conservative, and it's not necessarily negative, but it's something they segment…. So yeah, those retailers have always said that organic is something for the highest income classes and we absolutely can't make it suitable for the common man. And we don't try to do that, we just won't do it and it remains something for a small top layer. That has always been the approach of Dutch supermarkets. And that will have to change now."*

Second, many consumers are characterized as 'price addicts' who are unwilling to pay a premium for organic products. In a review, Aschemann-Witzel and Zielke (2017) found that the large price differences between organic and conventional products are indeed an obstacle to further market development. According to a researcher affiliated with a university this is fuelled by the past*: "you could say that in the Netherlands the willingness to pay extra for organic is relatively low. If you compare that with other countries, it is also because the entire agricultural modernization story was very strongly associated with producing food as cheaply as possible. And sell it to the consumer at a reasonable price. Our Dutch consumer has grown up with food that is simply relatively cheap at a standard quality. They will not easily switch and think: I do want to pay considerably more for organic."* However, the unwillingness to pay a premium for organic products is also fuelled by consumers' perception that organic is more expensive than conventional.

A third finding, in addition to the actual price difference, is that the price perception of consumers also plays a role in the low market share of organic. For example, a price experiment showed that consumers' prior knowledge of the market price strongly determined the purchase of organic products (Bunte et al., 2010). In this experiment, a temporary discount for organic products was introduced to observe differences in purchasing. Although organic prices were low and sometimes below conventional products, consumers still expected the prices to be high and did not buy organic products (Verburg et al., 2022). A representative of a trade association acknowledges this: *"The problem is that organic products are more expensive. Yes, but perhaps a much bigger problem… Is the perception that organic products are more expensive. This is greatly overestimated. So we often talk about price, but it is also price perception"*.

4.3.2 Resources allocation

Resource allocation is considered the second largest barrier (19%). However, a distinction must be made between three types of resources, namely financial (investments and subsidies), material (land and machines) and human (labour). According to many respondents, obtaining enough financial resources can be a major challenge for organic farmers as the transition from conventional to organic is a financially uncertain time associated with high costs. For example, a farmer needs to invest in machinery, cultivates (often) more extensively and requires more manual labour. In addition, during the transition period (often 2 years), a product may not yet be sold as organic. So in that period a farmer makes all these additional costs but cannot get a premium for their crops. All this together makes it complicated for farmers, who often do not have large financial buffers anyway, to make the transition from conventional to organic. An organic farmer

who has experienced the transition period confirms: *"They don't have a buffer, no. … They come from such a tight financial situation, so much pressure. I do know that when we started working together, my partner asked every week from May to July: how come we have enough money? It was because I was doing interim work at the time and that gave us liquidity. That man was under such incredible pressure and was asking himself: can I pay my bills?"*

Most farmers rely on banks to finance the transition. Their willingness to lend to organic farmers is ambiguous. For example, there are a number of respondents who argue that most banks are not willing to provide loans to organic farmers. However, there are also respondents who are more positive about banks, such as an organic farmer who was able to take out a loan from a bank without many setbacks to finance the transition. A representative of a bank says the following about it: *"We are a bank. We are not a charitable institution that says: well go ahead and see if it works. So we really try at the front to be critical of: are you ready? Does it fit? And unfortunately that doesn't always work, so you have to be able to separate the better entrepreneurs from the lesser entrepreneurs.".* Reintroducing subsidies to organic farmers could improve the financial position and ease of switching, but the opinions of respondents about subsidies are divided. Some find a subsidy to at least get through the transition period to be justified. But there is also a share of the respondents, strikingly enough mainly from the organic sector itself (such as farmers), who are not in favour of subsidies. A representative of a trade association explains why*: "Well, subsidies.... You always have to watch out for that. Because if you come up with a pot of money and then farmers transition and there is no market. Then the market collapses."*

An often mentioned barrier is the high agricultural land prices in the Netherlands and Noord-Brabant. Of the EU Member States, the Netherlands has the highest purchase price for one hectare of arable land in the EU (average €69.632 in 2019). In all regions of the Netherlands was the price of arable land above all other national averages in the EU (Eurostat, 2021b). Due to the scarcity of land for various functions (housing, activities, nature and recreation), agricultural land is expected to remain expensive (Vellinga et al., 2021). This complicates the competitive position of organic farmers compared to conventional ones, because organic systems have a lower land use yield than conventional systems. Moreover, organic crop rotations usually include crops that are not fit for human consumption (Kirchmann, 2019). There are a number of initiatives that are intended to make it easier for organic farmers to lease land. For example, PNB owns a lot of agricultural land and organic companies receive a preferential position and discount when issuing leases for provincial land. In addition, sustainable farmers receive a discount when leasing land from a large commercial landowner in the Netherlands. However, the latter is only a few percent discount.

A number of respondents also regard (the lack of) human capital (labour) as a barrier. For example weed control, especially in open crops such as onions, requires a lot of labour to manually remove the weeds. However, it is increasingly difficult to obtain sufficiently qualified workers. Mechanization (better and new techniques) and robotization can offer a solution and save labour, but these developments are lagging behind (Koopmans et al., 2021). Suppose the developments were this far, then it would be difficult for farmers to finance them.

4.3.3 Change in regime practices

After market creation (SF5) and resource allocation (SF6), change of regime practices (10%) is considered the third largest barrier. According to most respondents, regime parties are aware that change is necessary (SF4a), but the Dutch expertise system has traditionally been strongly focused on intensification, which is in conflict with organic farming (extensification). This resistance is best illustrated with two quotes. The first from a researcher at a university: *"We have an expertise system that does not really have a very strong interest in emphasizing or accepting the added value of organic production.*

This is viewed quite critically in the Netherlands. "You can't feed the world with organic." That's what they say in Wageningen. Organic is a kind of elite solution for specific parts of the world in which consumers are willing and able to pay for the specific qualities of such a product. But you can't feed the rest of the world with it. The Netherlands has the ambition, aspiration and sometimes perhaps the arrogance to think that we can play a very important role in feeding the world. So organic, niche niche, small niche market and not much more, because then it becomes a threat to the regular, the current conventional, the agricultural modernist story. Which very strongly wants to safeguard that export position and the potential. And of course there are also many interests in the supply and purchase industry. They very often have the feeling: but if you put organic in the spotlight, you disqualify the qualities of our product. … So the story of what value does organic add to society exactly? I think that is much more controversial in the Netherlands than in other countries that have embraced organic much more." The second from a consultant in organic farming: *"The Netherlands is, of course, quite successful in conventional agriculture, if you look at exports, etc. We have our logistics well organized. That also has everything to do with the location of the Netherlands. "That is the gateway to Europe for many imports from all over and we have a fantastic logistics system. And in combination with a high-quality and technically high-quality agriculture, we have developed a strong export position in conventional agriculture and therefore many authorities, Ministry of Agriculture , Wageningen University, the agricultural institutions and the interest group LTO, which are very much focused on a common technocratic approach and absolutely not on another system approach, such as organic farming."* These quotes, which are widely shared by respondents, show that letting go of practices that are not in line with the mission in the Netherlands and Noord-Brabant is very complex due to vested interests that collide with organic farming.

4.3.4 Creation of legitimacy

The EU regulations, the certified controlled production standards, and the EKO quality mark give institutional legitimacy to organic farming. In addition, only a few articles have appeared in local and Dutch newspapers between 2017-2022 that are critical of problems with organic farming such as the higher price and lower yield and the vast majority of the articles are mainly about the positive effects of organic farming on the environment. This function is nevertheless regarded by almost all respondents as a moderate barrier (**Figure 8**) and by a small share as a major barrier (7%) (**Figure 7**). According to respondents, the lack of legitimacy is (partially) noticeable in three areas, namely among consumers, farmers and the Dutch agricultural expertise system.

Firstly, regarding legitimacy among consumers. Although most respondents argue that this has improved in recent years, some argue that organic still has a bit of a "geiten wollen sokken" image. Moreover and widely supported is the notion that consumers are not well aware of the benefits of organic and the EKO label. For example, half of Dutch consumers (51%) indicate that they do not recognize the EU organic label (Hilhorst et al., 2020). A study by Bionext (2022) confirms that the level of knowledge about what organic stands for leaves much to be desired. This is probably also due to the large amount of brands, labels and logos that are available for organic products. In addition, brands and supermarkets are increasingly launching their own labels and unique selling points, which makes it difficult for consumers to distinguish. As one focuses on nature and the climate, the other emphasizes a fair price and animal welfare. This makes it difficult for consumers to understand why they should buy organic (Bionext, 2022). Moreover, if consumers are not sufficiently familiar with the benefits of an organic product, the willingness to pay the additional price will be low (Bionext, 2020).

Secondly, the legitimacy among farmers. Respondents give very contradictory answers to whether organic farming enjoys legitimacy among Dutch farmers. A group of respondents (13) argue that most farmers are conservative and do not see organic as a legitimate business. This is best illustrated by a quote from a researcher at a private research organisation: *"What I think is a very big obstacle is the perception of Dutch*

farmers about organic. I come from an arable farm myself and traditionally most farmers look at organic as if it's some kind of hobby or niche or separate groups that do things differently. Which in that way are a bit of an odd one out." On the other hand, a slightly smaller share of respondents (10) think that farmers are less narrow-minded and are willing to transition to organic, provided the conditions are right. Best illustrated with a quote from a consultant in organic farming: *"I think if there is a market, that switch could go terribly fast. No, there really is support there. A lot of arable farmers would really like to take that step. If they think it gives a more secure future, they will do it. I'm convinced of that."* The legitimacy that organic enjoys among farmers is therefore ambiguous. However, the target for 2030 is 15% organic farming acreage and not 100%. With this nuance in mind, this may not be the biggest barrier.

Thirdly, the legitimacy that organic farming enjoys among the expertise system in the Netherlands. This is closely related to SF9 (change in regime practices). Several respondents state that organic farming enjoys little legitimacy among the established expertise system in the Netherlands. Best illustrated with a quote from a researcher at a university: *"I would also say because our expertise system in the Netherlands is still very much focused on that modernization story and any claim from whatever angle that organic is healthier or better for the environment is heavily contested and or put under the magnifying glass."*

4.3.5 Solution Directionality

Although this case has a clear solution direction, this does not automatically mean that this solution direction (organic agriculture) is also widely supported in the system. Besides organic, there are also other solutions aimed at ensuring a more sustainable agricultural system that deal with the problems as described in 4.1.2 (e.g. nature-inclusive agriculture and circular agriculture). There are some respondents (7%) that consider the solution directionality a major barrier and most as a moderate barrier. In terms of policy, the national government has pursued a specific policy on organic farming in the past but nowadays no longer has a policy on organic. For example, in the first policy memorandum (*Landbouwkwaliteitsbesluit biologische productiemethode*) with an associated action plan (1997) the ambition of a market share of 5% in 2007 and 10% organic agricultural land in 2010 was drafted. Initially, subsidies for the transitional period of two years were also available (Bok & Lössbroek, 2000). An evaluation of the action plan (Bok & Lössbroek, 2000) suggested a stronger focus on market development, quality improvement and research. Subsequent memoranda therefore emphasized the government's demand-driven vision by improving the development of the organic value chain, increasing consumer demand, developing knowledge through research investments, setting up an organization that supports and promotes the organic sector, closing of the 'transition subsidy', and the catering of organic products in government buildings, including hospitals. The *Duurzaam voedsel* memorandum (2009) was the last memorandum in which organic farming was mentioned in government documents. Organic farming was mentioned only as one example of sustainable farming, but no further government support was given to organic farming (Ministerie voor Landbouw Natuur en Voedselkwaliteit, 2009). Since 2018, the vision and policy of the government has completely shifted to circular agriculture, where organic farming is no longer discussed (Verburg et al., 2022).

If the national government had followed through on their organic policy some respondents believe that this would have had a positive effect on the organic sector, as illustrated by a research at a private research institute: *"Yes, I think that if the Dutch government had said years ago, organic is for us the… the top that we all have to work towards, then that would be it. I think that would have had an effect."* However, organic was not pursued and resources were allocated to other initiatives, such as circular agriculture and nature-inclusive agriculture. However, according to many respondents, this also causes confusion. As illustrated by a researcher at a university*: ….you have circular, you have nature-inclusive, organic, regenerative, short chains, but what exactly is going to be stimulated? That is still a search, that is not clear. And farmers also indicate in*

surveys that they simply lack that clarity. From the state, from the government." Another researcher agrees: *"You have a lot of agricultural organizations and they don't know any more either. There is not one voice from the agricultural organizations about which future should ultimately be sought, precisely because there are so many differences, that diversity is enormous."*

Moreover, some respondents criticize the Dutch government for that it hardly intervenes in the food (consumption) system. As illustrated by a sustainability consultant in the Dutch retail sector: *"The government in the Netherlands is completely outside the food system. We have a crappy government when it comes to reforming the food system. Everything is left to the market. No correction takes place. Yes, little by little in recent years. The problems are towering. And that has gradually penetrated to supermarket chains and producers. But the government? Talking a lot, doing very little."*

4.3.6 Entrepreneurial Activity

Various types of entrepreneurs are active within the organic sector. For convenience, three types are distinguished: primary producers (farmers), retailers, and processors. The willingness of these parties to do more with organic is ambiguous. Some respondents argue that, provided market conditions improve, these parties are willing to while others argue that there is a lot of resistance. Therefore some see entrepreneurial activity as a large barrier (6%), but most only as a moderate barrier.

As for the primary producers (farmers), Noord-Brabant has a smaller share of organic farms and organic acreage than the average in the Netherlands (although slowly increasing). In 2018 2.2% of organic horticulture and arable crop farmers in Noord-Brabant were organic (or in transition to) and was the share of organic (or in transition to) horticulture and arable crop acreage 1.68%. In 2021 this increased to 2,45% of farmers and 2.19% of agricultural land (CBS, 2022). However, if this marginal growth continues, the 2030 target will be far from achieved. This slow growth can be explained by various reasons, but in particular the low market demand for organic products in the Netherlands (see 4.3.5), the high agricultural land prices, no financial compensation during the transition period (see 4.3.7), and the lack of legitimacy that organic enjoys among Dutch farmers, consumers, and the Dutch expertise system (see 4.3.7).

Regarding retail, the role of supermarkets has already been largely discussed in 4.3.1. Other sales channels are specialty stores and the foodservice industry. Especially in the latter sector, most entrepreneurs are not willing to use more organic products. The organic market share in foodservice is therefore low at 1.6% in 2019 (pre Covid-19) (Bionext, 2020). A spokesperson from a wholesaler that supplies the food service industry explains why: *"Look, if you discuss this with those catering companies, you always get the same story. Then they say, organic offers me nothing extra. I can't value organic on my menu, because they don't have a guest in their restaurant who says: I'm going to eat there because they have organic vegetables. So all I have is a higher purchase price because it's organic, but there's no way I can pass that on to my guest. … In the supermarket, if you are a conscious consumer. Then they stand in front of the shelf in a supermarket and they see two products next to each other. One is organically grown, the other is not. That's where you see the extra cost. But you are then able to decide that you take the organic variant out of conviction and you are willing to pay the extra price for it. So consumers can make their own purchase decision there. When you are eating in a restaurant. Then you choose a dish. If a component, for example the vegetable is then organically grown, that has little added value for you as a guest."*

As for processors the number of organically certified processors varies over the years in the Netherlands (Koopmans et al., 2021). Although this is not explicitly stated by respondents, the general consensus is that processors mainly look at the market demand for organics and as soon as this increases they will try to facilitate that demand and bring more organic products to the market.

4.3.7 Coordination

This function is only considered a major barrier by a very small part of the respondents (3%). Furthermore, only a small part of the respondents mention any coordination problems (**Figure 8**). According to many, the coordination in the organic sector itself is quite good. One of the advantages of the organic sector compared to conventional is the fact that the branch organizations of the organic sector are united in one branch organisation. Organic entrepreneurs work together in Biohuis (for farmers & growers), BioNederland (for trade & processing) and the Biowinkelvereniging (for organic specialty stores), but all are united in Bionext. Therefore, interests are less likely to collide. In addition, there are also smaller networks of organic farmers that are well organised, as illustrated by a consultant in organic agriculture: *"Uh, you have a number of study groups of organic farmers, that is pretty well put together. Are own initiatives, in which the trade often also is involved. That network is actually quite good and there is an organic field branch and there is an organic knowledge week and it is well organized actually. Uhm. Yes, no, that's not the issue."* Therefore, according to most respondents, Bionext is doing quite well at providing this coordination. However, no one denies that there is no room for improvement and they could use more resources. The fact that coordination is going well might also have to do with the fact that the organic sector has been around for decades and that the sector is relatively small.

4.3.8 Knowledge development

Rarely identified as one of the largest barriers (2%), but more than half of the interviewees (14) argue that knowledge development is a moderate barrier. According to these respondents there is still (much) knowledge missing in the field of organic farming. This is also supported by the Louis Bolk Institute in a SWOT analysis on the organic sector in the Netherlands. They argue that knowledge and innovation, specifically aimed at the organic sector, is limited. Mechanization and robotization seem necessary for some sectors. However, this development is not going fast enough. Moreover, there is no labelled funding for knowledge and innovation for the organic sector and applied research and government incentives are virtually absent after 2011 (Koopmans et al., 2021). This is also recognized by Verburg et al., (2022) who note that although much agricultural research is done at universities (e.g. Wageningen University and Research), the budgets to study organic farming practices decreased from 7 million to 2.4 million euros in 2012, mainly due to declining investment by private companies (Braakman, 2012). In response, an amendment to the national budget of the Ministry of Agriculture was implemented in 2013 (Ministerie van Economische Zaken Landbouw en Innovatie, 2013). This resulted in an extra budget of 5 million euros per year until 2017 for research in the organic sector. Furthermore, analysing Horizon 2020 (EU's 2014-2020 research and innovation funding program with a budget of approximately €80 billion) only reveals one project initiated by a Dutch organization that focuses on organic and about five projects where Dutch parties collaborated on a project focused on organic (CORDIS, 2020). This lack of research (funding) in organic is acknowledged by interviewees such as a project leader within a Dutch ministry who is not aware whether this might change: *"There are funds available, but little is available that is specifically aimed at organic. Much research is broader, with a broader sustainability ambition agenda that benefits organic as well. And will it come? I just don't know yet."*

Apart from funds, some interviewees (mostly researchers and consultants) also indicate that knowledge should be developed in different ways. This is best illustrated by a quote from a researcher at a Dutch university: *"Uh, well, there is always room for more knowledge. But you also have to develop different kinds of knowledge. Then you also have to involve farmers much more in knowledge development and farmer-driven knowledge development. … and not so much from the scientific approach in which scientists claim to solve the farmer's problems. And one of the things why organic farmers become organic so that they have to rely more on their own knowledge. It is about knowledge of the specific location, the specific ecological situation. So you have to rely much more on your own*

knowledge and get to work with it, and much less on that scientific knowledge that materializes, for example, in pesticides, fertilizers and et cetera. So it's a different kind of knowledge."

4.3.9 Knowledge diffusion

Like knowledge development, knowledge diffusion is rarely identified by respondents as a major barrier (1%) and by some as a moderate barrier. However, a number of obstacles to knowledge diffusion are mentioned. An undisputed and most frequently mentioned is the lack of knowledge diffusion through schools. This is also endorsed by the Louis Bolk Institute in a SWOT analysis on the organic sector in the Netherlands. They state that the various agricultural educational institutions pay little attention to organic farming in their curricula. Often students can only opt for a full organic educational track or an internship at an organic company. The lack of the opportunity for a minor to experience organic farming does not favour a qualified business succession (Koopmans et al., 2021). In addition, knowledge is, compared to conventional agriculture, more difficult to obtain for organic farmers. This is best illustrated by a quote from an advisor at a Dutch NGO: *"Someone who wants, will gain that knowledge and get to work. Only where you see in conventional agriculture, whether you like it or not, that it is simply offered. For knowledge about organic farming you really have to find out for yourself."*

Another impediment to knowledge diffusion is related to SF9 (change in regime practices). Knowledge on farms often comes from companies that benefit little from organic farming. This is best illustrated by a quote from an organic farmer: . *"Who gives advice on farms? I think that's just the guy who comes from crop protection. They have a very important advisory function. They will not immediately advise you to become organic. I think that independent information or at least the possibility to do so is also very important."*

4.3.10 Problem directionality

This function is seldom regarded as a barrier and never as a major barrier (0%). All interviewees agree that sustainability is regarded as an important issue and is therefore high on the agenda of (regime) parties in the agricultural sector. However, converting this awareness into concrete actions is sometimes not forthcoming. Some of the interviewees have ideas as to why this is. For example, an organic farmer remarks: *"I have the idea that people are aware, very well aware, of the questions that arise. And also aware that changes are coming. I just think that people are too preoccupied with today's problems to get through today. And therefore have too little time to adapt in the long term."* A researcher at a university of applied sciences thinks that this is also due to the way in which the current system is set up: *"Yes, sustainability is definitely high on the agenda. Only still if you look at the regime parties, there the economy still takes precedence over sustainability. So people, planet, profit. That's all very nice, but profit is number one. And it makes sense, because the entire system focuses on that. So it is also very difficult for farmers to start more sustainable practices."*

4.3.11 Reflexive governance

None of the interviewees regard this function as a major barrier or as a barrier at all. However, this does not mean that the function is therefore well fulfilled, because it is important that monitoring and evaluation take place to keep track of the progress of the mission. The fact that it is rarely considered a barrier is most likely due to that the policy framework in which the target of 15% organic agriculture is stated was only adopted by the Provincial Council in April of 2022. In addition, the national government, as explained in the previous section, has not pursued an active policy on organic agriculture for years and apart from a number of projects and campaigns carried out by Bionext, it seems that nothing has happened and the organic sector has been left to the market in recent years. Therefore, monitoring and adjustment of targets is not relevant as of yet. A provincial policymaker also confirms: *"Not yet. Adaptations are still in their infancy. We are now*

starting a number of activities.....We do try to evaluate along the way. So our plans may already be adjusted left and right. They may already be different from three months ago, but really big evaluation points, no, not yet. Yes, so no. That has not yet been evaluated."

4.4 Systemic Barriers

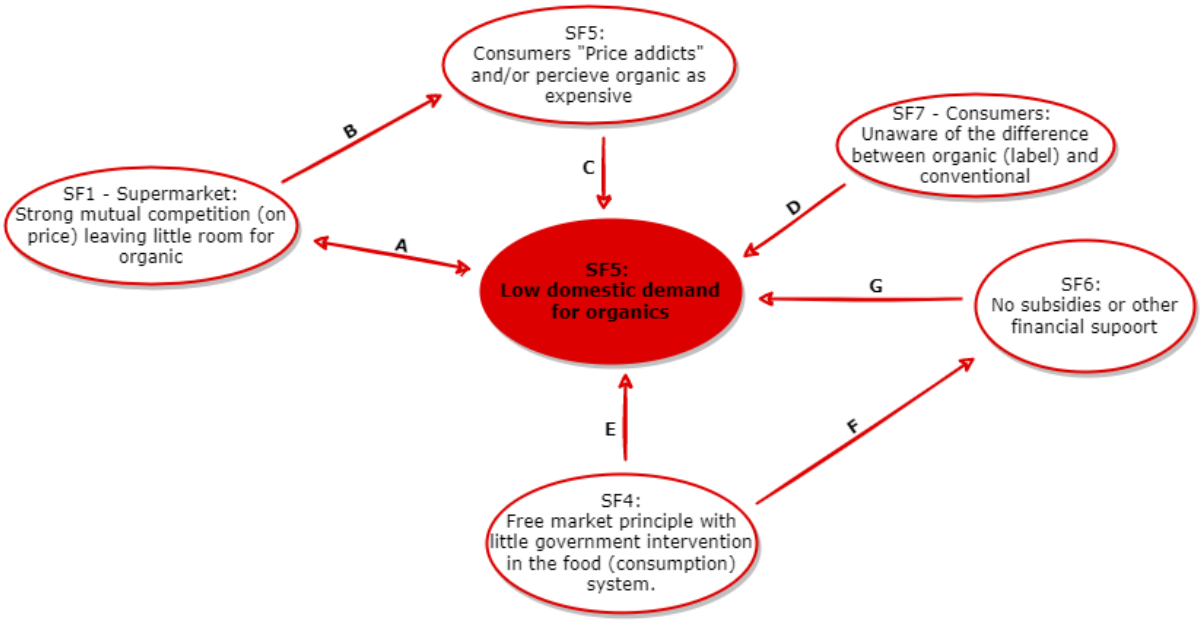
The system function analysis shows that there are a number of barriers. This section aims to uncover the root causes of the identified barriers. These root causes arise from those barriers that hinder the innovation system from being more successful in developing and disseminating innovations (Hekkert et al., 2020). With these interrelations in mind, narratives are composed that provide a basis for identifying which functions are at the root of the systemic problems. As visualized in **Figure 11**, two interrelated major clusters of barriers underlying different problems can be distinguished. These are the low demand for organic products and the small number of farmers that transition to organic.

4.4.1 Demand for organics

The first set of interrelated barriers revolve around the low demand for organic products (SF5). **Figure 9** schematically shows how the underlying problems are related to the low demand for organic. The letters in text correspond with the labelled connectors in **Figure 9**.

Figure 9

Interrelated barriers revolving around the low domestic demand for organics, with labelled connectors indicating the relationship between the identified problems.



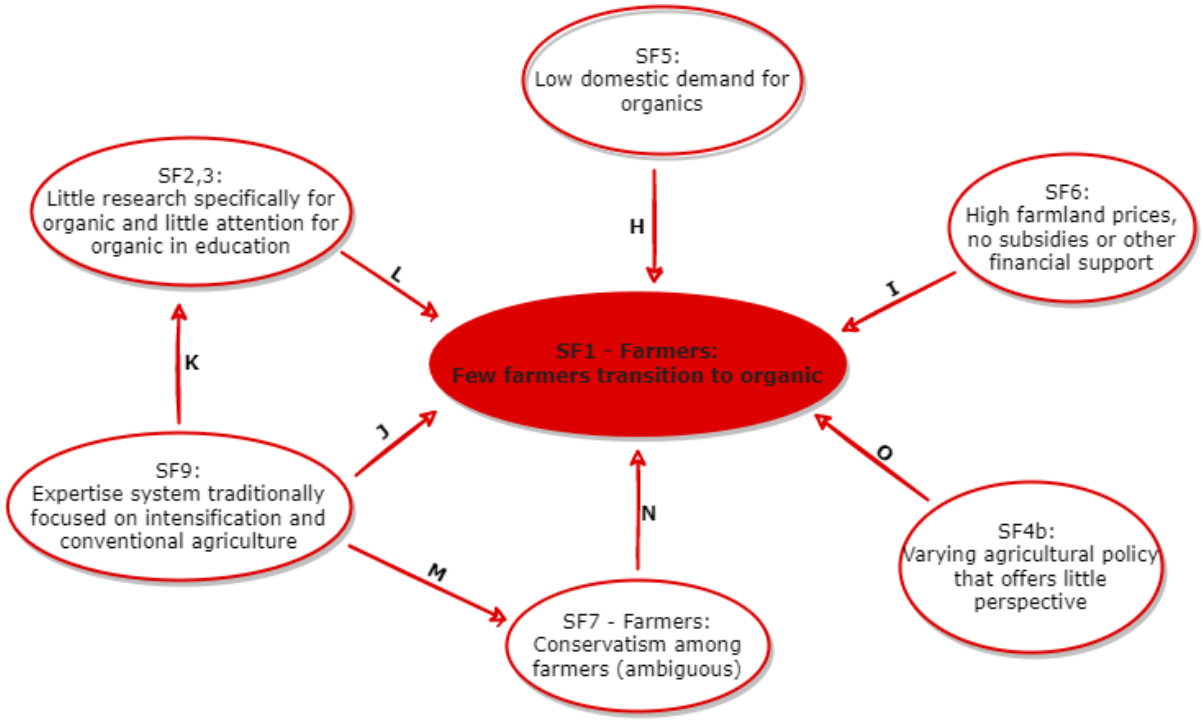
A first underlying problem associated with the low domestic demand for organics is that supermarkets (A), where most (organic) food products are sold, have strong mutual competition on prices. Which is disadvantageous for organic, because organic is on average more expensive than conventional products. Simultaneously, the low demand for organic products implies that supermarkets are not encouraged to, for example, increase the selection of organic products or bring them to the attention of consumers. Price is also often leading in the way supermarkets communicate towards consumers. Partly because of this (B), consumers are characterized as "price addicts" and because organic is often more expensive, consumers are therefore little tempted to buy organic products (C). Furthermore, many consumers perceive organic as much more expensive (C), although the actual price difference might be considerably less. Moreover, many consumers are not aware of the advantages of organic compared to conventional and what the organic label stands for (D). This decreases the willingness to pay a premium for organic. An additional

complicating factor is the fact that the Dutch government is far removed from the food system. As a result, the market is hardly adjusted and externalities are not priced (E). Partly because of this (F), there are no subsidies or other forms of financial support available to price these kinds of sustainability initiatives more economically in the market (G).

4.4.2 Farmers transition to organic

A second major obstacle is the slow increase of organic farmers (acreage) in Noord-Brabant (SF1). Although entrepreneurial activity (6%) was not among the top barriers in **Figure 7**, many large barriers are at the root of the low number of farmers that transition to organic. Therefore this problem is central in this cluster of barriers. How the underlying problems relate to the low number of farmers transitioning to organic is shown schematically in **Figure 10**. The letters in text correspond with the labelled connectors in **Figure 10**.

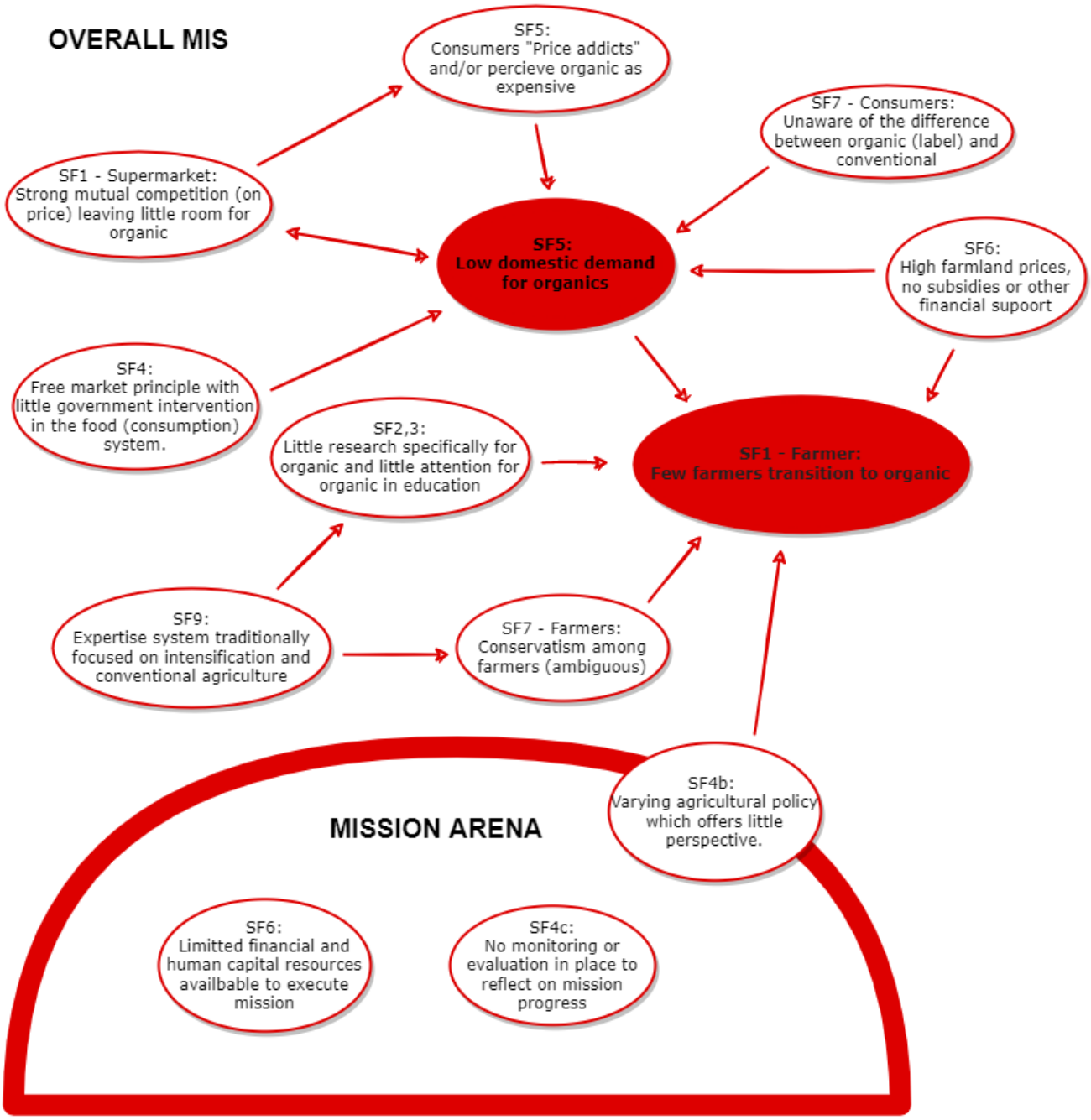
Figure 10
Interrelated barriers revolving around the few farmers that transition to organics, with labelled connectors indicating the relationship between the identified problems.



The biggest problem underlying the scarce amount of famers that transition to organic farming is the low demand for organic products (H). As long as demand is low, it is not interesting for farmers to enter the market and transition to organic. A rapid increase in the number of organic farmers is therefore not desirable when demand is low. However, this does not mean that farmers automatically transition to organic when market demand improves as some bottlenecks remain. First, the transition remains a financial bottleneck because it involves high costs and investments, while farmers do not yet receive a premium for their products. For example, farmers are currently in almost no way compensated to finance this transition period (I). Furthermore, the agricultural land prices in Noord-Brabant, just like in the rest of the Netherlands, are very high (I). Since farmers cultivate more extensively and often also partly grow crops that are not suitable for human consumption, it is difficult for organic farmers to compete with conventional farmers for the same plot of land. Second, the expertise system in the Netherlands has traditionally been strongly focused on conventional agriculture (J). As a result (K), little research is carried out into organic farming and little attention is paid to organic in education (L). The

latter in particular is an obstacle, because business successors do not easily come into contact with organic so lack the knowledge and skills to farm organically. Moreover, the current expertise system (M) contributes to maintaining an image among farmers that prefers conventional, intensive agriculture over alternative, more extensive forms of agriculture. This fuels conservatism among farmers to opt for a more extensive, alternative form of agriculture (N). The fourth and final bottleneck that emerges is the lack of long term perspective for farmers. Farmers are held responsible for all kinds of environmental problems. The government is trying to come up with solutions to these problems, but the existing plans (e.g. buy-up schemes) offer little perspective. As a result, farmers lack a long-term perspective, which makes them less inclined to change practices as policy might change again (SF4).

Figure 11
Complete overview of (interrelated) barriers in relation to the mission arena and the overall MIS.



4.5 (Planned) Mission Governance Actions

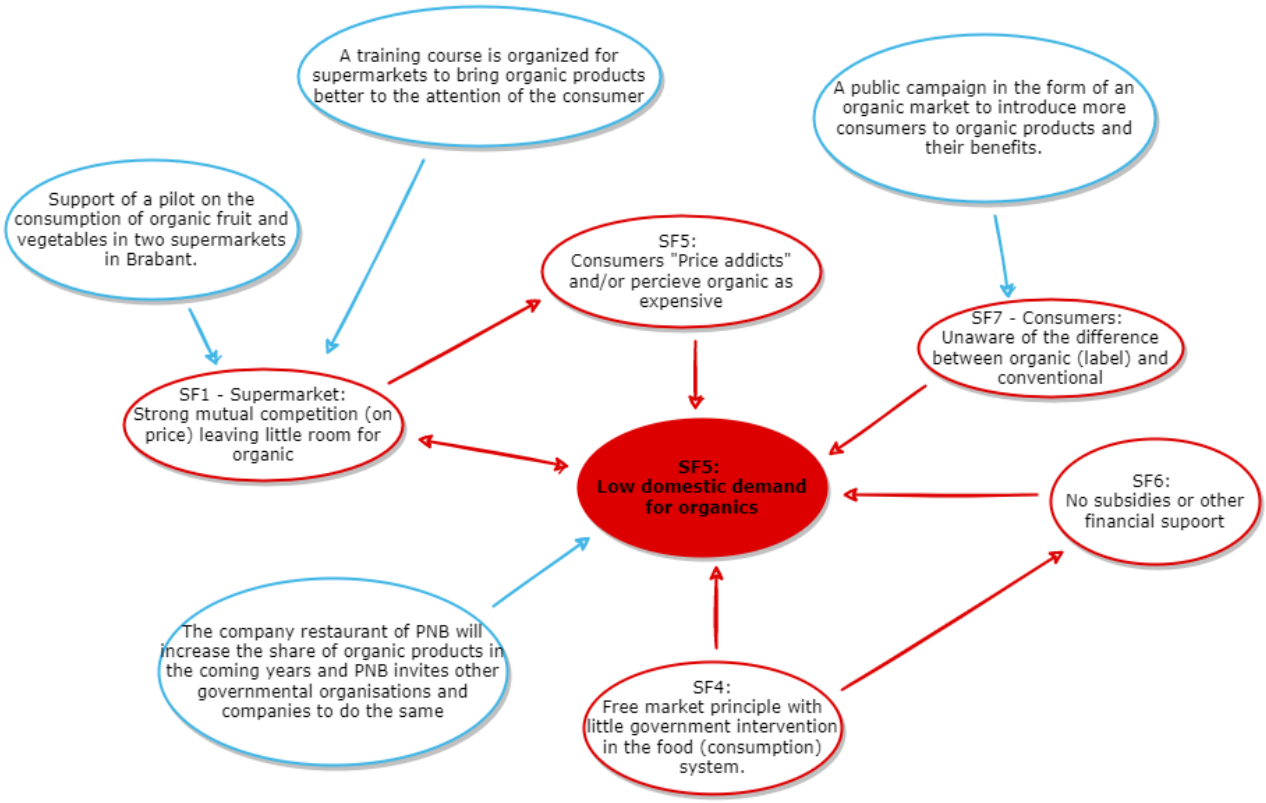
This section examines the systemic barriers and the current planned MGAs that are aimed at tackling these barriers. It is assessed whether the planned actions are sufficient to remove the identified obstacles. The planned or recently implemented MGAs are discussed in section 4.2.2 and those relevant to the barriers are discussed here. Since many of these MGAs are currently only plans and have not been put into practice, the impact is not yet measurable. However, this also means that there is still room for discourse and adjustments can still be made relatively easily. For each of the (planned) MGAs it is examined whether there are recommendation points that help ensure that the barriers are properly addressed. In addition, new MGAs (interventions) are issued for barriers that are not addressed because they do not fall within the scope of the (planned) MGAs. These recommendation and intervention points are drafted on the basis of interview data, expert consultations and literature. The proposed MGAs (interventions) aim to eliminate or reduce the adverse effects caused by the system barriers. **Table 6** gives an overview of the identified (interrelated) clusters of barriers, the (planned) MGAs, and the recommendations and interventions. The letters in text at 4.5.1 and 4.5.2 correspond with the letters in **Table 6** that are listed with the recommendations and interventions.

4.5.1 Demand for organics

The first main cluster of barriers (**Figure 9**) is the low demand for organic products. As described in 4.4, this is due to several underlying barriers. Consider **Figure 12** for a schematic overview of how current (planned) MGAs aim to tackle these barriers.

Figure 12

Interrelated barriers (red) revolving around the low domestic demand for organics and the MGAs (blue) targeting these barriers.



The first underlying problem is that consumers are unwilling to pay a premium for organic products and/or perceive organic products as to expensive. For now, no MGAs are planned to tackle this barrier. Intervention A, as often mentioned by respondents, suggests that the mission arena should advocate for true pricing as to create a more level playing field between conventional and organic and advocate for the abolishment or lowering of

VAT on organic products. However, the implementation lies not within the capabilities of the current mission arena, therefore the mission arena is advised to actively advocate for it at the national government and the European Union. What the mission arena can do is facilitate experiments to measure whether implementing these changes actually has an effect on the sales of organic products. When this is demonstrably effective, a stronger case can be made.

A second underlying problem is the unfamiliarity of many consumers about what organic (label) is and how it differs from conventional. There is a MGA planned to create a public campaign in the form of an organic market to introduce more consumers to organic products and their benefits. Recommendation (B) for this MGA is to increase awareness through other channels as well. However, because resources are limited, these campaigns should not target the general public, but specific groups of people and the routines they perform (de Krom et al., 2020). Because this also fits in with one of the objectives of the European Union in the action plan for organic agriculture, it is advised to explore whether additional funding to pursue this goal can be obtained. Furthermore, it is advised to collaborate with actors that are experienced in such campaigns such as branch organisation Bionext.

A third underlying problem is the strong mutual competition between supermarkets on price, resulting in little advertising and communication to consumers on organic. Two MGAs have been proposed to tackle this barrier, namely the support of a pilot on consumption of organic fruit and vegetables in two supermarkets in Brabant and a training course is organized for supermarkets to better draw attention of consumers to organic products. Although these MGAs are a good step to overcome this barrier, a proposed intervention I, which was also mentioned by a number of respondents, is to make actors in the food retail sector jointly responsible for making it more sustainable. This can be done, for example, by entering into a covenant with (local) prominent actors in the retail sector to reach agreements that are aimed at increasing the sale of organic products. In addition, agreements can be made in such a covenant to tackle the aforementioned barriers, for example by making agreements about the way in which about organic is communicated to consumers as to make them more aware of what organic is and possibly change the price perception of consumers as well.

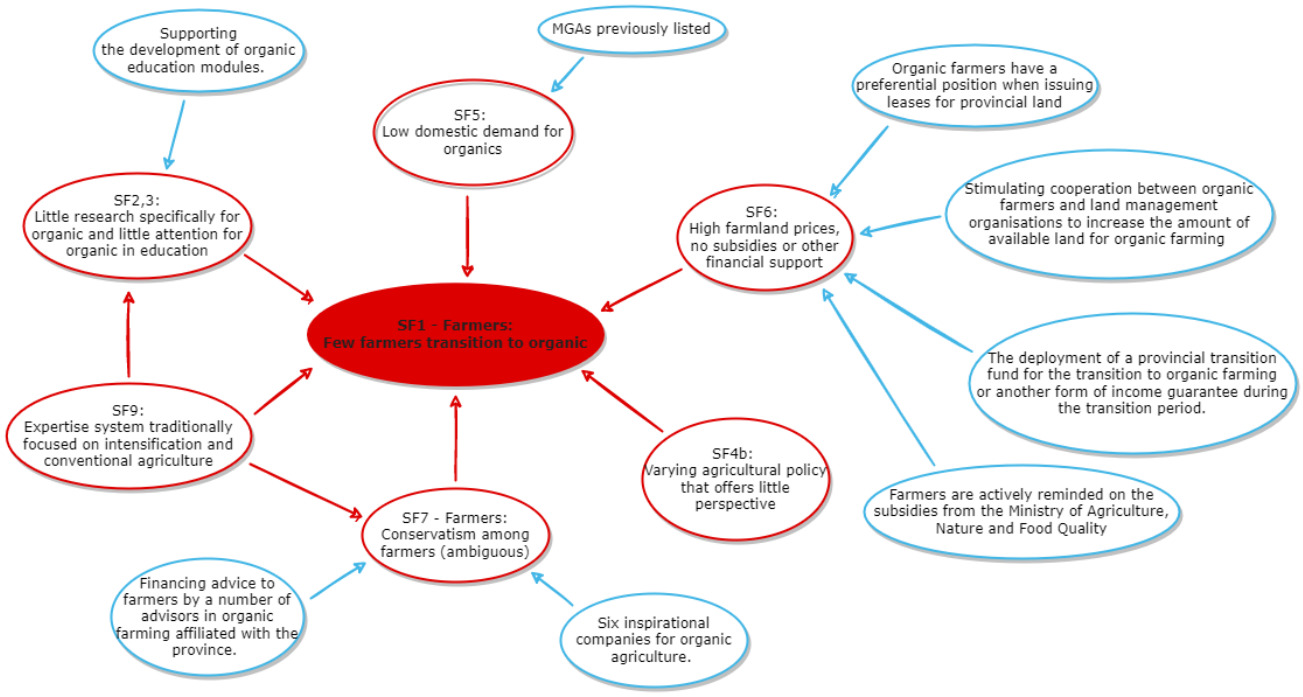
A fourth underlying identified problem is that there is little to no governmental intervention in the food (consumption) system. Although some of the aforementioned planned MGAs seem to hint at some kind of intervention, a minor recommendation (D) is that policies should be implemented consistently to avoid conflicting policy efforts at different levels and areas. In addition, there are no subsidies or other forms of financial support available to better price organic in the market. However, the mission arena's resources are too limited to implement this. This could also be achieved by lowering VAT on organic products and/or implementing true pricing (intervention A).

There is also a planned MGA that is directly aimed at increasing the demand for organic products. Namely that the company restaurant of the Province of Noord-Brabant will increase the share of organic products in the coming years. Moreover, the province, together with the 'Brabantse Milleu Federatie', invites other governmental organisations and companies to also opt for organic catering. This planned MGAs appears sufficient so no further recommendations or interventions are advised.

4.5.2 Farmers transition to organic

The second cluster of barriers revolves around the low number of farmers transitioning to organic. Consider **Figure 13** for a schematic overview of how current (planned) MGAs aim to tackle these barriers.

Figure 13
Interrelated barriers (red) revolving around the few farmers that transition to organic and the MGAs (blue) targeting these barriers.



The first underlying problem is that the demand for organic products is low. The planned and recommended MGAs to overcome this have been discussed in the previous section. A second underlying problem is the high price of agricultural land. Two MGAs are currently planned targeting this, namely that organic farmers have a preferential position in the lease of provincial land based on their Skal certification and the province encourages cooperation between organic farmers and land management organisations. The aim of this collaboration is to increase the amount of land for organic farming by entering into multi-year lease agreements and a lease price that matches the business model. As of now, these MGAs appear sufficient at tackling the barrier. However, if market demand increases and there is a threat of a shortage of organic supply, it is recommended I to reconsider these MGAs and to lease the provincial land exclusively to organic farmers.

A third underlying barrier that has been identified is the lack of subsidies or other forms of financial support for organic farmers. The planned MGAs that tackle this barrier are the use of a provincial transition fund to help finance the transition to organic agriculture or another form of income guarantee during the transition period. In addition, farmers are actively reminded on the subsidies from the Ministry of Agriculture, Nature and Food Quality with which they can get funding for the transition ('Economisch Herstelfonds' and 'Investeringsfonds Duurzame Landbouw'). There are, however, a number of recommendations and interventions for these MGAs. Firstly, it is recommended (F) that a transition subsidy is only open to farmers who operate in markets with crops/products where supply (threatens to) lag behind demand. The amount of the grant must then be determined on the basis of the available budget. Second, in order to accommodate parties in the organic sector and to create a more level playing field without making very high costs, it is recommended to reimburse the costs of a SKAL certification for farmers, processors, retailers, etc. (G). If resources from the transition fund remain after implementing these recommended MGAs, it is recommended that the funds are used to further stimulate demand (H).

A fourth underlying barrier is the conservatism among farmers towards organic. To mediate two MGAs are planned. Firstly, the province has committed itself to six inspirational companies for organic farming. On these farms, conventional famers can get acquainted with the practice of organic farming and exchange experiences. Secondly, the province reimburses the cost for farmers to get advice on organic farming by a consultant specialized in organic farming. Farmers who consider transitioning can participate in an orientation course together. These planned MGAs appear adequate at tackling the barrier for now, so no further intervention or attention is advised.

A fifth underlying problem is the Dutch expertise system that is strongly focused on conventional agriculture. As a result, little attention is paid to organic in research, advice and education. To overcome this, especially for education, a MGA is planned to support the development of organic training modules. This is preceded by an exploration of existing training models in the field of organic farming. The training models are intended to be made available to students of agricultural educational institutions, but also to former students and other persons in the sector who want to have training in the field of organic farming. An intervention (I) aimed at improving research and education is to recruit students (groups) to do research on cases at the province aimed at organic farming (such as the influence on soil and hydrology, but also practical questions that arise in consultation with organic farmers) and invite secondary and higher vocational education from the region to do the same.

A sixth underlying problem is the lack of long-term perspective for farmers. By drawing up a policy framework for 2030 with associated goals, the province is trying to ensure this long-term perspective. A recommendation (J) is to communicate the goals for 2030 regularly through various channels and partners and emphasize that these are long-term plans.

Table 6

Identified systemic barriers, planned or recently implemented MGAs, and recommendations / interventions points.

(Systemic) Barrier (and interrelated barriers)	**Planned or recently implemented Mission Governance Actions (MGA)**	**Recommendation / Intervention point.**
Demand for organics		
Consumer unwilling to pay (perceived) premium (SF5)	No planned MGAs	-Advocate for a reduction or abolition of VAT on organic products or true pricing as to achieve a more level playing field (A).
Consumer unaware of difference organic vs conventional and of organic label (SF7)	-A public campaign in the form of an organic market to introduce more consumers to organic products and their benefits.	-Increase awareness through other channels as well. However, these information campaigns should not be aimed at the general public, but at specific groups of people and the routines they perform. (B).
Supermarkets compete and advertise mainly on prices, so that organic receives little attention (SF1/7)	-Support of a pilot on the consumption of organic fruit and vegetables in two supermarkets in Brabant. -A training course is organized for supermarkets to bring organic products better to the attention of the consumer	-Draw up a covenant with (local) prominent actors in the retail sector in order to reach agreements to stimulate the sales of organic products (C).
Little to no governmental intervention in the food (consumption) system (SF4)	No planned MGAs	-Implement consistent policies to avoid conflicting policy efforts at different levels and areas (D).
Farmers transitioning to organic		
Low market demand for organic (SF5)	See previous MGAs	See previous recommendations / interventions
High land prices (SF6)	-Organic farmers have a preferential position when issuing leases for provincial land based on their Skal certification -Stimulating cooperation between organic farmers and land management organisations. The aim of this collaboration is to increase the amount of land for organic farming by entering into multi-year lease agreements and a lease price that is in line with the business model.	-As of now, these MGAs appear sufficient at tackling the barrier. However, if market demand increases and there is a threat of a shortage of organic supply, it is recommended to reconsider these MGAs and to lease the provincial land exclusively to organic farmers (E).

No subsidies or other financial support to transition (SF6)	-The deployment of a provincial transition fund for the transition to organic farming or another form of income guarantee during the transition period. -Farmers are actively reminded on the subsidies from the Ministry of Agriculture, Nature and Food Quality with which they can get funding for the transition	-Open up a transition subsidy only to farmers that operate in markets with product groups where the supply (threatens to) lag behind the demand (E). -Reimburse the SKAL certification cost (E). -If funds remain or no market (threatens to) lag behind demand, use funds to stimulate demand (G).
Conservatism among farmers (SF7)	-Six inspirational companies for organic agriculture. On these farms, conventional colleagues can get acquainted with the practice of organic farming and exchange experiences. -Financing advice to farmers by a number of advisors in organic farming affiliated with the province. Farmers who want to continue can participate in an orientation course together.	(Planned) MGAs are sufficient for now
Expertise system focused on conventional agriculture (SF9)	No planned MGAs	Out of scope of current mission arena
Little attention for organic in research and education (SF2 & 3)	-Supporting the development of organic education modules. This is preceded by an exploration of existing learning pathways in the field of organic farming. It is important that the learning track is made available to students of agricultural education as well as to former students and other persons in the sector who want to develop in the field of organic farming.	-Recruitment of students (groups) to research cases at the province aimed at organic farming and invite secondary and higher vocational education from the region to do the same (I).
Lack of long term perspective for farmers (SF4c)	- Policy framework for 2030	-Communicate the goals for 2030 regularly through various channels and emphasize that these are long-term plans (H).

5 Discussion

The recently developed structural-functional approach by Wesseling & Meijerhof (2021) is used as a foundation throughout this MIS analysis. Based on the results of this thesis, several insights contribute to the further development of this MIS approach. First, the thesis makes an empirical contribution by applying the concept of MIS in the case of the organic farming sector. The MIS framework is a new theory that is still under development. The empirical contribution of this thesis expands the literature by showing how MIS dynamics differ in different dimensions, as each mission is unique (Wesseling & Meijerhof, 2021).

Second, this thesis aims to improve the understanding of how a MIS relates to its geographic scope and the resulting coordination problems (Wanzenböck & Frenken, 2020). As it concerns a regional mission, initiated by regional actors, the mission arena is also strongly regional. However, many processes that affect the system (and the mission) are not tied to the region and are therefore difficult to influence by the mission arena. So for this case, this limits the mission arena's ability to coordinate the mission. It therefore seems that a limited geographic scope negatively affects the ability to coordinate a mission because many processes are not bound to a region and therefore hard to influence.

Third, complementary to Wesseling & Meijerhof (2021) and in line with Hekkert et al. (2020) the system functions coordination and change of regime practices are added. Although coordination did not lead to substantial barriers, in sustainability transitions the alignment of activities by a wide variety of actors by means of coordination processes is of great importance because interests and priorities may differ (Hekkert et al., 2020). The addition of change or regime practices also appears to be a valuable addition to the system functions as introduced by Wesseling & Meijerhof (2021). In (sustainability) transitions, the vested interests of parties that benefit from practices that are not in line with the mission are often significant (Hekkert et al., 2020). By mapping these, it is clear what vested interests the mission arena is up against and then this can be acted upon when MGAs are determined. This research therefore suggests that the addition of these system functions is meaningful for studying other missions.

Fourth, this thesis demonstrates that applying the MIS framework also lends itself to a mission with a predefined solution direction. Most previous MIS studies focused on missions where the solution direction was still open to discourse (Hekkert et al., 2020; Scheulderman, 2020; van Arkel, 2021; Wesseling & Meijerhof, 2021). However, this does require a different interpretation of the system function solution-directionality since this directionality has been determined from the outset. In this thesis this is mitigated by comparing to what extent the chosen solution is regarded as legitimate opposed to other possible solutions that could tackle the barriers as identified in the problem diagnosis.

To guarantee the accuracy of the study, some form of reliability and validity must be guaranteed (Morse et al., 2016). Reliability for qualitative research consists of two factors. First, internal reliability, which examines whether researchers make comparable judgments when analysing certain content to prevent personal bias (Bryman, 2016). This is mediated by regularly reporting new insights to experts to gauge whether this does not deviate from their knowledge of the sector. Second, external reliability refers to the extent to which a study can be replicated (Bryman, 2016). This is a challenge for research that is largely based on qualitative data, because the data is unique and if replicated with a comparable sample would yield different data. However, all steps taken during the analysis are accurately recorded, making the analysis replicable in a manner comparable to the original study (Lecompte & Goetz, 2016).

As for validity, for qualitative research it can be divided into two factors. First, internal validity, which examines whether there is a match between researchers' observations and the theoretical constructs they develop (Bryman, 2016). This is done by cross-checking results to ensure there is internal consistency between the findings (Riege, 2003). Second,

external validity is concerned with the extent to which findings can be generalized across social settings (Bryman, 2016). However, generalizing findings from a MIS study is complex, as each mission is unique due to different solution trajectories, geographical scope and degree of complexity (Wesseling & Meijerhof, 2021). Nonetheless, it is expected that some of the findings from this study may also be applicable to other regions where research is being conducted into the transition to organic farming.

Nevertheless some limitations have been identified. A first limitation is that only one researcher collected the data for this study (interviews) and performed the analyses. This may lead to interpretation errors and bias. To mitigate this effect, striking results from interviews are validated by verifying these results in successive interviews. Moreover, experts are regularly consulted to get feedback on results. Although this does not guarantee that no errors are made, it ensures that no major deviations arise in interpretating the results by the researcher.

A second limitation concerns the level of expertise of respondents. Some experts have a less holistic view of the system and mainly have expertise on a certain part of the system (such as on leasing agricultural land). On the one hand this provides depth on some specific system functions and barriers, on the other hand it may also cause bias as to what these respondents consider barriers. As a result, barriers from **Figure 7** may score too high (or too low) because these experts are not aware of problems that manifest in other system functions. Although **Figure 7** may deviate somewhat because of this, it is important to note that it only serves as an indication of where barriers arise, rather than a precise measurement. The interpretation of the data from the figure is therefore further elaborated in the accompanying texts for each system function.

A third limitation relates to the demarcation of horticultural and arable crops. Although from the outset this demarcation seems justified, in practice many organic farmers do not have such a strict demarcation on their farms. Since organic farmers are not allowed to use synthetic fertilizers, they often rely on organic animal manure. For example, all the interviewed organic farmers (four) had cattle next to their crops. This makes the distinction somewhat questionable. While this does not detract from the results, a more holistic approach might have sufficed.

A fourth limitation is related to the degree of depth and level of detail of this research. Given the limited time and resources to conduct this research, not all aspects can be equally well investigated. For example, there might be crop-specific problems, but this cannot be determined by means of this research and therefore generalization is necessary. This may leave some issues underexposed.

In view of the theoretical implications and limitations of this study, it is recommended for future research to investigate whether the effects of a regional mission on coordination problems that are observed in this thesis also hold for other regional missions. Furthermore, it would be interesting to research what the effects are on missions that are initiated on an even more local scale. As for the province, future research should investigate whether the (planned) MGAs are also sufficient to target the barriers in the organic cattle sector in Noord-Brabant, because these sector(s) are also part of the 2030 mission. This requires a new MIS study of which this research can serve as a blueprint.

6 Conclusion

For this research, a MIS-analysis is conducted on the mission of 15% organic farming acreage in 2030 in Noord-Brabant. The research is further delineated on organic horticultural and arable crops. In this section, an answer is provided to the research question of this thesis:

Which aspects of the organic horticulture and arable farming innovation system currently hamper the transition to 15% organic agriculture in the province of Noord-Brabant and do the ongoing or planned Mission Governance Actions (MGAs) adequately target these barriers?

To answer this question the five steps of the structural-functional approach as proposed by Wesseling & Meijerhorf (2021) are analysed. An extensive literature review, 24 interviews and numerous expert consultations provide data for these different steps. Various systemic barriers are identified from the system function analysis, which result in two clusters of the most pressing interrelated systemic problems: the low demand for organic products and the low number of farmers transitioning to organic farming. The planned or recently implemented MGAs targeting these barriers are consequently identified and reflected upon and were necessary new MGAs are proposed.

The first set of interrelated barriers manifest around the low demand for organic products. Many consumers are currently unwilling to pay a premium for organic and/or perceive organic as too expensive. This is partly fuelled by the strong focus on price in communication/advertising from retailers to consumers and little on organic. Partly because of this, consumers are often not well aware of what is organic compared to conventional. To overcome this, it is important that consumers are better informed about what organic is. It is expected that when consumers are more aware of what organic is the willingness to pay a premium will increase. However, collaboration with the retail sector is therefore necessary. A covenant is the most suitable instrument for this.

The second set of interrelated barriers revolve around the low number of farmers transitioning to organic. This is partly due to the low market demand for organic products. As long as demand is low, it is not interesting for farmers to enter the market and transition to organic. There are also financial barriers that make it difficult for farmers to transition to organic. For example, land prices in Noord-Brabant are very high and this makes it difficult for organic farmers to compete with conventional farmers for the same plot of land. In addition, the conversion period is a large financial burden for farmers, since their products cannot yet be sold as organic (and therefore with a premium). At the moment there are no financial instruments available to support farmers in this regard. Provided that the supply of organic markets (threatens to) lag behind the demand, then it seems justified to provide financial support to these farmers during the transition period (two years). Moreover, the expertise system in the Netherlands is strongly focused on conventional agriculture. As a result, little attention is paid to organic in research, advice and education. Thereby, farmers generally have little knowledge about organic and business successors do not easily come into contact with organic which fuels conservatism towards organic. Furthermore, farmers lack a long term perspective, which makes them less inclined to transition to a different business model (e.g. organic farming) as policy might change again.

In conclusion, PNB's mission for organic farming has only recently begun, so many of the MGAs are still only planned or under development. When the recommendations and interventions for the MGAs (**Table 6**) are adhered, there is a lot of potential that the identified barriers can be tackled. That said, however, these are uncertain times in the food sector. Due to several successive crises, food security and food prices are under pressure. This may make it even more challenging to transition to a more sustainable food system. It is therefore important to take the zeitgeist into account when implementing actions.

References

Adams, R. J., Smart, P., & Huff, A. S. (2017). Shades of Grey: Guidelines for Working with the Grey Literature in Systematic Reviews for Management and Organizational Studies. *International Journal of Management Reviews*, *19*(4), 432–454. https://doi.org/10.1111/IJMR.12102

Aschemann-Witzel, J., & Zielke, S. (2017). Can't Buy Me Green? A Review of Consumer Perceptions of and Behavior Toward the Price of Organic Food. *Journal of Consumer Affairs*, *51*(1), 211–251. https://doi.org/10.1111/joca.12092

Bengtsson, J., Ahnström, J., & Weibull, A.-C. (2005). The effects of organic agriculture on biodiversity and abundance: a meta-analysis. *Journal of Applied Ecology*, *42*(2), 261–269. https://doi.org/10.1111/j.1365-2664.2005.01005.x

Bergek, A., Hekkert, M., Jacobsson, S., Markard, J., Sandén, B., & Truffer, B. (2015). Technological innovation systems in contexts: Conceptualizing contextual structures and interaction dynamics. *Environmental Innovation and Societal Transitions*, *16*, 51–64. https://doi.org/10.1016/J.EIST.2015.07.003

Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., & Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: A scheme of analysis. *Research Policy*, *37*(3), 407–429. https://doi.org/10.1016/J.RESPOL.2007.12.003

Berry, P. M., Sylvester-Bradley, R., Philipps, L., Hatch, D. J., Cuttle, S. P., Rayns, F. W., & Gosling, P. (2002). Is the productivity of organic farms restricted by the supply of available nitrogen? *Soil Use and Management*, *18*, 248–255. https://doi.org/10.1111/j.1475-2743.2002.tb00266.x

Bionext. (2020). *BIONEXT TRENDRAPPORT 2020 ONTWIKKELINGEN IN DE BIOLOGISCHE SECTOR*. www.bionext.nl

Bionext. (2022). *Greenpaper Biologisch & communicatie*. www.biolekkervoorje.nl

Bok, R., & Lössbroek, T. (2000). *Evaluatie Plan van Aanpak Biologische Landbouw, 1997-1999*.

Boon, W., & Edler, J. (2018). Demand, challenges, and innovation. Making sense of new trends in innovation policy. *Science and Public Policy*, *45*(4), 435–447. https://doi.org/10.1093/SCIPOL/SCY014

Braakman, J. (2012, March 15). *Minder geld voor onderzoek naar biologisch*. Https://Www.Boerderij.Nl/Minder-Geld-Voor-Onderzoek-Naar-Biologisch.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706QP063OA

Bryman, A. (2016). *Social Research Methods* (5th ed.). Oxford University Press. https://books.google.com/books/about/Social_Research_Methods.html?hl=nl&id=cChhrgEACAAJ

Bunte, F. H. J., van Galen, M. A., Kuiper, W. E., & Tacken, G. (2010). Limits to Growth in Organic Sales. *De Economist*, *158*(4), 387–410. https://doi.org/10.1007/s10645-010-9152-3

Carlsson, B., & Stankiewicz, R. (1995). *On the Nature, Function and Composition of Technological Systems*. 21–56. https://doi.org/10.1007/978-94-011-0145-5_2

CBS. (2022). *Activiteiten van biologische landbouwbedrijven*. Https://Opendata.Cbs.Nl/Statline/#/CBS/Nl/Dataset/83922NED/Table?Dl=AC87.

CORDIS. (2020). *Horizon 2020*. Https://Ec.Europa.Eu/Info/Research-and-Innovation/Funding/Funding-Opportunities/Funding-Programmes-and-Open-Calls/Horizon-2020_en#programme-Analysis.

de Krom, M., Vonk, M., & Muilwijk, H. (2020). *Voedselconsumptie veranderen: bouwstenen voor beleid om verduurzaming van eetpatronen te stimuleren*.

de Wit, M., Londo, M., & Faaij, A. (2011). Productivity developments in European agriculture: Relations to and opportunities for biomass production. *Renewable and Sustainable Energy Reviews*, *15*(5), 2397–2412. https://doi.org/10.1016/J.RSER.2011.02.022

Doloreux, D. (2002). What we should know about regional systems of innovation. *Technology in Society*, *24*(3), 243–263. https://doi.org/10.1016/S0160-791X(02)00007-6

Duiker, S. (2004). *Effects of Soil Compaction*.
Edquist, C. (1997). Systems of Innovation: Technologies, Institutions, and Organizations. In C. Edquist (Ed.), *Systems of Innovation: Technologies, Institutions and Organizations*. Routledge. https://books.google.com/books/about/Systems_of_Innovation.html?hl=nl&id=Sf0POR0ffWEC
el Bilali, H. (2020). Transition heuristic frameworks in research on agro-food sustainability transitions. In *Environment, Development and Sustainability* (Vol. 22, Issue 3, pp. 1693–1728). Springer. https://doi.org/10.1007/s10668-018-0290-0
el Bilali, H., Callenius, C., Strassner, C., Lorenz Probst, |, & Bilali, H. el. (2018). Food and nutrition security and sustainability transitions in food systems. *Food Energy Secur*, 154. https://doi.org/10.1002/fes3.154
Elzinga, R., Janssen, M. J., Negro, S., Hekkert, M. P., Wesseling, J., Negro, S. O., & Hekkert, M. P. (2021). *Mission-oriented Innovation Systems Dynamics: Towards an assessment framework*.
European Union. (2020). From Farm to Fork: Our food, our health, our planet, our future. In *https://ec.europa.eu/commission/presscorner/detail/en/fs_20_908*.
Eurostat. (2021a). *Organic farming statistics*. Https://Ec.Europa.Eu/Eurostat/Statistics-Explained/Index.Php?Title=Organic_farming_statistics.
Eurostat. (2021b, November 30). *Agricultural land prices: huge variation across the EU* . Https://Ec.Europa.Eu/Eurostat/Web/Products-Eurostat-News/-/Ddn-20211130-2.
Food and Agriculture Organization of the United Nations. (1999). CODEX ALIMENTARIUS COMMISSION TO APPROVE INTERNATIONAL GUIDELINES FOR ORGANIC FOOD [Press release]. In *https://www.fao.org/waicent/ois/press_ne/presseng/1999/pren9940.htm*.
Foodprint. (2021). *How Industrial Agriculture Affects Our Soil*. Https://Foodprint.Org/Issues/How-Industrial-Agriculture-Affects-Our-Soil/#easy-Footnote-Bottom-11-1260.
Geels, F. W., Hekkert, M. P., & Jacobsson, S. (2008). The micro-dynamics of sustainable innovation journeys : editorial. *Technology Analysis and Strategic Management*, *20*(5), 521–536. https://doi.org/10.1080/09537320802292982
Grin, J., Felix, F., Bos, B., & Spoelstra, S. (2004). Practices for reflexive design: lessons from a Dutch programme on sustainable agriculture. *Undefined*, *1*(1–2), 126–149. https://doi.org/10.1504/IJFIP.2004.004618
Halberg, N. (2012). Assessment of the environmental sustainability of organic farming: Definitions, indicators and the major challenges. *Canadian Journal of Plant Science*, *92*(6), 981–996. https://doi.org/10.4141/cjps2012-035
Hekkert, M., Negro, S., Heimeriks, G., Harmsen, R., & Jong, S. de. (2011). *Technological Innovation System Analysis A manual for analysts*.
Hekkert, M. P., Janssen, M. J., Wesseling, J. H., & Negro, S. O. (2020). Mission-oriented innovation systems. *Environmental Innovation and Societal Transitions*, *34*, 76–79. https://doi.org/10.1016/J.EIST.2019.11.011
Hekkert, M. P., & Negro, S. O. (2009). Functions of innovation systems as a framework to understand sustainable technological change: empirical evidence for earlier claims. *Undefined*, *76*(4), 584–594. https://doi.org/10.1016/J.TECHFORE.2008.04.013
Hekkert, M. P., Suurs, R. A. A., Negro, S. O., Kuhlmann, S., & Smits, R. E. H. M. (2007). Functions of innovation systems: A new approach for analysing technological change. *Technological Forecasting and Social Change*, *74*(4), 413–432. https://doi.org/10.1016/J.TECHFORE.2006.03.002
Hekkert, M., Reike, D., Rainville, A., & Negro, S. (2020). *Transition to Circular Textiles in the Netherlands An innovation systems analysis*.
Henle, K., Alard, D., Clitherow, J., Cobb, P., Firbank, L., Kull, T., McCracken, D., Moritz, R. F. A., Niemelä, J., Rebane, M., Wascher, D., Watt, A., & Young, J. (2008). Identifying and managing the conflicts between agriculture and biodiversity conservation in Europe–A review. *Agriculture, Ecosystems and Environment*, *124*(1–2), 60–71. https://doi.org/10.1016/J.AGEE.2007.09.005

Hilhorst, E., Kranenburg, L. K., & de Jong, J. (2020). *Vertrouwen van de Nederlandse consument in het biologisch keurmerk van de Europese Unie*. www.ioresearch.nl
Hole, D. G., Perkins, A. J., Wilson, J. D., Alexander, I. H., Grice, P. V., & Evans, A. D. (2005). Does organic farming benefit biodiversity? *Biological Conservation*, *122*(1), 113–130. https://doi.org/10.1016/j.biocon.2004.07.018
Hussain, S., Siddique, T., Saleem, M., Arshad, M., & Khalid, A. (2009). *Chapter 5 Impact of Pesticides on Soil Microbial Diversity, Enzymes, and Biochemical Reactions* (pp. 159–200). https://doi.org/10.1016/S0065-2113(09)01005-0
IPCC. (2018). *IPCC SPECIAL REPORT ON GLOBAL WARMING OF 1.5°C*.
Janssen, M. J., Torrens, J., Wesseling, J. H., & Wanzenböck, I. (2021). The promises and premises of mission-oriented innovation policy—A reflection and ways forward. *Science and Public Policy*, *48*(3), 438–444. https://doi.org/10.1093/SCIPOL/SCAA072
Janssen, M., Torrens, J., Wesseling, J., Wanzenböck, I., & Patterson, J. (2020). *Position paper "Mission-oriented Innovation Policy Observatory."* https://www.researchgate.net/publication/342130493
Kattel, R., & Mazzucato, M. (2018). Mission-oriented innovation policy and dynamic capabilities in the public sector. *Industrial and Corporate Change*, *27*(5), 787–801. https://doi.org/10.1093/ICC/DTY032
Kirchmann, H. (2019). Why organic farming is not the way forward. *Outlook on Agriculture*, *48*(1), 22–27. https://doi.org/10.1177/0030727019831702
Koopmans, C., Geijzendorffer, I., Janmaat, L., Schurer, B., Sleiderink, J., de Wit, J., & Wagenaar, J.-P. (2021). *SWOT-analyse van de biologische landbouw met kansen voor stimulering*. www.louisbolk.nl/publicaties
Larrue, P. (2021). The design and implementation of mission-oriented innovation policies: A new systemic policy approach to address societal challenges. *OECD Science, Technology and Industry Policy Papers*. https://doi.org/10.1787/3F6C76A4-EN
Lecompte, M. D., & Goetz, J. P. (2016). Problems of Reliability and Validity in Ethnographic Research: *Http://Dx.Doi.Org.Proxy.Library.Uu.Nl/10.3102/00346543052001031*, *52*(1), 31–60. https://doi.org/10.3102/00346543052001031
Levin, K., Cashore, B., Bernstein, S., & Auld, G. (2012). Overcoming the tragedy of super wicked problems: Constraining our future selves to ameliorate global climate change. *Policy Sciences*, *45*(2), 123–152. https://doi.org/10.1007/S11077-012-9151-0/TABLES/3
Lundvall, B.-Å. (1992). National Systems of Innovation Towards a Theory of Innovation and Interactive Learning. *Pinter Publishers*. https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=1918818
Maeder, P., Fliessbach, A., Dubois, D., Gunst, L., Fried, P., & Niggli, U. (2002). Soil Fertility and Biodiversity in Organic Farming. *Science*, *296*(5573), 1694–1697. https://doi.org/10.1126/science.1071148
Magdoff, F., & van Es, H. (2021). *Building soils for better crops : ecological management for healthy soils*.
Malerba, F. (2002). Sectoral systems of innovation and production. *Research Policy*, *31*, 247–264.
Mazzucato, M. (2016). From market fixing to market-creating: a new framework for innovation policy. *Https://Doi-Org.Proxy.Library.Uu.Nl/10.1080/13662716.2016.1146124*, *23*(2), 140–156. https://doi.org/10.1080/13662716.2016.1146124
Mazzucato, M. (2018). Mission-oriented innovation policies: challenges and opportunities. *Industrial and Corporate Change*, *27*(5), 803–815. https://doi.org/10.1093/ICC/DTY034
Ministerie van Economische Zaken Landbouw en Innovatie. (2013, January 25). *Vaststelling van de begrotingsstaten van het Ministerie van Economische Zaken, Landbouw en Innovatie (XIII) voor het jaar 2013*. Https://Zoek.Officielebekendmakingen.Nl/Kst-33400-XIII-125.Html.
Ministerie van Landbouw, Natuur en Voedselkwaliteit (2021). *Samenvatting Nationaal Strategisch Plan*.

Ministerie van Landbouw Natuur en Voedselkwaliteit. (2018). *Landbouw, natuur en voedsel: waardevol en verbonden. Nederland als koploper in kringlooplandbouw*.
Ministerie voor Landbouw Natuur en Voedselkwaliteit. (2009). *Nota Duurzaam voedsel*.
Morse, J. M., Barrett, M., Mayan, M., Olson, K., & Spiers, J. (2016). Verification Strategies for Establishing Reliability and Validity in Qualitative Research: *Http://Dx.Doi.Org.Proxy.Library.Uu.Nl/10.1177/160940690200100202*, *1*(2), 13–22. https://doi.org/10.1177/160940690200100202
Natural Resources Conservation Service. (1998). *Soil Quality Information Sheet: Pesticides*. www.nssc.nrcs.usda.gov
Nelson, R. R. (1993). *National Innovation Systems: A Comparative Analysis*. https://papers.ssrn.com/abstract=1496195
Niggli, U. (2015). Sustainability of organic food production: challenges and innovations. *Proceedings of the Nutrition Society*, *74*(1), 83–88. https://doi.org/10.1017/S0029665114001438
Oehl, F., Sieverding, E., Ineichen, K., Mäder, P., Boller, T., & Wiemken, A. (2003). Impact of Land Use Intensity on the Species Diversity of Arbuscular Mycorrhizal Fungi in Agroecosystems of Central Europe. *Applied and Environmental Microbiology*, *69*(5), 2816–2824. https://doi.org/10.1128/AEM.69.5.2816-2824.2003
Pointer. (2022, May 8). *Supermarkten prijzen biologisch eten nauwelijks aan in folders*. Https://Pointer.Kro-Ncrv.Nl/Supermarkten-Prijzen-Biologisch-Eten-Nauwelijks-Aan-in-Folders.
Provincie Noord-Brabant. (2022). BRABANTS BELEIDSKADER LANDBOUW EN VOEDSEL 2030. In *https://www.landbouwenvoedselbrabant.nl/beleidskader/default.aspx*.
Reganold, J. P., & Wachter, J. M. (2016). Organic agriculture in the twenty-first century. *Nature Plants*, *2*, 15221. https://doi.org/10.1038/NPLANTS.2015.221
Rehfeld, D., Terstriep, J., Welchhoff, J., & Alijani, S. (2015). *Comparative Report on Social Innovation Framework. Proy. SIMPACT.*
Riege, A. M. (2003). Validity and reliability tests in case study research: A literature review with "hands-on" applications for each research phase. *Qualitative Market Research: An International Journal*, *6*(2), 75–86. https://doi.org/10.1108/13522750310470055
Ritter, J., & Eng, P. (2012). *Soil Erosion — Causes and Effects*.
Rodríguez Eugenio, N., McLaughlin, M. J., & Pennock, D. J. (2018). *Soil pollution : a hidden reality*. FAO.
Sanderson, F. J., Kucharz, M., Jobda, M., & Donald, P. F. (2013). Impacts of agricultural intensification and abandonment on farmland birds in Poland following EU accession. *Agriculture, Ecosystems and Environment*, *168*, 16–24. https://doi.org/10.1016/J.AGEE.2013.01.015
Scheulderman, L. (2020). *Mission-oriented Innovation System (MIS) analysis on circular water authorities in 2050*.
Schot, J., & Steinmueller, W. E. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, *47*(9), 1554–1567. https://doi.org/10.1016/j.respol.2018.08.011
Seufert, V., & Ramankutty, N. (2017). Many shades of gray—The context-dependent performance of organic agriculture. *Science Advances*, *3*(3). https://doi.org/10.1126/sciadv.1602638
Skal Biocontrole. (n.d.). *Toezichthouder op de biologische keten in Nederland*. Https://Www.Skal.Nl/over-Ons.
Skinner, C., Gattinger, A., Krauss, M., Krause, H. M., Mayer, J., van der Heijden, M. G. A., & Mäder, P. (2019). The impact of long-term organic farming on soil-derived greenhouse gas emissions. *Scientific Reports 2019 9:1*, *9*(1), 1–10. https://doi.org/10.1038/S41598-018-38207-W
Smits, R., & Kuhlmann, S. (2004). The rise of systemic instruments in innovation policy. *International Journal of Foresight and Innovation Policy*, *1*(1/2), 4–32. https://doi.org/10.1504/IJFIP.2004.004621
Soil Association. (2016). *The impact of glyphosate on soil health*.
Stoate, C., Báldi, A., Beja, P., Boatman, N. D., Herzon, I., van Doorn, A., de Snoo, G. R., Rakosy, L., & Ramwell, C. (2009). Ecological impacts of early 21st century agricultural

change in Europe – A review. *Journal of Environmental Management*, *91*(1), 22–46. https://doi.org/10.1016/J.JENVMAN.2009.07.005
Suurs, R. A. A. (2009). *Motors of sustainable innovation : Towards a theory on the dynamics of technological innovation systems*. http://dspace.library.uu.nl/handle/1874/33346
Suurs, R. A. A., & Hekkert, M. P. (2009). Cumulative causation in the formation of a technological innovation system: The case of biofuels in the Netherlands. *Technological Forecasting and Social Change*, *76*(8), 1003–1020. https://doi.org/10.1016/J.TECHFORE.2009.03.002
Tuck, S. L., Winqvist, C., Mota, F., Ahnström, J., Turnbull, L. A., & Bengtsson, J. (2014). Land-use intensity and the effects of organic farming on biodiversity: a hierarchical meta-analysis. *Journal of Applied Ecology*, *51*(3), 746–755. https://doi.org/10.1111/1365-2664.12219
University of California - Davis. (2016, October 12). *Why insect pests love monocultures, and how plant diversity could change that*.
van Arkel, J. (2021). *Analysis of the Dutch Mission-oriented Innovation System for sustainable aviation*.
Vellinga, T., Praasterink, F., de Wolf, P., Angelucci, D., Verheijen, L., & van Cappellen, F. (2021). *Bouwstenen voor beleidsontwikkeling Agrofood Noord-Brabant 2040*. www.wageningenUR.nl/livestockresearch
Verburg, R. W., Verberne, E., & Negro, S. O. (2022). Accelerating the transition towards sustainable agriculture: The case of organic dairy farming in the Netherlands. *Agricultural Systems*, *198*. https://doi.org/10.1016/j.agsy.2022.103368
Vermunt, D. A., Negro, S. O., van Laerhoven, F. S. J., Verweij, P. A., & Hekkert, M. P. (2020). Sustainability transitions in the agri-food sector: How ecology affects transition dynamics. *Environmental Innovation and Societal Transitions*, *36*, 236–249. https://doi.org/10.1016/J.EIST.2020.06.003
Vermunt, D. A., Wojtynia, N., Hekkert, M. P., van Dijk, J., Verburg, R., Verweij, P. A., Wassen, M., & Runhaar, H. (2022). Five mechanisms blocking the transition towards 'nature-inclusive' agriculture: A systemic analysis of Dutch dairy farming. *Agricultural Systems*, *195*. https://doi.org/10.1016/J.AGSY.2021.103280
Wanzenböck, I., & Frenken, K. (2020). The subsidiarity principle in innovation policy for societal challenges. *Global Transitions*, *2*, 51–59. https://doi.org/10.1016/J.GLT.2020.02.002
Wanzenböck, I., Wesseling, J., Frenken, K., Hekkert, M., & Weber, M. (2019). A framework for mission-oriented innovation policy: Alternative pathways through the problem-solution space. *SocArXiv*. https://doi.org/10.31219/OSF.IO/NJAHP
Wanzenböck, I., Wesseling, J. H., Frenken, K., Hekkert, M. P., & Weber, K. M. (2020). A framework for mission-oriented innovation policy: Alternative pathways through the problem-solution space. *Science and Public Policy*, *47*(4), 474–489. https://doi.org/10.1093/SCIPOL/SCAA027
Weber, K. M., & Rohracher, H. (2012). Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework. *Research Policy*, *41*(6), 1037–1047. https://doi.org/10.1016/J.RESPOL.2011.10.015
Wesseling, J. H., & Edquist, C. (2018). Public procurement for innovation to help meet societal challenges: A review and case study. *Science and Public Policy*, *45*(4), 493–502. https://doi.org/10.1093/SCIPOL/SCY013
Wesseling, J. H., & van der Vooren, A. (2017). Lock-in of mature innovation systems: the transformation toward clean concrete in the Netherlands. *Journal of Cleaner Production*, *155*, 114–124. https://doi.org/10.1016/J.JCLEPRO.2016.08.115
Wesseling, J., & Meijerhof, N. (2021). *Developing and applying the Mission-oriented Innovation Systems (MIS) approach*. https://doi.org/10.31235/OSF.IO/XWG4E
Wieczorek, A. J., & Hekkert, M. P. (2012). Systemic instruments for systemic innovation problems: a framework for policy makers and innovation scholar. *Science & Public Policy*, *39*(1), 74–87. https://doi.org/10.1093/SCIPOL/SCR008

Appendix

Appendix A: Diagnostic questions

System Function	Description	Diagnostic questions
SF1:Entrepreneurial activities	Experiments with (clusters of) solutions to enable learning; entering markets for new solutions; engaging in business model innovations to foster the diffusion of solutions.	• Is entrepreneurship at this moment adequate to achieve the organic farming mission? • Are experiments to develop existing and new solutions conducted fast enough to complete the mission?
SF2:Knowledge development	Learning by searching and by 'doing', resulting in development and better understanding of new technical and social knowledge on problems and solutions, through R&D, social research and behavioural science research.	• Is sufficient knowledge developed to understand the societal problem and the harmful effects of innovative goods and practices? • Is knowledge to develop existing and new solutions created fast enough to complete the mission? • Is knowledge created to help actors to *unlearn* practices harmful to the mission sufficiently rapidly?
SF3:Knowledge diffusion	Stakeholder meetings, conferences, governance structures, public consultations, mission progress reports and other forms of disseminating technical and social knowledge for the mission's solutions and societal problems.	• Is knowledge about the societal problem diffused sufficiently to formulate a broadly supported, clear, time-bound and ambitious mission? • Is knowledge to develop and use solutions diffused amongst all stakeholders sufficiently rapidly to complete the mission?
SF4:Providing directionality	Besides pre-existing institutional structures in the context of the mission arena, the mission arena is central to providing direction and mobilizing support from the existing innovation system structures that comprise the overall MIS.	• Have the governance structures been set up to establish an influential and well-embedded mission arena, in which different stakeholder interests are reflected, to direct and help mobilize the overall MIS? • Is an inside/political or outside/managerial governance approach taken?
4A:Problem directionality	The direction provided to stakeholders' societal problem conceptions and the level of priority they give it.	• Do stakeholders prioritize the mission's societal problems and framework conditions in relation to other societal problems and demands?
4B:Solution directionality	The direction given, both by existing system structures and the mission arena, to the search for new and further development of existing technological and social solutions, as well as the coordination efforts needed to identify, select, and exploit synergetic sets of solutions to the mission.	• Do stakeholders know what solutions are necessary to complete the mission (both innovative solutions and phasing-out of old practices and technologies)? • Do stakeholders agree on what the necessary solutions are, or do they agree that they do not know all necessary solutions yet? • What solution directions are currently being prioritized over others, and by what system structures or system contextual factors?

		• Do stakeholders sufficiently recognize and exploit the interdependencies between different solutions?
4C:Reflexive governance	Reflexive deliberation, monitoring, anticipation, evaluation and impact assessment procedures; these provide the analytical and forward-looking basis for redirecting the system's problem framing and search for solutions based on lessons learned and changing context. Reflexive governance can be seen as second-order directionality, and it can be initiated by the mission arena or by critical outsiders.	• Is the mission's progress monitored transparently (e.g., by a dedicated taskforce) and is the MIS on track to meet the mission? • If not, have sufficient measures been taken to catch up? • Is the impact and relevance of the mission governance actions regularly evaluated and, if necessary, are they adequately redesigned? • Does multi-stakeholder deliberation take place to assess whether the mission still adequately captures a pressing societal problem? • If it does not, is progress being made towards reorienting the mission?
SF5:Market formation	Creating a niche market and upscaling support for technical and social solutions; phasing out or destabilizing markets for practices and technologies harmful to the mission.	• Do formal or informal policies support the sufficiently rapid diffusion of innovative solutions and the phasing out of harmful technologies and practices to complete the mission? • Do stakeholders adopt the solutions sufficiently rapidly?
SF6:Resources allocation	Mobilization of human, financial and material resources to enable all other system functions.	• Have sufficient human, financial and material resources been mobilized to fulfil the other system functions?
SF7: Creation of legitimacy	Creating legitimacy for prioritizing (a) the problem and (b) the development and diffusion of the solutions, at the cost of harmful practices and technologies.	• Do stakeholder groups and the public vocally support the mission's societal problem and solutions? • Do stakeholders attempt to generate more support from the public or from other actors for the mission's societal problem and solutions?
SF8: Coordination	Alignment of activities by a wide variety of actors through coordination processes.	• Are the activities of a wide variety of actors that are involved in the mission aligned? • Is the mission sufficiently coordinated? If not, who (should) bear(s) this responsibility? • Are actors aware of roles and responsibilities in the mission?
SF9: Change in regime practices	Next to the creation and diffusion of novelty it is important that the existing production and consumption systems, in which rules and practices have become deeply engrained, change their routines and practices in line with the mission objective. three dimensions of change: 1) Increasing awareness that change is necessary 2) Experimentation with novel technologies, business models, new modes of governance in line with mission objective 3) Abandoning practices that are not in line with mission objective.	• Are regime actors aware that change is necessary and are they willing to change practices? • Do stakeholders abandon harmful practices and technologies sufficiently rapidly? • Have resources been withdrawn from harmful practices and technologies to stop their continuation? • Is there (sufficient) pressure on regime actors to change practices?

Appendix B: Interviewguide

Allereerst bedankt voor de tijd die je neemt om jouw kennis en expertise omtrent de (biologische) landbouw sector voor dit onderzoek te willen delen. De duur van dit interview is ongeveer een uur.

Data & Geïnformeerde toestemming

Ik wil graag een geluidsopname van het interview maken om de data achteraf te analyseren. Ik stuur zo meteen ook een geïnformeerd toestemming formulier na, zou je die kunnen ondertekenen.

Persoonlijke introductie en probleemstelling

Ik ben masterstudent Innovation Sciences/innovatiewetenschappen aan de Universiteit Utrecht. Ik ben sinds november bezig met mijn masterscriptie en voer deze bij de Provincie Noord-Brabant uit. Hierbij doe ik onderzoek naar groei van de biologisch sector in de provincie Noord-Brabant, waarbij ik focus op de productie van plantaardige gewassen (akker/tuinbouw) die in de buitenlucht geteeld worden (dus niet op veeteelt en kastuinbouw), houd hier rekening mee in je antwoorden. Waarom dit vraagstuk? De provincie heeft in het beleidskader Landbouw en Voedsel 2030 de ambitie van 15% biologisch landbouwareaal in 2030 gesteld. Voor nu is het areaal biologische landbouw in Brabant ongeveer 3%. De biologische sector moet dus binnen 8 jaar met minstens een factor 5 groeien om deze ambitie te halen. Ik wil via dit onderzoek achterhalen welke obstakels er weggenomen moeten worden om dit te halen.

Heb je nog vragen of opmerkingen voordat we starten?

Algemene vragen

- Kunt je kort iets over jezelf en jouw achtergrond vertellen?
- Hoe relateert jouw werk en/of dat van jouw organisatie zich tot de biologische landbouw en dan met name gericht op de plantaardige sector?
- Wat is je visie en die van je organisatie op biologische landbouw?
- De ambitie van de provincie zoals ik die net schets: een factor 5 groei van de biologische sector in 8 jaar, wat zijn volgens jou dan de 3 grootste belemmeringen/problemen die het behalen van dit doel in de weg staan?
- Liggen hier mogelijk andere problemen/belemmeringen aan ten grond slag en/of houden de belemmeringen elkaar of andere belemmeringen mogelijk in stand?
- Hoe zouden deze belemmeringen volgens je weggenomen kunnen worden? Bij welke partijen of organisaties ligt dan de verantwoordelijkheid?
- Zie je kansen voor biologisch of biologische sector die op dit moment niet benut worden?
- Naast de zojuist benoemde belemmeringen, zijn er volgens je nog andere belemmeringen relevant die niet binnen deze top 3 vallen?
- Hoe zouden deze belemmeringen volgens je weggenomen kunnen worden? Bij welke partijen of organisaties ligt dan de verantwoordelijkheid?

Dan heb ik nog een aantal verdiepingsvragen op thema's die ik van te voren wellicht relevant achten, maar nu nog niet benoemd zijn. Wellicht ontstaan hier ook problemen, al kan het natuurlijk ook zijn dat hier juist dingen goed gaan. Dan hoor ik dit uiteraard ook graag.

Richting geven aan de missie

Functie 4a: Prioritering van de problemen

-De landbouw sector staat voor meerdere grote opgave en uitdagingen en organisaties hebben hier dan ook mee te maken hebben in hun dagelijkse bedrijfsvoering. Welke opgaves/uitdagingen de hoogste prioriteit, ofterwijl staan het hoogst op de agenda? In hoeverre wordt er door verschillende organisaties in die keten **prioriteit** geven aan **duurzaamheidsambitie**, ofterwijl hoe hoog staat duurzaamheid op de agenda? Zitten er grote verschillen tussen verschillende organisaties in de sector?

Functie 9: Verandering van het dominante systeem

-Zijn organisaties in de gangbare landbouw sector zich ervan **bewust dat verandering nodig** is en zijn ze **bereid** om praktijken te veranderen? Zijn alle partijen even (on)bewust of zit hier verschil tussen? *Kunt je jouw antwoord nader toelichten? Hoe zouden deze belemmeringen verholpen kunnen worden? Bij wie ligt dan de verantwoordelijkheid?*
-Is er (voldoende) **druk** (op politiek, boeren, verwerkers, consumenten, etc.) om praktijken te veranderen? Waar komt de druk vandaan? (politiek, maatschappelijk, etc.)?
-Worden gevestigde belangen sterk verdedigd?

Hermobilisatie van middelen & Marktdestabilisatie

Via het GLB gaat in toenemende mate geld naar meer duurzame vormen van landbouw. In hoeverre worden middelen (financieel, menselijk & materiaal) verder nog weggehaald en herplaats van de gangbare landbouw? en wordt de markt van gangbare landbouwproducten op enige manier verstoord of ontregeld of is het business as usual? *Niet echt:* Zou dit volgens jou wel moeten gebeuren? Hoe en door wie dan? *Ja:* In hoeverre worden deze weggehaalde middelen nu dan ingezet voor biologische landbouw? Wordt dit voldoende (snel) gedaan?

Functie 4b: Prioriteren van oplossingsrichting

Definitie

-Er bestaan verschillende oplossingen/initiatieven om naar een meer duurzaam landbouw systeem te gaan. In hoeverre heb je het gevoel dat er **eensgezindheid** tussen organisaties in de sector en de overheid over wat de noodzakelijke oplossing voor een meer duurzaam landbouwsysteem is? Wat voor effect heeft dit? In hoeverre heb je het gevoel dat die oplossing volgens de sector en overheid biologische landbouw is? Zit er (groot) verschil tussen de sector en overheid.

Functie 7: Creëren van legitimiteit

-In hoeverre is er **draagvlak/steun** voor biologische landbouw in Nederland/Brabant door politiek, de consument en de sof is er sprake van **weerstand**? *Kunt je jouw antwoord nader toelichten? Hoe zouden dit verbeterd kunnen worden? Bij wie ligt dan de verantwoordelijkheid?*
-Wordt er sterk gelobbyd dit te verhogen? Door wie?
-Hoe beoordeel je het draagvalk/steun voor de gangbare landbouw in Nederland? Hoe verhoudt zich dit tot biologisch?

Functie 1: Ondernemers activiteiten

-Kijkend naar de gehele keten van ondernemers actief in de landbouw keten (en dan met name boeren, verwerkers, retail/supermarkt), welke partij(en) zijn het meest conservatief ten opzichte van biologisch?
-Zijn er veel boeren met belangstelling om te schakelen? Wat weerhoud ze en als ze omschakelen, tegen welke problemen lopen ze aan?
-Wat is de houding van supermarkten tegenover biologisch? Zijn supermarkten bereid om meer biologische producten in de schappen te leggen? En die van verwerkers? Horeca?

Functie 2: Kennisontwikkeling

-Wordt er voldoende **onderzoek** gedaan en andere vormen van **kennis** gecreëerd omtrent biologische landbouw? Wat richt dit onderzoek zich dan met name op? Waar en door wie vind dit voornamelijk plaats?

Functie 3: Kennisverspreiding

-In hoeverre wordt **kennis** die ontwikkeld is voldoende **gedeeld** en **verspreid?** en via welke kanalen gebeurt dit? *Kun je jouw antwoord nader toelichten? Hoe zouden deze belemmeringen verholpen kunnen worden? Bij wie ligt dan de verantwoordelijkheid?*

Functie 6: Mobiliseren van middelen

Financieel

In hoeverre zijn er genoeg middelen, financieel, materieel en menselijk (kapitaal) beschikbaar om de doelen te halen? Wat voor instrumenten zouden ingezet moeten worden? Welke partijen zouden (meer) middelen moeten ontvangen en wat voor middelen? Waar moeten deze middelen van komen (Markt/privaat/publiek)?

Functie 8: Coördinatie

-In hoeverre zijn de activiteiten van de verschillende organisaties in de biologische landbouw keten (veredelaars, boeren, verwerkers, groothandelaren, retail/supermarkt, ketenorganisaties, kennisinstellingen, overheid, etc.) goed op elkaar afgestemd en wordt dit voldoende gecoördineerd? Verschilt dit sterk van de gangbare landbouw? Moet één partij volgens jou hier in voorop lopen? Wie?

Functie 5: Marktcreatie

-Ontwikkeld de markt omtrent biologische landbouw volgens je snel genoeg om de 15% doelstelling te behalen of zijn er belemmeringen die weggenomen moeten worden?

Afsluitende vragen

- Bij aanvang van ons onderzoek noemde je …… als grootste belemmeringen voor de groei van de biologische landbouw. Na het doornemen van de rest van mijn vragen bent je nu wellicht tot andere inzichten voor je top 3 gekomen of ziet je dit nog altijd als de 3 belangrijkste belemmeringen?
- Heb je nog iets toe te voegen aan dit interview wat nog niet benoemt is?
- Kent je wellicht nog andere personen/organisaties die interessant/van belang zijn om te interviewen voor dit onderzoek?
- Mocht ik nog informatie missen vind je het goed als ik nog eens contact opneem voor een paar korte vervolgvragen?
- Heb je graag dat ik een transcript van dit gesprek naar je toe stuur zodat je dit nog kunt controleren?

Appendix C: Structural Elements (Actors)

actor	role	website	category	sub_industry	size	Location	Organic_influence
Rijksoverheid	Government	https://www.rijksoverheid.nl/onderwerpen/landbouw-en-tuinbouw	Public administration	Public adminstration	National	The Hague	Medium, no policy on organic farmin
Provincie Noord-Brabant	Government /intermediary	https://www.brabant.nl/onderwerpen/landbouw-en-voedsel	Public adminstration and land owner	Public adminstration and land owner	Regional	s-Hertogenbosch	High, amitious target on organic farming
Europese Unie	Government	https://ec.europa.eu/info/food-farming-fisheries/farming/organic-farming_nl	Public adminstration	Public adminstration	European	Brussels	High, amitious target on organic farming
Ministry of agriculture nature and food quality	Government	https://www.rijksoverheid.nl/ministeries/ministerie-van-landbouw-natuur-en-voedselkwaliteit	Public adminstration	Public adminstration	National	The Hague	Medium, no policy (yet) on organic farming
Ministry of Nature and Nitrogen	Government	-	Public adminstration	Public adminstration	National	The Hague	Low, needs to come into office yet
Waterschappen (Brabantse Delta, De Dommel, Aa en Maas	Government	https://www.waterschappen.nl/	Public adminstration	Public adminstration	Regional	-	Low, no direct influence but could raise alarm if values are too high
Municipalities	Government /intermediary	-	Land owner	Land owner	Local	-	Low-medium, sells/rents agricultural land
The Netherlands Food and Consumer Product Safety Authority, NVWA	Government	https://www.nvwa.nl/	-	-	National	Utrecht	Low-medium
Rijksdienst voor Ondernemend Nederlend (RVO)	Government	https://www.rvo.nl/subsidie-en-financieringswijzer/subsidie-groen-economisch-herstel-landbouw/samenwerken	Public adminstration	Public adminstration	National	-	Low
Groen Ontwikkelingsfonds Brabant	Government	https://www.groenontwikkelfondsbrabant.nl/over-gob	Public administration	Public administration	Regional	s-Hertogenbosch	Low

Planbureau voor de leefomgeving	Knowledge / Government	https://www.pbl.nl/onderwerpen/landbouw	Knowledge Institute	Research institute	National	The Hague	Low-medium
HAS hogeschool	Knowledge	https://www.has.nl/	Knowledge Institute	Educational / Research	Regional/ National	s-Hertogenbosch & Venlo	Medium, Educates (future) farmers but lacks training program on organic farming
Wageningen University	Knowledge	https://www.wur.nl/nl/onderwijs-opleidingen/master/msc-opleidingen/msc-organic-agriculture.htm	Knowledge Institute	Educational / Research	International	Wageningen	Medium-high, has a master program dedicated to organi farming
TNO	Knowledge	https://www.tno.nl/nl/	Knowledge Institute	Research institute	National	-	Low
Louis Bolk Instituut	Knowledge	https://www.louisbolk.institute/sustainable-agriculture	Knowledge Institute	Research institute	National	Bunnink	Medium-high
Delphy	Knowledge	https://delphy.nl/	Knowledge Institute	Private Research institute	National	Wageningen	Low-Medium, seems to focus more on convetional agriculture
Cropeye	Knowledge/ Intermediary	https://www.cropeye.com/activiteiten/actueel	Consultancy/research	Private Research institute	National	De Lier	Low
Zetadec	Knowledge/ Intermediary	https://www.zetadec.com/expertises	Consultancy/research	Private Research institute	National	Wageningen	Low
Keygene	Knowledge/ Intermediary	https://www.keygene.com/	Consultancy/research	Private Research institute	International	Wageningen	Low
HLB	Knowledge/ Intermediary	https://www.hlbbv.nl/index.php	Consultancy/research	Private Research institute	National	Wijster	Low
TOP BV	Knowledge/ Intermediary	https://top-bv.nl/	Consultancy/research	Private Research institute	National	Wageningen	Low
Hive-Unilever	Knowledge/ Intermediary	https://hive.unilever.com/	Research	Private Research institute	National	Wageningen	Medium
Yuverta	Knowledge	https://www.yuverta.nl/	Knowledge Institute	Educational / Research	National	-	Medium-High

Biodiversity in Business	Knowledge/ Intermediary	https://biodiversityinbusiness.eu/	Consultancy/research	Private Research institute	National	Wageningen	Low
Warmonderhof	Knowledge/ Intermediary	https://warmonderhof.nl/	Knowledge Institute	Educational / Research	Regional/ National	Dronten	Medium
CLM	Intermediary	clm.nl	Consultancy	Consultancy	National	Culemborg	Low-Medium
ZLTO/Biohuis	Intermediary	https://www.zlto.nl/sector/biologischelandentuinbouw	Interest group	Interest group	National	Den Bosch	High
Bionext	Intermediary	https://bionext.nl/	Interest group	Interest group	National	Ede	High
BioNederland	Intermediary	https://www.bionederland.nl/over-ons	Interest group	Interest group	National	Ede	High
SKAL	Intermediary	https://www.skal.nl/	Certification Body	Certification Body	National	Zwolle	High
a.s.r. real estate	Intermediary	https://asrrealestate.nl/huren-en-erfpachten/landelijk-vastgoed	Land owner	Land owner	National	Utrecht	Medium-High
Fagoed	Intermediary	https://www.fagoed.nl/home/default.aspx	Land owner	Land owner	National	Arnhem	Low-Medium
Biowinkelvereniging	Intermediary		Trade association	Trade association	National	-	Medium
Prisma	Intermediary	https://prismafruit.nl/	Trade association	Trade association	National	Tiendeveen	Low
Biotuinders	Intermediary	http://www.debiotuinders.nl/	Interest group	Interest group	National	-	Low
Vereniging van Biologische boeren Zuid-West Nederland	Intermediary		Interest group	Interest group	Regional	Nieuw-Beijerland	Medium
Brabantse Mileufederatie	Intermediary	https://www.brabantsemilieufederatie.nl/themas/duurzame-landbouw/	NGO	NGO	Regional	Tilburg	Medium-High
Triodos Bank	Intermediary - Financial	https://www.triodos.nl/biologische-landbouw	Financial insitute	Financial insitute	National	Zeist	High

Rabobank	Intermediary - Financial	https://www.rabobank.nl/kennis/biologische-landbouw?query=&tab=knowledge&page-number=1&page-size=30	Financial insitute	Financial insitute	International	Utrecht	High
Naturim	Intermediary - Consultants	https://www.naturim.nl/	Consultancy	Consultancy	National	Alphen	Low-Medium
Landco	Intermediary - Consultants	https://www.landco.nl/biologische-landbouw/	Consultancy	Consultancy	National	Wageningen	Low
Nationaal Groenfonds	Intermediary - Financial		Financial insitute	Financial insitute	National	Amersfoort	Medium
Doornebosch advies	Intermediary-consultancy	https://doornebosch.info/	Consultancy	Consultancy	National	Deventer	Low-Medium
Agro-eco advisors	Intermediary-consultancy	http://www.agro-eco-advisors.com/nl/over-ons/	Consultancy	Consultancy	National	Bellingwolde	Low-Medium
Cumela	Intermediary-Trade association	https://www.cumela.nl/	Trade association	Trade association	National	Nijkerk	Low
Bejo	Supply	https://www.bejo.nl/organic-right-start	Seed Supplier	Organic seed supplier	National	Warmenhuizen	Medium
Rijk Zwaan	Supply	https://organic.rijkzwaan.com/	Seed Supplier	Organic seed supplier	International	De Lier	Medium
Voorst	Supply	https://nl.biovitalis.eu/	Seed Supplier	Organic seed supplier	International	Voorst	Medium
Agrifirm - Bioteam	Supply	https://www.agrifirm.nl/sectoren/biologisch/	(raw) Material supplier	(raw) Material supplier	International	Apeldoorn	Low
Ecotone	Supply/demand	https://www.ecotone.bio/	food group	food group	International	France	Medium
Udea (Ekoplaza	Demand	udea.nl	Wholesale	Wholesale	National	Veghel	High

Ahold Delhaize (Albert Heijn)	Demand	https://www.aholddelhaize.com/	Multinational	Multinational	International	Zaandam	High
Sperwer Groep (Plus en Spar)	Demand	https://www.plus.nl/info-over-plus/organisatie/geschiedenis	Supermarket	Supermarket	National	Utrecht	High
Koninklijke Jumbo Food Groep	Demand	https://www.jumbo.com/	Supermarket	Supermarket	International	Veghel	High
Lidl Stiftung & Co	Demand	https://info.lidl/en	Supermarket	Supermarket	International	Neckarsulm	Medium
ALDI	Demand	https://www.aldi.nl/	Supermarket	Supermarket	International	Essen	Medium
Superunie	Demand	https://www.superunie.nl/	Purchasing Association	Purchasing Association	(Inter)national	Beesd	High
Jan linders	Demand						
Sligro Food Group (Sligro, Spar)	Demand	https://www.sligrofoodgroup.nl/nl/home	Catering and large-scale consumer suppliers.	Catering and large-scale consumer suppliers.	International	Veghel	Medium-High
HANOS	Demand	https://www.hanos.nl/	Catering and large-scale consumer suppliers.	Catering and large-scale consumer suppliers.	International	Apeldoorn	Medium
Bidfood	Demand	https://www.bidfood.nl/	Catering and large-scale consumer suppliers.	Catering and large-scale consumer suppliers.	National	Ede	Medium
Detailresult Groep N.V. (DekaMarkt, Dirk)	Demand	https://www.detailresult.nl/	Supermarket	Supermarket	National	Velsen-Noord	Medium
Boni	Demand						
Vomar	Demand						
Nettorama	Demand						
Picknick	Demand						
Poiesz	Demand						
Hoogvliet	Demand						
Boon Food Group	Demand						

Van TOL Retail	Demand						
Crisp	Demand						
Amazing Oriental	Demand						
Huuskes	Demand						
Nautilus Organic	Demand	https://www.nautilusorganic.nl/	Cooperation	Cooperation	National	Emmeloord	Medium
Eosta	Demand	https://www.eosta.com/nl	Cooperation	Cooperation	International	Waddinxveen	Medium
Biotropic	Demand	https://www.biotropic.com/	Cooperation	Cooperation	International	Bleiswijk	Low-Medium

Appendix D: Subsidies and grants for organic farming in the Netherlands (RVO)

Table X: Subsidies and grants available to farmers in the Netherlands.

Subsidy/Fund	Description/Link to organic	Targeted at
Basisbetaling 2022 - RVO	Farmers can receive income support through the basic payment, provided they meet certain conditions to qualify for income support. For example, they must do business in a sustainable and socially responsible manner.	Farmers
Vergroeningsbetaling 2022 - RVO	In addition to the basic payment, farmers may be eligible for a greening payment. They can qualify for this if they grow different crops (crop diversification), set up 5% of the arable land as an ecological focus area and if they maintain permanent grassland.	Farmers
Subsidiemodule agrarische bedrijfsadvisering en educatie (SABE) - RVO	Farmers can receive a voucher or project subsidy to, among other things, have a business plan drawn up for conversion or to become a demonstration company.	Farmers
Investeringsfonds Duurzame Landbouw – The Dutch National Fund for Green Investments	Farmers who make their business operations sustainable on several fronts can make a claim from the Sustainable Agriculture Investment Fund. The fund has seven sustainability goals: Fewer crop protection products, Fewer greenhouse gases, Less nitrate leaching, Increased biodiversity, Better soil, Circular use of animal feed, Improved animal health and welfare,. Progress must also be made in at least four of these areas, and none of the targets should be backwards.	Farmers
Klimaatfonds voor de landbouw – The Dutch National Fund for Green Investments	Fund that focuses on financing projects that contribute to the realization of the goals of the Ministry of Agriculture, Nature and Food Quality (LNV) under the Climate Agreement. The focus is on projects aimed at making agriculture more sustainable and preserving biodiversity.	Farmers

Borgstellingskrediet voor de Landbouw (BL) - RVO	Farmers who want to switch to organic farming or a more sustainable way of production can obtain a guarantee loan of up to € 2.5 million from their financier.	Farmers and processors
Investeren in groen-economisch herstel - RVO	Subsidy for investments in sustainable agriculture for 38 types of investments in 5 categories	Farmers
Extra betaling jonge landbouwers 2022 - RVO	Farmers under the age of 40 can receive extra subsidy from the CAP	Farmers
Milieu-investeringsaftrek (MIA) en Willekeurige afschrijving milieu-investeringen (Vamil) voor ondernemers - RVO	Farmers or processors can invest in environmentally friendly equipment and techniques at a tax advantage	Farmers and processors
Versneld natuurherstel 2022 - RVO	Subsidy for measures that improve the quality of nitrogen-sensitive habitats (habitats) or habitats of species. Or to buy agricultural land to improve or expand these areas.	Farmers
Subsidie groen-economisch herstel landbouw - RVO	Subsidy aimed at partnerships in the agricultural sector aimed at, among other things, making the agricultural sector more sustainable and economically stronger.	Farmer collectives
Agrarisch Natuur- en Landschapsbeheer (ANLb) - collectieven - RVO	The ANLb is a subsidy for agricultural collectives that protects and improves the environment of animals and plants.	Farmer collectives
Gemeenschappelijke Marktordening (GMO) Groenten en fruit - RVO	Subsidy for recognized producer organizations aimed at making or improving the fruit and vegetable production of the members more sustainable.	Wholesalers
LIFE: Europese natuur-, milieu- en klimaatprojecten - RVO	LIFE grants subsidies to projects that further develop or put into practice European policy on one of the following topics: Nature and biodiversity, Circular economy and quality of life, Climate mitigation and adaptation, Renewable energy transition	Knowledge institutes, NGOs, Companies, Governmental agencies