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Ine Coteur, Fleur Marchand, Lies Debruyne, Ludwig Lauwers

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Understanding the myriad of sustainable development processes in agri-food systems: a case in Flanders

Coteur Ine^{1,3*}, Marchand Fleur^{1,2}, Debruyne Lies¹, Lauwers Ludwig^{1,3}

¹ *Social sciences Unit, Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), Merelbeke, Belgium*

² *Ecosystem Management Research Group and IMDO, University of Antwerp, Wilrijk, Belgium*

³ *Department of Agricultural Economics, University of Ghent, Ghent, Belgium*

*Corresponding author: address: Burg. Van Gansberghelaan 115, box 2; 9820 Merelbeke, Belgium;
email: ine.coteur@ilvo.vlaanderen.be

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1.1 Introduction

Internal and external signals, such as globalization, climate change, increasing demands from society and market integration, incite actors in the agri-food system toward more sustainable practices (Hubeau et al., 2017a). Main challenges to this sustainable development of the agri-food system include the complex structure of the system, the contested nature of the sustainability concept, the relation between the many chain actors, and their changing sustainability objectives (e.g. Bond et al., 2013; Boström et al., 2015; Fischer et al., 2012; Galli et al., 2016; Grimm et al., 2014; Hák et al., 2016; Kirwan et al., 2017; Matopoulos et al., 2007; Smith, 2008). Actors of the agri-food system are continually seeking new ways to organize the sustainable development of the whole system. Many initiatives have already emerged to steer the agri-food system toward sustainable development.

In these initiatives, actors can use a diversity of approaches and tools at different levels: sustainability assessments, processes designed to direct decision-making towards sustainability, integrate sustainability into decision-making or operationalize sustainable development to guide decision-making toward increased sustainability (Bond et al., 2012; Hugé et al., 2013; Pope, 2006). Sustainability assessments aid the transition towards sustainable development (Pope et al. 2004) and assessment tools facilitate these assessments by measuring and monitoring sustainability. Yakovleva et al. (2009) list examples of sustainability assessments such as the life-cycle approach to sustainability impacts, food miles, the ecological footprint and the farm sustainability indicators from the Organization for Economic Co-operation and Development (OECD). Similar to other sectors, sustainability assessments and accompanying tools that emerge to address the agri-food system differ in origin, focus and approach. The Sustainability Assessment for Food and Agriculture systems (SAFA) developed by the FAO, is one example (FAO, 2013). van Asselt et al. (2014) describe a protocol for evaluating the sustainability of agri-food production systems, and Peano et al. (2015) present the SAEMETH framework. Although these sustainability assessments are currently being applied, literature is still lacking on chain-wide sustainability assessment or performance measurement, especially for food supply chains (Bourlakis et al., 2013; Gunasekaran et al., 2004; Grimm et al., 2014; Seuring & Müller, 2008; Maestrini et al., 2017; Winter & Knemeyer, 2013; Yakovleva et al., 2009).

Indeed, many factors influence the actual chain-wide sustainability assessment of agri-food systems. Trust, cooperation between companies and the appropriate tools are

necessary when measuring sustainability chain-wide (Xia & Tang, 2011). Galli et al. (2016) describe five challenges in the sustainability assessment of food supply chains: i) the complexity of the food supply chain, ii) the multidimensionality and iii) the pliability of the sustainability concept, iv) the changing nature of sustainability objectives and v) the governance aspects of an assessment. Since the agri-food system consists of specific food supply chains such as the bread, dairy or chocolate food supply chain, sustainable supply chain management (SSCM) may also be useful to monitor and steer sustainable development of the agri-food system. However, measuring the sustainability performance remains one of the main challenges in SSCM (Schöggl et al., 2016; Yakovleva et al., 2009). Various difficulties, such as overcoming mistrust in data sharing and the lack of control in organizations regarding the chosen evaluation criteria, may arise during the development of reliable performance measures in supply chains (Hervani et al. 2005; Schöggl et al. 2016; Hassini et al. 2012). These difficulties limit the implementation of sustainability assessments, and therefore also the adoption of sustainable practices. In addition, both internal and external factors such as policy and regulation, market forces, product development or process capability are possible constraints (Hassini et al., 2012). Although sustainable supply chain management and sustainability assessment are supportive approaches in the sustainable development of the agri-food system, persistent difficulties suggest that more insight into the sustainable development processes of the agri-food system is needed.

The objective of this research, initiated by an open demand from leading actors of the Flemish agri-food system, is to understand and structure the myriad of sustainable development processes in the agri-food system. From the on-demand case, we first picture the Flemish agri-food system actors' needs regarding sustainable development processes and note which approaches they use to achieve sustainable development with a focus on sustainability assessments. Because these actors assign great importance to interaction, dialogue and communication within sustainability assessments as main drivers, we have defined the main building blocks of sustainable development processes and structured the various approaches actors follow to achieve sustainable development based on these building blocks.

This paper is structured as follows. First, the methods section describes the research approach. Second, the results section describes the needs of different actors within the agri-food system regarding the system's sustainable development process and how two building blocks are derived from needs in order to structure current and potential approaches into five models for sustainable development processes. The discussion section reflects on these five models and how they can fulfil the expressed needs of the actors. The paper ends with general conclusions and recommendations for future research.

1.2 Methodology

1.2.1 On-demand research

The on-demand nature of our research created the opportunity to work with several actors and stakeholders of the Flemish agri-food system, guiding their sustainable development process. Indeed, this research originates from work done within a project that aimed at transforming the Flemish agri-food system towards more sustainability. This project, referred to as the 'transformation project', was initiated in 2013 by leading actors of the agri-food system and is seen as a continuous activity, adaptive to new research insights. Several researchers, including the authors of this paper, were asked to facilitate the process of transformation. The researchers took on three roles: that of reflexive scientist, facilitator and intermediary (Hubeau et al., 2017a). The process is driven by various actors of the agri-food system who seek solutions for ongoing sustainability challenges, direct as well as indirect actors were involved. The transformation project already produced a system description of the Flemish agri-food system and shared transformation pathways were defined and bundled into a strategic plan and an action plan (Hubeau et al., 2017a).

The involved actors considered chain-wide cooperation and chain-wide initiatives as essential. During the project, actors regularly expressed their need for guidance in their sustainable development and more specifically for help with their sustainability assessment approaches. Within the context of this transformation project, an inspiration event was set up to inspire and stimulate Flemish chain actors towards sustainable development of their agri-food system. During the inspiration event, the work of four existing chain-wide initiatives was presented and their specific sustainability assessment approach were elaborated and reflected on: (i) IKM sustainability monitor (BE); (ii) Foundation Skylark ('Stichting Veldleeuwerik', NL); (iii) 'Zeeuwse Vlegel' (NL); (iv) Bord Bia's food and drink sustainability program – 'Origin Green' (IE). Evidence from their approaches was used to validate some of the case study derived insights (see section 1.2.3: data collection and analysis).

1.2.2 The agri-food system as research object

The agri-food system is defined as “a dynamic and complex system operating within a larger socio-ecological system, influenced by different systems such as natural systems (e.g., land), institutional systems (e.g., subcontracting industries or retailers) and social systems (e.g., consumer organisations)” (Francis et al., 2003; Lamine, 2011 in Hubeau et al., 2017a). The political, economic and research context also shapes the agri-food system, which consists of specific food supply chains such as the bread, milk or chocolate food supply chain. Figure 1 (a) represents such a food supply chain (FSC) in its complex configuration to visualize its many interactions. Many food supply chains are linked, thus products produced by one chain actor can supply different FSCs. However, for reasons of concept clarity throughout this study, we simplified the configuration of a specific FSC (Figure 1**Error! Reference source not found.** (b)). A FSC traditionally consists of four main industries: the subcontracting industry, the agricultural industry, the food industry and the retail industry. These industries are the internal actors of the agri-food system. External actors include consumers, the government, NGOs, research and innovation institutions and financial institutions. Because these external actors also have an impact on the agri-food system, they are often included in sustainable development processes.

[Figure 1 (a) and (b)]

The agri-food system is our research object because both internal and external actors were involved during our research. Indeed, both these actor groups were interviewed, invited to the inspiration-event and involved in a focus group. As most of these actors are involved in multiple FSCs or represent an industry, we could surpass the level of individual FSCs. Merely focusing on one or more FSC would have limited our research because it would not allow taking into account the dynamics of the agri-food system as a whole. These dynamics and interaction between the various actors prove to be important, confirmed by our research results. More, our results highlight the importance of both the agri-food system, the FSC and industry level.

1.2.3 Data collection and analysis

This research is based on four sets of data sources. First, during the period 2013-2017 of the transformation project, we gathered information via field notes and meeting reports. Second, the initiatives presented during the inspiration event were studied in depth by gathering relevant information on the characteristics of these initiatives (Triste et al., 2017). Third, to define the needs of different actors regarding sustainability assessments and their approaches for achieving sustainable development, we performed 10 semi-structured interviews with 11 interviewees from different industries of the Flemish agri-food system

(subcontracting industry (1), Agricultural industry (2), Food industry (1), Retail industry (4), NGO (1), Research and innovation (2)). Open-ended questions were used to discover and understand sustainable development processes, how they take place at this time and how they can be shaped in the future. One important focus was to uncover the determining conditions for the setup and implementation of sustainability assessments within these processes and the use of assessment tools or metrics.

The data from the interviews were analysed in NVivo 11 using open coding as described by Mortelmans (2007). Data were organized and placed into subgroups. Various topics, such as the goal of a sustainability assessment or the role of the government, were mentioned by more than one interviewee and then labelled as a concept. Concepts were further analysed and grouped into categories. The first round of coding focused on the needs. This revealed additional aspects crucial for sustainable development of the agri-food system, which resulted in a second round of coding focused on the building blocks for sustainable development processes and the structuring of the different approaches for sustainable development.

Lastly, a fourth data source was a focus group with seven actors from the Flemish agri-food system (both internal and external actors), used mainly to validate and enhance the first results. The aim was to further structure sustainable development processes of the agri-food system, taking into account the needs of the chain actors. We also discussed how possible solutions for these needs can enhance and facilitate these processes. Overall, data triangulation (Guion et al., 2002) and methodological triangulation were used to increase the validity of the research. Data triangulation was ensured by frequently discussing the results with researchers within the field of agriculture and food science and using the focus group to enhance our results through discussions with actors of the agri-food system. Methodological triangulation was applied by using different types of data sources such as field notes, meeting reports, results of the inspiration event and interviews.

1.3 Results

1.3.1 What are the expressed needs regarding sustainable development processes?

In the first coding round, we identified nine needs regarding sustainable development processes in the agri-food system in Flanders. Besides the mere assessment, tools and metrics attributes, most expressed needs concerned interactive aspects. We clustered the coded needs into three groups. Two of them highlight the interaction aspects, related to the interaction with internal and external actors.

1.3.1.1 *Needs related to the interaction between the actors internal to the agri-food system*

Enhance cooperation and knowledge exchange. Many actors stressed the importance of bringing together chain actors to enhance cooperation and knowledge exchange, both within a specific industry (e.g., the agricultural industry) and between industries (e.g. between the agricultural and the food industries). The actors believe this will increase the understanding of production processes or sustainability challenges within different industries. It can also create trust between chain actors and enhance transparency (Triste et al., 2017). Although trust creation is a difficult, time-consuming and expensive process, all actors tend to agree that it is worth the effort.

Enhance communication. Communication about sustainability is often mentioned as a primary goal for monitoring the sustainability of the agri-food system. However, opinions differ with respect to target group and content of the communication. External groups such as consumers, media and other interest groups may be interested in the sustainable development of the agri-food system or the sustainability of products. In contrast, some actors identify the internal actors as the main and often only target group for communication. The aim of this internal communication is to inspire and stimulate others to integrate sustainability to an increased extent into their operations and to think in long-term sustainability goals. As a result, enhancing the communication towards both target groups is important to i) increase transparency and trust towards and to create awareness among consumers as well as to ii) stimulate cooperation between chain actors and a further incorporation of sustainability goals into food production.

Economic valorisation of sustainability efforts. This need implies that sustainability efforts must be translated in a fair price or sharing of costs and benefits throughout the agri-food system. This is needed to stimulate the implementation of sustainable practices and to guarantee the longevity of the agri-food system. Almost all stakeholders from the inspiration event agree that farmers should receive financial compensation for their sustainability efforts (Triste et al, 2017).

1.3.1.2 *Needs related to the interaction with the external actors of the agri-food system*

Engaged and stimulating government. Stakeholders agree that primarily agri-food chain actors need to be involved in the sustainable development of the agri-food chain, but the government also plays an important role. Government can not only stimulate the internal actors of the system but also consumers or researchers. However, the current legislative framework is limited regarding the sustainable development of the agri-food system. Cooperation and dialogue between the government and agri-food system actors is therefore

needed. Furthermore, development of policy instruments to stimulate firms towards more sustainable practices are requested by stakeholders. The willingness of firms to participate varies widely, often due to economic constraints, thus it is important to first identify the leading firms who can initiate the sustainable development and who can act as an example to other firms.

Responsible consumers. Society is demanding increased sustainability of food products and is therefore an important driving factor in the sustainable development of an agri-food system. However, in its role as consumer, society does not always provide adequate remuneration and appreciation for these demands, which often results in a lack of valorisation of sustainability efforts by the farmer. Therefore, the right tools are needed to engage consumers and to stimulate them to make sustainable decisions. This will enhance the sustainable development of an agri-food system where the efforts toward sustainability are (financially) valued.

Match between research and practice. Many research results are already available; the stakeholders believe these results are available for actors of the agri-food chain through experimental stations and applied research institutes. However, it is important to continuously support the implementation of research results in practice by translating research results to applications for more practical use, thereby overcoming technical barriers for innovation and new sustainable practices.

1.3.1.3 Needs related to the sustainability tools & metrics used during sustainability assessments

Uniform data collection system. Many types of data collection already exist, both at industry level and firm level. At firm level, the available data is mainly collected within a specific accountancy system and often only addresses economic data. Comparison between firms with different accountancy systems is therefore difficult, as different measuring methods may be used for the same variable. At industry level, government or private institutions often collect data. However, data are not always publically available, which makes it difficult for actors to find and use the right data when monitoring sustainable development. If we want to assess sustainable development based on data, a uniform data collection system is needed to ensure reliability of the results, to make the assessment more efficient and to enhance the transparency and traceability of production processes and products.

Support firms and food supply chains in the implementation of sustainable practices. Sustainability assessment tools should provide insights into the current actions and challenges of a food supply chain or the agri-food system as a whole. To meet these

identified challenges, sustainable practices need to be implemented. Support is needed for firms to identify, develop and implement these practices (Triste et al., 2017). Support can be delivered by knowledge centres or by government supported advisors, who can for instance use action plans or sustainability plans to enhance implementation of sustainable practices. However, results are not conclusive on how to organize this support. Actors believe that getting advice from experts specialized in specific sustainability topics can advance the timely achievement of sustainability goals.

Managing the dynamic and normative character of sustainability. Sustainability is a dynamic concept that will evolve over time. Managing the dynamic character of sustainability and finding a balance between different parameters of sustainability is therefore needed. Many participants of the inspiration event see sustainability as a concept of continuous development, but other participants value the use of standards that have a more static character (Triste et al., 2017). Finding ways to handle diverse interpretations of the sustainability concept is another important part of this need.

1.3.2 Building blocks for sustainable development processes of the agri-food system

As an intermediate conclusion from the first-round coding and elucidating needs, we found that the sustainable development of the agri-food system will not be achieved by merely implementing a sustainability assessment. To achieve sustainable development, cooperation, dialogue and communication between internal and with external actors are as much a key driver as the mere goal of getting insight in the sustainable development by using sustainability assessments. More, our data revealed that they might be crucial for determining the variability in current and potential approaches. Therefore, they are further fine-tuned into two building blocks for sustainable development processes: sustainability assessments and stakeholder interaction.

These building blocks are presented in Figure 2. First, a sustainability assessment is used to define challenges, measure the sustainable development of the system and evaluate progress. Sustainability assessment and related tools are mentioned by the actors as having great potential for use as supportive tools, but the sustainable development of the agri-food chain should be the main goal of such tools. Tools should therefore deliver insights about current actions, identify the challenges of the agri-food system under study and identify areas where progress is being made. A second important building block is the interaction among internal actors and interaction with external actors. The revealed communication and cooperation are the central pillars of interaction, with sharing of knowledge as one of the spearheads. Sharing best practices and practical examples are an

effective way to stimulate firms to use sustainability assessments and implement sustainable practices. A sustainable development process ideally offers opportunities to learn from these best practices by organizing meetings such as demonstration events or discussion groups. Interviewees said it is important that firms are free to choose their development pathway and thus the practices they implement. Discussion groups and network events related to a specific sustainability theme can be helpful to enhance implementation of sustainability initiatives such as *Bord Bia* or *Foundation Skylark*, as these bring interested parties together. Nevertheless, bringing different food supply chains together to learn may also create new opportunities to increase the agri-food chain's sustainability. An open dialogue between agri-food chain actors is thus crucial during a sustainable development process. Most actors agree that cooperating with other chain actors is not easy, requiring support and facilitation to ensure successful sustainable development processes.

[Figure 2]

1.3.3 Five models for sustainable development processes in the agri-food system

The final challenge is now to find out whether these two building blocks capture the variability of currently observed approaches from the actors of the Flemish agri-food system working on the sustainable development of the agri-food system. From the data, we already observed that the actual approaches are various and differ in applying the two building blocks of sustainability assessment and stakeholder interaction. In particular, monitoring, communication and cooperation are being implemented differently. Therefore, we have analysed these different approaches and the initiatives presented at the inspiration event based on the method and implementation level of the monitoring approach. From this analysis, we were able to distinguish five models for sustainable development processes in the agri-food system.

Figure 3 presents the five models based on the level of their monitoring approach. Models 1 and 2 monitor at agri-food system level, models 3 and 4 at food supply chain level and model 5 at industry level. The results presented below include the models that are currently being applied as well as models for future implementation. We aim at structuring these approaches based on these building blocks, in order to unravel sustainable development processes and enable actors to better organize these processes in the future. An overview of the five models for sustainable development processes is presented in Table 1.

[Figure 3]

Model 1 occurs at the agri-food system level. All steps, including goal setting, monitoring and communication, happen at this level. During the start-up phase, actors of the agri-food system collectively seek themes where action is needed through the organization of discussion groups and stakeholder meetings. Actors cooperate to create awareness and modify the behaviour of other chain actors using best practices and inspiration events. Various tools can be used, such as a system analysis and strategic or action plans. Follow-up of the actions stipulated within the action plan can be part of either the monitoring or follow-up phases. The agri-food system communicates collectively about its sustainable development to internal as well as external actors. This model is applied within the transformation project of the agri-food system in Flanders, where shared transformation pathways were developed during multiple stakeholder meetings and the creation of chain-wide initiatives is encouraged to inspire other chain actors (Hubeau et al. 2017a). As a result, model 1 is an overarching approach with an objective to stimulate and align other initiatives.

Model 2 also occurs at the agri-food system level. Similar to model 1, monitoring is done at the level of the agri-food system, but in model 1 the implementation of actions is monitored, whereas in model 2, the effects of actions at the level of all individual industries are monitored and numbers are aggregated. Furthermore, an equilibrium is sought throughout the system, striving for a positive evolution towards sustainability at the level of the system. In other words, not every industry must show a positive evolution for the entire agri-food system to achieve sustainability. Stakeholders point out that at this time, each industry is being evaluated individually based on their positive evolution towards sustainability. Instead, the actors would rather implement a system approach because monitoring at that level may validate the effectiveness of sustainability actions at industry level. Furthermore, stakeholders believe that a more coherent policy may be built on monitoring at system level instead of merely surveying sustainability parameters in a fragmented way. However, they realize that this requires thorough investigation and financial resources, as complex sustainability assessment tools will be needed. Furthermore, this approach requires a different way of thinking within the agri-food system. Intense cooperation between actors will be necessary to optimize processes and potentially to spread costs and benefits throughout the system. At this level, the agri-food system's actions and progress regarding sustainable development would be communicated to the internal and external system actors. To the best of our knowledge, no such initiatives currently exist.

Model 3 occurs at the food supply chain level. Monitoring is also implemented at that level and focuses on the integration of the data for one product. Goals are set at product level and results of the different parts of the food supply chain level for that product are aggregated. The sustainability of the product is evaluated based on complex sustainability tools, such as life cycle assessments. To achieve a positive evolution towards sustainability an intense cooperation between all actors in a food supply chain will be needed. Sustainable development would be primarily communicated to the consumer, for instance via a sustainability label. Aggregated monitoring with a product focus tracked throughout the whole food supply chain is found in scientific literature in some examples of LCA, but to our knowledge, the actors at the food supply chain level are not using this tool on a day-to-day basis.

Model 4 also focuses on a food supply chain, but it does not use aggregated monitoring. This model employs a thematic approach. Here, actors from different industries individually determine specific themes requiring action. Within these themes, they seek to address specific problems, e.g., a food waste problem within a supermarket. These problems are solved by setting up specific chain-wide projects with cooperation of several chain actors. Monitoring often occurs at firm or industry level and a range of sustainability tools can be used depending on the problem. These tools can be basic, such as a list of sustainable practices that actors implement, or complex, such as indicator sets. Design and implementation of the follow-up phase (if one is used) depends on the project. During the 'transformation project', several chain-wide projects were tested for implementation. An example of this is a project where a fish auction, retail companies, a catering school and research institutions cooperated to produce a fish burger produced from by-catch in the fisheries industry. Another example, *Zeeuwse Vlegel*, also illustrates this model. This initiative produces wheat without the use of pesticides or chemical fertilizers. In this project, farmers, millers, bakeries, an environmental federation, consumer organizations and farmer organizations are involved to produce a regional product, in this case bread. This bread is then sold as *Zeeuwse Vlegel* in bakeries. Consumer-oriented communication is also included in this model.

In Model 5, monitoring occurs at individual industry level, mostly focusing on only one industry within a food supply chain, together with a strong collaboration at the level of a food supply chain. Actors of a food supply chain collectively draft a trajectory for its sustainable development and collaborate during the start-up phase of the assessment. However, the collaboration does not proceed to achieve the sustainable development of the supply chain, as goals are set at industry level. Each industry can be evaluated based on basic or complex sustainability tools. Currently, most of initiatives focus on the agricultural industry. In this

model, the design of the follow-up phase also depends on the project or initiative being taken. The first example, the *IKM sustainability monitor*, was set up by the dairy sector and industry, in collaboration with farmers' organizations. They use a checklist of sustainability measures to evaluate dairy farmers, the dairy industry and the distribution industry. Farmers can choose which sustainability measures they want to pursue. Audits are used to evaluate the implementation of the measures. The farmers are not supported in the implementation of those measures and no follow-up phase is included. The main goal of IKM is to secure their position on the international sales market and respond to sustainability demands from society. Communicating their progress towards relevant actors of the industry and the broader community is crucial. A second example is *Foundation Skylark*, whose goal is to develop a sustainable arable farming industry. This group focuses on the monitoring and implementation of a sustainability plan. Knowledge exchange between arable farmers, suppliers, farmers' organizations and advisory organizations is crucial. Farmers design a sustainability plan using 10 indicators and need to implement four new measures each year. Discussion groups between farmers based on the sustainability plan are organized to discuss the measures a farmer takes and the overall progress of the farm. The Irish food and drink sustainability program "Origin Green", created by *Bord Bia*, is a third example of this model. This is one of the few initiatives focusing on multiple industries of a food supply chain: the farms, manufacturing companies and retail and food services are evaluated. Each industry has its own sustainability targets and firms work individually on their sustainable development. An "Origin Green sustainability charter" stimulates companies to develop a sustainability plan and achieve concrete sustainability targets. *Bord Bia* also supports farmers by providing advisory services and feedback is given on the sustainability plans during workshops. *Bord Bia* communicates about the sustainable development of the Irish food industry as a whole.

Table 1: Overview of the five models for sustainable development processes

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
ASSESSMENT					
1. Start-up phase sustainable development					
Level of goal setting	AFS	AFS Focus on positive evolution of AFS: not every industry needs to evolve positively to achieve a sustainable AFS	PRD Throughout whole AFS	Within one specific FSC	IND Mostly within one specific industry: goals are rarely set for more than one industry
Process	Actors of the AFS collectively seek themes where action is needed through organization of discussion groups and stakeholder meetings	No current initiatives known	No current initiatives known	Actors, mostly from an industry, choose specific themes where to take action. A thematic approach is followed where chain-wide and specific projects are set up	Actors of the AFS or a FSC collectively draft a trajectory for the sustainable development of the agri-food system. Focus mostly on one industry
2. monitoring with sustainability tool					
Level of monitoring	AFS Monitoring implementation of actions	AFS Aggregated monitoring to capture the effect of all actions at industry level	FSC Aggregated monitoring	FSC/IND/FRM	IND Every industry is monitored and evaluated separately
3. Follow-up sustainable development					
Process	Follow-up action plan	No current initiatives known	No current initiatives known	Project dependent	Project dependent

	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5
INTERACTION					
1. Cooperation	Between actors AFS to initiate behaviour change via best practices and inspiration events	Between actors AFS to optimize for instance sustainability processes	Between actors AFS to optimize for instance production processes	Between firms in FSC to solve specific sustainability problems within FSC	Between actors of AFS or specific FSC at start of sustainable development process/minor collaboration between actors during monitoring and follow-up of sustainable development
2. Communication	Actors of AFS communicate to other actors of AFS in function of inducing a behavioural change and society	Actors of AFS communicate to other actors of AFS and society	Communication about sustainability of product, mostly to consumer	Firms within specific FSC communicate to other actors of AFS and society	Sustainable development occurs at industry level, but communication is done by actors of AFS or specific FSC Communication to other actors of AFS and society

legend: AFS = agri-food system; FSC = food supply chain; IND = industry; FRM = firm; PRD = product

1.4 Discussion: guidance of sustainable development processes

To guide sustainable development processes, we reflect on the use of the five models, how they can fulfill the needs identified by actors of the Flemish agri-food system, and what can be confirmed by previous research. Based on the specific context in which each of the 5 models is used, we suggest to distinguish a macro and micro level (Figure 4). The macro level entails models 1 and 2, (at agri-food system level) with the micro level consisting of models 3, 4 and 5 (at food supply chain or industry level). Complementary use of the models should enable the agri-food system to respond to the dynamic character of sustainability, as long term goals are set at macro level and the more changeable short term goals are set at micro level.

[Figure 4]

The macro level is needed to formulate general sustainability goals for the agri-food system, including the ecological, economic and social aspects of sustainability. These sustainability goals are monitored with a systemic sustainability tool. This tool will monitor specific sustainability parameters in an aggregated way to evaluate the sustainability progress of the agri-food system. Close cooperation between the actors of the system and the government is necessary, as results may help to shape policy. Good governance is essential; the sustainability assessment tools of model 1 may help in the formulation of sustainability goals as model 1 involves all actors of the agri-food system. Within this assessment, a shared vision can be developed and points of action can be determined through the use of a system analysis and strategic or action plans. This can build a comprehensive understanding of the sustainability challenge and, thus, create an awareness among actors of the benefits of proactively working on sustainable development (Broman & Robèrt, 2015). The need for enhanced communication between internal actors of the agri-food system can be fulfilled by this model, because stakeholder meetings and discussion groups are necessary to develop common sustainability goals. Model 2 focuses more on the evolution of the system towards sustainability using a complex sustainability assessment. To our knowledge, no such assessment tools are currently being implemented in practice. A thorough investigation of the feasibility of such sustainability assessment tools at agri-food system level is therefore required. Furthermore, extensive research will be needed to meet the need for data and appropriate monitoring tools. Authors such as Fritz et al. (2017), Schögggl et al. (2016) and Wognum et al. (2011) argue for a more standardized data exchange system to reduce costs and enhance the aggregation and comparability of results. An important requirement for making a large amount of data available for many stakeholders is trust and confidentiality (Schögggl et al., 2016).

Although governmental actors must be closely involved at the macro level, the actors argue that policy-makers cannot stipulate the approaches that actors use to achieve the sustainability goals. Indeed, actors want to choose an approach that is adapted to the context in which they operate. The question then remains if and how policy makers could stimulate the agri-food system actors to achieve these goals. Our results show that actors should be stimulated to achieve sustainability goals through chain-wide cooperation. This can be stimulated at micro level, where chain actors can concretize the sustainability goals based on the context in which they operate. Because sustainability is an object of competition for actors (Galli et al., 2016), this may give chain actors the opportunity to retain their potential for revenue. Models 3, 4 and 5 can all be used at the micro level. Actors believe that the complementary use of these models generates flexibility and gives agri-food system actors the chance to work on sustainable development of the system while staying within their own limits. Each firm or industry can choose a model that best suits its current context, for instance based on the goal they want to achieve or the feasible intensity of cooperation. First, the models at micro level have a different focus. Model 3 focuses on sustainable products, model 4 on sustainable food supply chains and model 5 focuses primarily on sustainable industries. Second, the intensity of cooperation between actors also varies between the models as a more intense cooperation is needed in model 3 than in model 5, where cooperation is only needed in the start-up phase. This complementary use of models is desirable due to the lack of a one-size-fits-all solution for sustainable development or one exclusive pathway towards sustainability (Boström et al., 2015; Fischer et al., 2012; Foley et al., 2011; Schiefer et al., 2015).

The need to support firms to identify, develop and implement sustainable practices after using a sustainability assessment tool is mostly covered by the models at micro level. Within models 4 and 5, individual firms are directly involved to achieve sustainable development goals or to solve specific problems. Practice, however, shows that the support being provided differs significantly between projects or initiatives. Actors involved at the start-up phase of a sustainable development process should be aware of this and should incorporate support to more efficiently achieve sustainability goals. The sustainability progress generated by the actors of different food supply chains and industries can then be captured by the sustainability tool at macro level, provided that such a tool exists. This will allow the agri-food system to grasp the impact of individual sustainability initiatives on the sustainable development of the entire system.

The need for an engaged and stimulating government is primarily reflected at the macro level, where cooperation between chain actors and the government is crucial. Stakeholders agree, however, that a coherent policy originating from the different departments of the government is essential and has the potential to enhance cooperation and facilitation of the

sustainable development of the agri-food system. They state that legislation often focuses on penalization instead of stimulation. Wognum et al. (2011) agree that legislation should stimulate cooperation in supply chains. Furthermore, stakeholders also want the government to engage and sensitize the consumer. They believe that the consumer is the 'pull-factor' towards the sustainable development of the agri-food system. However, Smith (2008) also believe that firms such as manufacturing businesses can empower consumers by 'offering sustainability enhancements to existing high-quality product reputations', linked to action within FSCs. Here, enhanced communication is key, but stakeholders are still looking for effective ways to communicate with consumers. Model 3 (micro level) mostly focuses on consumer communication as it monitors the sustainable development at product level. Labeling may be one possible solution here, but further research is needed to decide what kind of label is most effective and which sustainability tools are needed.

The need for cooperation, among internal and external actors of the food system is prominent in literature (e.g., Seuring & Müller, 2008; Smith, 2008; Wognum et al., 2011). In our case, both at the macro and micro levels, chain-wide cooperation will be needed to achieve predefined sustainability goals. Models 1, 2, 3 and 4 incorporate cooperation between agri-food chain actors as close collaboration is necessary to develop shared sustainability goals, monitor sustainability goals at systems and product level or solve specific sustainability problems at FSC level. Model 5 also includes cooperation between chain actors, even if only during the start-up phase of the sustainable development process. This form of cooperation is essential to initiate the sustainable development process of a specific FSC or industry. Multi-stakeholder initiatives involve both internal and external actors of the agri-food system. They have more potential for steering sustainable development, as every actor has specific knowledge and skills (Smith, 2008). Bringing actors together in sustainable development processes is needed to understand the complex nature of problems and incorporate different viewpoints (Galli et al., 2016). Incorporating these viewpoints may be one of the reasons why bringing actors together is a time-consuming and often expensive operation. Furthermore, some key factors play an important role in the success of a collaboration and the sustained nature of relationships: factors such as trust, motivation, information exchange, transparency and effective communication (Hubeau et al., 2017c). These key factors need to be taken into account when setting up sustainable development processes. By organizing stakeholder events, discussion groups or inspiration events, the need for increased cooperation and communication between chain actors can be supported, provided that the specific context is considered and key factors are taken into account. Furthermore, the match between research and practice can be made at these events or discussion groups by presenting research results in a practical way and within a more informal context.

Chain-wide cooperation can also partly fulfil the need for economic validation of sustainability efforts. If costs and benefits will be shared throughout a FSC, chain-wide communication and information exchange are essential (Wognum et al., 2011). Wognum et al. (2011) believe that redistribution of costs and benefits will convince chain-actors to take sustainable measures. Despite their awareness of and the importance of collaboration, stakeholders who participated in the inspiration event agreed that currently no solutions exist to stimulate or organize the interaction between chain actors. There are many possible reasons for this: for example, the governance structure of the agri-food system, a lack of trust among actors, the economic inability to engage in a sustainable development process or the risk involved (e.g. Galli et al., 2016; Hassini et al., 2012; Hubeau et al., 2017; Seuring & Müller, 2008; Smith, 2008). Further research is therefore needed to help bridge this gap.

The on-demand nature of our research led to the involvement of Flemish agri-food system actors who were also part of the transformation project. We thus use case-specific data to elucidate needs, define the building blocks and finally arrive at five models of sustainable development processes. Although to gain in-depth insights in the approaches for sustainable development of an agri-food system a single case study might be appropriate (Flybjerg, 2004; Yin, 2003), generalizing results from a case study remains a dangerous exercise. From our case, the expressed needs and the resulting five models might be most vulnerable to case specificity. We are confident, however, that the building blocks are pivotal and robust methodological instruments for further research. Our research at least provided evidence for use of these building blocks in structuring and analysing the current and potential approaches the actors follow to achieve sustainable development. Not only do the five models based on the Flemish agri-food system validated the building blocks' use, they were also able to structure some foreign examples such as Bord Bia's Origin Green, Zeeuwse Vlegel or the Skylark system. This demonstrates that the building blocks can be used to structure the myriad of sustainable development processes, but we acknowledge that further research is necessary to validate and deepen out the five models.

1.5 Conclusion

Expressed needs and current sustainability assessment approaches in the Flemish agri-food system yielded two main building blocks for sustainable development processes. From our case, the main conclusion is that sustainability assessments themselves and their mere reliance on assessment tools do not suffice as a guiding principle for the sustainable development of an agri-food system. Besides, as our research showed, interaction between chain actors plays an equally important role as a driver for sustainable development processes. Cooperation and communication are essential, not only for the implementation of separate

sustainable development processes, but also for the sustainable development of the entire agri-food system.

In our case, and validated by four other initiatives, the building blocks “sustainability assessment” and “interaction” allowed to distinguish five models for sustainable development processes in the agri-food system. This model structuring helped to describe the myriad existing sustainable development processes. We used the models to sort the sustainable development processes into macro and micro level, which facilitates understanding the long term as well as short-term sustainability goals in the complex context of an agri-food system. As such, our research addresses the important knowledge gap of how guide and steer sustainable development processes within a complex agri-food system that consists of a variety of supply chains, industries and individual firms. As agri-food firms as well as industries all work within a different context and pursue different goals, there is no one-size-fits-all solution for sustainable development processes. Revealed models can be used in a complementary way, or adjusted to other contexts. The underlying building blocks must be seen as a starting point for future research further validating and implementing the models.

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Figure 1: Representation of a food supply chain in its complex (a) and simplified (b) configuration

Figure 2: Building blocks for sustainable development processes of the agri-food system

Figure 3: Presentation of the five models for sustainable development processes based on the level of their monitoring approach

Figure 4: Macro and micro level differentiation of the five models

Highlights

- How should sustainable development processes be guided within the agri-food system?
- Stakeholder interaction as important driver for sustainable development processes
- The myriad of sustainable development processes structured into five models
- Complementary use of the models responds to the dynamic character of sustainability
- Sustainable development processes sorted into a macro and micro level

(a)

(b)

SOCIO-ECOLOGICAL SYSTEM

External actors of agri-food system: government, NGO's, research and innovation institutes, financial institutes,...

Building blocks for sustainable development processes of the agri-food system

AGRI-FOOD SYSTEM

Model 1 and model 2

Model 3 and model 4

Model 5

MACRO LEVEL

Goals macro level:

- Formulate sustainability goals at agri-food system level
- Monitor progress sustainable development of the agri-food system

MODEL 1

Develop shared vision and work out strategic and action plans based on dialogue and discussion between agri-food chain actors

MODEL 2

Monitor progress by striving for a positive balance at system level

MICRO LEVEL

Goals micro level:

- Concretize sustainability goals set at macro level
- Context specific approach with a focus on the sustainable development of food supply chains and industries

MODEL 3

focus on sustainable products

MODEL 4

focus on sustainable FSCs

MODEL 5

focus on sustainable industries