

Rethinking incumbent firms in sustainability-oriented industry transitions:

**Conceptual advancements and empirical insights
from the German meat industry**

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Charlott Hübel

born on the 1st of June, 1992 in Bochum

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First reviewer: Prof. Dr. Dr. h.c. Stefan Schaltegger

Second reviewer: Prof. Dr. Jacob Hörisch

Third reviewer: Jun.-Prof. Dr. Samantha Dijkstra-Silva

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*This dissertation is dedicated to my grandfather
Klaus Hübel*

Dissertation content

A. Dissertation framework (conceptual)

Integrated incumbent firm behavior in sustainability-oriented industry transitions: Developing a Multi Embeddedness Framework

B. Rigidity and lock-in (empirical)

Hübel, C. & Schaltegger, S. (2022): Barriers to a sustainability transformation of meat production practices - An industry actor perspective. *Sustainable Production and Consumption* 29, 128-140. <https://doi.org/10.1016/j.spc.2021.10.004>
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C. Intent for sustainability and contribution potential (conceptual)

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D. Processes of exploration and reorientation (empirical)

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Annex

- I. Author contributions to dissertation papers and publication status
- II. Presentations related to this dissertation
- III. Declaration

A. Dissertation framework

Integrated incumbent firm behavior in sustainability-oriented industry transitions: Developing a Multi Embeddedness Framework

**Integrated incumbent firm behavior in sustainability-oriented
industry transitions:
Developing a Multi Embeddedness Framework**

Charlott Hübel

Centre for Sustainability Management (CSM)
Leuphana Universität Lüneburg
Universitätsallee 1
D-21335 Lüneburg, Germany
Tel. +49 176 82474738
Charlott.Huebel@leuphana.de

Abstract

While transition research recognizes incumbent firms' crucial role in sustainability-oriented industry transitions, descriptions of transition-related firm behavior remain dispersed. Many studies characterize incumbent firms as passive and innovation-averse, whereas others point to reactive behaviors that are triggered by external pressures and result in incremental innovations. Again other studies highlight incumbent firms' proactive exploration of radical sustainability innovations. Recently, transition scholars have called for an integrated view that acknowledges the diversity in incumbent firm behaviors within industries as well as within firms. However, research that explores processes of such integrated behavior, particularly at firm and individual level, is currently lacking. This framework paper addresses the research gap by adopting an integrated view of incumbent firm behavior, analyzing passive, reactive and proactive behaviors at firm and individual level. It does so with the aim of completing the currently disparate picture of incumbent firm behavior in sustainability-oriented industry transitions. The four articles of this dissertation are viewed through the lens of Geels' Triple Embeddedness Framework (TEF), which currently considers passive and reactive behaviors. By adding the consideration of incumbent firm proactivity as well as multi-level interactions between industry, firms and individual managers, the main elements of the TEF are extended. A new Multi Embeddedness Framework (MEF) is developed that details processes and outcomes of integrated incumbent firm behavior including passivity, reactivity and proactivity. A discussion of the developed framework reveals crucial properties of integrated incumbent firm behavior and details a new understanding of incumbent firms in sustainability-oriented industry transition. The insights put forward in this framework paper provide valuable contributions to the transition literature as well as important management implications with regard to the stimulation and promotion of proactive behaviors.

Keywords: Incumbent firm, firm behaviour, triple embeddedness framework, industry transition, sustainability

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1. Introduction

The important role of incumbent firms in advancing sustainability-oriented industry transitions is increasingly recognized in the sustainability transition literature (Turnheim and Sovacool, 2020; Loorbach and Wijsman, 2013). Incumbent firms are referred to as firms-in-industries (Geels, 2014a), which are embedded in the established socio-technical structures of their industry and thereby contrast new entrant firms (Turnheim and Geels, 2019; Berggren et al., 2015). It is argued that incumbent firms, due to their accumulated knowledge and capital, can profoundly influence production and consumption patterns by reorienting “in the directionality of innovations“ (Geels, 2014a, p. 263). However, incumbent firms’ embeddedness in different market environments often encourages them to adhere to the standards, norms and routines from which they wish to depart (Wells and Nieuwenhuis, 2012; Geels, 2014b). This ‘paradox of embedded agency’ (Holm, 1995) makes it difficult for incumbent firms to introduce innovations that challenge established system configurations. Some incumbent firms, therefore, remain passive in transitions and are driven out of the market by competing new entrant firms (Geels, 2002). Others, however, find ways to break with established routines, engage in innovation and advance transition efforts – in a more or less radical manner and with more or less success (Bergek et al., 2013; Berggren et al., 2015). This suggests that in one and the same industry, different incumbent behaviors on a spectrum from passive to proactive can be observed (Magnusson and Werner, 2022; Ampe et al., 2021).

Despite recent calls for an integrated view of incumbent firm behavior that includes passivity, reactivity and proactivity (Van Mossel et al., 2018; Magnusson and Werner, 2022; Turnheim and Sovacool, 2020; Steen and Weaver, 2017), empirical transition research has so far neglected to explore associated processes and implications for sustainability transitions. In the past, salient transition research has adopted a passive or reactive view of incumbent firms (e.g. Geels, 2002; Geels and Schot, 2007). At most, the postulated views acknowledge that incumbent firms can reorient towards sustainability, but often only after continuous external pressures and performance decline. For instance, Geels (2014a) combined the passive and reactive view of incumbent firm behavior by developing a so called Triple Embeddedness Framework (TEF). The TEF conceptualizes incumbent firms as embedded actors locked-in to industry structures, who, upon increasing pressures from different environments, can formulate response strategies and gradually reorient towards sustainability. An integrated view of passive, reactive and proactive incumbent firm behavior and respective empirical insights is, however, lacking.

An exploration of integrated incumbent firm behavior in transitions necessitates not only strategic and operational considerations at the level of the firm, but also cognitive and emotional processes at the level of individual managers. Particularly in the context of proactive behaviors, cognitive aspects such as managerial intent, motivation, sensing and evaluating, become important (Kaffka et al., 2020; Ardichvili et al., 2003; Cornelissen and Clarke, 2010). This is due to the fact that the common outside-in perspective is now complemented by an inside-out perspective. Even though transition research acknowledges the importance of cognition (Geels, 2014a; Geels, 2020), processes thereof at the level of individual managers are not explored. Most importantly, it remains unclear how such internal processes can be linked back to industry transitions, including relevant interactions with different firm environments.

Addressing the outlined research gap, this paper adopts an integrated view of incumbent firms and attends to the research question: *“How can an integrated view of incumbent firm behavior advance our understanding of incumbent firms in sustainability-oriented industry transitions?”* Exploring this research question can account for diverging firm behaviors, including proactivity, shine light on hitherto neglected firm- and individual-level processes and reveal their implications for wider industry transition. While the exploration of integrated behavior leads to an increase in complexity, it promises a more complete picture of incumbent firm behavior in sustainability transitions. Already combining the passive and reactive view of incumbent firm behavior, Geels’ (2014a) Triple Embeddedness Framework (TEF) serves as analytical lens for this framework paper. The four articles of this dissertation are viewed through the main elements of the TEF, resulting in the framework’s extension. A new Multi Embeddedness Framework (MEF) is developed that details processes at firm and individual level and reveals insights into integrated incumbent firm behavior including passivity, reactivity and proactivity.

The paper is structured as follows: Section 2 reviews the literature on incumbent firm behavior in industry transitions and presents the main elements of the TEF. Thereupon, Section 3 describes the methodology in terms of research context and basis of analysis. Section 4 details the extension of each of the TEF’s elements to develop a new framework, i.e. the MEF. The following Section 5 discusses the MEF with regard to properties of integrated incumbent firm behavior and related understandings of incumbent firms in industry transition. Finally, Section 6 summarizes the main insights and includes recommendations for management and research.

2. Literature review and theoretical foundation

2.1 Incumbent firm behavior in industry transitions

Transition studies propose different views on incumbent firm behavior, ranging from passive and reactive to proactive (van Mossel et al., 2018; see Table 1). This section presents the different views and, in doing so, highlights recent calls for an integrated view combining passive, reactive and proactive behaviors (Magnusson and Werner, 2022).

For a long time, prevalent sustainability transition studies have described incumbent firm behavior as rather *passive* and innovation-adverse, starkly contrasting the innovation-oriented behavior of smaller start-ups in market niches (e.g. Geels, 2002; Geels and Schot, 2007; Kemp et al., 1998; Schot and Geels, 2008; Raven et al., 2016). According to these studies, market niches serve as protected spaces for the development of radical innovations, from which they are disseminated into the mainstream (Kemp et al., 1998; Geels, 2002). Incumbent firms as embedded actors in rigid industry regime structures are bounded to the status quo and find it difficult to engage in disruptive activities. The literature around the passive view on incumbent firm behavior focuses on prevailing lock-ins, resistance to reorientation and resulting competitive disadvantage (Unruh, 2000; Wells and Nieuwenhuis, 2012; Lee and Hess, 2019). Other transition studies acknowledge incumbent firms' capacity for adaptation, postulating the possibility of *reactive* behavior. According to this view, incumbent firms have the ability to partly escape lock-in and reorient towards sustainability once they face increasing external pressures and performance problems (Geels, 2014a; Penna and Geels, 2015; Karltorp and Sandén, 2012). By gradually reorienting their strategies, they remain competitive and thus contribute to industry transition (Geels, 2014a). Strategies can include institutional strategies towards the external environment of the firm (Smink et al., 2015a) as well as innovation strategies through which incumbents develop innovations themselves (Kishna et al., 2017; Onufrey and Bergek, 2021).

More than 20 years ago, Chandy and Tellis (2000) challenged the perception of incumbents as non-innovative laggards doomed to be driven out of the market by newcomers. In the past decade, the view that incumbent firm can also shape industry transitions *proactively* has received growing attention in the transition literature (Bergek et al., 2013; Berggren et al., 2015; Werner et al., 2022). Here, incumbent firms perceive opportunities for radical innovations early on and use them to their advantage to become first-movers in their industry (Steen and Weaver, 2017). Research finds that incumbent firms' innovative capacity manifests in their accumulated

capital, competences and experience, all of which allow them to develop new technologies, integrate them into existing ones and thereby potentially outperform experience- and resource-weak newcomers (Bergek et al., 2013). At the same time, incumbent firms can use their position of power to influence other industry actors, diffuse sustainable business models and thereby support industry-scale transitions (Bidmon and Knab, 2018; Rovanto and Bask, 2021). This proactive view is closely related to research streams such as sustainable entrepreneurship which has acknowledged the innovative capacity of incumbent firms (Schaltegger et al., 2016; Schaltegger and Wagner, 2011).

Table 1: Literature review of different incumbent firm behaviors

Incumbent firm behavior	Explanation	Literature
Passive	Their embeddedness in dominant industry structures makes incumbent firms resist reorientation towards sustainability. Radical innovations are mainly developed and disseminated by new entrants in protected market niches.	Geels, 2002; Geels and Schot, 2007; Geels, 2010, Geels 2014b; Smith and Raven, 2012; Wells and Nieuwenhuis, 2012; Lee and Hess, 2019; Kemp et al., 1998; Unruh, 2000; Raven et al., 2016;
Reactive	In response to increasing external pressures, incumbent firms strategically reorient towards sustainability and gradually contribute to the destabilization of the prevailing industry regime.	Penna and Geels, 2015; Karltorp and Sandén, 2012; Kishna et al., 2017; Onufrey and Bergek, 2021; Smink et al., 2015a
Proactive	Incumbent firms have the capacity to perceive market opportunities for radical sustainability innovations, integrate them with existing capabilities and substantially drive sustainability transition.	Chandy and Tellis, 2000; Bergek et al., 2013; Berggren et al., 2015; Werner et al., 2022
Integrated	Incumbent firms display internally diverse behaviors ranging from passive and reactive to proactive behavior.	Van Mossel et al., 2018; Magnusson and Werner, 2022; Turnheim & Sovacool, 2020; Steen & Weaver, 2017; Ampe et al., 2021

More recently, transition scholars have begun to criticize the conceptual separation between passive, reactive and proactive incumbent firm behaviors. Instead, they call for a more “nuanced” (Magnusson and Werner, 2022), “heterogeneous” (Steen and Weaver, 2017; Eggers and Park, 2018) and “pluralized” (Turnheim and Sovacool, 2020; Ampe et al., 2021) understanding. Such an *integrated* view of incumbent behavior will make it “necessary to go beyond the description of the firm as a coherent unit” and instead, view incumbents as multifaceted actors capable of simultaneous, potentially contrasting behaviors (Magnusson and

Werner, 2022, p. 10). A recent empirical study by Stalmokaite and Hassler (2020) has found evidence of a mixed portfolio of integrated reactive and proactive innovation strategies in shipping firms facing challenges of decarbonization. While the study provides insights into pressure- and opportunity-driven reorientation processes over time, it did not explain fully integrated firm behavior, including firm passivity. Studies have also fallen short in linking co-existing behaviors with external environments, including their impact on industry transition. The Triple Embeddedness Framework developed by Geels (2014a) lays the conceptual groundwork for combining passive and reactive incumbent firm behavior, accounting for both resistance and reorientation. While it also does not describe fully integrated behavior, the framework begins to detail mutual interactions between incumbent firms and different external environments that mediate firm behavior. The following section presents the TEF's main elements.

2.2 Triple Embeddedness Framework (TEF)

According to the TEF, incumbent firm behavior is influenced by two external environments, the socio-political and economic environment, and mediated by a so called industry regime (Geels, 2014a). The industry regime encompasses industry-specific norms, standards, knowledge and mindsets and forms incumbent firms' perceptions and activities towards industry transitions. This triple embeddedness of incumbent firms can account for firm rigidity, but can also generate the necessary conditions for firm reorientation. Incumbent firm behavior is described along three main elements: While (1) incumbent firms experience *lock-in* from the prevalent industry regime and therefore rather resist fundamental change, they still have the possibility to (2) *strategically respond* to increasing environmental pressures and (3) *gradually reorient* towards sustainability. While accounting for passivity and reactivity, the TEF, to date, does not provide insights into proactive incumbent firm behavior, which would require an in-depth exploration of processes at firm and individual level. The following sections briefly summarize the three main elements of the TEF, outline the framework's shortcomings with regard to firm- and individual-level processes and identify relevant research streams.

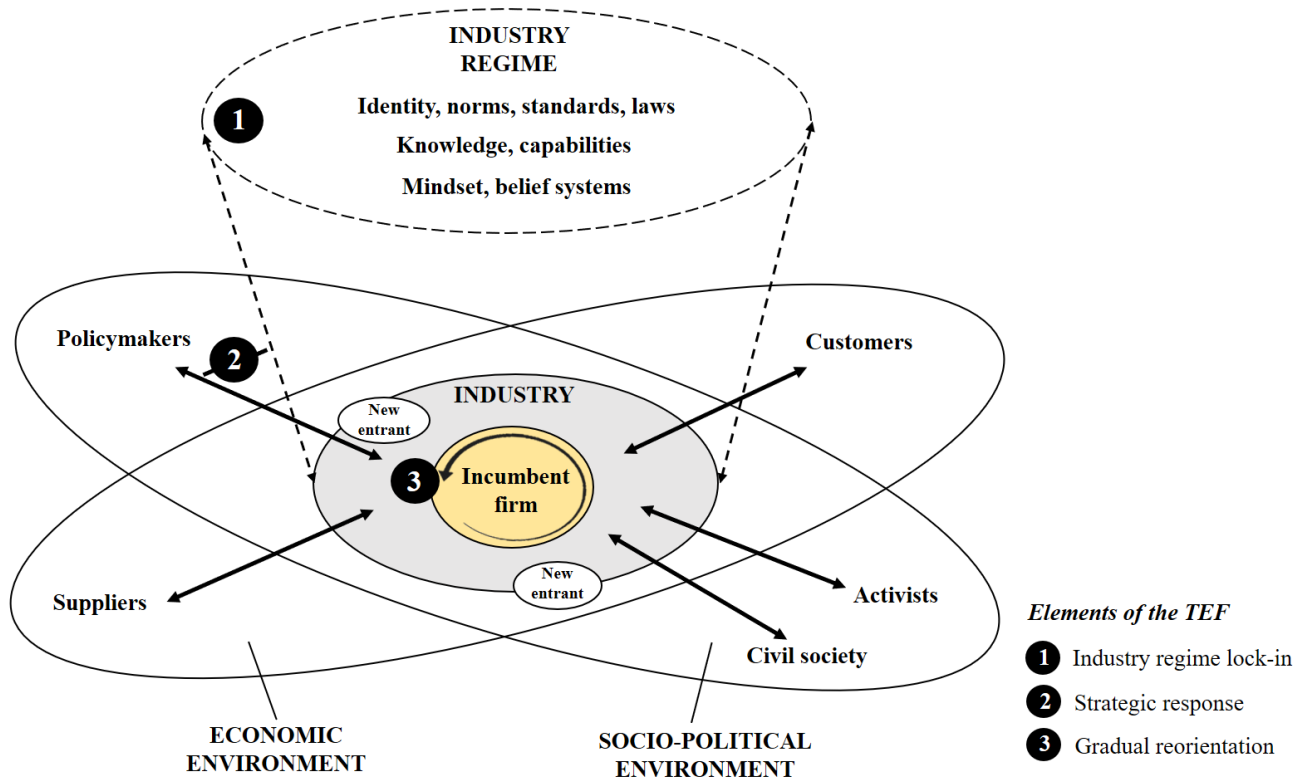


Figure 1: Triple Embeddedness Framework (TEF) (adapted from Geels, 2014a)

2.2.1 Industry regime lock-in

The TEF postulates that, due to isomorphic industry dynamics, many regime elements have become locked-in to certain patterns (Element 1 in Figure 1). The prevailing lock-in is due to different reinforcing mechanisms related to industry-specific capabilities, culture, norms and regulations. These reinforcements encourage incumbent firms to continue business as usual and thus create barriers for them to reorient towards sustainability. As a result, incumbent firm reorientation tends to be incremental and related innovations largely stay on existing trajectories.

Geels bases his ideas of rigidity, isomorphism and lock-in on social science theories such as neo-institutionalism (DiMaggio and Powell, 1983), evolutionary economics (Dosi, 2000) and economic sociology (Polanyi, 1944; Krippner, 2001). As the author aimed at explaining the complexity of the co-evolution of industries, including explanations for industry rigidity and incumbent firm passivity, he takes an industry-level perspective. This is why the TEF focuses on the explanatory power of the industry regime, which accommodates for the targeted broad understanding of institutional influences. Even though the framework does mention

organizational theory, lock-ins are exclusively explained as regime-level phenomena. Geels himself notes that, to date, the TEF “does not address what goes on inside firms, which would introduce another layer of complexity” (2014a, p. 275). More importantly, it does not address what goes on inside individuals. This is despite the fact that previous research has found lock-ins related to mindsets, mission and identity as particularly strong and hardest to change (Turnheim and Geels, 2019). Still, firm-level theories, including organizational path dependence (Sydow et al., 2009), or individual-level theories, including behavioral theories (Kollmuss and Agyeman, 2002; Ajzen, 1991) are not considered by the TEF. An application thereof, however, would provide more nuanced understandings of restrained incumbent behaviors in sustainability transitions and may help to identify levers for cognition-driven reorientation and, eventually, contributions for sustainability-oriented industry transition.

2.2.2 Strategic response

The TEF suggests that incumbent firms can, to a certain degree, overcome lock-in once they face increasing external pressures such as new market competition or regulatory changes. When pressures become so high that they negatively affect firm performance, they trigger different strategic responses by incumbent firms towards their environments (Element 2 in Figure 1). The pursued strategies help firms position and defend themselves against pressures. For instance, to respond to market pressures, firms can select externally-oriented innovation strategies to develop improved products. They can also pursue internal strategies of rethinking routines, capabilities and belief systems to adapt to the changing competitive landscape. The main aim of both complementary strategy approaches is to re-establish a fit between the firm and its environments.

As Geels’ (2014a) aim was to conceptualize industry reorientation in relation to grand challenges, focusing on the intersection of passive and reactive incumbent firm behavior was his deliberate choice. He did, therefore, exclusively consider strategic behavior as a response to external pressures rather than as the result of opportunity perception. In light of recent calls for more heterogeneous understandings of incumbent firms (Magnusson and Werner, 2022; Steen and Weaver, 2017; Turnheim and Sovacool, 2020), however, the additional consideration of proactive incumbent firm behavior might be a valuable research avenue. In this regard, recent transition research that considers crucial firm-market interactions concludes that “incumbent firms can respond proactively with the ambition to shape markets” (Werner et al., 2022, p. 22). The implications of this view would be that the main trigger for reorientation is not external

pressure, but instead a firm's deliberate intent to contribute to industry transition. In this regard, the sustainable entrepreneurship and sustainability innovation literature (Vuorio et al., 2018; Schaltegger and Wagner, 2011; Klewitz and Hansen, 2014) has highlighted the importance of sustainability motivations, goals and intentions of individuals for proactive innovation endeavors. Such individual-level aspects have not been considered by the TEF, so far. Geels (2014a, p. 275) himself acknowledges the potential to delve deeper into cognitive approaches "with an individualistic orientation". Another implication of a proactive view would be that the overall aim is no longer achieving a fit with external environments, but rather to actively shape and transform them. To date, the impact of different approaches for industry transitions are beyond the scope of the TEF. Once you consider proactive behavior, however, the choice of measures and their potential effectiveness in terms of industry transition becomes an essential field of analysis.

2.2.3 Gradual reorientation

The TEF merges the two presented elements of lock-in and strategic response in a temporal manner by determining a consecutive process of incumbent reorientation (Element 3 in Figure 1). Initially, incumbent firms tend to resist change due to prevailing regime lock-ins. With increasing pressures and performance problems, they respond by first exploiting existing resources for incremental innovations and thereupon exploring new knowledge and technology for more radical innovations. Here, collaborations with start-ups or peripheral firms are mentioned as valuable opportunities to explore new technologies. Eventually, culminating pressures encourage firms to fundamentally rethink their purpose, beliefs and identity. This gradual reorientation process is accompanied and facilitated by cognitive processes of sensemaking and learning: External signals are identified and interpreted (sensemaking) and environmental feedback and experiences are evaluated (learning) to inform strategic choice and actions.

While the TEF argues for incumbent firm's capacity to reorient, questions remain regarding firm- and individual-level processes, i.e. regarding *how* reorientation plays out in detail and *by whom* exactly the change is brought about. While learning and sensemaking are assessed as crucial facilitators of incumbent reorientation, processes thereof, particularly at the level of individual managers, are not detailed. To give an example, Geels (2014a) mentions collaborations between incumbent firms and start-ups as facilitators of reorientation but does not delve into associated processes of learning and knowledge internalization. This is in line

with other transition studies describing the importance of interorganizational collaboration without detailing related processes at individual level (e.g. Engwall et al., 2021). In the context of the TEF, learning is triggered by environmental developments including unfamiliar events or cultural pressures. Collaborative learning environments between individuals are not further explored. This is despite the fact that seminal alliance research determines learning in alliances to be crucial for advancing corporate innovation and transformation (Weiblen and Chesbrough, 2015; Inkpen and Currall, 2004). Insights into such firm- and individual-level learning processes could form a valuable addition to the TEF, as they may detail the driving forces of reorientation. Further, the TEF relates cognitive interpretative processes, i.e. sensemaking, to the interpretation of environmental signals. However, individual processes of interpretation are not further detailed, particularly with regard to detecting and reflecting about not only market threats, but also market opportunities. This is despite the fact that research has emphasized the role of cognitive models and processes for coping with the uncertainties and ambiguities that come with the proactive initiation of innovative activities (Hill and Levenhagen, 1995). While Geels (2014a) did not delve into opportunity contexts, he did suggest that the perception and interpretation of opportunities might accelerate the process of reorientation. In this regard, research has shown how sensemaking can drive proactive innovation behavior (Kaffka et al., 2020; Ardichvili et al., 2003; Cornelissen and Clarke, 2010). Delving deeper into the literature on organizational sensemaking (Weick, 1979; Maitlis, 2005) could reveal how managers make sense of organizational developments and arrive at decisions for firm reorientation over time.

Table 2: Main elements of the TEF, their shortcomings and relevant research streams

TEF Element	Addressed aspect	Shortcomings	Relevant research stream(s) to address shortcomings
Industry regime lock-in	Incumbent firms are locked-in to prevalent industry regime elements, which renders reorientation difficult	Firm- and individual-level lock-in and its implication for reorientation efforts	Behavior theories (Kollmuss and Agyeman, 2002; Ajzen, 1991) Organizational path dependence (Sydow et al. 2009)
Strategic response	Incumbent firms respond strategically to increasing external pressures with the aim of adaptation and environmental fit	Managerial intent for sustainability and proactive choice of innovation measures with the aim of contributing to industry transition	Sustainable entrepreneurship and sustainability innovation (Vuorio et al., 2018; Schaltegger and Wagner, 2011; Klewitz and Hansen, 2014)
Gradual reorientation	Incumbent firms gradually reorient towards sustainability along a process that is accompanied by externally oriented learning and sensemaking	The nature and impact of cognitive processes related to learning in alliances and firm-internal sensemaking with regard to both threats and opportunities	Alliance learning (Weiblen and Chesbrough, 2015; Inkpen and Currall, 2004) Organizational sensemaking (Weick, 1979; Maitlis, 2005)

2.3 Research Objectives

This framework paper addresses the above outlined shortcomings of the TEF by advancing it respectively. It does so by adopting an integrated view of incumbent firm behavior, combining passive, reactive and proactive behavior. While the TEF has addressed passive and reactive behavior through its focus on lock-in and strategic response, this paper adds the exploration of proactive incumbent firm contributions to sustainability-oriented industry transitions, thereby accounting for fully integrated incumbent firm behavior. Adopting this view necessitates both firm-level and individual-level analyses, thus adding, in Geels' (2014a, p. 275) words, the missing "layer of complexity" to the TEF. Analysis is based on extensive empirical data, which provides new insights into firm- and individual-level reorientation processes. Concretely, this research looks at what is going on inside and in between firms and individual managers, including cognitive processes of learning and sensemaking. It does so while still considering incumbent firms' embeddedness in and interaction with other environments. The overall research objective and sub-aspects can be summarized as follows:

This research extends the TEF by firm- and individual-level insights with the aim of arriving at an integrated view of incumbent firm behavior encompassing passive, reactive and proactive behaviors. The framework extension aims to

- determine the significance of firm- and individual-level lock-in for firm reorientation
- consider proactive behavior through managers' deliberate intent for industry transition
- detail the role of learning and sensemaking processes for firm reorientation over time

3. Methodology

3.1 Research context

The empirical data that forms the basis for this dissertation has been obtained from 23 incumbent operations in the German meat industry. On the one hand, data was collected from 22 actors along the meat production chain, including farmers, butchers, traders, producers and retailers. On the other hand, data was collected in the context of a longitudinal in-depth analysis of one particular incumbent firm, a large European meat producer with a turnover of €2.8bn in the fiscal year 2020/21. The firm launched a fundamental reorientation process by engaging in extensive exploration activities in the field of sustainable protein solutions. To ensure anonymity, the following elaborations will refer to the case firm as BIGMEAT.

The rationale for selecting the meat industry as research context results from several reasons. First, food systems are linked to major global sustainability challenges such as resource scarcity, ecosystem degradation, and climate change (Crippa et al., 2021; Springmann et al., 2018). In this regard, (industrial) meat production has been assessed to cause major negative impacts on the environment (Steinfeld et al., 2006; Fiala, 2008), animal welfare (Gregory and Grandin, 2007) and public health (Walker et al., 2005). These producer-induced impacts render analyses on transition processes in the food and meat industry important. Second, individual-level considerations, including behavioral and emotional factors, play a big part in food or meat consumption and production (Stoll-Kleemann and Schmidt, 2017; Hoek et al., 2021). For instance, in Germany, the production and consumption of meat is deeply embedded in the national culture (Mellinger, 2000), which might make it difficult for individuals to engage in transitions towards more sustainable behavioral patterns. The food context thus offers valuable opportunities to delve deeper into individual-level processes influencing transition-related behavior.

Lastly, besides the more traditional topics of mobility and energy transitions, sustainability-oriented food system transitions have become a growing topic of interest in the transition literature (e.g. Cohen and Ilieva, 2015; El Bilali, 2019). In this regard, a recent literature review concludes that there is a research gap in analyzing the role of firms in transition processes in the agro-food system (El Bilali, 2019). Indeed, much research dealing with sustainability transitions in general (e.g. Vittersø and Tangeland, 2015) and in the meat industry in particular (e.g. Stoll-Kleemann and Schmidt, 2017) has focused on the perspective of consumers. This is despite the fact that transitions in the agro-food sector have been found to be dependent on the engagement of regime actors such as incumbent firms (Vermunt et al., 2020). There is thus high potential to address the producer perspective, analyzing incumbent meat firms' barriers and success factors for reorienting towards sustainable meat production systems.

3.2 Basis of analysis

The basis of analysis encompasses four scientific articles that all address firm- and individual-level processes of incumbent firm reorientation. Each article corresponds with a different element of the TEF and provides relevant insights that address the identified shortcomings. Table 3 provides an overview of the different articles and the elements of the TEF that they cover.

Table 3: Scientific articles considered for this dissertation

		Articles				
		No.	Author(s)	Short title	Focus	Theoretical lens / Literature
Element of the TEF	Regime lock-in	1	Hübel and Schaltegger, 2022	Industry Actor Barriers	External and internal reorientation barriers as perceived by individual industry actors	Model of pro-environmental behavior (Kollmuss and Agyeman, 2002)
	Strategic response	2	Dijkstra-Silva et al., 2023	Innovation Management	Deliberate selection of management measures for sustainability innovations and potential contributions to industry transition	Sustainability transition (Loorbach and Wijsman, 2013), sustainability innovation (Klewitz and Hansen, 2014) & innovation management (Van de Ven, 1995)
	Gradual reorientation	3	Hübel et al., 2022	Alliance learning	Processes of alliance learning and outcomes for sustainability innovation and industry transition	Alliance learning theory (Doz, 1996; Inkpen, 1998; Inkpen and Currall, 2004)
		4	Hübel, 2022	Managerial Sensemaking	Top and middle manager sensemaking and its influence on a firm's exploration and transformation	Organizational sensemaking (Weick, 1979; Gioia and Chittipeddi, 1991)

The first article contains the results of a qualitative research study conducted by Hübel and Schaltegger (2022) and is titled “*Barriers to a sustainability transformation of meat production practices - An industry actor perspective*”. The analysis is based on 22 semi-structured interviews with incumbent actors, i.e. firms and individuals, along the meat production chain as well as one interview with the chief editor of a leading meat industry journal. Applying Kollmus and Agyeman’s (2002) model of pro-environmental behavior, the interview analysis reveals multi-level barriers for reorienting meat production practices towards sustainability. The article provides the missing individual- and firm-level analysis of reorientation barriers.

The second article is titled “*Company contributions to the sustainability transition of markets: An innovation management perspective*” and contains conceptual work conducted by Dijkstra-Silva et al. (2023). The article links sustainability transition literature with insights from sustainability innovation and innovation management literature to propose a framework for managing company contributions to sustainability transitions of markets. The article addresses managerial choice and deliberate intent for industry transition as well as potential resulting contribution pathways, thus covering the second element of the TEF and adding intention and visioning.

The two remaining articles are both based on the in-depth case study of BIGMEAT. The empirical database includes a total of 40 interviews, observations at 11 events and meetings as well as 71 documents. The two articles represent the heart of this dissertation and reveal detailed insights into individual- and firm-level processes of incumbent reorientation at the intersection of passive, reactive and proactive behavior. Article No. 3 by Hübel et al. (2022) is titled “*Strategic alliances for corporate sustainability innovation: The ‘how’ and ‘when’ of learning processes*”. Applying seminal alliance learning theory, the article examines, how learning about and from startup firms can help advance and accelerate an incumbent firm’s reorientation process. The last article titled “*Entrepreneurship-driven organizational transformation for sustainability: a sensemaking lens*” analyzes sensemaking processes of BIGMEAT’s top and middle managers and shows how sensemaking mediated firm-internal transformation and innovation activities.

4. Framework extension: From triple to multi embeddedness

Based on the presented empirical and conceptual contributions, this chapter extends the TEF with regard to its three main elements of industry regime lock-in, strategic response and gradual reorientation. New firm- and individual-level insights address the identified shortcoming of the TEF and result in the development of a Multi Embeddedness Framework (MEF) which complements the insight provided by the original framework. The MEF offers an integrated view of incumbent firm behavior in industry transitions, meaning that it combines passive and reactive with proactive incumbent firm behavior and details processes thereof. The framework’s elements are highlighted in Figure 2 and explained in the following sections.

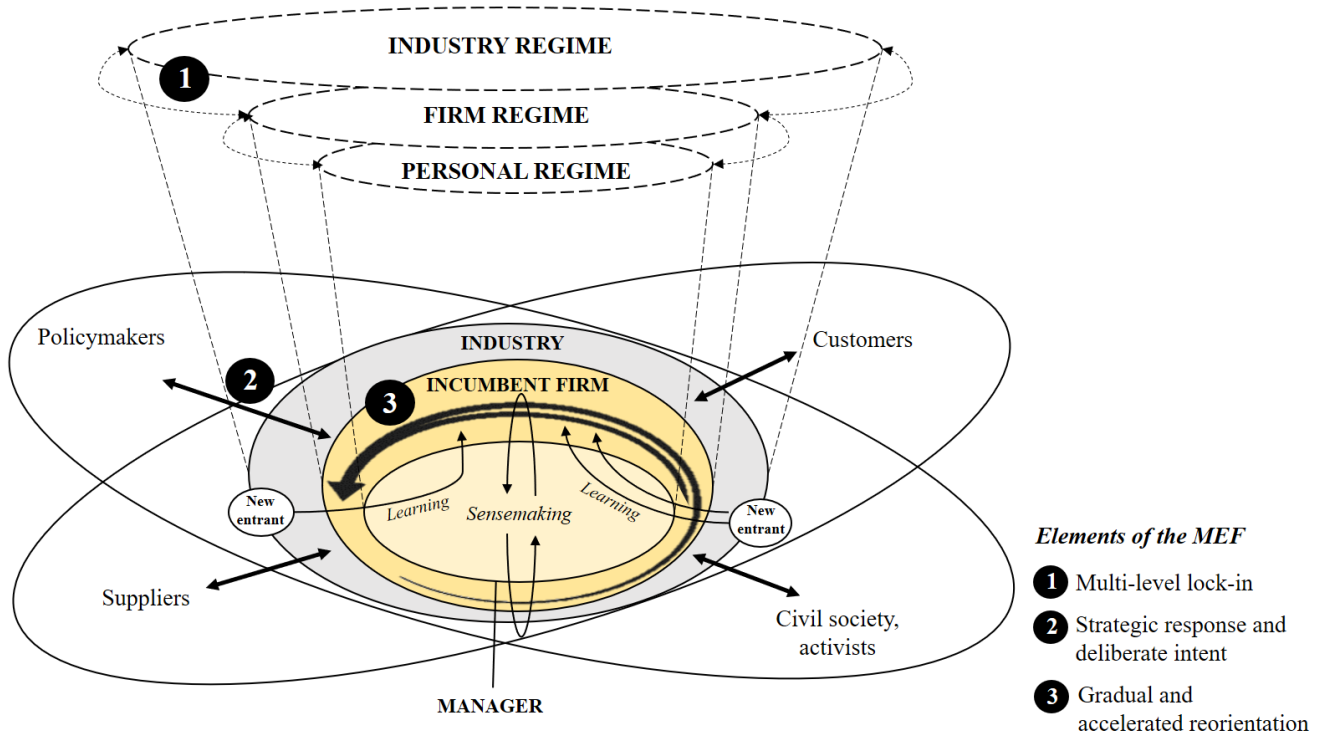


Figure 2: Multi Embeddedness Framework (MEF)

4.1 Multi-level lock-in

According to the TEF, lock-ins arising from the industry regime account for the tendency of incumbent firms to (initially) resist reorienting towards sustainability. The findings of this dissertation, however, point to a multi-level lock-in of incumbent actors. Besides the industry regime, incumbent firms seem to be additionally influenced by an ‘organizational regime’ at firm level as well as a ‘personal regime’ at individual level (Element 1 in Figure 2). The MEF accounts for the complexity of transition efforts by describing reorientation barriers resulting from the three regimes as well as their interacting elements. In the following, multi-level regime influences are described on the basis of the dissertation’s empirical insights.

The analysis of meat industry actor barriers by Hübel and Schaltegger (2022) reveals that reorientation barriers not only arise from lock-ins at industry level through industry-specific infrastructure, standards and mindsets, but also at firm level through firm-specific resource allocation and operational procedures and at the level of individual managers through personal knowledge, emotional and cognitive responses, values and attitudes. Firm-level lock-in as perceived by meat industry actors, for example, can derive from long-term investments into agricultural property like pig fattening stables, which create sunk costs and render reorientation endeavors neither desirable nor feasible. The organizational regime, in this regard, encompasses

resource factors which mediate operations at firm-level. The personal regime, on the other hand, influences individual behavior. According to the results of Hübel and Schaltegger's (2022) meat industry study, personal regime lock-in, for instance, can derive from emotional commitment to long-standing family traditions in animal husbandry or butchery. Here, the authors identify particularly strong individual-level lock-ins for operation owners. Hübel's (2022) sensemaking analysis later shows that emotional commitment to conventional meat operations can become an equally impeding factor for a firm's middle managers. In the case of BIGMEAT, managers' commitment rendered it difficult for them to consider the exploration of alternative protein innovations and accept the new organizational identity as protein provider.

Hübel and Schaltegger's (2022) analysis further proposes that the difficulty of reorientation for incumbent firms is increased by the constant interaction of multi-level factors contributing to lock-in (connecting arrows between regimes in Figure 2). For instance, emotional commitment to long-standing operations (emotional lock-in) can cause a status quo bias (cognitive lock-in), which, in turn, encourages incumbent actors to defend and reinforce industry-oriented standards (industry lock-in). The differentiation of and interaction between different regime levels takes into consideration the different roles of incumbent actors as individuals, managers, organizational actors and industry members and acknowledges the complexity of reorientation efforts from an actor perspective.

4.2 Strategic response and deliberate intent

The TEF accounts for reactive incumbent firm behavior by determining external pressures as triggers for escaping lock-in and gradually reorienting towards sustainability. In contrast, the conceptual and empirical contributions of this dissertation suggest the possibility of proactive incumbent firm behavior that is based on resources, values and mindsets at the level of the firm and managers. In this regard, the MEF includes the importance of individual managers' deliberate intent for sustainability (Element 2 in Figure 2). As the empirical insights show, however, deliberate intent does not replace lock-in and/or strategic responses, but instead co-exists with both.

This dissertation's analyses suggest that reorientation can be facilitated by specific firm- and individual-level factors rooted in the proactive view of incumbent firm behavior. In this regard, Dijkstra-Silva et al. (2023) propose that the management of carefully selected innovations and resources at firm level as well as managers' deliberate intent for sustainability at individual level are crucial antecedents for innovation-driven reorientation and transition contribution.

BIGMEAT, for instance, selected those innovations that could be integrated into their existing production and sales structure (Hübel et al., 2022). For maximum industry impact, they combined their market experience and distribution network with the innovativeness of novel protein solutions of international start-up firms. Exploration decision were fundamentally facilitated by the availability of the required financial and material resource base. In this regard, Dijkstra-Silva et al. (2023) suggest that the adequacy and contribution potential of innovation management measures differs with each company, depending on its size, resource base and market position. BIGMEAT, due to its large resource base and dominant position in the European market, had the potential to fundamentally influence various industry environments, including suppliers, politicians, consumers and competitors. By forming distribution partnerships which helped making sustainable protein products available to the mainstream market, BIGMEAT used its potential as major contributor to transition.

With regard to the individual level, Dijkstra-Silva et al. (2023) suggest that if managers display a deliberate intent to contribute to industry transition, they will select those management measures which promise the furthest-reaching impact across industry environments. In this regard, the authors propose so called “contribution pathways” of individual management measures: A measure targeted at improving sustainability in one industry environment can trigger changes in others, including the economic and socio-political environment, and ultimately, the industry regime. In the case of BIGMEAT, managers’ intent was influenced by the firm’s long term orientation as a family firm and respective openness towards sustainability topics (Hübel et al., 2022). This orientation towards long-term survival and growth made BIGMEAT top managers not only make sense of market pressures to reorient towards sustainability in general (reactive view), but also made them eager to detect and use opportunities to drive reorientation towards promising new markets (proactive view) (Hübel, 2022). Deliberate managerial choice was thus based on the firm’s long-term orientation and facilitated by continuous managerial sensemaking. Hübel’s (2022) sensemaking analysis shows how two particularly passionate members of the top management team had detected opportunities in the alternative protein field years before meat alternatives became a mainstream topic. Sensing the chance for additional business growth, they initiated first investments and distribution partnerships. While the initial launch of exploration activities was done without the explicit intent to contribute to sustainability transition, learning processes in the context of alliances impacted individual top managers’ perceptions and made them change their intentions over time (Hübel et al., 2022). However, as the analyses also showed, deliberate intent and

proactivity by few managers of the top management team did not spill over to middle managers who were largely engaged in the conventional meat business. Here, strategic response behaviors aimed at (re-)establishing environmental fit dominated, resulting in a firm-level co-existence of strategic response and deliberate intent.

4.3 Gradual and accelerated reorientation

The TEF describes reorientation as a gradual process, over the course of which incumbent firms move from denial to fundamental recreation. In contrast to the suggestions of the TEF, the analyses of BIGMEAT's alliance learning and sensemaking processes reveal that reorientation processes at firm- and individual level have to be neither consecutive nor gradual. Instead, they suggest that reorientation towards radical innovation can be vastly accelerated, implying the simultaneous existence of different stages of reorientation within a firm (Element 3 in Figure 2). The MEF therefore incorporates the possibility of co-existing gradual and accelerated processes of reorientation. The split arrow in the inner circle in Figure 2 visualizes this co-existence. In the following, potential acceleration as well as co-existence of different reorientation stages will be explained on the basis of the empirical insights.

As the analyses of Hübel et al. (2022) and Hübel (2022) show, BIGMEAT's exploration activities were accelerated by (1) alliance learning and (2) alternating sensemaking (fine-lined arrows going through the inner circle in Figure 2). Regarding the first aspect, continuous alliance learning made BIGMEAT progressively reorient towards different protein markets, from meat alternatives to egg and cheese alternatives. The analysis of Hübel et al. (2022) reveals that learning at BIGMEAT was vastly increased and accelerated through the firm's creation of a broad portfolio of alliances with different start-ups for alternative protein solutions. Here, the paper distinguishes the important roles of learning *about* and learning *from* start-ups. Learnings *about* the characteristics, values and goals of the start-up partners lead to the formation of further alliances with start-ups for increasingly radical sustainability-oriented solutions (e.g. 3D-printed meat). Learning *from* partner firms prompted BIGMEAT managers to adopt new perspectives and integrate global sustainability concerns into decision-making. Successful reorientation towards sustainability thus not only depends on the internalization of technical knowledge, but especially on personal value-based learnings. For instance, alliance partners taught BIGMEAT top managers the importance of global food security, which made them more eager to explore further alternative protein solutions. Interestingly, the analysis also found that negative learning experiences in alliances in terms of process delays and broken promises were

crucial for the acceleration of BIGMEAT's in-house innovation activities in terms of plant-based protein solutions. The case of BIGMEAT not only showed the link between individual-level learning and firm-level innovation, but also the link between learning, innovation and industry transition. For instance, the learning alliances contributed to the transition of the economic environment through the increased availability of alternative protein solutions in the mainstream market as well as the transition of industry regime elements through the increased acceptance of and knowledge about vegan alternatives.

Regarding the second factor, Hübel (2022) suggests that sensemaking activities by top and middle managers can help firms navigate and accelerate internal transformation processes. The analysis of BIGMEAT's sensemaking processes finds that this navigation and acceleration is achieved through a continuous alternation between sensemaking *for* innovation activities (interpretation of environmental or firm-internal changes) and sensemaking *of* innovation activities (interpretation of exploration impacts). If pursued at both top and middle management level, sensemaking processes can profoundly advance and accelerate a firm's reorientation towards sustainability, including changes to structure, culture and identity. BIGMEAT only unleashed the full potential of sensemaking rather late in its exploration process by including middle managers into sensemaking and creating an open space for ideas. While the inclusion of middle managers helped overcoming hierarchical tensions, it also lay bare internal diversity in terms of different managerial intentions and preferences. Eventually, those processes lead to a compromised solution, as BIGMEAT created an overarching identity of "protein provider" which allowed different meanings to co-exist. Instead of the replacement of established meanings, meanings were accumulated over time, which reflected the parallel pursuit of reactive and proactive strategies. While BIGMEAT's top managers reacted to environmental pressures to increase eco-efficiency and animal welfare in the conventional meat business, they proactively engaged in exploration for radical alternative protein solutions. The acceleration of exploration through learning and sensemaking existed independently from gradual reorientation in the conventional business.

5. Discussion and contribution

While the TEF conceptualizes passive and reactive incumbent firm behavior, the newly developed MEF provides processual firm- and individual-level insights into *integrated* incumbent firm behavior that encompasses passivity, reactivity and proactivity. This section discusses the MEF with regard to specific properties of integrated incumbent firm behavior and their implications for a potentially new understanding of incumbent firms in industry transition. In each subsection, contributions to the sustainability transition literature are highlighted.

5.1 Properties of integrated incumbent firm behavior

The elements of the MEF point to several properties of integrated incumbent firm behavior. These properties can be subsumed under the three terms (1) co-existence (2) accumulation and (3) interaction, each of which is discussed in the following.

(1) Co-existence

Integrated firm behavior is most fundamentally based on the co-existence of different processes and meanings. While the TEF suggests one path for incumbent firm reorientation (lock-in → strategic response → gradual orientation), the MEF allows for several paths to overlap. This overlap manifests in the co-existence of multi-level regime lock-in and firm reorientation, the co-existence of strategic response and deliberate intent as well as the co-existence of gradual reorientation and accelerated transformation. Previous transition research has already pointed to heterogeneous incumbent firm behavior, ranging from innovation-adverse to innovation-oriented and from competitive to collaborative behavior (Magnusson and Werner, 2022; Steen and Weaver, 2017). However, respective studies merely point to behavioral diversity *among* different firms of the same industry rather than behavioral diversity *within* one and the same firm. Stalmokaite and Hassler's (2020) recent study approached internal diversity by revealing the co-existence of reactive and proactive strategies. This finding may relate to innovation management research arguing for the simultaneous pursuit of exploitation and exploration activities (O'Reilly and Tushman, 2011). The MEF, however, argues for co-existent passivity, reactivity and proactivity and thus completes the picture of fully integrated firm behavior. It therefore contributes to sustainability transition research that currently lacks such a comprehensive behavioral view. The MEF further adds the perspective of the embeddedness of incumbent firms in different regimes and industry environments. Co-existing developments always result from or relate to developments in other environments.

(2) Accumulation

Integrated incumbent firm behavior results in an accumulation of meaning, not in the replacement thereof. According to the TEF, increasing pressures allow incumbent firms to escape lock-in and pursue strategies that lead to firm reorientation. The ultimate outcome of this process is strategic recreation, meaning comprehensive changes in strategy, technology, mission, beliefs and identity. Despite not formulating it explicitly, the TEF suggests that previous firm activities and meanings cease to exist. The integrated view of the MEF argues for the integration of the old into the new, which manifests differently among hierarchical management levels. Alternating sensemaking of old and new meanings help create new meanings that incorporate established ones. This not only includes the integration of exploitation and exploration activities, but also the integration of different exploration paths. In the case of BIGMEAT, alternating sensemaking of innovation activities helped the firm to create a diverse alliance portfolio with increasingly radical value propositions. The overall outcome of these processes, however, was not the continued replacement of previous activities, but an accumulation that created an overarching, integral identity. This processual perspective of the integrated view of incumbent firm behavior represents a new contribution to transition research. In the transition literature, the aspect of accumulation has been addressed with regard to industry developments, where new knowledge is progressively combined with established technologies (Bergek et al., 2013). However, firm-level insights have been lacking, so far. At firm level, diversity in strategy pursuit has been discussed (Stalmokaite and Hassler, 2020), but without considering implications of accumulation.

(3) Interaction

The interaction between industry environments, firms of the same industry and between individuals inside a firm is cause and outcome of integrated firm behavior. According to the TEF, the relationship between the firm and its environments is bi-directional in the sense that incumbent firms receive information from the environment and formulate strategies to respond to that information. Complementing these insights, the MEF accounts for more complex relationships by revealing a multi-level interaction between different regimes and environments. On the one hand, regime interactions increase complex lock-in accounting for passive behavior. On the other hand, environmental interactions can cause positive chain reactions of taken sustainability measures, accounting for reactive and proactive behaviors.

In addition, the MEF not only shows how incumbent firms react to information from the environment (reactive behavior), but also how they deliberately seek new knowledge through collaborations with other industry members (proactive behavior). The TEF along with many conceptualizations of incumbent firms in sustainability transitions do not consider collaborative relationships between incumbent and new entrant firms (e.g. Geels and Schot, 2007; Kemp et al., 1998; Schot and Geels, 2008; Raven et al., 2016). These frameworks regard incumbent firms as separate from innovation spaces, rather incapable of collaborating with niche firms due to prevailing institutional logics (Smink et al., 2015b). Associated discussions with regard to niche regime interactions have remained on system level (Costa et al., 2022; Mylan et al., 2019). The MEF, in contrast, shows how individual-level learning in alliances with start-ups can be cause and outcome of proactive behavior of incumbent firm managers. Additional interactions between top and middle managers in the form of shared sensemaking processes help reflect on diverse internal behavioral patterns and can lead to shifts from passivity to reactivity, or reactivity to proactivity respectively. These cognitive individual-level insights in terms of learning and sensemaking processes present a fundamentally new perspective to transition research, which today, has focused on system-level (e.g. Geels, 2002; Geels and Schot, 2007) and, to some extent, firm-level analyses (e.g. Geels, 2014a; Stalmokaite and Hassler, 2020).

The three presented properties of integrated incumbent firm behavior describe the complexity of sustainability-oriented reorientation and innovation. The co-existence of passivity, reactivity and proactivity, the accumulation of meanings over time and the interactions between individuals, firms and firm environments render reorientation a multi-faceted and contested endeavor. At this point, the question remains how these new insights into integrated incumbent behavior influence the current understanding of incumbent firms in industry transition. Integrated incumbent firm behavior considers an incumbent firm's capacity for proactivity, including the stimulation and acceleration of sustainability-oriented exploration. In this regard, transition studies have stated that the early detection, development and dissemination of radical innovations bears the potential of incumbent firms to contribute to industry transitions (Bergek et al., 2013; Berggren et al., 2015; Chandy and Tellis, 2000). However, as proactive behaviors tend to co-exist with passive and reactive behaviors, an incumbent firms' eventual contribution to industry transitions remains unclear. In the end, does integrated behavior make incumbent firms drivers, laggards or losers of industry transition? The following section will discuss the implications of the three presented properties with regard to a potentially new understanding of incumbent firms in industry transition.

5.2 Understanding of incumbent firms in industry transition

When analyzing the three properties of integrated firm behavior in terms of their implications for industry transition, different conclusions can be drawn. The two properties of co-existence and accumulation seem to provide firms with the potential to moderately contribute to industry transitions (see first two rows in Table 4). This conclusion is largely in line with transition research ascribing a rather reduced role to incumbent firms (Geels, 2002; Geels and Schot, 2007; Kemp et al., 1998). As proactive behavior always co-exists with some degree of passivity and reactivity inside the firm, different preferences have to be considered and balanced. The continuous balancing over time is likely to result in an accumulation of meanings, which makes it difficult, if not impossible, to fully replace established, potentially unsustainable firm practices by those oriented towards sustainability. It is true that bi-directional sensemaking between established and new meanings may help accelerate internal exploration and reorientation. However, as the case of BIGMEAT shows, the outcome of such processes in terms of firm identity and sustainability-oriented in-house innovations tend to be of rather moderate nature. While the developed in-house innovations might increase industry sustainability by providing consumers with sustainable alternatives, their moderateness may impede more fundamental transition. The conclusion can be drawn that if an incumbent firm seeks to proactively drive transitions, the co-existence and accumulation of different behaviors and meanings inside the firm may have a hampering effect on such endeavors. Considering the urgency of profound industry transition regarding pressing sustainability challenges (van der Leeuw et al., 2012), internal incumbent firm processes alone seem to be insufficient to drive industry transition.

Table 4: New understanding of incumbent firms in industry transitions

Properties of integrated incumbent firm behavior	Description	Understanding of incumbent firms in industry transition	
		Per property	Overall
Co-existence	Parallel development of different behaviors and processes inside the firm related to passivity, reactivity and proactivity.	Incumbent firms as actors with the potential to <i>moderately</i> contribute to industry transitions through - Continuous balancing of different behaviors inside the firm, including the exploration of sustainable alternatives	Incumbent firms as actors with the potential to <i>moderately</i> or <i>profoundly</i> contribute to industry transition, depending on the emphasized property
Accumulation	Progressive increase of meanings, combining old and	Incumbent firms as actors with the potential to <i>moderately</i> contribute to industry transitions through	

	new activities (or business units) within the firm.	- Compromised firm-internal solutions with regard to firm identity and sustainability innovations
Interaction	Mutual interlinkages and processes between firm environments as well as between and within firms.	Incumbent firms as actors with the potential to <i>profoundly</i> contribute to industry transitions through <ul style="list-style-type: none"> - Strategic use of causal chains in and between industry environments - Formation of distribution partnerships with innovation-focused (new entrant) firms and exploitation of related alliance learnings - Initiation of shared sensemaking processes for sustainability-oriented exploration

While the properties of co-existence and accumulation might allow for rather moderate incumbent firm contributions to industry transition, the property of interaction holds the potential for more profound firm contributions (see third row in Table 4). First, as the paper by Dijkstra-Silva et al. (2023) suggests, proactive behavior can become very impactful, if it is deliberately oriented towards influencing industry environments. This may be the case even if such behavior is only limited to few, but powerful individuals inside the firm. Proactive top managers can purposefully select measures while considering causal chains within industry environments and, thus, potentially trigger far-reaching industry change. Second, the BIGMEAT case showed how engaging with sustainability-oriented start-ups in the form of distribution partnerships can actively increase the availability of sustainable solutions at the market. Respective alliance learning processes can further develop managers' deliberate intent to contribute to industry transition, resulting in the formation of more alliances with progressively radical value propositions. The outcome for industry transition can be increased. Third, involving middle managers into shared sensemaking early on can accelerate internal reorientation and exploration activities, which, in turn, can shorten the time to market of in-house innovations. These implications show the crucial importance of multi-level interactions between individuals, between firms and between firm environments for driving industry transitions. Previous research, including the TEF, has addressed firm-environment relationships (e.g. Smink et al., 2015a) as well as interfirm collaborations (e.g. Engwall et al., 2021), focusing on strategic response and adaptation or externally-oriented learning. This study is the first to provide in-depth insights into the complexity, but also crucial role of multi-level interactions involved in industry transitions, particularly key learning and sensemaking processes at the level of individual managers.

Combining the previous elaborations creates a rather ambiguous understanding of incumbent firms in industry transition. Incumbent firms can be both, moderate and profound contributors to industry transition. As all three properties always apply simultaneously, different potentials for industry transition contribution coincide. For instance, an exclusive focus on the property of interaction would not be possible, as all properties are inherently interrelated and thereby complete the complex picture of integrated incumbent firm behavior. This interrelation, however, also opens up opportunities for an increased contribution potential of incumbent firms. In this regard, this paper argues that incumbent firms possess the ability to emphasize specific properties, which can, in turn, increase or decrease another property's influence. For instance, an incumbent firm that initiates a particularly large number of external interactions to internalize new knowledge and drive innovation, will automatically experience a change in co-existing behaviors. Proactive behaviors become more prominent, while passive and reactive behaviors become more subtle. Leveraging multiple interactions can become outcome and cause of proactive behaviors and thereby increase a firm's contribution to sustainability transition. This is how, eventually, an incumbent firm can actively influence its role in sustainability-oriented industry transition.

6. Conclusion

This paper offers an integrated view of incumbent firm behavior which goes beyond the understanding of incumbents as coherent actors that engage in passive or reactive behavior in industry transitions. In line with recent conceptual research proposing a heterogeneous understanding of incumbent firm behavior (Magnusson and Werner, 2022; Turnheim and Sovacool, 2020), the works of this dissertation find evidence of simultaneous passive, reactive and proactive behaviors inside incumbent firms, varying according to business units and management levels. Extending Geels' (2014a) *Triple Embeddedness Framework*, the developed *Multi Embeddedness Framework* proposes that integrated incumbent firm behavior results from incumbent firms' embeddedness in multiple environments and regime influences. New firm- and individual-level insights detail processes and outcomes of integrated firm behavior and reveal three crucial behavioral properties: Co-existence, accumulation and interaction. Discussing these properties in the context of industry transition suggests that incumbent firm managers may actively increase their firm's contribution of sustainability-oriented industry transitions by emphasizing multi-level interactions between firm environments, firms and individuals. By making possible interactions explicit, the MEF could

be an adequate framework to guide firms in their endeavor to contribute to industry transition in a meaningful way. The insights put forward by this paper have several implications for management and research.

6.1 Management implications

The discussion section showed that, if multi-level interactions are deliberately emphasized and promoted, incumbent firms might be able to increase their contribution to sustainability-oriented industry transition. The property of interaction, however, relies on the prevalence of proactive behaviors amongst individual managers. To date, a vast number research studies has found largely passive and reactive incumbent firm behavior (e.g. Wells and Nieuwenhuis, 2012; Smink et al., 2015a), with cases like BIGMEAT being the exception rather than the rule. Thus, identifying measures for the stimulation and promotion of proactive behaviors inside the firm could be a valuable undertaking.

Based on the insights of this dissertation, proactive behavior is likely to be displayed by few individual managers, possibly at top management level. As suggested by the BIGMEAT studies, top managers can stimulate and accelerate the progressive dissemination of proactive behavior within the firm through two related measures: Fostering a culture of sensemaking and fostering a culture of learning. First, fostering a culture of sensemaking across different managerial levels requires formalization and active promotion. In this regard, the sensemaking literature suggests several measures and tools to promote sensemaking, including the initiation of change workshops (Ala-Laurinaho et al., 2017), software-based concept mapping (Faily et al., 2012), strategic linguistic terms (Jalonen et al., 2018) and storytelling (Bietti et al., 2018). The aim of these measures is to encourage organizational members to make sense of uncertain or novel situations and to become more reflective about personal knowledge and assumptions, firm-internal practices and external developments. As the BIGMEAT case shows, involving middle management into sensemaking practices is crucial for the operationalization of proactive activities. If managers of different hierarchical levels continuously alternate between making sense of environmental developments and making sense of internal developments, including innovation activities and changes to firm identity, they might be able to detect market opportunities early on and translate them effectively into innovation activities on firm level.

Second, to increase the extent and radicality of exploration and innovation activities, this research's findings advise top managers to promote a culture of learning. At BIGMEAT, learning in the context of alliances profoundly increased the extent and radicality of exploration

activities and ultimately contributed to industry transition. These processes were fundamentally facilitated by managers' openness towards new knowledge, which has been deemed crucial for the pursuit of proactive innovation activities (Calantone et al., 2002). Organization and management research identified key antecedents of learning orientation. For instance, top managers can promote learning by establishing an organic organizational structure based on shared responsibilities, flexibility and open communication (Fiol and Lyles, 1985; Rebelo and Duarte Gomes, 2011). Particularly, if top managers encourage participative decision-making, employees are more likely to freely voice their opinions, share information and exchange ideas (Flores et al., 2012). To foster participation and open communication, top managers can adopt a transformational leadership approach through which they encourage creativity, communicate inspirational visions and act as role models for positive change (Coad and Berry, 1998).

As these elaborations show, a sensemaking culture is crucial for the initiation of exploration activities. Managers have to become aware of potential external opportunities and threats, the firms' potential capabilities and inefficiencies as well as their personal abilities and flaws. Thereupon, a strong learning orientation can facilitate the exchange of internal knowledge, the internalization of external knowledge and the respective continuous adaptation of exploration activities. At BIGMEAT, the exploration of the alternative protein field was additionally facilitated by the long-term thinking of top managers, which, in turn, was based on the family firm's general sustainability orientation. In this regard, previous research confirms that sustainability orientation can facilitate innovations (Jin et al., 2018). The same research (Jin et al., 2018) also found that innovation culture can facilitate sustainability orientation. Indeed, the alliances that were formed as part of BIGMEAT's exploration created crucial learnings that further increased sustainability awareness amongst managers. These insights suggest that proactivity can be source and outcome of sustainability orientation. While the mentioned aspects, sensemaking, learning and sustainability orientation, are crucial antecedents for sustainability-oriented proactivity in incumbent firms, this research also clearly suggests that exclusively proactive behavior and/or the complete overhaul of an incumbent firm's established meanings seems highly unlikely. Incumbent firm managers will always have to face the challenge of balancing different internal behaviors, exploitation and exploration, reluctance and ambition, tradition and progress. This study merely offers a way for them to navigate through this balancing act while actively pushing for the maximum outcome for sustainability.

6.2 Limitations and future research

This research comes with several limitations which offer opportunities for future research. Most of the empirical insights that resulted in the extension of the TEF were based on the case of BIGMEAT, which constitutes a unique example of reorientation in the meat industry. To increase external validity of the new framework, future research could test the framework's main propositions in different firms and industries. At BIGMEAT, proactive behavior was limited to few individuals of the top management team, while middle managers exerted largely passive behavior in the early phases of reorientation. The question remains whether this study's proposals with regard to properties of integrated firm behavior and implications for industry transition would still hold true if the internal occurrence of individual behaviors was different. In this regard, for instance, some studies have pointed to a much higher involvement of middle managers in organizational change efforts (Sharma and Good, 2013), while others have found diversified motivations and behaviors among managers of the same hierarchical level (Visser and Crane, 2010).

Further, the case study data did not reveal distinguishable insights into the relationship between individual-level processes and developments in socio-political environments. While the data does indicate impact on the economic market environments and different regime structures, implications with regard to civil society and politics are not further discussed. It is left to future research to investigate the implications of integrated firm behavior on such environments and to test whether the suggested properties and their transition impact potential remain the same. Due to the MEF's multi-level approach, such testing would require in-depth data about individual-level processes in relation to industry developments, ideally with empirical insights into transition impacts. While corresponding with Geels' (2014a, p.275) suggestion to add "another layer of complexity" through the analysis of individual-level processes, it should not be the aim of future empirical studies to cover all aspects of the MEF simultaneously. Instead, future studies could focus on particular sub-aspects. For instance, due to the nature of the BIGMEAT case, this study analyzed interactions in the form of alliances with start-ups. Future research could transfer the MEF's propositions regarding interactions to other alliance contexts, including alliances with universities (Orecchini et al., 2012) or suppliers (Berardi and de Brito, 2021). Based on the analyzed interactions with actors in other industry environments, further extensions of the framework might formulate new propositions and thereby progressively extend the complex picture of incumbent-driven industry transition towards sustainability.

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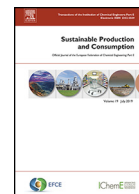
B. Rigidity and lock-in

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Barriers to a sustainability transformation of meat production practices - An industry actor perspective

Charlott Hübel, Stefan Schaltegger*

Centre for Sustainability Management (CSM), Leuphana University Lüneburg, Universitätsallee 1, D-21335 Lüneburg, Germany

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ABSTRACT

The negative impacts caused by current industrial meat production challenge industry actors to transform meat production towards more sustainable practices. However, despite the necessity for change and the availability of various sustainability solutions, transformational shifts have failed to materialize, so far. This study applies and extends the Kollmuss-Agyeman model of pro-environmental behavior to the context of producers and analyzes their perceived barriers to the transformation of meat production practices. The qualitative empirical study is based on 23 interviews with actors along the meat production chain. The analysis reveals that industry actors' perceived barriers are highly complex. This complexity results from (1) multiple interactions among and between internal and external influencing factors and (2) the simultaneous existence of barriers that reinforce the status quo on the one hand and restrain the pursuit of sustainable production practices on the other hand. Based on these findings, opportunities for overcoming barriers are discussed in today's context. This study's contributions are twofold: First, the analysis complements previous research on barriers to sustainable meat production practices by detailing barriers and their interactions for actors along the entire meat production chain. Second, this investigation extends the Kollmuss-Agyeman model by specifying interactions of external influencing factors and by differentiating reinforcement and restraint barriers relevant for producers.

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1. Introduction

The global consumption of meat products is expected to rise by 73% until 2050, with the vast majority of products being sourced and manufactured in industrial settings (FAO, 2011). Industrial meat production practices, however, cause major negative impacts on land, water, biodiversity, animal and consumer health (Steinfeld et al., 2006; Ilea, 2009; Rossi and Garner, 2014). Increasing concerns about the sustainability of such practices have led to calls for a sustainability transformation of meat production implying a *fundamental* reconsideration of how and how much meat is produced (Nierenberg, 2006; Nalau and Handmer, 2015). Transformative change of meat production practices can include, amongst others, a shift to extensive, agro-ecological forms of livestock farming (Escribano, 2016; Herren et al., 2015; Nardone et al., 2004) or to the production of alternative protein sources such as plant-based meat, cultivated meat or mycoproteins (Bhat et al., 2017; Hashempour-Baltork et al., 2020).

Established industry actors play a crucial role in driving transformational change of industries by implementing and supporting

sustainable production practices (Schaltegger and Hansen, 2017; Schaltegger et al., 2016). In the meat industry, 'industry actors' refers to individuals and organizations along the production chain, who are involved in the sourcing, production, processing and distribution of meat (as e.g. used by Zokaei and Simons, 2006). Despite the availability of various sustainability approaches, however, meat production practices of industry actors have not yet amounted to fundamental change in the number of animals slaughtered, in the share of organic or agro-ecological farming or in the availability of alternative protein products (Allievi et al., 2015; Chemnitz and Wenz, 2021). This study's purpose is to identify causes for meat industry actors' reluctance to shift towards sustainable production practices. Due to actors' embeddedness in different contexts (Battilana et al., 2009), various internal factors (i.e. personal, socio-cultural) and external factors (i.e. economic, regulatory) influence decision-making and may jointly create barriers to transformation (Hoek et al., 2021). This study therefore departs from the following research question: 'What are perceived internal and external barriers of industry actors along the meat production chain to transform their production practices towards sustainability?'

A number of publications address barriers to sustainable production and particularly sustainable food production. While

* Corresponding author.

E-mail address: stefan.schaltegger@leuphana.de (S. Schaltegger).

the respective research distinguishes internal (i.e. cognitive and emotional) and external (i.e. economic and regulatory) barriers (Laurett et al., 2021; Stuart et al., 2014; Fleming and Vanclay, 2010; Hoek et al., 2021; Liu et al., 2021), research on transformation barriers as perceived by actors involved in the production of meat is, however, scarce and fragmented (e.g. Läßle and Kelley, 2013; Hyland et al., 2016; Hermann et al., 2016). The existing studies mostly focus on the perspective of farmers but leave a research gap with regard to a broader analysis of barriers and interactions between barriers. Sustainability impacts and influencing factors of meat production are regarded as highly complex (Stoll-Kleemann and Schmidt, 2017) and a comprehensive analysis of perceived barriers to sustainable agricultural production is considered a crucial prerequisite for achieving sustainable development (Laurett et al., 2021). To date, however, no study has systematically investigated internal and external barriers as perceived by different actors along the meat production chain, including farmers, live-stock traders, butchers and meat companies.

Previous research highlights the potential of Kollmuss and Agyeman's (2002) model of pro-environmental behavior (hereinafter referred to as Kollmuss-Agyeman model), which considers internal and external influencing factors as well as their interactions (Siegel et al., 2018; Stoll-Kleemann and Schmidt, 2017; Stoll-Kleemann, 2019). This study applies and transfers the model to the context of meat production by conducting a qualitative empirical analysis along the meat production chain in Germany. The qualitative analysis aims at gaining a more comprehensive picture of barriers as perceived by meat industry actors in order to complement previous research on sustainable production practices in general and meat production practices in particular. While the model has previously been applied to analyze meat consumer behavior (Stoll-Kleemann and Schmidt, 2017) an analysis in the meat producer context is missing. The purpose of such a producer-oriented analysis is to create novel insights from a production actor perspective that may differ from previous analyses and could help to further develop the Kollmuss-Agyeman model.

This study's contributions are twofold: First, it complements previous barrier analyses to sustainable meat production by revealing and detailing the complexity of transformation barriers as perceived by meat industry actors. The complexity results from (1) interactions among and between internal and external influencing factors and (2) the simultaneous existence of barriers that reinforce the status quo on the one hand and restrain the pursuit of sustainable production practices on the other hand. Second, this study extends the Kollmuss-Agyeman model for the context of producers by specifying interactions of external influencing factors and by differentiating reinforcement and restraint barriers.

The following section, Section 2, reviews the relevant literature and introduces the Kollmuss-Agyeman model. Section 3 outlines the applied methods, Section 4 presents the results and Section 5 discusses the empirical findings in light of existing research and theory. The concluding section, Section 6, outlines potential limitations and proposes implications for research and practice.

2. Literature review

2.1. Barriers to sustainable production practices

There is a considerable amount of research analyzing barriers to sustainable production practices in general (e.g. Klitkou et al., 2015; De Jesus & Medonca, 2019; Gupta et al., 2020; Guenther et al., 2013) and sustainable food production practices in particular (Laurett et al., 2021; Stuart et al., 2014; Fleming and Vanclay, 2010; Hoek et al., 2021; Liu et al., 2021; Rodriguez et al., 2009). Many studies distinguish between internal and external barriers. Internal barriers address actors' lack of sustainability

knowledge and awareness (Laurett et al., 2021; Fleming and Vanclay, 2010), cognitive disconnects (Ives et al., 2018; Pachirat, 2011) as well as negative emotional responses such as apathy and delegation (Uusi-Rauva and Heikkurinen, 2013; Festinger, 1957). Some studies investigate barriers of disempowerment and dependencies amongst smaller industry actors arising from power asymmetries between big and small industry actors (Virah-Sawmy et al., 2019; Belaya et al., 2009; Talay et al., 2018).

External barriers identified in the research literature include infrastructure and technology 'lock-in' (Klitkou et al., 2015; Unruh, 2000; Gupta et al., 2020) as well as various economic and regulatory factors of influence. Economic barriers arise from market factors such as insufficient consumer demand (Guenther et al., 2013; Gupta et al., 2020) as well as organizational factors such as sunk costs, i.e. irreversible investments into established facilities, economies of scale, i.e. cost advantages gained through an increased production scale (Klitkou et al., 2015) as well as uncertainties about the return on investments (Gupta et al., 2020; David, 1985). Regulatory barriers can arise from inhibiting regulations, a lack of subsidies (Laurett et al., 2021) or conflicting policies (De Jesus and Mendonça, 2018), i.e. policies aiming for sustainability improvements for one aspect, but simultaneously causing sustainability problems for another aspect. A few studies address interactions between barriers (Hoek et al., 2021; Klitkou et al., 2015; Luthra et al., 2014). These interactions may increase the complexity of barriers to sustainability-oriented changes in production practices, but also the difficulty to identify starting points for transformation.

Some research focuses on barriers for sustainable meat production. Table 1 lists studies that deal with barriers to specific sustainable practices for different livestock types, whilst most studies adopt the perspective of farmers. The identification of barriers ranges from economic and regulatory to personal barriers. Contextual barriers regarding infrastructure, subsidies, information and training are mentioned most in the studies.

While the presented studies offer first insights into barriers to sustainability-oriented change in meat production, three important aspects have not been analyzed to date: First, by mainly focusing on livestock farmers and producers, the perceptions of further actors along the meat production chain has not been investigated so far. Second, the studies identify internal and external barriers, while interactions between them still remain to be analyzed. Third, with the exception of Läßle and Kelley (2013), no particular model or theory has informed such analyses. Läßle and Kelley (2013) applied the Theory of Planned Behavior (Ajzen, 1991) to identify the determinants of Irish cattle and sheep farmers' intentions to convert to organic farming. While the Theory of Planned Behavior can predict and explain a range of behaviors, a comprehensive account of environment, economic and regulatory factors that may influence actors' behaviors is still missing. To expand the existing research knowledge on barriers of sustainability transformation, the following analysis applies the Kollmuss-Agyeman model to empirically investigate internal and external barriers to changes in meat production practices.

2.2. Model of pro-environmental behavior

The Kollmuss-Agyeman model offers a comprehensive approach to barrier analysis and aims to explain behavioral change on the basis of internal and external factors influencing transformation decisions and processes. The model is well suited for analyzing meat producers' transformation barriers for two reasons as explained in the following.

First, by considering both internal and external influencing factors as well as the interactions between them, the model not only accommodates for industry actors' embeddedness in and engage-

Table 1
Previous research on barriers to sustainable meat production.

Author(s)	Perspective or actor group	Study focus	Model/theory	Identified barriers to change
Läpple and Kelley (2013)	Conventional cattle and sheep farmers in Ireland	Understanding the uptake of organic farming	Theory of Planned Behavior	Insufficient subsidy payments, technical inability, lack of farm management
Gwin (2009)	Grass-fed and organic beef producer groups in the U.S.	Innovation and challenges for grass-fed beef in the U.S.	–	Conventional meat infrastructure, difficulty to balance increased production speed and sustainability goals, low availability of raw materials
Panahzadeh Parikhani et al. (2015)	Livestock farmers of Meshkinshahr	Barriers to the application of Good Agricultural Practices	–	Five barrier categories: Infrastructure barriers, informational- educational barriers, institutional-support barriers, personal barriers, economical barriers
Newton and Blaustein-Rejto (2021)	Rural farmers and livestock producers in the U.S.	Opportunities and challenges of plant-based and cultured meat production	–	Fear of loss of livelihood or income, transitioning barriers to the alternative meat sector
Hyland et al. (2016)	Beef and sheep farmers in Wales	Perceptions of climate change and willingness to implement measures	Constructs: Self-identity, behavioral capacity	Avoidance, denial and desensitization through a lack of understanding and awareness
Hermann et al. (2016)	Organic and conventional hog farmers in Germany	Investment behavior and status quo bias	–	Status quo bias
(Virah-Sawmy et al., 2019)	Major companies in the soy-meat food sector, trade between Europe & Brazil	Assessment of the effectiveness of policy instruments	Constructs: Policy paradigms	Lack of application of instruments due to lack of coordination in market governance; different risk perception and uptake of sustainability measures along the supply chain

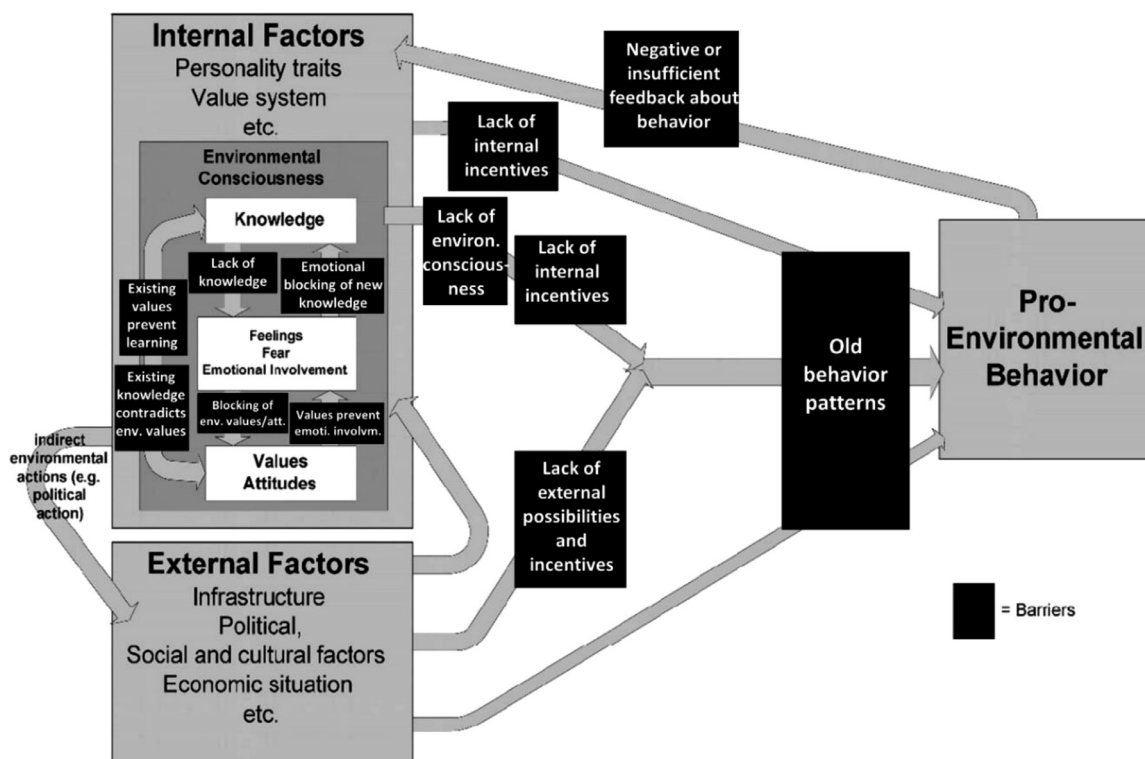


Fig. 1. Kollmuss and Agyeman's (2002, p. 257) model of pro-environmental behavior.

ment with different contexts (Battilana et al., 2009; Hoek et al., 2021), but also for the complexity of sustainability transformation (Abson et al., 2017). It thus offers a more comprehensive view than previous models such as the Theory of Planned Behavior (Ajzen, 1991), the Value-Belief-Norm Model (Stern, 2000), the Value Identity Personal Norm Model (van der Werff and

Steg, 2016) or mergers thereof (Ateş, 2020). Fig. 1 shows Kollmuss and Agyeman's (2002) original model, which indicates how pro-environmental behavior is influenced by the interaction of different factors (gray arrows) and which barriers impede positive influence on pro-environmental behavior (black boxes). Internal factors include actors' "complex of pro-environmental consci-

Table 2
Previous research applying or building on the Kollmus-Agyeman model.

Author(s)	Study focus	Reference to model	Contribution to the model
Siegel et al. (2018)	(Re)Storying Pro-Environmental Behavior	Model development	Considering the complex, varied, and interconnected influences: Intertwining External and Internal Factors of Influence
Stoll-Kleemann and Schmidt (2017)	Barriers and opportunities for reducing meat consumption	Model application	Incorporation of further factors: Habits and taste
Stoll-Kleemann (2019)	Barriers and opportunities for behavior change towards ocean literacy	Model application	Incorporation of further factors: Habits and comfort
Uusi-Rauva and Heikkurinen (2013)	Barriers to environmental advocacy campaigns in organizations	Theoretical review strongly informed by the model	Development of a multilevel model of barriers to individual environment behavior in the organizational context. Addition of the organizational context to individual and societal context
Latif et al. (2013)	Role of environmental knowledge in creating pro-environmental residents	Theoretical review strongly informed by the model	Empirical confirmation of the model: No direct relationship between environmental knowledge and pro-environmental behavior. Environmental value as mediator.
Byers and Gilmer (2018)	Unified approach to sustainable consumption behavior	Synthesis of research on understanding and promoting pro-environmental behavior	Synthesis of Kollmus and Agyeman (2002), Fuchs (2017) and Phipps et al. (2013) to a conceptual framework on how consumption behavior can be developed and changed. Pro-environmental behavior is understood as nested within societal subsystems.
(Petri and Faust, 2021)	Understanding permaculturist motivations among residents	Synthesis of behavioral research	Combination of various determinants to construct a whole picture of behavior patterns

ness”, i.e. their knowledge of sustainable solutions, emotional and cognitive involvement and pro-environmental values, as well as their “locus of control”, i.e. their perceived ability to bring about change through their own actions (Kollmus and Agyeman, 2002; Newhouse, 1991). Internal factors are in interactions with each other and increase the complexity of behavioral change. External factors include socio-cultural norms and standards, the industry infrastructure, economic conditions and the regulatory environment. To answer the key research question, this study focuses on how internal and external factors influence behavior negatively, thus providing a better understanding of why meat production practices have not transformed considerably, so far.

Second, an adoption of the model to the meat production context can complement previous applications of the model and provide new insights that may confirm or extend the model itself or previous theoretical extensions. Table 2 lists studies that have applied and dealt with the model previously.

Stoll-Kleemann and Schmidt (2017) applied the model to the context of meat consumption, showing that meat consumer behavior is particularly influenced by internal factors, including emotions, cognitive dissonance and socio-cultural factors like social identity. This finding is in line with sustainability transformation research, which emphasizes the relevance of “deep” personal factors for sustainability transformation (Abson et al., 2017; Ives et al., 2020). Uusi-Rauva and Heikkurinen (2013), however, suggest that in the organizational context, external factors may become much more prevalent, as personal factors are deeply embedded in and influenced by organizational and societal factors. This corresponds with the results of a recent review by Hoek et al. (2021), who put particular emphasis on the external context. Taking the idea of embeddedness further, Siegel et al. (2018) as well as Byers and Gilmer (2018) propose a complex interconnectedness among and between internal and external factors. To date, however, this complex interconnectedness, particularly between external factors, has not been incorporated in the Kollmus-Agyeman model. This may be due to the fact that it has never before been applied to the context of industry actors. Some applications of the model (Stoll-Kleemann and Schmidt, 2017; Stoll-Kleemann, 2019) added new influencing factors, including taste and comfort, suggesting barriers based on positive emotions or connotations with the status quo. In the same vein, path dependence research (Vergne and Durand, 2011) suggests that reluctance to change not only stems from negative mechanisms rendering alternative paths less attractive, but also from positive mechanisms supporting the current path.

The review of the existing research literature reveals that the application of the Kollmus-Agyeman model to the context of meat producers could both provide complementary insights into factors influencing behavior change towards sustainability, as well as extend the model to the analysis of barriers as perceived by producers.

3. Method

3.1. Design and empirical setting

A qualitative research approach has been deemed suitable for research analyzing complexities of sustainability transformation (Strauss, 1987; Luederitz et al., 2017) and barriers to sustainable production practices (for the supply chain see, e.g., Sajjad et al., 2020; for the fashion industry see, e.g., Sirilertsuvan et al., 2019). This qualitative analysis investigates the meat industry of Germany as a relevant empirical case, since previous publications have pointed to slow sustainability-oriented change in German meat production, despite increasing social pressures and the existence of various different sustainability solutions (Chemnitz and Wenz, 2021; Chemnitz et al., 2018; Clausen and Mathes, 2017).

3.2. Sampling

Through heterogeneous and snowball sampling, 23 participants from the main meat production phases of rearing, fattening, slaughtering, processing, marketing and retailing were selected (Savin-Baden and Major, 2013). The sample was mainly collected in Northwest Germany (Fig. 2), which is the region with the highest livestock density in Germany (Fig. 3). The participants cover different phases of production and sizes of operation. The analysis focuses on meat production and therefore does neither consider consumers nor gastronomic facilities and private households.

3.3. Data collection

Data was collected with 23 semi-structured interviews (Table 3) and from participant observation. The semi-structured interviews provide insights into the respondents’ “opinions and beliefs” (Easterby-Smith et al., 2012), which was deemed particularly important for the identification of perceived internal barriers. The interview script included questions regarding work practices, internal

Table 3
Overview of interviews.

Interviewee(s)	Meat production chain phase(s)
F1 Farmer (owner)	Rearing
F2 & F3 Two Farmers (owners)	Rearing –Fattening
F4 Farmer (owner)	Fattening
F5 Farmer(owner)	Fattening
F6 Farmer (owner)	Fattening
LT 1 Livestock trader (managing director)	Trade & Transport
LT 2 Livestock trader (managing director)	Trade & Transport
S1 Slaughterhouse manager	Slaughtering – processing
S2 Small slaughterhouse operator (owner)	Slaughtering – processing – marketing
P1 Processing plant manager (officer for agriculture and animal welfare)	Processing
B1 Butcher (owner)	Processing – marketing
B2 Butcher (owner)	Processing – marketing
B3 Butcher (owner)	Processing – marketing
B4 & B5 Butcher association manager (managing director) & butcher (owner)	Processing – marketing
PA1 Producer association manager (managing director)	(Fattening) – processing – marketing
MC1 Meat company manager (communication manager)	Processing – marketing
MC2 Meat company manager (supply chain manager)	Processing – marketing
MC3 Meat company manager (senior buyer)	Processing – marketing
MC4 Meat company manger (product manager)	Vertically integrated
MM1 Meat marketing platform manager (managing director)	Marketing
R1 Retail manager (managing director of a supermarket)	Retail
R2 Retail manager (CSR manager of a discounter)	Retail
E1 Meat industry (chief editor of industry journal)	Support function

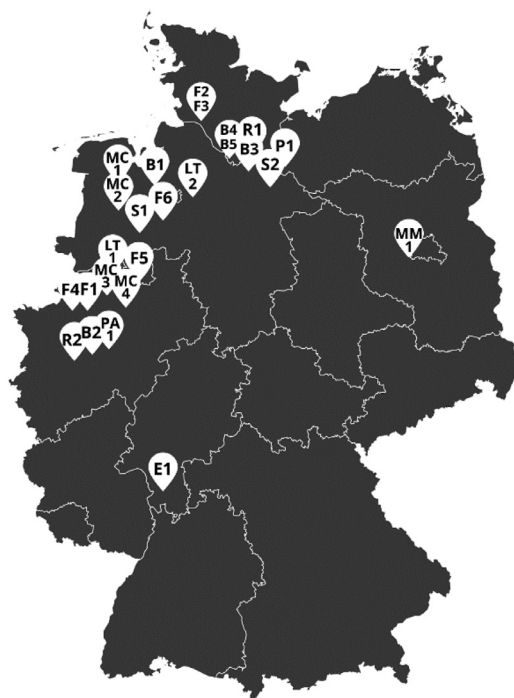


Fig. 2. Geographical distribution of interviews.

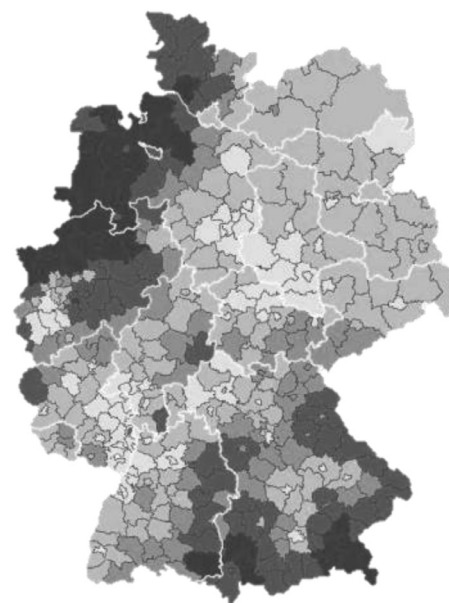


Fig. 3. Areas in Germany with high livestock density (Thünen-Institut/Statistisches Bundesamt, 2016).

as well as external factors (see Appendix A for the interview script used in the research).

All interviews were conducted with actors directly involved in the production, marketing, and sales of meat, with the exception of one interview conducted with the chief editor of a leading meat industry journal. The number of interviews was guided by data saturation (Glaser and Strauss, 1967). All interviews but one were conducted at the locations of industry actors or via telephone between July 2018 and October 2018, lasted on average about 45 min and were subsequently transcribed. For one interview, answers were provided in written form. In six cases, data was additionally

collected in the form of observations during site visits (1 rearing farm, 3 fattening farms, 1 butchery and 1 livestock trader). Observation helped to gain more comprehensive insights and served to triangulate findings (Yin, 2009). Data from observation was protocolled (Babbie, 2013). To secure participants' anonymity, all data is presented here without participant or company names (Gioia et al., 2013).

3.4. Data analysis

Data was analyzed deductively, in light of internal and external factors as defined by the Kollmuss-Agyeman model. A combination of a-priori coding (through a code template) and pattern coding (emergent from the data) resulted in the identifi-

Table 4
Results of the data analysis.

Influence factors (categories)	Barriers for meat industry actors (2nd order themes)	
Internal	Consciousness complex (knowledge, emotional & cognitive reactions, values & attitudes)	<i>A status quo bias</i> (Hermann et al., 2016; Engler et al., 2019), i.e. cognitive attachment to business as usual, impedes reflections about its negative impacts <i>Cognitive dissonance</i> (Stoll-Kleemann and Schmidt, 2017; Festinger, 1957), i.e. a value-behavior gap, which results in denial and delegation of responsibility <i>Disconnects</i> (Ives et al., 2018; Pachirat, 2011) impede cognitive and emotional involvement in the impacts of industrial meat production <i>Apathy</i> (Uusi-Rauva and Heikkurinen, 2013) results from fear and frustration about contextual conditions; leads to inaction concerning sustainability <i>Emotional commitment</i> reinforces positive attitudes towards conventional meat; blocks sustainability-relevant knowledge
	Locus of control	<i>Power asymmetries</i> (Virah-Sawmy et al., 2019; Belaya et al., 2009; Talay et al., 2018) reduce the perceived ability to drive change and perceived control over the success of initiatives
External	Norms & standards	<i>A conventional meat paradigm</i> (Gwin, 2009; Dagevos and Voordouw, 2013) guides behavior in favor of the continued production of conventional meat <i>Industry-oriented standards</i> (Klitkou et al., 2015) complicate shifts to small-scale production
	Industry infrastructure	<i>Industry specialization and synergies</i> (Klitkou et al., 2015; Unruh, 2000) foster the use of structures for producing and marketing conventional meat
	Economic conditions	<i>Market (dis)incentives</i> (Guenther et al., 2013; Gupta et al., 2020) arising from the global market for conventional meat hamper shifts to ecological products <i>Economies of scale</i> (Klitkou et al., 2015) foster the adherence to paradigms of growth, expansion, specialization and concentration <i>Sunk investments</i> (Gupta et al., 2020; David, 1985) and negative financial feedback loops hamper investments into sustainability solutions
	Regulatory environment	<i>Regulatory (dis-)incentives</i> (Lauret et al., 2021; De Jesus and Mendonça, 2018) create framework conditions to the detriment of small-scale meat production

cation of 13 second-order themes and the allocation to respective influence factor categories (Fereday and Muir-Cochrane, 2006; Saldaña, 2015). By alternating between the emergent second-order themes and previously reviewed literature, themes were linked, where possible, to previous research on barriers to sustainable production practices (Gioia et al., 2013). For example, this analysis found cognitive *dissonance* to be an important barrier for meat producers, mirroring Stoll-Kleemann and Schmidt's (2017) findings on meat consumption behavior. Further, the data revealed a *status quo bias* among the interviewees, tying in with a previous investigation of hog farmers by Hermann et al. (2016). As another example, the data pointed to barriers attributable to *economies of scale* – a barrier which has previously been discussed in the context of energy production by Klitkou et al. (2015). While most second-order themes could be linked to precedents in literature, one theme – *emotional commitment* – is a new concept derived from the data (Gioia et al., 2013). Table 4 (see Section 4) provides an overview of the 13 second-order themes and their link to previous literature on barriers to sustainable production as well as associated influence factor categories of the Kollmuss-Agyeman model. Measures employed to achieve validity include peer scrutiny, reflective commentary as well as the involvement of more than one data source and researcher (Shenton, 2004). Data analysis was validated in the context of a workshop entitled “The changing meat industry – paths and approaches of a sustainability transformation” in March 2019, to which all study participants were invited.

4. Results

This section outlines key findings from the conducted interviews and observations. Table 4 provides an overview of results of the data analysis, including the identified second-order themes and influence factor categories. It shows how different internal and external factors influence industry actors' meat production behavior and create multiple barriers to a sustainability transformation of production practices. The following subsections are structured according to the results of the data analysis, including internal barriers (Section 4.1) and external barriers (Section 4.2). Furthermore, barrier interactions arising from the data are outlined (Section 4.3).

4.1. Internal barriers

4.1.1. Consciousness complex

The data reveals that the consciousness complex, particularly cognitive and emotional reactions, influence industry actors' behavior with regard to meat production practices. It frames the thinking of meat industry actors in terms of the adequacy and importance of specialization (F1; E1), intensive livestock farming (F5) and conventional meat products (B3). Here, actors engage in “shifting baselines” (Pauly, 1995, p. 430), meaning that they use a selective, considerably recent past in the frame of the same conventional operations as a baseline for justifying the current system. Two interviewees, for instance, stated that “animals are now kept better than 30 years ago” (LT2) and that “40 years ago, the sows had still been chained” (F5). Against this background, a processing plant manager perceives a 10 percent increase in space a sufficient success for animal welfare (P1). The data further shows that actors experience *cognitive dissonance*, i.e. moments where their behavior does not match their values (Festinger, 1957). For instance, even though some interviewees openly question the reasonableness of industrial meat production (MC3; R1), they overcome the dissonance by denying their own responsibility and instead blaming consumers (MC2), politics (MC4) or other industry members for slow transformational change: “The barriers are not with us, but are clearly with the farmers” (B4). In sum, the interviews reveal that cognitive awareness of the negative impacts of industrial meat production is suppressed by a *status quo bias* that “the current state of things is locked-in as a mental reference point” (Engler et al., 2019), p. 610).

The data further shows that industrial meat production fosters various *disconnects* (Ives et al., 2018), which impede actors from becoming cognitively and emotionally involved with the negative impacts of production practices. It is particularly apparent on industrial livestock farms, where farmers perceive the architectural design and short fattening periods as impeding factors for the development of personal relations with the animals (Observation; F2; F3). Here, farmers point to the fact that they “rarely touch the animal. It is led, kept and herded into other sheds” (F2). Different interviewees further point to highly anonymized and spatially separated supply chains, which lead to disconnects between produc-

ers (S1; MM1) in the sense that different members of the meat industry “have lost the understanding for each other” (B2). The geographical distance of production and slaughter facilities (Observation S1; E1) as well as “no-trespassing”-signs on livestock farms (Observation; F5) additionally contribute to a consumer-producer-disconnect (Pachirat, 2011). As a consequence, one of the interviewed farmers experiences that “agriculture fulminates against consumers, consumers fulminate against agriculture” (F5), where nobody feels responsible and enabled to change. This circumstance, in turn, results in growing frustration amongst industry actors over their “very difficult situation” caused by increasing legislation (F6), the “unfair” treatment by the media (F5) and the lack of appreciation from the public for their (sustainability) efforts (LT2; F2; F3). These perceptions can, in the worst case, lead to *apathy* about the likelihood and feasibility of sustainability measures (informed by “sense of fatalism” as outlined by Uusi-Rauva and Heikkurinen, 2013). Some “don’t know how long they will still have the strength” to make efforts “nobody appreciates” (F5). Here, interviewees also point to the perceived injustice of urging meat industry actors to change while other areas of production and consumption are perceived to remain unchallenged (F2; F3; F6). Others are “paralyzed” by existential fears (F1; F5; S2; B1). As one butcher comments, the situation “has gotten so deadlocked that there is just not the courage to fundamentally change” (B1).

However, not only negative, but also positive emotional reactions create barriers to changes in meat production practices. In many cases, the interviews show that meat industry actors’ attitudes, values and resulting *emotional commitment* to their work in livestock farming and butcher trade have been shaped by long-standing family traditions (F1; F2; F3; B2; B3; B5). In turn, these practices “is exactly what [they] want to pass on to [their] children” (B2). The fact that most farmers and butchers own their operations themselves intensifies the commitment and further strengthens respective professional identities (Zellweger and As-trachan, 2008). Due to past efforts, industry actors feel that they have earned the right to secure their achievements, as one of the farmers passionately resumes: “We fight for it now [...] and we will carry on” (F5). Not only farmers and butchers, but also managers of meat companies are proud of their meat products, referring to them as “top quality” (B3) “exceptional” (B4; B5), “natural” (MC2) and “honest and clean” (MC3). Interviewees find meat to be “very important foodstuff” (B2; B3; B4), which should be available for everybody and, therefore, cheap (F1). Accordingly, they build and maintain specialized knowledge in conventional meat production and only few engage with strategies for fundamental industry change (P1; MC2). For instance, many reject alternatives such as plant-based substitutes and cell-based meat as “unnatural” (MC2), “dubious” (F6), “out of the question” (B1) and “a long way off” (P1). Self-reinforcing commitment creates a barrier to sustainability transformation that could make some professional titles and job descriptions obsolete.

4.1.2. Locus of control

The data shows that *prevailing power asymmetries* along the meat production chain influence meat industry actors’ perceptions of how much sustainability-oriented change is considered possible. Interviewees identify industrial slaughterhouses and retailers as actors in the meat production chain exerting power over others and upholding the status quo (F2; F3; S1; MC2; E1). On the one hand, this unequal distribution of power leads to the reduced perceived ability amongst many actors to drive transformation. While farmers feel obliged by industrial slaughterhouses to adhere to conventional specifications for animal mass and size (F2; F3), meat producers feel pressured by retailers to fulfill conventional meat product requirements in terms of shelf life, ingredients, product characteristics and trends (F1; MC2). On the other hand, the unequal dis-

tribution of power, coupled with the interlacement of production chain stages, leads to a reduced perceived control over the success of sustainability initiatives. Farmers, for instance, feel that a shift to organic or agro-ecological livestock production crucially depends on actions by retailers (F1; F6). As one farmer concludes: “If in retail nobody can communicate what we produce, then the topic is dead” (F1).

4.2. External barriers

4.2.1. Norms and standards

Cultural norms and industry standards create further barriers for meat industry actors to change their production practices. Concerning the former, industry actors’ activities are embedded in a “meat-friendly” national culture (Mellinger, 2000), defined by a *conventional meat paradigm* (term informed by “meat-centric paradigm” as used by Dagevos and Voordouw, 2013). Industry actors themselves also actively contribute to upholding this paradigm. For instance, the advertisement-induced romanticizing of conventional meat production through large meat producing companies continually strengthens socio-cultural preferences for (cheap) conventional meat (Gossard and York, 2003): “For a long time, we have advertised green fields, but in reality, it wasn’t like that [...] For a long time, we have advertised healthy meat, but it was just conventional meat.” (LT1). According to the senior buyer of a large meat company, this messaging has successfully established a positive image of conventional meat brands in society, the legitimacy of which is constantly reinforced (MC3). The conventional meat paradigm with images and beliefs of meat being inherently a healthy and natural product creates barriers to change towards extensive, agro-ecological meat production or towards the production of alternative protein sources.

Concerning the latter, industry actors are very much aware that *industry standards* in terms of animal breeds, fattening periods, shed structures, transport, slaughtering and processing are aligned to the industrialized mass production of meat (Observations F2; F3; F5; LT1; S2). They also refer to the highly regulated and standardized documentation, relating to hygiene, product sampling and payroll accounting (S2; B4; B5; E1). Adopting the established standards allows highly industrialized and automated facilities to work in a cost and time efficient way (S1). Small-scale slaughter facilities and butcheries, who can hardly meet the vast number of requirements and cost-efficient quantity of production, gradually disappear (S2; B1; B3; B5). As a consequence, the diversity of actors and approaches to meat production that could provide a basis for different paths of development and change, is reduced.

4.2.2. Industry infrastructure

Industry specialization and synergies reinforce the existing industrial structures for the production and marketing of conventional meat. The highly specialized supply chains and infrastructure, with production stages fitting to each other, allow industry actors to work very efficiently (S1; B2). At the same time, interviewees note that the established network of professional intermediaries like producer associations and livestock traders increase the anonymity of business relations and makes them easily exchangeable (F2; F3; LT2; S1; B4). For the manager of an industrial slaughterhouse, “it is supply and demand and business relationships result from that.” (S1). Any transformation towards sustainability that requires changing interactions in the supply chain can therefore not be realized by one actor alone but requires many actors to agree on the same or similar change and to act in a coordinated manner. As the infrastructure of each actor is highly specialized, too, investments and time would be needed, including coordination of who changes when. One meat company manager outlines the difficulty regarding the introduction of organic meat products:

“We as [Meat company X] have not even access to the farmers. This means that I always have to contact the slaughterhouse first to get in contact with the farmers. And then, the slaughterhouse and [Meat company X] have to convince the farmer: we’d like to do it like this, would you join? But the farmer will only join if he gets more money.” (MC3)

4.2.3. Economic conditions

The interviews reveal that barriers linked to economic factors include both market and organizational incentives and disincentives. The availability of cheap animal feed from abroad for conventional animal rearing (PA1) and attractive export opportunities (S1) create *market incentives* for big meat producers to continue business as usual. Interviewees agree that incentives to sell meat from conventionally raised animals are high, as there is a well-functioning global system, in which, for instance, German demand for fine cuts (e.g. filet) is complemented by Asian demand for “residual” parts (e.g. feet, ears and tails) (F5; S1; B4; B5; E1). Thus, advantageous complementary marketing opportunities in different markets create barriers to transformational change for German meat industry actors who actively participate in the global market (S1). At the same time that global demand for conventional meat products is high, local organic or agro-ecological meat remains in market niches due to constantly low consumer demand and the lack of a globalized market for such products (F1; PA1; MM1; R1). This circumstance *disincentivizes* meat industry actors to consider organic or agro-ecological products as viable alternatives (MC3; MC4).

Concerning organizational barriers, through *economies of scale* (David, 1985) meat industry actors feel encouraged to adhere to and expand conventional production (LT1; MC1; MC3). Through specialization, automation and large-scale acquisition activities, big industry actors like international meat companies and industrial slaughterhouses continue to benefit from decreasing costs (F1; LT2; S1; MC1). With increasing global competition, “the market will push [them] to grow even bigger” (LT2). Consequently, achieving a high degree of concentration, consolidating cost leadership and making continuous investments is an essential factor for business success (S1; P1; MC1; MC4), or even for survival in the market (LT2). As the interviewed industry actors are fully aware of this situation, this barrier impairs change that reduces specialization or requires different kinds of specialization leading to cost increase of less (fast) cost reduction than for those who further optimize their specialization role in the industrial system. For other meat industry actors, especially farmers and smaller meat marketers, *sunk investments* and high uncertainties about the return on investment for sustainable alternatives create barriers to transformation (F4; F5; F6; S2). Initial investments also captivate industry actors in negative feedback loops. Here, a pig fattening farmer points to the high investments into animal sheds, which are usually amortized over more or less 25 years and constitute long-term liabilities (F6).

4.2.4. Regulatory environment

On the one hand, the data shows that powerful actors benefit from *regulatory incentives* such as subsidies for processing and transportation of meat that create a reluctance to transformational change (S1; B3). Financial incentives for incremental improvements (e.g. animal welfare initiatives) at times also impede more transformative action (F1; F6). On the other hand, the data highlights *regulatory disincentives* such as conflicting policies and excessive bureaucratic requirements that create transformation barriers. Concerning the former, the product manager of a meat company points to regulatory contradictions with regard to shed adjustments for animal welfare improvements:

“Since the building permit is accompanied by a change of emission limits, it [the shed extension] is not approved by the au-

thorities. So, on the one hand the animal welfare authorities say “do it” and on the other hand the building authorities prevent it.” (MC4)

Further, the multitude of different sustainability standards and labels causes confusion among producers, which, at worst, leads to inaction through overload, uncertainty and irritation (F5; P1; R1; R2). Concerning excessive bureaucratic requirements, interviewees referred to documentation, quality control and conversion procedures (e.g. to organic farming), which are implied in sustainability measures and, therefore, render them unattractive (F6; S2; MC3; PA1; MM1). The influential power of some industrially operating large-scale actors and the power imbalance between large and small operators leads to a constant reinforcement of legal requirements, which restrict possible transformative change (F1; P1).

4.3. Barrier interactions

The data reveals multiple interactions among and between internal and external barriers. As an example for interactions among internal barriers, *emotional commitment* to their operations can cause a *status quo bias* among some of the interviewed farmers and butchers, which impedes them from engaging with alternative solutions (F1; F2; F5). As an example for interactions among external barriers, *market (dis)incentives* lead to highly specialized and large-scale operations, encouraging farmers, slaughterhouse managers and meat company managers to adhere to and uphold *industry-oriented standards* (F1; S1; MC1). As an example for interactions between internal and external barriers, *economies of scale* can result in internal barriers such as *cognitive disconnects* (F2; F3). Cognitive disconnects, in turn, hamper reflections about the impacts of industrial meat production leading to inaction, thereby upholding the *conventional meat paradigm* (LT2).

5. Discussion: the complexity of transforming meat production practices

The qualitative empirical analysis of barriers for a sustainability transformation of meat production practices reveals a high degree of complexity with multiple obstacles, which meat industry actors perceive. Identifying them is a first step to develop approaches for overcoming them and for sustainability transformation (Guenther et al., 2013).

5.1. Barrier complexity and model extension

Based on the Kollmuss-Agyeman model, Fig. 4 provides an overview of the findings. The complexity of barriers originates from multiple interactions among and between internal and external factors (left column), leading to the simultaneous existence of barriers characterized by reinforcement and restraint (second column). *Reinforcement barriers* encourage industry actors to continue pursuing established practices and make them perceive transformation as something *undesirable* (plus signs in second column). At the same time, *restraint barriers* hinder industry actors from pursuing sustainable alternatives and make them perceive transformation as something *unfeasible* (minus signs in second column). The on-going mutual interaction of different barriers results in a continuation of business as usual and, ultimately, in the lack of a sustainability transformation of meat production practices (right column). In the following, factor interactions and resulting barrier types displayed in the two columns of Fig. 4 are explained further and linked to previous research.

Factor interactions – The analysis reveals the existence of interactions among and between different internal and external factors, which create mutually enhancing barriers. Factor interactions

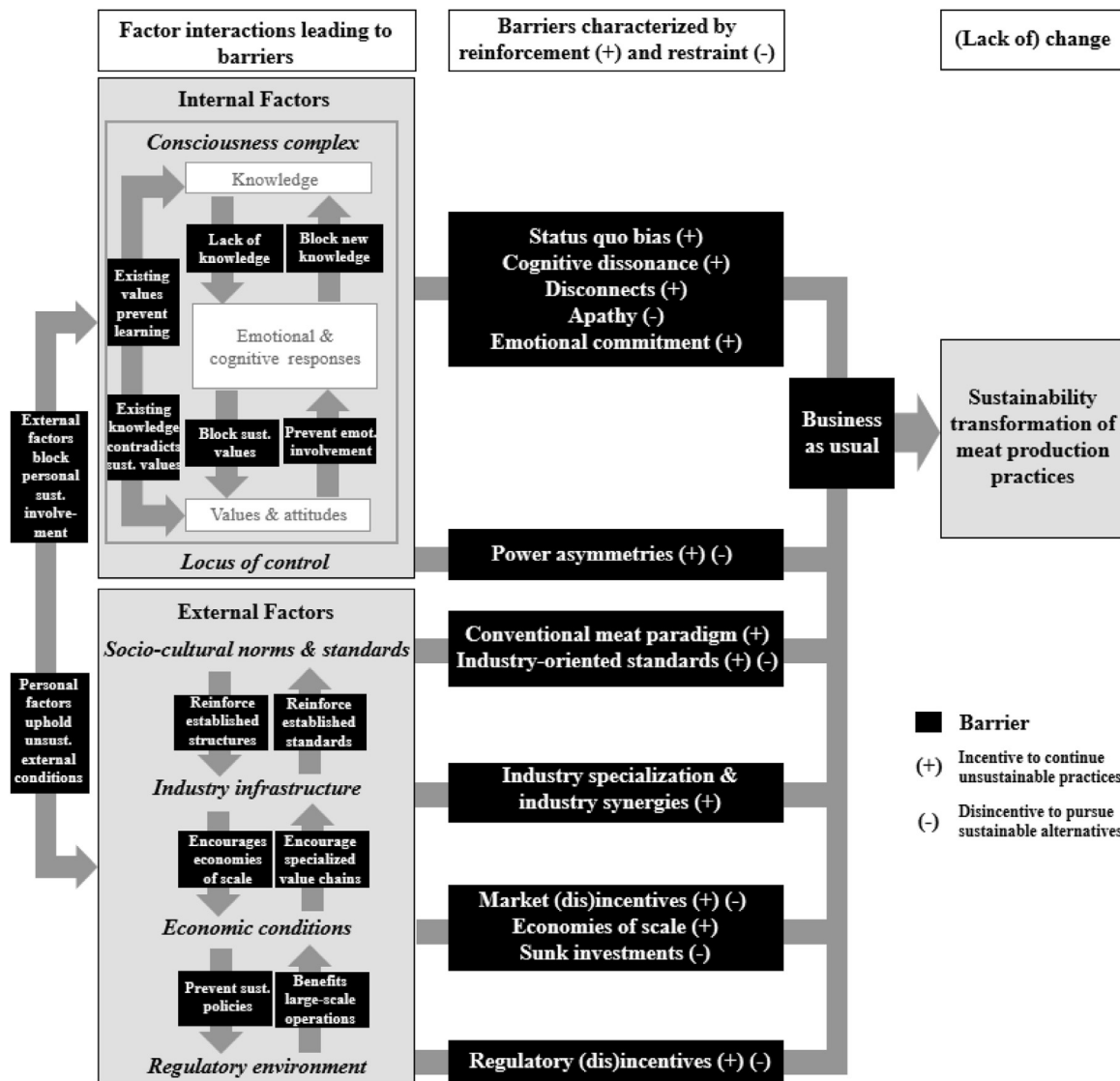


Fig. 4. Barriers to a sustainability transformation of meat production practices (based on the Kollmuss-Agyeman model).

are shown by gray arrows in left column of Fig. 4. While this finding is in line with research on barriers to sustainable production systems (Hoek et al., 2021; Klitkou et al., 2015; Luthra et al., 2014), it contributes to previous research on barriers to sustainable meat production practices, where barrier interactions have not been considered so far (e.g. Läpple and Kelley, 2013; Gwin, 2009; Hermann et al., 2016). In addition, this study provides further insights into the particularities of industry actors' external barriers and barrier interactions that result in an extension of the Kollmuss-Agyeman model. First, linking to earlier suggestions by Hoek et al. (2021) and Uusi-Rauva and Heikkurinen (2013), this study shows just how much meat industry actors' behaviors are shaped by the external context. The interviewed meat industry actors perceived strong influences from the organizational, industry, economic and regulatory context that jointly create barriers to sustainability-oriented changes in meat production practices. Seeing organizational, economic and regulatory influencing factors on par with internal factors diverts from Stoll-Kleemann and Schmidt's (2017) findings for the context of meat consumption, which emphasized the dominance of internal and socio-cultural factors. Second, this study extends the Kollmuss-Agyeman model by conceptualizing and visualizing external barrier interactions

(Siegel et al., 2018; Byers and Gilmer, 2018). The results show that an application in the context of producers – as a difference to consumers, residents and individuals – asks for a new emphasis on external factors. The extension complements Kollmuss and Agyeman's (2002) conceptualization of interactions among internal factors and unveils the previous underrepresentation of external factors. At the same time, it considers the system interconnectedness, which has been suggested, but not yet specified, by Siegel et al. (2018) and Byers and Gilmer (2018).

Reinforcement and restraint barriers – The findings reveal that the barriers created by mutually interacting internal and external factors can be differentiated into two types of barriers: Barriers characterized by reinforcement that uphold the status quo and barriers characterized by restraint that render alternatives unattractive or unfeasible. The bracketed plus and minus signs in the second column of Fig. 4 differentiate such reinforcement and restraint barriers. This additional barrier complexity extends the Kollmuss-Agyeman model and model adoptions in other contexts (e.g. Stoll-Kleemann and Schmidt, 2017). While adding a previously unconsidered aspect to Kollmuss and Agyeman's work, this finding relates to existing research on path dependence mechanisms (Vergne and Durand, 2011). This study's findings propose

that experiences of reinforcement or restraint vary for different actors along the meat production chain. The interviews reveal that while big powerful industry actors are reluctant to pursue transformation because they are incentivized to continue business as usual (reinforcement barriers), smaller industry actors are rather trapped in negative feedback loops that render change unfeasible (restraint barriers). This finding extends Virah-Sawmy et al.'s (2019) argument that companies along the soy-meat value chain experience sustainability challenges and associated risks quite differently. The differentiation of barrier types and the specification of barrier complexity contributes to previous research on barriers to sustainable production practices (Laurett et al., 2021; Hoek et al., 2021; Gupta et al., 2020; Gwin, 2009; Rodriguez et al., 2009). The question, however, remains, where within this complex web of barriers starting points for sustainability transformation could lie.

5.2. Opportunities for overcoming barriers in today's context

To create transparency about the web of interacting barriers is a first important step for identifying starting points for industry and food system transformation (Hoek et al., 2021). While Kollmuss and Agyeman (2002) suggest that transformative behavior change relies on the combined effect of internal and external factors, sustainability transformation research (Abson et al., 2017; Ives et al., 2020; O'Brien and Sygna, 2013) ascribes particular importance to “deep” internal factors, including knowledge, mindsets and values, for achieving change towards sustainability. This corresponds with recent findings that behavior changes in general (Ateş, 2020), and changes of agricultural practices in particular (Govindharaj et al., 2021) are crucially dependent on people's knowledge, self-identity, attitudes as well as subjective and moral norms. Through changes at the personal level, actors are enabled to engage in approaches such as sustainable entrepreneurship, which has been discussed in literature as an important approach for achieving sustainability transformations of markets (Johnson and Schaltegger, 2020). To foster change at the personal level, however, external triggers and nudges may be needed (Byerly et al., 2018).

In this regard, previous research has shown that external global shocks can positively influence pro-environmental behavior (Ivlevs, 2019). The scandal ‘Dieselgate’ for the automotive industry (e.g. Brand, 2016) or the current global Covid pandemic are examples for how external shocks with disruptive impacts across production chains can accelerate shifts in industry actors' mindsets and, consequently, practices. The pandemic has raised discussions about the fragility of our food systems and the need for resilience in food supply chains (Boyacı-Gündüz et al., 2021; Hobbs, 2021). Discussions have particularly focused on the meat industry, whose practices in slaughtering and processing have been severely disrupted. As a consequence, awareness is growing for the need to accelerate the transformation towards alternative meat production systems, particularly alternative proteins (Anomaly, 2020) and/or agroecological livestock production (Perrin and Martin, 2021). In the US, for instance, the Covid pandemic encouraged producers to slow growth rates (Marchant-Forde and Boyle, 2020). In Germany, the slaughterhouse scandals during the Covid pandemic hampered the consumers' image of the meat industry and at the same time accelerated the producers' exploration of the alternative protein sector (Chemnitz and Wenz, 2021). The question is, however, whether producers will continue to enforce changes beyond the pandemic.

6. Conclusion

Applying the Kollmuss-Agyeman model, this study finds that meat industry actors perceive multiple barriers for a sustainabil-

ity transformation of meat production practices, and that the interactions among and between internal and external factors create a complex and reinforcing web of barriers. In doing so, the conducted analysis contributes to previous research on sustainable production practices in general and sustainable meat production practices in particular, and in addition, extends the Kollmuss-Agyeman model. Based on the insights of sustainability transformation research (Abson et al., 2017; Ives et al., 2020), this study suggests a temporal hierarchy of behavior changes by identifying change of internal factors, including knowledge, mindsets and values, as crucial starting points for transformation. These “deep” factors of change can be stimulated by, for instance, external triggers, which encourage actors to reflect upon their current practices and to pursue sustainability more fundamentally. The analysis comes with some limitations and has implications for both research and practice, which will be detailed in the following.

6.1. Limitations

As all interviews were conducted with actors in the German meat industry, limitations arise with regard to the geographical scope of this analysis. The study's results may not be representative for other countries or industries. While various conditional factors may be comparable in the EU, this may be different for Non-EU countries and other continents. For instance, economic barriers arising from market incentives might be even higher in countries like the U.S. or Brazil, which are the biggest exporters of meat worldwide. At the same time, socio-cultural barriers might be perceived as lower in countries like India or Bangladesh, where meat consumption is not as firmly embedded in the national culture. Indeed, a recent study found that markets in India possess particularly high potential for plant-based and cultivated meat alternatives (Bryant et al., 2019). Analysis results might also differ for producers in other industries. Since meat production operations are often embedded in family traditions, producers experience particularly high emotional barriers. In contrast, producers in the automotive, oil or gas industry, might experience less emotional barriers, but higher techno-economic barriers due to the complexity of shifts to renewable energy innovations.

6.2. Implications for research

Considering the identified limitations, this study provides a basis for further applications of the Kollmuss-Agyeman model to producers and respective investigations of barriers to sustainable production practices in different national contexts and industries. In this regard, a quantitative analysis of barriers could also be dealt with. Further, this analysis indicated differences in barrier perceptions resulting from diverging positions in power. It may be a valuable future research avenue to identify strategies for harnessing existing positions of power for advancing sustainability transformation and opportunities for empowering (seemingly) marginalized industry actors. In doing so, participatory approaches could allow for the integration of practical knowledge into scholarly work. Practitioners often “develop a deep understanding of the problems and tasks that arise in particular situations” (Van de Ven, 2007, p. 4) and can therefore provide relevant contributions to problem identification and solution development (e.g. Lang et al., 2012). Finally, future research could examine, which types of barriers dominate when seeking different sustainability approaches (i.e. improvements in animal welfare, shifts to extensive production systems or the substitution of animal-based products by alternative proteins).

6.3. Implications for practice

In terms of practical implications, this study is the first to offer meat industry actors a comprehensive picture of their complex barrier situation, particularly with regard to relevant contextual conditions as well as interactions between internal and external barriers. Many barriers are related to the high complexity of the current meat supply chain, which leads to spatial and cognitive disconnects resulting from highly specialized operations amongst actors. Overcoming these barriers and achieving transformation beyond the boundaries of individual organizations therefore requires a high level of cooperation throughout the production chain. Industry actors are encouraged to reflect upon their personal scope of action and engage in collaboration for sustainable production practices. The analysis furthermore offers political decision-makers a framework to better understand interactions between legislation, standards, infrastructure and socio-cultural norms. For instance, understanding the link between contradictory legislation, actors' inaction and the maintenance of norms and standards of industrial meat production might lead to multi-level initiatives for encouraging sustainable practices as well as focused, more effective legislation. Particularly the disclosure of the difficulties small-scale operations face might initiate change towards less complex regulations supporting sustainability transformation. As the interviews indicate, insufficient incentives for more sustainable production practices, targeted incentives are needed to establish advanced animal welfare programs as well as to diversify and regionalize agricultural practices. Since many industry actors seem to be unaware of more sustainable options such as the production of alternative protein products, policy initiatives that integrate knowledge from different research domains and practice are needed to provide actors with relevant information on sustainable alternatives.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Interview Script

Opening the interview

Introduction of researcher and research context – Presentation of interview contents – Information on confidentiality and anonymity – Signing of agreement to participate in the research

Interview Part 1: Company development and work practices

- (1) Historical development of operation or company (built expertise, family tradition ...)
- (2) Work practices and work environment of interviewee
- (3) Work routines with other industry actors along the supply chain
- (4) Changes in work environment and related challenges

Interview Part 2: External factors

- (1) External factors influencing work operations (regulations, consumer demand ...)
- (2) Current developments and trends in industry and society
- (3) Strategies to respond to new developments/trends and encountered challenges

Interview Part 3: Internal factors

- (1) Awareness of and opinion on sustainable production practices (e.g. extensive organic meat production & production of alternative protein products)
- (2) Perceived role/agency of interviewee in advancing sustainable production practices

- (3) Personal estimate of the future development of meat production

Ending the interview

Thanking the interviewee for his/her participation – Opportunity for the interviewee to add statements – Explanation of the further procedure

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C. Intent for sustainability and contribution potential

Dijkstra-Silva, S., Hübel, C. & Schaltegger, S (2023): Company contributions to sustainability transitions of markets: An innovation management perspective *(to be submitted)*

Company contributions to the sustainability transition of markets: An innovation management perspective

Samanthi Dijkstra-Silva^a, Charlott Hübel^b and Stefan Schaltegger^b

^a*TU Dresden, Helmholtzstr. 10, 01069 Dresden*

^b*Leuphana Universität, Universitätsallee 1, 21335 Lüneburg*

Abstract

To contribute to sustainability transitions of markets requires companies to transform within and beyond their core business. Vast research suggests that companies can do so by engaging in sustainable product, process and organizational innovations. The extant literature has argued that such sustainability innovations can lead to a creative destruction of unsustainable market structures, including supply chains, consumption patterns, the competitive landscape and regulatory conditions. To date, a comprehensive and systematic view on how sustainability innovations can be *managed* to contribute to sustainability transitions of markets is however lacking. This article contributes to the sustainability transition literature by offering an innovation management perspective on company contributions to sustainable market transitions. A conceptual framework is developed that distinguishes five scopes of market transitions that companies can target: the organization itself (core), supply chains and suppliers (input), consumers and consumer systems (the output), competitors and alternative organizations (the substitute) and the socio-political environment (the arena). Linking the five scopes to innovation processes, products and organizations results in fifteen fields of action in which companies can select targeted management measures. Based on the framework, different contribution pathways of companies' are discussed theoretically and with practical case examples for potential company contributions to the sustainability transition of markets.

Keywords: sustainability transition, innovation management, market transition, company contribution

1. Introduction

Companies, whether new entrants or incumbent firms, can play a crucial role in contributing to the sustainability transition of markets (Geels and Schot, 2007; Loorbach and Wijsman, 2013; Geels, 2014). The relevance of companies for sustainability transitions is grounded in their embeddedness in and influence on different market environments, including the economic, cultural and political (Geels, 2014). Due to their constant interaction with these environments, companies can re-structure supply chains (Thorlakson et al., 2018), change consumer behavior (Pinkse and Bohnsack, 2021), shape the competitive landscape (Schaltegger et al., 2016) and generate far-reaching impact on societal infrastructures and institutions (Bolton and Hannon, 2016), as well as, ultimately, the natural environment (Whiteman et al., 2013). By effectively addressing all environments relevant to the sustainability transition of markets, companies can become game changers in their markets (Loorbach and Wijsman, 2013; Schaltegger et al., 2022). To generate such transformative impact, companies are often required to introduce and manage sustainability innovations on a product, process and organizational level (Klewitz and Hansen, 2014; Silvestre and Țîrcă, 2019).

Much of the previous analyses on innovative company contributions to sustainability transitions of markets takes an overarching systems perspective with an emphasis on market interactions between different companies (e.g. Hockerts and Wüstenhagen, 2010; Markard et al., 2012). Other studies are located at the intersection of companies, innovation and policy (Delmas et al., 2019; Kivimaa and Rogge, 2022). A considerable body of literature, furthermore, discusses examples of companies and their innovation-driven sustainability contributions to organizational (Blum-Kusterer and Hussain, 2001; Hübel, 2022), market (Hörisch, 2018; Hansen and Schaltegger, 2013; Schaltegger et al., 2016) or societal transformations (Bolton and Hannon, 2016; Bidmon and Knab, 2018). While these analyses are instructive in illustrating transformative innovations of companies, our conceptual understanding as to how companies apply management measures aimed at the sustainability transition of markets is limited.

The existing literature reveals both, the relevance of company innovations and contributions to sustainability transitions as well as a huge variety of different kinds of corporate sustainability contributions. This important research, linking niche-level induced sustainability effects beyond organizational boundaries, is, however, disperse. A framework that supports a systematic management of innovative company contributions to different scopes of sustainability transitions of markets is missing, so far. With increasing sustainability challenges, the demand for

research increases on how companies can address their contributions to the sustainability transition in a systematic manner (Schaltegger et al., 2020). Various authors have called for a management perspective, suggesting to link concepts and frameworks used in management studies with sustainability transition-related research questions (Markard et al., 2012; Bolton and Hannon, 2016; Köhler et al., 2019).

Addressing this research gap, the following conceptual research analytically combines research on sustainability transition and innovation management and develops a theoretical framework for managing company innovations aimed at sustainability transitions of markets. It proposes various management measures at the intersection of three, often distinguished types of sustainability innovations, i.e. process, product and organizational, and five scopes of market transition that can be identified in the transition management literature, i.e. the company (the core), supply chains (the input), consumption of the sold products and services (the output) and competition (the substitute) as well as regulations, governance and culture (the arena). The framework has relevant practical implications in terms of a systematic analysis of management options as well as the prioritization of management measures and adequate strategic orientations.

The framework contributes to the academic literature by taking an innovation management perspective to sustainability transitions of markets. By combining largely separate bodies of literature, the paper advances conceptual clarity by introducing scopes of transitions which can be targeted by management. Based on these scopes, contribution pathways are identified, which support associated company contributions to a sustainability transition. Implied assumptions, managerial intent and choice of measures for targeted contribution pathways are discussed critically.

The paper is structured as follows: After a review of the literature on sustainability transitions of markets, we outline the innovation management perspective and introduce three types of sustainability innovations that are often distinguished. We thereupon develop a framework by distinguishing different scopes of market transition, linking them to different types of sustainability innovations and identifying management measures. The framework is discussed with regard to managerial intent and choice of measures. We highlight how the framework can guide the development of contribution pathways, which may help systematize and increase a company's contribution to the sustainability transition of markets.

2. Companies and sustainability transitions of markets

In the sustainability transition literature, the sustainability transition of markets is considered a crucial sub-pillar of a system-wide societal sustainability transition (Geels and Schot, 2007). Sustainability transitions of markets entail the fundamental re-orientation of established markets towards creating social and environmental values (Loorbach and Wijsman, 2013). We briefly outline three lines of discussion in the sustainability transition literature relevant for our analysis; the relevance of companies for a sustainability transition of markets, the embeddedness of companies in the market environment as well as effective means to achieve a market transition.

Addressing the first line of discussion, the sustainability transition and entrepreneurship literature argues that companies, as key actors within a market, can initiate and shape the sustainability transition of markets (Geels and Schot, 2007; Loorbach and Wijsman, 2013; Schaltegger and Wagner 2011). The role of companies in market transitions has been mainly analyzed taking a system perspective (Markard et al., 2012; Loorbach et al., 2017). The sustainability transitions research domain applies a systems perspective to explain how dynamics at different system levels can lead to the large-scale diffusion of sustainability innovations and the replacement of unsustainable practices (Geels and Schot, 2007; Geels 2011; Chappin and Ligtoet, 2014; Geels, 2014). Similarly, the sustainable entrepreneurship research domain regards sustainable markets as the result of individual (e.g. Schaltegger, 2002; Dixon and Clifford, 2007) and co-evolutionary market interactions between incumbent firms and sustainability start-ups in market niches (Hockerts and Wüstenhagen, 2010; Schaltegger et al., 2016). Both research domains consider sustainability start-ups in market niches as important sources of radical novelties and as initiators of transition processes, while incumbent firms of established regimes are often assigned a rather reactive role in transitions. More recently, the role of incumbents in sustainability transitions has been highlighted (Schaltegger et al., 2022). Some authors have challenged the bottom-up bias and suggested a distributed notion of agency, acknowledging proactiveness in both niche and regime actors (Geels, 2011; 2020; Berggren et al., 2015) as well as in strategic alliances (Hübel et al., 2022). Recognizing the crucial role of both incumbents and newcomers, both large and small companies, for the sustainability transition of markets, the framework developed in this paper seeks suitability for all types of companies.

With regard to the second line of discussion, market transitions are understood to not only require changes in product offerings and purchasing behavior but to go along with more profound

changes within and between organizations as well as the overarching social, cultural and political environments (Farla et al., 2012; Markard et al., 2012). In this regard, research has acknowledged the embeddedness of companies in and influence on these environments (Battilana et al., 2009; Coenen et al., 2012; Rogge and Reichard, 2016). The activities of a company to advance market transitions are therefore not limited to organizational boundaries. Geels' (2014) triple embeddedness framework details how companies are embedded in and simultaneously shape the economic and socio-political environment. While the economic environment constitutes market relationships to suppliers, consumers and competitors, the socio-political environment highlights companies' links to political decision-makers, institutions and civil society groups (Turnheim and Geels, 2012). By employing strategies and measures that are not limited to the organization itself, but also influence suppliers, consumers, competitors and socio-political conditions, companies can substantially advance changes in markets and industries – and ultimately society at large (Loorbach et al., 2010; Loorbach and Wijsman, 2013; Loorbach et al., 2017; Geels, 2014).

Addressing the effective transformation of markets, the transition literature points to the introduction and diffusion of sustainability innovations by companies (Elzen et al., 2004; Geels and Schot, 2007; Geels, 2014; Smink et al., 2015). In this regard, much of the literature has taken a systems perspective. Various studies describe the diffusion of innovations from niche to regime level (Geels and Schot 2007) as well as the co-evolution of innovation-focused start-ups and 'laggard' incumbents (Schaltegger et al., 2016). Few studies have zoomed in to firm level, taking a strategic focus (Geels, 2014; Berggren et al., 2015) or conceptualizing internal transition management (Loorbach and Wijsman, 2013; Schaltegger et al., 2022). However, a detailed conceptualization of what scopes of market transition companies can address with the management of sustainability innovations is lacking so far. This is despite the fact that previous research has pointed to different impacts created by sustainability innovations (Klewitz and Hansen, 2014; Adams et al., 2016) and has explicitly put a management perspective on the 'agenda for sustainability transitions research' (Köhler et al., 2019).

To lay the groundwork for the link between managing sustainability innovations and corporate contributions to the sustainability transition of markets, the next section deals with the innovation management perspective introducing three types of innovations for sustainability, process, product and organization innovations.

3. An innovation management perspective

Companies are key enablers of innovation (Weber and Rohracher, 2012) and can initiate processes of creative destruction through the introduction and diffusion of innovations in the market (Schumpeter, 1943; Schaltegger et al., 2018; Johnson and Schaltegger, 2020). The success of innovations is largely reliant on a company’s effective innovation management (Tushman and Nadler, 1986; Tidd, 2001). To achieve large-scale impact in the market, innovations for sustainability therefore need to be managed deliberately (Klewitz and Hansen, 2014). This section therefore distinguishes different types of innovations and associated management measures.

The sustainability-oriented and conventional innovation literature often distinguishes three types of innovations: Process, product and organizational innovations (Polder et al., 2010; Ballot et al., 2015; Klewitz and Hansen 2014; Tavassoli and Karlsson, 2015; Adams et al., 2016; Carboni and Russu, 2018; see Table 1). Process innovations are often considered to be the starting point for management to address sustainability, and can trigger subsequent changes in the product life cycle or organization (Klewitz and Hansen, 2014). In corporate practice, process innovations are often incremental (e.g. Carboni and Russu, 2018). Product innovations that change the value offered by the company fundamentally, can be both incremental and radical (Dangelico and Pujari, 2010). Organizational innovations, such as e.g. business model innovations, mostly have a rather fundamental impact on all essential domains of organizational activity and thus are often radical in nature (Boons and Lüdeke-Freund, 2013; Schaltegger et al., 2012).

Table 1: Process, product and organizational innovations

Type of sustainability innovation	Definition	Examples / Concepts	Literature
Process innovations for sustainability	Improvement of production or supply chain processes through e.g. environmental technologies, which are facilitated by non-technological changes	<ul style="list-style-type: none"> - Cleaner production - Zero waste production - Eco-efficiency - Industrial symbiosis - Dematerialization - Circular production 	Adams et al., 2016; Altham, 2007; Boer and During, 2001; Chertow, 2000, 2007; Gurbuz et al., 2004; Klewitz and Hansen, 2014; Michelsen and Fet, 2010; Moyano-Fuentes et al., 2018
Product innovations for sustainability	New products or services or a combination of both, which seek to achieve market differentiation while at the same time minimizing environmental impacts and/or being socially responsible	<ul style="list-style-type: none"> - Sustainable product design - Sustainable sourcing - No/Low-waste packaging - Sustainable product labeling and certification - Product-service systems 	Bhamra et al., 2008; Borin et al., 2011; Dangelico and Pujari, 2010; de Medeiros et al., 2014; Iyer and Soberman, 2016; Jaffry et al., 2004; Kennedy et al., 2017; Mont, 2002; Rennings, 2000; Tang and Bahmra, 2008

Organizational innovations for sustainability	Fundamental changes to structures, routines and management practices, leading to new types of organizations	<ul style="list-style-type: none"> - Systematic integration of sustainability into the core business - Sustainable business model innovation - Systems innovation 	Antikainen and Valkokari, 2016; Bolton and Hannon, 2016; Chesbrough, 2010; Evans et al., 2017; Gaziulusoy et al., 2013; Klewitz and Hansen, 2013, 2014; Rennings, 2000; Schaltegger et al., 2012, 2016; Schiederig et al., 2012; Schumpeter 1943; Silva 2021
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To manage *process innovations for sustainability*, companies are required to access or create new knowledge, adapt equipment or procedures and integrate them into existing performance measurement and reporting systems (Robertson et al., 2012; Morioka and Carvalho, 2016). A strong focus on learning is a basis to advance a company’s process innovation capability (Frisshamar et al., 2012) such as business experimentation capabilities for sustainability (Weissbrod and Bocken, 2017) or life cycle thinking (Kralisch et al., 2017). To implement changes, process innovations for sustainability typically require the allocation and coordination of intra-organizational resources – and intra-organizational collaboration (Gopalakrishnan et al., 1999) – but can also involve external stakeholders along the supply chain (Adams et al., 2016). The latter may include introducing, co-developing and monitoring sustainability-oriented operational change at existing supplier companies (Walton et al., 1998). To ensure effectiveness, it is necessary to monitor the adherence to these codes of conduct and guidelines continuously and introduce fines for misconduct. Integration can be supported by formalized management tools such as environmental management systems (Rennings et al., 2006; Wagner, 2008), environmental management accounting (Burritt et al., 2002) as well as social and ethical codes of conduct for business operations (Haugh and Talwar, 2010).

Similarly, *product innovations for sustainability* can be managed successfully through internally focused innovation-oriented learning and knowledge management (Cormican and O’Sullivan, 2003; De Medeiros et al., 2014) or externally oriented partnering and collaboration (Bhamra et al., 2008; Klewitz and Hansen, 2014; Melander, 2017). Both internally and externally focused approaches usually require companies to integrate sustainability performance metrics in product development (Kennedy et al., 2017) and purchasing strategies (Murray, 2000), often aided by life-cycle assessments (Chang et al., 2014). Due to the novelty and interdisciplinary nature of sustainable product innovations, management often relies on acquisitions (e.g. Austin and Leonard, 2008) or cooperative strategies including collaborative technology scouting, open innovation and strategic learning alliances (Kennedy et al., 2017; Hübel et al., 2022). Collaborative methods include NGO-business-partnerships (Pattberg, 2004; Mousavi

and Bossink, 2020) as well as consumer-integrated product development and user-led innovation (Ornetzeder and Rohrer, 2006; Hoffmann, 2007). To ensure far-reaching impact, product innovations for sustainability need to take the attractiveness for mainstream consumers into account, including few or no compromises with conventional product usage preferences (Pinkse and Bohnsack, 2021). Nudging strategies (Bodur et al., 2015; Demarque et al., 2015; Lehner et al., 2015), sustainability labelling (van Dam and Jonge, 2015) as well as transparency management (Montecchi et al., 2021) can further facilitate sustainability-oriented consumer choices.

The management of *organizational innovations for sustainability* requires transformational leaders supporting innovation- and learning-oriented cultures (Miles et al., 2009; Chen and Chang, 2012; Senge et al., 2015; Adams et al., 2016), sustainability visions (Ferdig, 2007; Schaltegger et al., 2012; Pieroni et al., 2019) as well as boundary spanning and empowerment for sustainability-oriented change (Razavi and Attarnezhad, 2013). Learning and awareness building for sustainability can be facilitated through e.g. employee trainings and other company initiatives in education for sustainable development (Shen and Benson, 2016). To ensure comprehensive change along the entire value chain, a company can transform its own business models (Boons and Lüdecke-Freund, 2013) and further engage in collaborative business modelling (Heikkilä and Heikkilä, 2013; Rohrbeck et al., 2013) to encourage sustainable business model innovations at suppliers that align with the sustainable value proposition of the focal company (Norris et al., 2021). Due to their comprehensiveness and disruptive character, organizational innovations require further management skills. These include the ability to coordinate people with heterogeneous interests (Van de Ven, 1995), to consider both formal aspects, such as structure and tools, as well as informal aspects, such as culture and mindsets (Boer and Durig, 2001) and to balance sometimes contradictory demands for economic, social and environmental solutions (Ferdig, 2007; Stubbs, 2019).

Depending on the choice of innovation for sustainability, a company's contribution to a sustainability transition of markets may differ. To date, however, the contribution of a company to a sustainability transition (of markets) remains a rather fuzzy term, which needs further conceptualization. The next section combines transitions and innovation management perspectives to conceptualize possible contributions to sustainability transformations beyond organizational boundaries by introducing a theoretical framework that distinguishes scopes of market transitions and by discussing their link to contributions to a sustainability transition.

4. Framework for managing company innovations for market transitions

In the following, we develop a framework for managing company innovations aimed at a sustainability transition of markets. We conceptually advance our understanding of a sustainability transition of markets by distinguishing five scopes of market transitions, and linking these to the three types of sustainability innovations (Table 2): The first dimension of the framework identifies different *scopes of market transitions*, which a company can consider, the second dimension addresses the *management of innovations for sustainability*. By linking insights from these two literature streams, we identify fifteen fields of sustainability transition action illustrated with exemplary management measures across different scopes. We argue that, while companies may already apply these measures individually to reach strategic aims, our framework is profoundly based on managerial intent to contribute to sustainability transitions of markets. To substantiate the applicability of the theoretical framework, we reviewed two practice examples, the food company Unilever as an incumbent and the energy company Lichtblick as a start-up (see Appendix A). While some measures might have resulted in a sustainability transition of selected markets, e.g. the Marine Stewardship Council (MSC) certification by raising standards in the fishing industry affecting suppliers and consumers by Unilever, other activities have not resulted in a sustainability transition of markets. This has two implications. First, the need to select measures carefully when aiming at a sustainability transition of markets (see Chapter 4.3 under “choice of measures”). Second, some management approaches provide a base for further levers (partially addressed in Chapter 5 ‘company contribution pathways’). For example, when offering of a sustainable product the focal company needs to be sustainable itself. Additionally, a sustainability mindset of suppliers, e.g. through supplier training, might be necessary to realize sustainability solutions.

The following section goes on to (1) identify five scopes of market transition, (2) link them with innovation management approaches in an overall framework, and (3) lay out the framework’s basic assumptions in terms of management intent and choice of measures.

4.1 Scopes of market transition

Recent research emphasizes the necessity to analyze how companies can contribute to change within and beyond organizational boundaries, i.e. change at the level of the organization, the level of markets as well as on the level of society and the natural environment (Johnson and Schaltegger, 2020; Rijnsoever, 2022). The link between managing sustainability innovations at

the micro level of a company and creating management contributions to sustainability transitions at the market level, however, has not been conceptualized so far. By drawing both on the sustainability transitions literature (Loorbach and Wijsman, 2013; Loorbach et al. 2017; Geels, 2014) and the sustainability innovation management and entrepreneurship literature (Hockerts and Wüstenhagen, 2010; Schaltegger and Wagner, 2011), our framework distinguishes *five scopes of a market transition*: Organizations can focus on innovations that aim at a sustainability transition in the company itself (*the core*), supply chains (*the input*), consumption patterns (*the output*), competitor behaviors (*the substitute*) and the socio-political environment (*the arena*).

Fundamental for any sustainability transition of a market is managing the organization itself. The organization addresses *the core*, which needs to operate sustainably (Loorbach and Wijsman, 2013) in order to create any changes beyond its boundaries. Companies can pursue corporate sustainability through advancing fundamental organizational change encompassing a company's strategy, processes, structures, identity and culture (Kungl and Hess, 2021).

A company's value creation, however, is not only centered in the company itself, but also in supply chains through the purchase of *inputs* (Thorlakson et al., 2018). In many cases, activities in supply chains and therefore inputs are linked to sustainability problems such as pollution, transport emissions, hazardous materials, conflict minerals, poverty and workers' health (Yawar and Seuring, 2015; Silva and Schaltegger, 2019). By sourcing sustainable materials and engaging in sustainable supply chain management practices, companies can actively advance sustainability in supplier companies and support mainstreaming sustainable practices in supplier markets (Metta and Badurdeen, 2012; Boström et al., 2015; Broemer et al., 2019).

On the *output* side, companies have the power to support sustainability-oriented change in purchasing and product use behavior of consumers through sustainable product design and respective marketing strategies (White et al., 2019). To change consumption patterns in a market towards sustainability, involves creating a critical mass needed for market transitions and requires companies to go beyond targeting 'the green consumer segment' and instead address mass market consumers (Schaltegger 2002; White et al., 2019).

A company's actions can further trigger changes in competitor behavior, the *substitute* (e.g. the companies that could substitute the company if it is not successful). With sustainability becoming a competitive topic in a market, other companies may copy sustainable practices, re-

sulting in a co-evolution of increasingly sustainable companies and therefore the transition towards increasingly sustainable markets (Hockerts and Wüstenhagen, 2010; Schaltegger et al., 2016). Companies may also choose to collaborate with competitors directly, for example by co-developing or co-marketing sustainable products (Bengtsson and Kock, 1999; Christ et al., 2017; Tian et al., 2019).

Lastly, companies are not just regulation takers bound by societal conditions, but can also actively influence regulations, public policies, norms and mindsets representing the industry regime, i.e. the *arena* (Bendell and Kearins, 2005; Markard and Truffer, 2008; Geels et al., 2014). Approaches of corporate politics have been discussed under the notion of responsible and ethical lobbying (Scherer and Palazzo, 2011; Barron and Skountridaki, 2020). Many involve collaborations with societal and political actors (Moldovan et al., 2016), the aim being to establish industry initiatives, codes of conduct, standards and norms for sustainability (Giovannucci and Ponte, 2005). The academic literature has addressed these phenomena differently through e.g. the notion of “institutional entrepreneurship” (Nasra and Dacin, 2010; Schaltegger and Wagner, 2011) or intermediaries (Kivimaa et al., 2019). The sustainable entrepreneurship literature has further emphasized that entrepreneurial companies can correct market and government failure (e.g. Dean and McMullen, 2007).

For all five scopes of company contributions, sustainability transitions of markets can be facilitated through the innovation of processes, products and organizations. However, innovation efforts need to be *managed* to create considerable effects (Tushman and Nadler, 1986; Tidd, 2001).

4.2 Managing sustainability innovations across scopes of market transition

Combining the management of three innovation approaches, i.e. process, product and organizational innovations, across scopes of market transition results in various management measures that can contribute to the sustainability transition of markets. Summarized in Table 2, this section discusses how managerial approaches can contribute to transitions and provides exemplary management measures. Management measures differ not only with the desired scope of the contribution but also with the type of innovation employed. Taking the example of supply chains, a company can increase its contribution with regard to the *input* by managing process, product and organizational innovations, measures which have been discussed in the sustainable supply chain management literature (e.g. Seuring and Müller, 2008). For instance, managing a company’s contribution to supply chain sustainability through *process* innovation requires a company to train suppliers for new sustainability practices and support and incentivize their

implementation and/or sanction non-compliance with supplier codes of conduct. Through continuous monitoring and assessment, a suppliers' progress in sustainability performance can be ensured. Managing the same contribution scope of *inputs*, but through *product* innovation, already requires a different set of managerial skills. Here, conducting life cycle assessments of purchased products and drawing the necessary conclusions for sustainable sourcing strategies is vital for achieving sustainable product supplies. Lastly, *organizational* innovations in supply chains require the focal company to support and incentivize thorough integration of sustainability standards in supplier companies. This can be achieved through collaborative business modelling, sharing best practices, training and educating (e.g. Harms et al., 2013).

Table 2: Framework for managing company innovations aimed at a sustainability transition of markets

		Scopes of market transitions					
		CORE (the company)	INPUT (supply chains)	OUTPUT (consumption)	SUBSTITUTE (competition)	ARENA (regulation, governance and culture)	
Managing types of sustainability innovations	Processes	<ul style="list-style-type: none"> - Adapting knowledge to sustainability requirements - Shifting resources to align operations/production with sustainability standards - Assessing and reporting progress (e.g. Environmental management accounting & systems) 	<ul style="list-style-type: none"> - Training suppliers - Incentivizing and supporting sustainable production processes - Assessing and monitoring suppliers' sustainability measures (through supplier questionnaires; codes of conducts) - Implementing sanction 	<ul style="list-style-type: none"> - Monitoring of consumption patterns of customers/consumers (surveys of what consumers do) - Managing the type, frequency and geographical location of delivery, distribution and communication channels 	<ul style="list-style-type: none"> - Collaborating with competitors on sustainable industry standards and business practices - Sharing best practices 	<ul style="list-style-type: none"> - Managing actor networks - Holding stakeholder dialogues (e.g. for creating shared industry standards) 	Innovated processes
	Products	<ul style="list-style-type: none"> - Knowledge management (research & knowledge integration) - Integrating sustainability metrics in product design - Engaging in open innovation & forming strategic alliances 	<ul style="list-style-type: none"> - Managing supply chains for sustainable products - Conducting life cycle assessments - Super scouting resource materials; developing sustainable sourcing strategies - Supply chain transparency management 	<ul style="list-style-type: none"> - Increasing consumer dialogues to achieve product co-development - Implementing consumer education and communication campaigns - Acquiring an established sustainable product label or certification 	<ul style="list-style-type: none"> - Managing knowledge & relationships for co-development of products with competitors 	<ul style="list-style-type: none"> - Lobbying responsibly & ethically for sustainable product standards - Building public-private partnerships for new product standards and labels - Cooperating with media to educate consumers on sustainability issues of product supply chains 	Innovated products
	Organization	<ul style="list-style-type: none"> - Adopting a transformational & systems approach to leadership - Fostering a learning- and sustainability-oriented culture - Training employees - Implementing company initiatives to increase internal visibility and communication 	<ul style="list-style-type: none"> - Training, mobilizing and incentivizing suppliers for integrating sustainability - Engaging in collaborative business modelling with suppliers 	<ul style="list-style-type: none"> - Targeting mainstream consumers - Implementing marketing strategies that consider psychological aspects of consumer behavior - Nudging through use of descriptive norms and prediction requests 	<ul style="list-style-type: none"> - Creating and innovating collaborative business models for sustainability - Mutual learning, harmonizing, coordinating operations and standards - Establishing joint supplier assessment and training centers with competitors 	<ul style="list-style-type: none"> - Cooperating with e.g. NGOs, media, regulators to develop new industry standards/regulations - Co-creating multi-organizational sustainable business models that create new sustainability-oriented markets 	Innovated organization
		Transformed core	Transformed inputs	Transformed outputs	Transformed substitutes	Transformed arena	

4.3 Managerial intent and choice of measures

Our framework is based on two main assumptions: First, managerial intent is a core requirement for contributing to lasting, large-scale sustainability transition of markets. Second, the selection of adequate management measures differs with each company, for example with regard to size, resource base, market position, and business environment.

Given global climate change predictions and other sustainability challenges (Rockström et al., 2009; Stern and Stern, 2007), companies are increasingly required to select and manage their innovations with the concrete aim of contributing to sustainability transitions of markets (Schaltegger et al., 2022). We argue that having a *managerial intent for sustainability* is essential for achieving the desired contribution to market transition. In doing so, the proposed framework differs from previous approaches that may have strategic purpose with regard to sustainability or competitiveness, but often neither put the sustainability transition of markets in the center nor take an innovation management approach to contributing intentionally to sustainability transitions. Our framework, in contrast, emphasizes a company's deliberate intent to contribute to a sustainability transition of markets through the careful selection of targeted management measures. As a basis for managerial intent, sustainability transition and innovation research emphasize the importance of a company's sustainability orientation (Kennedy et al., 2017; van Lieshout et al., 2021).

Once a company targets the sustainability transition of markets, a core issue is the starting point for management. At a first glance, the framework seems to suggest that a company's contribution to sustainability transitions could be maximized if it succeeds implementing various management measures at the intersection of all three innovation types and five scopes of market transitions. This may, however, not necessitate the simultaneous pursuit of all managerial approaches nor may it be attainable or desirable. The potential inadequacy of applying all managerial approaches equally and simultaneously is demonstrated by the following reasoning: Depending on a company's size, resources, value proposition and market environment, the required focus and the feasibility to contribute successfully to a sustainability transition of the market may differ. Choosing an adequate starting point therefore depends on a company's and measure's impact potential, i.e. its potential to contribute successfully to a sustainability transition of markets. The intentional choice of management measures may help a company stay within its financial possibilities and at the same time maximizing its contribution to market transition. While our framework displays the range of areas that can be addressed to create sustainability contributions, the choice of the adequate managerial focus needs to be assessed

specifically for each company, product and market environment. We discuss how a maximal contribution to sustainability transitions of markets can be managed in the section on company contribution pathways (Section 5).

Taking the case of synthetic fertilizers as an example, their main sustainability problems are caused in the use on agricultural land (Lykogianni et al., 2021). For a multinational fertilizer producer, managing process innovations at the output scope and contributing to changed agricultural practices (e.g. training of farmers to prevent overuse and ensure efficient application as well as better monitoring of how much is needed at what moment of time) may therefore be crucial. A start-up offering fairly and sustainably produced smartphones might prioritize to manage product innovations at the input scope, as smartphone production is linked to sustainability issues in its supply chains such as conflict materials and high emissions (Wernink and Strahl, 2015). A key challenge for any company managing their innovations aimed at sustainability transitions is therefore to intentionally identify the appropriate management measure(s).

Geels (2014), in his triple embeddedness framework, suggests that continuous learning and sensemaking can help a company to select appropriate approaches to influence different industry environments. Through these continuous activities, companies can interpret environmental developments, organize information and evaluate appropriate management measures. Based on Geels' ideas, it can be assumed that the sustainable phone producer opted for managing sourcing strategies and product design after having evaluated the market for smartphones and having identified unsustainable supply chains as an important issue to address. The company's focus on product innovation and its consequences for innovations in the supply chain results from these initial sensemaking and learning activities. While the prerequisites of strategy and management selection have been discussed in the literature, the eventual contribution of the chosen managerial focus to different market environments has not been explored, so far. Particularly, it has remained unclear whether companies can influence the extent of their contributions based on the selection of management measures.

This section has developed a new framework that offers companies different fields of actions for managing their innovations aimed at the sustainability transition of markets. In the following, the framework will be discussed with regard to its implications for the extent of individual company contributions.

5. Company contribution pathways

Previous research has established that companies can engage in different sustainability innovations to contribute to sustainable development in general (Klewitz and Hansen, 2014; Silvestre and Țircă, 2019) and sustainable market transitions in particular (Bolton and Hannon, 2016; Geels and Schot, 2007; Schaltegger et al., 2016). With our developed theoretical framework, we conceptualized possible management measures at the intersection of scopes of market transitions and types of sustainability innovations. The framework postulates that for companies to contribute to an effective sustainability transition of markets, they can and need to intentionally select suitable managerial starting points that correspond with a company's individual context. However, the question remains whether and how companies can influence the eventual outcome for market transition, i.e. whether and how companies can maximize their transition contribution. In this regard, we suggest that each management measure has a specific *contribution pathway (CP)*. The pathway concept proposes that each selected management measure not only manages the direct innovation in one scope of market transition but can trigger further changes across different scopes. One management measure can thus become the starting point of a wider dissemination throughout the market.

To analyze the extent of a company's contribution to the sustainability transformation of markets, we therefore distinguish different CPs with distinct measures of sustainability transition management. At first sight, the term contribution pathway suggests a link to the typology of sociotechnical transition pathways (Geels and Schot, 2007; Geels et al., 2016). However, Geels and Schot's original typology takes a system perspective and discusses pathways based on differences in timing and nature of multi-level interactions and pressures. This research, does not focus on external pressures, but highlights management choice in one organization's transition scope, which triggers change in other scopes. Both sustainability transition and corporate sustainability transformation research emphasize the effectiveness of an interplay between comprehensive changes at the intersection of core and arena (mindset, norms, beliefs) as well as inputs, outputs and substitutes (co-evolution of actors) (Geels and Schot, 2007; Hockerts and Wüstenhagen, 2010; Schaltegger et al., 2016). In this regard, Schaltegger and Johnson (2019, p.23) argue that "the combination of developing ventures with sustainability-oriented values at the core [...] and co-evolution of market actors [...] appears as an effect pathway for meso-level sustainability-oriented market innovations and transformations".

Further, the progressive nature of innovation-driven market transition has been addressed in transition research (Geels and Schot, 2007; Loorbach et al., 2017; Schaltegger and Wagner,

2010) and links to arguments of actor interaction and co-evolution in sustainability transformation (Hockerts and Wüstenhagen, 2010; Schaltegger et al., 2016). Most closely related to this work, Geels (2014) has conceptualized causal mechanisms within different market environments: Pressures are first exerted by activists, then spill-over to the wider public, thereupon to policymakers or consumers and then to companies, who can react strategically to these pressures. Instead of adopting such an outside-in-perspective, our work deliberately takes an inside-out-perspective, making management activities of individual companies the starting point for market transition such as suggested in the sustainable entrepreneurship literature (e.g. Jolink and Niesten, 2015; Parrish, 2010). For the sake of clarity, the following discussion focuses on one management choice per transition scope and presents *idealized contribution pathways* triggered by one choice. Table 3 distinguishes the resulting five *contribution pathways* (triggered by one exemplary management measure) and identifies the resulting contribution of the organization to a sustainability transition of markets.

The first contribution pathway, CP1, starts from management measures for innovating the *core*. CP1 provides a foundation for all following choices. If a company lacks a sustainable core, it risks that all further management measures aimed at a sustainability transition of markets are considered greenwashing (Laufer, 2003). Thus, ensuring a sustainable core is a pre-requisite for other changes. A sustainable core covers the company's sustainability mindset and values impact how seriously the intent becomes to implement management measures aimed at other contribution pathways. By changing the focal organization, i.e. the core, the company contribution is identified as transformed core, CC¹.


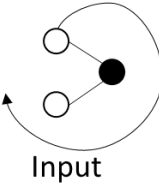
CP2 starts from management measures for innovating the *input*, which, in turn, affects the core. For instance, if a company engages in management measures for sustainable sourcing, internal purchasing policies, product development and marketing strategies will be adapted, leading to a transformation of both, input and core. By transforming the input, change affects multiple level such as new materials, processes, mindsets of individuals of input organizations, i.e. different suppliers as well as the core, resulting in a transformed input and core and a corporate contribution to the power of two, CC².

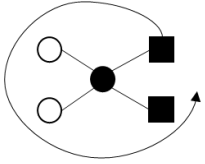
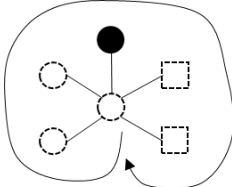
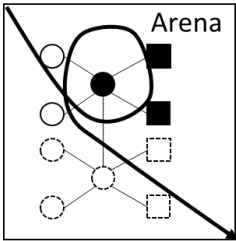
CP3 starts from measures for innovating the *output*, including, for instance, offering a novel sustainable product including nudging strategies. This measure can, in turn, affect product development and marketing at the *core* and sourcing at the *input*. A transformed output can affect a large part of consumers by not only offering alternative products but creating alternative mindsets. An example could be the marketing campaign by Patagonia stating "Do not buy this

jacket”. While a transformed output focuses on consumer level change, it requires pre-requisite transformations at input and core, resulting in a corporate contribution to the power of 3, CC³.

CP4 starts from measures for innovating the *substitute*, such as co-creating sustainable innovations with competitors. This measure not only changes competitor’s offering, but can also affect activities at the *core*, *output* and *input*, resulting in a company contribution to the power of four. Finally, CP5 starts from measures for innovating the *arena*, creating the potentially longest pathway. It includes managing actor networks or private-public partnerships, often involving the co-creation of sustainability innovations. While most immediately, the resulting innovations will influence institutional conditions (culture, regulations), the increased sustainability requirements will require adaptations at all organizations, including *core* and *substitute*, which, in turn, might lead to further changes at the *input* and the *output*. With the subsequent triggers, a contribution to a sustainability transformation of markets affects all five areas, resulting in a company contribution to the power of five, i.e. CC⁵. While the ultimate contribution is difficult to quantify, we argue that it is more than mere addition because these changes are exponentiated by affecting a variety of (interrelated) individuals and organizations.

Table 3: Idealized contribution pathways to the sustainability transition of markets

Contribution pathway (CP)	Starting point of the managing organization Example of management measure	Transitions triggered in SCOPE: (potential causal chains)	Company contribution (CC) to the sustainability transition of markets
CP1	Innovating the CORE Example measure: Business transformation	CORE Fundament for all further innovations and management measures aimed at a sustainability transition of markets	CC ¹ = Transformed core 
CP2	Innovating the INPUT Increasing socio-ecological standards in supply chains	INPUT → CORE - Input: Supplier trainings to transform suppliers to achieve envisioned standards or switching suppliers thereby signaling the procurement market (of inputs) that more sustainable inputs are desired - Core, e.g. organization introduces supplier code of conduct at core organization, adapting procurement policies	CC ² = Transformed core and input 

CP3	Innovating the OUTPUT Example measure: Increasing consumers sustainability mindset	OUTPUT → CORE → INPUT - Output: Sustainable product is offered and incentivizes sustainable consumer behavior - Core: Marketing strategy ensures the offered product is sustainable, e.g. changes in purchasing / suppliers - Input: Product input is manufactured sustainably	CC ³ = Transformed output, core and input  Output
CP4	Innovating the SUBSTITUTE Example measure: Co-creating sustainable market structures with competitor(s)	SUBSTITUTE → OUTPUT → CORE → INPUT - Substitute: Competitors switch to more sustainable products, changing their own output, input and core - Output: Consumers choices change to more sustainable offers - Core: Collaborations improve sustainability of own organization - Input: Higher sustainability standards of suppliers, such as higher supplier compensations (e.g. fair trade)	CC ⁴ = Transformed core, input, output and substitute  Substitute
CP5	Innovating the ARENA Example measure: Elevating sustainability point of reference by (co-)creating sustainability certification	ARENA → SUBSTITUTE → OUTPUT → CORE → INPUT - Arena: Introduce certificate, ensure high trust through higher market standards, regulations and collaborations with NGOs - Substitute: Competitors restructure offer to comply with certification - Output: Availability of certified products - Core: Collaboration with NGO to develop sustainability certification - Input: Ensure product is aligned with high sustainability standard of certificate	CC ⁵ = Transformed core, input, output, substitute and arena  Arena

Linking the CPs to practice shows different interrelations between the scopes, confirming that, to trigger CPs, each company needs to carefully manage their measures with the intent of sustainability transitions of markets (see table with practice examples in Appendix B). CP5 could be observed, for instance, at Unilever. The company partnered with the WWF to co-develop the Marine Stewardship Council certification (MSC, 2022; Ponte, 2012 REF). Most fundamentally, the activity contributed to a market transition at the arena by introducing a new standard, a private governance institution and label (Ponte, 2012). This, in turn, resulted in changes at the core, as Unilever shifted resources to accommodate for the changed purchasing policies. The altered purchasing policies, based on the new standards, resulted in changes at the input by increasing the number of certified sustainable fisheries. Identifying sustainable inputs on product packaging then increased consumer awareness of sustainability in fish products, thus triggering changes at the output level. Finally, the increased awareness and demand for sustainable

fish increased the overall amount of sustainably certified fish of other food producing companies, large food service and food distribution companies, thus impacting the substitute. Today, 14% of marine catch have been certified with the MSC, arguably a transformative contribution of 14% after 25 years (Arton et al., 2020; MSC, 2022).

In essence, a company's contribution (CC) is the achieved extent of transition, meaning the degree of replacement of unsustainable market structures by sustainable alternatives at the core, the input, the output, the substitute and/or the arena. How much a company can contribute to sustainability transitions of markets with each management measure depends on the careful and focused management of the contribution pathway which promises furthest-reaching impact in the market.

6. Conclusion

By taking a management perspective and linking the innovation management and sustainability transition literature, we propose a theoretical framework for managing innovations aimed at the sustainability transition of markets. The framework distinguishes five scopes of market transitions - the core, input, output, substitute and arena -, and offers management measures by linking each transition scope to the management of sustainable process, product and organizational innovations. The effective implementation of management measures depends on (1) a company's management intent to achieve a sustainability transformation of markets and (2) the careful selection of adequate management measures based on the potential company contribution to the sustainability transition of markets. The previous section discussed potential contribution pathways for each selected starting point based on scope. The proposed conceptual framework aims to support companies in carefully selecting management measures with the aim of a sustainability transition of markets and to become a game changer in its market.

Future research benefits from the theoretical framework to structure systematic approaches for managerial interventions aimed at the sustainability transition of markets. For management research, the framework can support developing tools for measuring specific contributions. So far, the maximization of company contributions to market transition can merely be estimated by identifying the type of innovation measure employed and comparing it to the current market share and impact of the respective company. However, for higher rigor, concrete and ideally measurable indicators are needed. Therefore, developing this contribution further to assess its impacts and distilling indicators to use for controlling and reporting relevant data may be a worthwhile future research endeavor. In addition, further research may want to explore how the

framework can capture all categories without risking to attribute effects of one category to another. With its conceptual focus, this contribution has not dealt with underlying drivers and levers of sustainability transitions. Recent sustainability transformation literature for example, considers underlying “deep” changes in mindsets, beliefs, values, norms and competencies as most important leverage points for large-scale transitions (Abson et al., 2017; Ives et al., 2020; Buhr et al., 2023). The link between actor mindsets in different scopes and different innovation management approaches to innovation foci and scopes of sustainability contributions therefore need to be investigated further. Lastly, while referencing some illustrative practice examples, it was beyond the scope of this conceptual research to conduct empirical research analyzing company contributions and respective innovation management techniques in practice. Future in-depth case studies can provide a more direct analysis oriented towards the presented framework, revealing crucial company activities in the different categories.

Lastly, the framework assists companies to consider their sustainability commitments and respective impacts more intentionally. It does so by (1) encouraging companies to consider their contributions beyond the organizational boundaries and (2) engage in a process that allows them to select adequate management measures for maximum impact.

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I. APPENDIX A: Application of the framework to two practice examples

For illustration and applicability purposes of the framework, we discussed our framework drawing on two examples, a large incumbent firm, Unilever, and a small niche actor, Lichtblick.

Table 1 (Appendix A): Unilever's management measures for contributing to the sustainability transition of markets

		Scopes of market transitions				
		CORE	INPUT	OUTPUT	SUBSTITUTE	ARENA
Managing types of sustainability innovations	Pro-cesses	Zero waste to landfill programme	Sustainable code of conduct	#1RinseIsEnough campaign	The Sustainability Consortium (TSC)	Collaboration with Global Reporting Initiative
	Products	90% cut of phosphates in detergents, 50% fewer emissions, same performance	Various tools for suppliers, e.g. cool farm tool (GHG calculator)	Lifebuoy soap to increase handwashing and hygiene practices in developing countries	Refrigerants Naturally! Campaign to encourage climate friendly alternatives for refrigeration	Marine Stewardship Council organisation and certificate developed in cooperation with WWF
	Organization	Sustainable Living Plan encompasses entire company and its impact on markets and society	Training programmes, e.g. "I am Walls", unemployed to entrepreneur	5 Levers for change: Program to make consumers more sustainable	Initiatives at World Business Council for Sustainable Development for joint industry action	Involvement and support for SDGs

Table 2 (Appendix A): Lichtblick's management measures for contributing to the sustainability transition of markets

		Scopes of market transitions				
		CORE	INPUT	OUTPUT	SUBSTITUTE	ARENA
Managing types of sustainability innovations	Processes	"Ökoprofit" Environmental Management System	Sustainable purchasing guidelines	Business customers adapt purchasing policies to sustainability	Transparency for feed-in tariffs (through legal measures)	Comment regulations / proposals in energy markets in favour of sustainability
	Products	Vision includes innovative products with the objective of energy market transformation, e.g. "swarm energy" ("Schwarmenergie")	Consumers become suppliers by creating their own green energy; Lichtblick provides IT solution	Consumers to suppliers by creating their own green energy; Lichtblick provides IT solution	Transparency for feed-in tariffs (through legal measures)	Collaboration with municipality to offer green power for e-cars
	Organization		investments in new wind, solar	Inform consumer and offer calculator for green power	called for transparency of feed-in tariffs with court action at federal court	2005 - increase transparency of feed-in tariffs at Federal Supreme Court

II. APPENDIX B: Practice examples for contribution pathways

Contribution pathway (CP)	Example company	Contribution pathway (CP)	Company contribution (CC)	Measurable market impact
CP1	Green Mountain Power (GMP): Business transformation towards green energy, as discussed in Throop and Mayberry (2017)	CORE: Business model innovation towards renewable energy (Orsted; GMP) & smart-grid technology (GMP) <i>Potential further impacts:</i> ARENA: Nationwide system of electric vehicle charging stations SUBSTITUTE: Inspiration for other conventional energy providers to orient towards sustainability	CC ¹	Green Mountain Power serves ca. 270,000 customers, with 90% carbon-free power (Morehouse, 2019). Green Mountain Power has been named to TIME's List of the TIME100 Most Influential Companies (GMP, 2022).
CP2	Fairphone: Introduction of fairly produced modular phones, discussed in Wernink and Strahl (2015); Nylund et al. (2021)	INPUT: Increasing socio-ecological standards in smartphone supply chains OUTPUT: Increased demand for fairly produced phones SUBSTITUTE: Pressure on other phone manufacturers to increase supply chain transparency and to consider modularity	CC ³	Doubling of sales in 2020, increasing influence in smartphone market (Fairphone, 2020). Fairphone sold nearly 95,000 phones in 2020 compared to almost 59,000 in 2019, representing a sales increase of 76%. (SCM, 2021)
CP3	Patagonia: as discussed in Zint and Frederick (2001) Chouinard and Stanley (2012); O'Rourke and Strand (2017); Rattalino (2018)	OUTPUT: Consumer consider slow fashion, responsible consumption and sufficiency ARENA: Increased social discourse about throwaway culture and sustainable clothing	CC ²	10% market share in the outdoor apparel market, making it the number 1 market share holder. 10% year-on-year growth rate. (Cascade, 2021)
CP4	Tony's Chocolonely: Co-creation of market for 100% slavery free chocolate with other chocolate producers; discussed in Blom et al. (2014)	SUBSTITUTE: Co-creation of a 100% slavery-free chocolate industry OUTPUT: Raising awareness on slavery in chocolate value chains; Encouraging consumers to make responsible consumption choices	CC ²	In 2019, Tony's Chocolonely was the biggest chocolate brand in the Netherlands with a market share of around 19% and growth of 27% compared to the previous year (Kraaijenbrink, 2019). The open chain program has four big allies until now, including ALDI and Ben & Jerrys (Tony's Open Chain, 2022)
CP5	Unilever: Co-development of the Marine Stewardship Council (MSC) certification with the WWF, discussed in Ponte (2012)	ARENA: Co-creating a mainstream market for sustainable fish by introducing new standards, a private governance institution and label CORE: Supplier code of conduct, sustainability strategy INPUT: Increasing the number of sustainable certified fisheries OUTPUT: Increasing consumer awareness of sustainability in fish purchases SUBSTITUTE: Increasing amount of sustainable fish at large food service and food distribution companies	CC ⁵	14% of marine catch have been certified with the MSC Fisheries Standards according to the organization itself. => Arguably a contribution of 14% after 25 years (Arton et al., 2020; MSC, 2022)

D. Processes of exploration and reorientation

Hübel, C., Weissbrod, I. & Schaltegger, S. (2022): Strategic alliances for corporate sustainability innovation: The ‘how’ and ‘when’ of learning processes. *Long Range Planning*, 102200. <https://doi.org/10.1016/j.lrp.2022.102200>

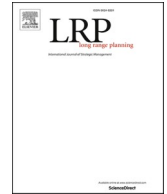
Hübel, C. (2022): Entrepreneurship-driven organizational transformation for sustainability: A sensemaking lens, *Journal of Organizational Change Management*, 35(1), 240-256. <https://doi.org/10.1108/JOCM-03-2021-0067>



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Strategic alliances for corporate sustainability innovation: The ‘how’ and ‘when’ of learning processes

Charlott Hübel^{*}, Ilka Weissbrod, Stefan Schaltegger

Centre for Sustainability Management (CSM), Leuphana Universität Lüneburg Universitätsallee 1, 21335 Lüneburg, Germany

ABSTRACT

Mounting sustainability pressures challenge established firms to engage with sustainability innovations, which are often introduced by startups. Research on alliance learning has established the potential of learning from startups to advance corporate innovation. Here, scholars have outlined alliance learning processes and outcomes and have distinguished learning *about* and learning *from* alliance partners as two key learning types. The saliency of learning *from* the operational alliance process is stressed. To date, however, no study has investigated alliance learning processes and outcomes for sustainability innovations. This is despite the fact that sustainability research suggests learning processes in the sustainability context have a distinct nature. This study addresses this research gap by analyzing the sustainability-specific learning processes and outcomes of a large European meat producer and wholesaler with a turnover of \$2.7bn in the fiscal year 2019/2020. The firm formed alliances with nine startups for sustainable plant, insect-based and cell-based protein solutions. Our analysis (1) identifies three distinct characteristics of sustainability-related alliance learning processes and outcomes, and (2) specifies the temporal occurrence and outcomes of learning types in alliance learning phases. In contrast to findings of prior research, our study reveals that learning *about* alliance partners is of key importance throughout the whole sustainability-oriented alliance learning process. In addition, the findings highlight that alliance learning outcomes may support an established firm's contribution to the sustainability transformation of mass markets.

1. Introduction

Increasing societal and environmental challenges such as poverty and climate change have moved sustainability - i.e. the aspiration to “safeguard intergenerational equity” (Bansal and DesJardine, 2014: 70) in an economy operating within the space of planetary boundaries (Rockström et al., 2009) - from a niche to a mainstream issue (Bocken and Geradts, 2020). With mounting sustainability regulations and stakeholder pressure, established firms in different industries are challenged to analyze their strategies and practices with regard to sustainability requirements (Schaltegger and Hörisch, 2017). Firms can, and need to, respond to this new “sustainability imperative” (Lubin and Esty, 2010: 2) by engaging with sustainability innovations, often involving fundamental reconfigurations of products and processes so that they not only target economic but also environmental and/or social benefits (Arnold and Hockerts, 2011; Klewitz and Hansen, 2014). In doing so, established firms can secure their existence (Schaltegger and Hörisch, 2017), gain competitive advantage (Hall and Vredenburg, 2004; Hermundsdottir and Aspelund, 2021) and, at the same time, contribute to the transformation of markets and industries toward sustainable development (Hockerts and Wüstenhagen, 2010; Schaltegger and Wagner, 2011).

Established firms, however, frequently face difficulties in developing and adopting sustainability innovations (Bocken and Geradts, 2020). Such innovations are different from conventional innovations (Kennedy et al., 2017; Weissbrod, 2019), as they come with

^{*} Corresponding author.

E-mail address: charlott.huebel@leuphana.de (C. Hübel).

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directional risks¹ (Hansen et al., 2009), involve different externalities in innovation and diffusion phases (Rennings, 2000) and require interdisciplinary learning toward systems thinking (Adams et al., 2016; Wals and Corcoran, 2012). While established firms struggle to implement sustainability innovations, a growing number of sustainability startups has started to introduce sustainable product innovations to the market (Hockerts and Wüstenhagen, 2010). Sustainability startups differ from conventional startups by integrating social and environmental value creation into their core business (Dean and McMullen, 2007) and following a values-oriented (Parrish, 2010), as well as a stakeholder-oriented (Freudenreich et al., 2019) approach.

In studies of how established firms advance innovation, strategic management research emphasizes the potential of strategic alliances. Leading scholars argue that strategic alliances can drive corporate innovation through organizational learning (Inkpen, 2008; Inkpen and Dinur, 1998; Kavusan et al., 2016; Schildt et al., 2012). Researchers have studied development and interaction patterns of alliance learning (Bingham et al., 2015; Davis and Eisenhardt, 2011; Doz, 1996; Kale and Singh, 2007), alliance learning types (Das and Kumar, 2007; Inkpen and Currall, 2004; Inkpen and Tsang, 2007) and alliance learning outcomes (Doz, 1996; Kavusan et al., 2016; Liu and Lui, 2020). Regarding learning types, initial research suggests that learning *about* alliance partners may dominate in the early phases of an alliance, whereas learning *from* dominates in the operational alliance phases (Das and Kumar, 2007). Empirical research confirms that alliances with startups hold high learning potential for established firms (Alvarez and Barney, 2001; Gopalakrishnan et al., 2008; McCutchen and Swamidass, 2004; Mitra, 2007; Weiblen and Chesbrough, 2015; Rothaermel, 2001). At the same time, sustainability research shows that sustainability startups possess sustainability innovation capabilities related to a sustainability-specific value proposition, creation and delivery, which established firms often lack (Keskin et al., 2020; Schaltegger et al., 2016). Learning from sustainability startups in the context of strategic alliances, therefore, might help established firms to develop capabilities for sustainability innovation.

The distinct nature of sustainability innovation and startups might suggest that sustainability-oriented alliance learning processes differ from those in conventional alliances. To date, however, no study has empirically investigated alliance learning processes and outcomes for sustainability innovations. Our study addresses this research gap and is guided by the research question: How do learning processes in strategic alliances between an established firm and sustainability startups unfold and influence sustainability innovation in the established firm? To answer this research question, we develop a *process model for alliance-driven learning for corporate sustainability innovation*, which depicts both the processes and outcomes of alliance learning from the perspective of an established firm. The analysis aims to gain new insights into the temporal occurrence and outcomes of two learning types (i.e. *from* and *about*) in alliance processes in a highly topical context. Using a qualitative methodology, we investigate processual dynamics in the established firm with regard to its alliances with sustainability startups, depicting how interactions evolve over time (Langley et al., 2013). An exploratory single case study design (Yin, 2009) was adopted to achieve an in-depth understanding of the interorganizational and personal interactions inherent to alliance learning.

Our findings contribute to the strategic management literature by establishing three distinct characteristics of alliance learning processes and outcomes in the context of sustainability innovations. This is done by specifying the temporal occurrence and outcomes of the two established learning types *about* and *from* and by describing novel alliance experiences in three distinct alliance learning phases.

Our review of literature on alliance learning processes and alliance learning outcomes is followed by a description of the methodology we adopted for data collection and analysis. After presenting the findings and the discussion of the results, we develop the process model. Our conclusions address areas for further research.

1.1. Literature review

Sustainability research claims that for sustainability innovations to address complex global challenges, they require interdisciplinary learning in collaborative environments (Bradbury-Huang et al., 2010; Mülling Neutzling et al., 2018; Rohrbeck et al., 2013). Strategic management research has identified strategic alliances as a valuable collective learning environment (Doz, 1996; Inkpen, 1998; Inkpen and Tsang, 2007; Kale and Singh, 2007) that can spur corporate innovation (Inkpen, 2008; Inkpen and Dinur, 1998; Kavusan et al., 2016; Mitra, 2007; Rothaermel, 2001; Schildt et al., 2012; Weiblen and Chesbrough, 2015). In strategic alliances, partners “exchange, share or co-develop [...] resources, competencies and capabilities” (Russo and Cesarani, 2017: 1) and seek “solutions to long-term needs, rather than temporary fixes” (Chen and Chen, 2002: 1008). To answer this study’s research question of *how* learning in strategic alliances advances corporate sustainability innovation therefore requires a deeper understanding of alliance learning processes and outcomes.

1.2. Alliance learning processes

The literature provides two complementary perspectives on alliance processes. The first relates to the overall alliance life cycle and is broken down into a linear sequence of partner selection, partner management and partner termination (Heimeriks et al., 2015) or formation, operation and outcome (Das and Teng, 2002; Russo and Cesarani, 2017). The second perspective, on which our study focuses, zooms in on the operational phase of an alliance starting with its formation. In this perspective, processes occur in a dynamic, iterative manner and are strongly related to learning (Inkpen and Tsang, 2007; Kumar and Nti, 1998). The alliance learning process

¹ Directional risk is the risk of not knowing beforehand the direction of an innovation’s actual effects on sustainable development.

generally involves articulation, codification, sharing and internalization (Kale and Singh, 2007). Doz (1996) and Doz and Hamel (1998) introduce an evolutionary view of alliance learning, as based on earlier work by Ring and Van de Ven (1992). This alliance learning theory suggests that successful alliances move through several cycles of learning, re-evaluation and readjustment, with each learning cycle making the alliance more efficient over time. Whether learning occurs and whether the alliance evolves favorably is determined by the initial conditions of the alliance, including partner expectations and strategies as well as absorptive capacities (Doz, 1996; Kumar and Nti, 1998). As the learning process evolves, alliance conditions change and shape subsequent behavior. Researchers argue that a favorable evolutionary path requires that partners are sufficiently compatible for learning to occur (Doz, 1996; Hamel, 1991; Lane and Lubatkin, 1998). Research on alliances between large and small firms suggests that due to differences in resource portfolios, market experience and cultures such alliances can involve unequal processes to the detriment of the smaller firm (Barabel et al., 2014; Doz, 1988; Minshall et al., 2010; Pérez et al., 2012; Prashantham and Birkinshaw, 2008).

Strategic management scholars have distinguished two main types of learning that occur in the alliance process: learning *about* the alliance partner and learning *from* the alliance partner (Doz and Hamel, 1998; Khanna et al., 1998; Inkpen and Currall, 2004; Inkpen and Tsang, 2007). Doz's (1996) seminal work on alliance learning has largely focused on the first type of learning, learning *about*, which is partner-specific learning that occurs along five dimensions: environment, goals, skills, task and process. This type of learning focuses on the management of individual alliances and is linked to the concept of alliance management learning (Ireland et al., 2002). Learning *from*, which is also referred to as content learning (Das and Kumar, 2007), involves knowledge that has value to a firm outside the scope of the alliance, as firms can internalize knowledge to enhance their own operations (Khanna et al., 1998; Inkpen and Currall, 2004). Individual-level components, including personal interactions, are key building blocks for developing such knowledge integration capabilities (Felin et al., 2012).

Some studies explicitly link learning to different phases in the alliance life cycle (Das and Kumar, 2007; Heimeriks et al., 2015; Schildt et al., 2012). In their conceptual paper, Das and Kumar (2007) suggest that the partner selection phase is dominated by learning *about* the partner, while the partner management phase is increasingly dominated by learning *from* the partner. This is in line with research on interorganizational trust, highlighting that partner familiarity and understanding is needed for knowledge transfer to occur (Inkpen and Currall, 2004; Nielsen, 2005; Nielsen and Nielsen, 2009).

2. Alliance learning outcomes

Alliance learning research suggests that the two types of learning can result in different outcomes for the alliance and its members. Learning *about* the alliance partner helps firms to build trust, improve coordination and increase overall alliance performance (Inkpen and Currall, 2004; Khanna et al., 1998; Liu and Lui, 2020). In particular, positive experiences related to gaining knowledge *about* the partners increase a firm's motivation to continue the alliance (Das and Kumar, 2007). It has also been suggested that learning *about* an alliance partner can influence decisions on entering into and learning in further alliances (Gulati et al., 2009; Heimeriks et al., 2007; Heimeriks and Duysters, 2006). The more alliances a firm enters and the more diverse the partner firms are, the more learning can occur (Cui and O'Connor, 2012; Jiang et al., 2010). By contrast, Grant and Baden-Fuller (2004) propose with their knowledge accessing theory of strategic alliances that the more firms focus on only accessing knowledge, i.e., learning *about*, without the intention of integrating and applying that knowledge, the more alliances they can enter. Learning *about* therefore does not only relate to advancing an individual alliance, but also to whether a firm enters further alliances. With increasing experience with alliances, firms develop an alliance learning capability, which results in increased learning and alliance success over time (Anand and Khanna, 2000; Kale and Singh, 2007; Schilke and Goerzen, 2010).

The impact of learning *from* goes beyond improved alliance performance and can also substantially advance a firm's internal innovation. The link between learning success and corporate innovation has received substantial attention in the strategic management literature (e.g. Berghman et al., 2013; Cohen and Levinthal, 1990; Jiménez-Jiménez and Sanz-Valle, 2011). With regard to learning in the context of alliances, it is argued that a firm's ability to absorb and exploit a partner's knowledge is particularly high in alliances with a high degree of technological overlap or a complementary knowledge base (Kavusan et al., 2016; Schildt et al., 2012; Shenkar and Li, 1999). Subramanian and Soh (2017) further argue that learning *from* a wider range of alliance partners can increase the breadth of resulting innovation produced by the focal firm. However, learning *from* can also have a negative impact on alliances or even lead to early alliance termination, when one partner "outlearns" the other, takes advantage of its increased bargaining power and starts using its acquired knowledge competitively (Hamel, 1991; Inkpen and Beamish, 1997; Inkpen and Currall, 2004; Van de Ven and Walker, 1984). Research indicates that in alliances between large firms and startups the large firm is much more likely to win the learning race, rendering these types of partnerships difficult to maintain (Alvarez and Barney, 2001). Winning the learning race, however, requires that the large firm is able to overcome learning challenges attributable to a potential lack of management commitment and core business-focused corporate structures (Kohler, 2016).

2.1. Research gap

Extant research has neglected to explore alliance learning processes and outcomes in the context of sustainability innovations. Learning for sustainability innovations might be different, as it is influenced by the degree of commitment to a firm's sustainability strategy (Kennedy et al., 2017) and it involves further requirements, including the unlearning of prior knowledge that contradicts sustainability principles (Adams et al., 2016; Bossink, 2007; Magnusson et al., 2003). With their purpose to contribute to social and environmental goals beyond organizational boundaries, sustainability innovations require learning towards systems and about empathetic thinking (Wals and Corcoran, 2012) as well as learning about the interrelationships between organization, society and the

environment (Johnson and Schaltegger, 2020). In addition, differences in motivation, values and ideologies between mainstream and sustainability-oriented actors may complicate or prolong alliance learning processes, as actors tend to be resistant to learning from one another (London et al., 2004; O'Mahony and Bechky, 2008; Rondinelli and London, 2003; Stern and Hicks, 2000). Alliance learning outcomes might differ too, as sustainability innovations can support the sustainability transformation of whole markets and industries (Hockerts and Wüstenhagen, 2010; Schaltegger et al., 2016; Schaltegger and Wagner, 2011).

The investigation of sustainability-related alliance learning processes addresses the outlined research gap. Fig. 1 synthesizes previous research findings, illustrates the main research gap and highlights three specific aspects that have not been addressed by research, so far.

This study's in-depth analysis attends to all three of the outlined aspects, thereby contributing to alliance learning research. First, the investigation may provide empirical insights into how and when established firms learn *about* and *from* sustainability startups, thereby confirming or deviating from Das and Kumar's (2007) suggestion that the alliance process is increasingly dominated by learning *from*. Second, the investigation may shed light on how differences in the temporal occurrence and purpose of learning types influence experiences in the sustainability-related alliance process and, vice versa, affect the evolutionary path of alliances. Lastly, the investigation may give indications of broader sustainability-related alliance learning outcomes beyond organizational boundaries – an aspect that has not been investigated so far, neither in the sustainability nor in the alliance learning literature.

3. Methods

3.1. Empirical approach

In order to investigate the relationship characteristics of alliance learning for corporate sustainability innovation, we employ a qualitative, exploratory case study design (Yin, 2009). The qualitative study design allows for an in-depth analysis of alliance learning processes in a unique setting, “capturing the nuances of processes in and around organizations” (Langley et al., 2013: 10). Given the study's focus on corporate innovation, the analysis adopts the perspective of the established firm, i.e. its learning cycles and outcomes as partner-specific learning processes. We investigated innovation processes in a large established European meat producer and wholesaler with a turnover of \$2.7bn in the fiscal year 2019/2020. This firm, anonymized as BIGMEAT, entered nine strategic sustainability-oriented alliances with international startup firms for alternative protein products. Given the social discourse on meat consumption and production (Sapontzis, 2004) and the radicalness of new meat replacement innovations (Shapiro, 2018), alliances between a meat producing firm and alternative protein startups constitute an intriguing and highly topical research case.

BIGMEAT is family owned and run and the alliances are part of the firm's strategy to diversify its product portfolio toward meat alternatives and thereby future-proof its business. The startup alliance partners offered ethical and ecological food tech innovations, including plant-based, insect-based, cell-based and 3D-printed meat analogues. All of the startups aimed to make their products available to the European mass market. BIGMEAT supported the alternative protein product startups by providing finance, infrastructure and market know-how, while the startups granted BIGMEAT access to state-of-the-art protein product innovations. Nine

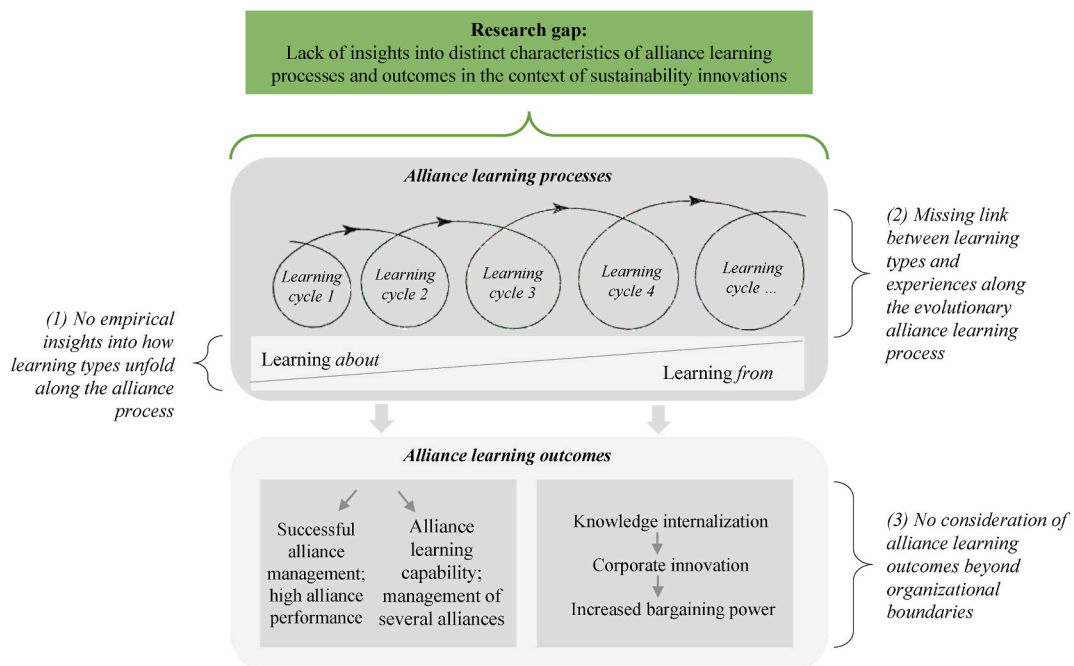


Fig. 1. Synthesis of previous alliance learning research and identified research gap.

strategic alliances were established between February 2016 and mid 2019 (Table 1) in the form of strategic investments (S, B, E) and/or distribution partnerships (A, C, D, F, G, H). All but one alliance (G) are still ongoing at the time of the completion of the research.

The first alliance, Alliance S, remained undisclosed to the public due to reputational concerns voiced by both partners. While the owner of Startup S was concerned about potential negative responses from its vegan customer base, BIGMEAT's management had not yet formulated and communicated their strategic intentions to become involved in the alternative protein field at the point of alliance formation.

3.2. Research process

We designed the case research to ensure internal validity, construct validity, and reliability (Gibbert et al., 2008). The research process (Fig. 2) was abductive (Dubois and Gadde, 2002) and alternated between the literature, empirical findings and data analysis (Thomas, 2010).

The link between alliances and corporate innovation (e.g. Weiblen and Chesbrough, 2015) and sustainability-oriented interactions between startups and established firms (e.g. Hockerts and Wüstenhagen, 2010) provided the foundation for this study. Our empirical observations of alliance learning processes, however, could not be fully explained in this initial theoretical framework. We therefore engaged in an iterative abductive process of "theory matching," resulting in a revised theoretical framework that incorporated constructs of alliance learning (Kovács and Spens, 2005). By alternating between data collection, data analysis and theory matching, we gained an increasingly comprehensive understanding of the phenomenon of alliance-driven learning for corporate sustainability innovation. This deeper understanding encouraged us to develop a new process model.

4. Data collection and preparation

The lead researcher sought to collect salient data without influencing the alliance process or interviewees using a variety of data collection methods. First, the data collection included semi-structured interviews (Wengraf, 2001) as well as informal conversational interviews (Turner, 2010) with managers from BIGMEAT and the startup partners (see Appendix A, Tables A.1 and A.2). For those interviews that were conducted in German, relevant text sections were translated by the lead researcher. Top managers interviewed included BIGMEAT's CEO and Chairman, the Board Lead for Alternative Proteins (previous Head of M&A), and the CEO of two BIGMEAT subsidiaries. Middle managers included managers from sales, marketing, project management, product development, communication, sustainability management and the new head for the alternative protein unit. The interviews with startups were conducted with the founders and top managers. Second, the lead researcher engaged in balanced participatory observations. This included taking part in the ongoing activities of the participants while consciously observing and, after the interaction, recording the observations made. In doing so, we aimed for a balance between observation and participation (DeWalt and DeWalt, 2002). Third, we collected data in the form of documents (Prior, 2003). Each data source fulfilled a different purpose during analysis (Table 2). In total, our database comprises 40 formal and informal interviews, observations at 11 events and 71 documents.

As proposed by Dwyer and Buckle (2009), we adopted an insider-outsider perspective to take into account the complexity of human experiences and the impossibility for qualitative researchers to remain completely separate from the study. The lead researcher travelled to the company headquarters and participated in industry events and conferences while the co-researchers acted as 'sparring partners' to reflect on the observations at a critical distance. Interactions with study participants took place in work settings, at meetings and at industry events. The Board Lead for Alternative Proteins was the main point of contact during the 18-month long investigation.

Data was collected from August 2018 until February 2020. To reconstruct the strategic decisions and alliance processes that occurred prior to August 2018, interviewees were asked to recall the alliance process back to February 2016 and these recollections were used as retrospective data (Pettigrew, 1990). The final three interviews with top and middle management at BIGMEAT (Interviews 10; 11; 12) corroborated the data findings and were used to seek final clarification of some factual information (e.g. people involved, timelines). Interviews were transcribed ad verbatim and the observational data, including interviews, were uniformly protocolled (McLellan et al., 2003).

Table 1

The nine strategic alliances of the BIGMEAT research case.

Alliance	Core product value proposition of startup	Alliance formed	Alliance status
S	Plant-based protein	Beginning of 2016	Commercialization active
A	Cell-based protein	End of 2017	Commercialization planned for 2022/23
B	Insect-based protein	Beginning of 2018	Commercialization active
C	Plant-based protein	April 2018	Commercialization active
D	Plant-based protein	July 2018	Commercialization planned for 2021
E	Insect-based protein	July 2018	Commercialization planned for 2021
F	Plant-based and cell-based protein	November 2018	Commercialization planned for 2021
G	Plant-based protein	November 2018	Planned commercialization stopped
		<i>Terminated January 2020</i>	
H	Plant-based protein and technology platform	Mid-2019	Commercialization planned for 2021

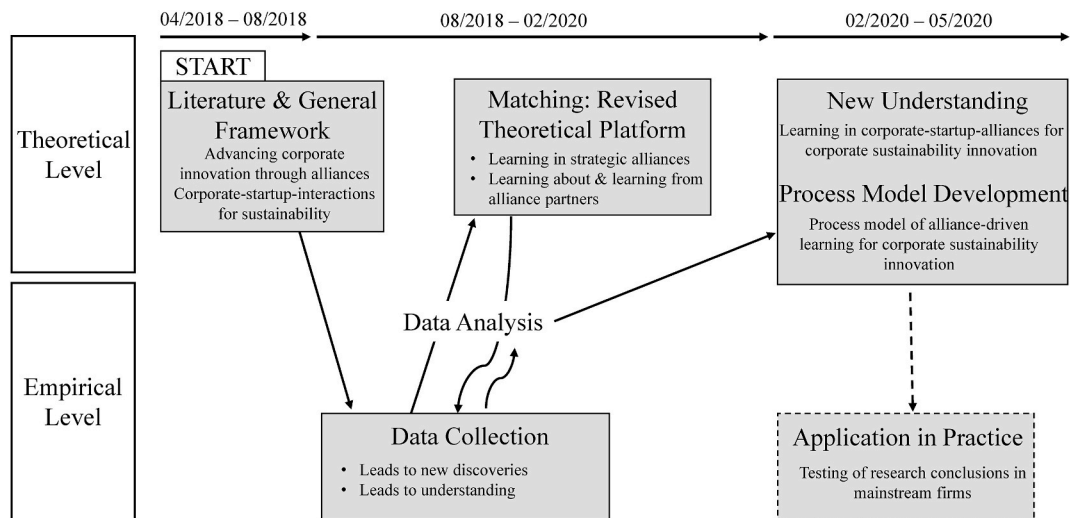


Fig. 2. Abductive research process used in the case study (adapted from Kovács and Spens, 2005, 139).

Table 2
Data sources and their use in the analysis.

Data types	Sources	Use in the analysis
Semi-structured interviews at BIGMEAT	12 formal interviews with top and middle managers (see Appendix A, Table A1)	<ul style="list-style-type: none"> Reconstruct the process of alliance development Investigate the motivations behind alliance formation and learning intentions Examine changes over time/whether and how organizational learning occurred
Semi-structured interviews at startups	8 formal interviews with founders/top managers (see Appendix A, Table A1)	<ul style="list-style-type: none"> Reconstruct the process of alliance formation and development Investigate startup motivations Corroborate statements about alliance formation and processes by BIGMEAT managers
Informal interviews	20 informal interviews at BIGMEAT with top and middle management (see Appendix A, Table A2)	<ul style="list-style-type: none"> Supplement formal interviews Gain deeper insights into personal motivations and learning over time
Balanced participatory observation	6 industry events 4 meetings 1 press event	<ul style="list-style-type: none"> Investigate the relationship and fit of partners Investigate the direct collaborative learning processes
Publicly available documents	30 firm reports & press releases 29 media reports 4 firm magazines	<ul style="list-style-type: none"> Analyze the external communication of the alliances Examine external communication of alliances Examine external perceptions (e.g. media coverage) of alliances and its implications
Internal documents	8 presentations and written communication	<ul style="list-style-type: none"> Examine internal communication of alliances and related learning processes and outcomes

4.1. Data analysis

The data analysis was composed of three steps. Step one used the qualitative data analysis software program MAXQDA (see Appendix B, Figure B1) to conduct a coding process. Table 3 shows the resulting 106 first-order descriptive, process and emotion codes (Saldaña, 2015), which were grouped into 8 second-order codes. All first-order and second-order codes were compiled in a codebook (DeCuir-Gunby et al., 2011; Saldaña, 2015) and were discussed between two researchers.

In step two of the data analysis, we marked codes and specific text sections according to the alliance the statements referred to. The alliance-specific text sections are organized in matrix tables (Miles et al., 2014). The process was informed by alliance learning research (Doz, 1996; Doz and Hamel, 1998; Inkpen and Currall, 2004) and identified the learning cycles (i.e. cycles of learning, re-evaluation and readjustment), including the temporal occurrence of learning types (i.e. learning about and learning from), and their respective outcomes (columns in Table 4). We systematically identified learning about and learning from alliances in the collected data set (rows in Table 4). Data sections referring to one or more of Doz’s learning dimensions, i.e. the partners’ environment and market context, the partners’ goals and motives, the partners’ skills, the alliance task and the alliance process, all indicated learning about. Statements were classified as instances of learning from if the data referred to knowledge from the partners with a clear intention to internalize and use the knowledge, unconnected to the alliance process (Inkpen and Currall, 2004). Both learning processes and outcomes were analyzed from the perspective of BIGMEAT in order to identify the scope and dominant type of learning at BIGMEAT. The process generated nine matrix tables, one for each alliance. Table 4 shows the simplified matrix table of Alliance F.

Table 3

First-order and second-order codes identified in qualitative data.

Codebook containing first- and second-order codes	
First-order codes	Second-order codes
<ul style="list-style-type: none"> • Openness • Pioneer thinking • Growth through diversity • Traditionalism • Sustainability views • Future of meat business • Customer orientation • Product focus • Employee orientation 	<ul style="list-style-type: none"> • Careful decision-making • Family business • Market orientation • Corporate identity • Uniqueness • Strategy • Personal conviction • Company connectedness • Competitive advantage • Authenticity • Profit orientation • Collaboration focus
	Established firm characteristics & strategy
<ul style="list-style-type: none"> • Fascination/hype • High expertise • Seriousness/long-term thinking • Vegan vs. meat • Low awareness • Perception of startup • New knowledge • Generation 2.0 • Structural change • New sustainability perspective • Positive feedback • More involvement • New innovativeness • Opportunities for meat business • Risks for meat business • Positive experience 	<ul style="list-style-type: none"> • Skepticism • No defined process • Market opportunity • Trust in leadership • Existential fear • Acceptance • Ambivalent work tasks
	Established firm initial conditions
	<ul style="list-style-type: none"> • Negative experience • Limits to internal change • Disagreements/discussions • Employee encouragement • Staff shortages • Company image • Strategy development • Newness • Product development challenge • Knowledge sharing • Learning challenge
	Established firm internal processes
<ul style="list-style-type: none"> • Planning & management • Structural integration • Enthusiasm • Compatibility • Pragmatism • Personal contact • Partner fit • Type of partnership • Challenges • Established firm support • Open communication • Further alliance potential 	
	NewCo/Accelerator Platform
	<ul style="list-style-type: none"> • Goals • Differences • Philosophy & values • Unstructured process • Competition
	Alliance conditions
	<ul style="list-style-type: none"> • Startup dominance • Time-consuming • Mutual partnership • Alliance re-evaluation • Functioning collaboration • Alliance synergies
	Alliance processes
<ul style="list-style-type: none"> • Strategy/approach • Motivation for partnership • Praising established firm • Sustainability mission • Business motivation • Alliance goal • Initial concerns • Personal story 	
	Startup perspective
<ul style="list-style-type: none"> • Industry change • Startup hype • Competition • Negative reputation • Uncertainties 	<ul style="list-style-type: none"> • New knowledge • Market orientation • Independence • External feedback • Expertise • Established firm products • Technological innovation • Growth • New market access • Business challenges • Welcoming partner learning • Political awareness • Stakeholder pressure • Decreasing hype • Local market challenges
	External conditions

Note: The code book and related coding process were the basis for creating nine matrix tables, which provide insights on learning processes and outcomes of each alliance.

Table 4
Matrix table of BIGMEAT's learning processes and learning outcomes in Alliance F.

ALLIANCE F		Learning processes at BIGMEAT (learning cycles)			
		Initial conditions	Learning	Re-evaluation	Readjustment
Learning outcomes at BIGMEAT	About	<i>Personal fit:</i> Alignment with startup management, compatibility of competencies	<i>Local market challenges:</i> Regulatory barriers	<i>Dealing with challenges:</i> Open communication, more support for startup	<i>Goal readjustment:</i> Postponing market launch, adjusting alliance management
	From	<i>Fascination</i> with R&D process, awareness of opportunities for core business	<i>New R&D knowledge</i> for development of plant-based protein products, potential for competitive advantage <i>New sustainability perspectives</i> related to global food security	<i>Re-orientation:</i> Desire to focus on own strength	<i>New innovativeness:</i> Accelerating development of own plant-based protein products

In the third and final data analysis step we reconstructed the timeline of alliance learning and linked it to BIGMEAT's innovation process. To increase the findings' validity, we conducted three triangulation interviews (Interviews 9; 10; 11) as well as a presentation and group meeting with four key BIGMEAT managers toward the end of data analysis in late February 2020. These measures did not result in additional second-order codes of the previously collected data on the alliance learning process.

4.1.1. Findings

The findings on BIGMEAT's alliance learning are presented in three parts. The first two parts cover alliance learning processes and alliance learning outcomes, with tables summarizing the key data findings and relating them to prior research. The third part merges the key findings into a *process model for alliance-driven learning for corporate sustainability innovation*.

4.2. BIGMEAT's alliance learning processes

The data indicates that while BIGMEAT learned extensively in its alliances with sustainability startups, the learning scope and intensity varied. This variation in learning over time is seen in the different temporal occurrence of learning *about* and learning *from*, impacting the frequency of learning cycles, as well as in the different experiences for BIGMEAT in distinct learning phases. Fig. 3 depicts the learning cycles for BIGMEAT in each of the nine alliances as boxes encompassing instances of learning *about* and/or *from*, re-evaluation and readjustment in the alliance learning phases.

Occurrence of learning types: The learning cycles of BIGMEAT include instances of both learning *about* and learning *from*. Learning *about* occurred in all nine alliances and continuously throughout the alliance processes. This type of learning was the main trigger for learning cycles, confirming the importance of partner familiarity and trust on the scope of alliance learning (Inkpen and Currall, 2004; Nielsen, 2005; Nielsen and Nielsen, 2009). In total, five alliances (Alliances B, C, D, F and G) went through one or two full cycles of learning, re-evaluation and readjustment, with Alliance C being the only alliance that saw the completion of two full learning cycles. Accordingly, Alliance C offered extensive learning opportunities to BIGMEAT managers (Interviews 5; 8; 10). For middle management, including sales (Interviews 5; 7; 8) and marketing (Interview 12), it was the first alliance the managers were involved in and the one that required the most intensive contact. Late 2019 saw a cluster of parallel learning cycles, pointing to an alliance learning capability developed by BIGMEAT (Anand and Khanna, 2000; Kale and Singh, 2007; Schilke and Goerzen, 2010). In line with this, BIGMEAT managers perceived learning to be particularly high at later phases of the alliance processes (Interviews 4; 9; 10).

The data indicates that learning *from* only occurred after extensive learning *about* had taken place and that it only occurred in the early stages of Alliances C, D and F. Interestingly, learning *from* was limited to those three alliances and did not reoccur in later stages of the alliance process. BIGMEAT's top management offered explanations for the lack of learning from Startups B and G, who they considered "outliers" in terms of learning and integration opportunities due to startup focus on niche products such as insect-based meat analogues or plant-based mozzarella (Board discussion February 2020; Interviews 10; 8).

No.	Finding	Main topic	Relation to prior research
1.1	While the established firm continuously learned <i>about</i> all partners, the occurrence of learning <i>from</i> was limited to three instances and partners, and was not relevant in later alliance phases.	The diverging temporal occurrence of learning <i>about</i> and learning <i>from</i> in the alliance process	The finding contrasts with earlier research suggesting that the partner management phase would be dominated by learning <i>from</i> (Das and Kumar, 2007).

Three learning phases: The data findings suggest that BIGMEAT's overall alliance learning process can be separated into three distinct phases (bottom, Fig. 3). The first phase involved overcoming a perceived "inhibition threshold" to learning (Interview 10). Before entering the first alliance, Alliance S, the startups were perceived as "ideological stereotype images of enemies" (Informal interview 1) and reservations existed on both sides about collaboration between a meat firm and a vegan firm (Interviews 1; 3; 10; 13). The differences in values and missions (see Appendix C) strongly impacted the early alliance phase (Interviews 1; 10; 13). Barriers were

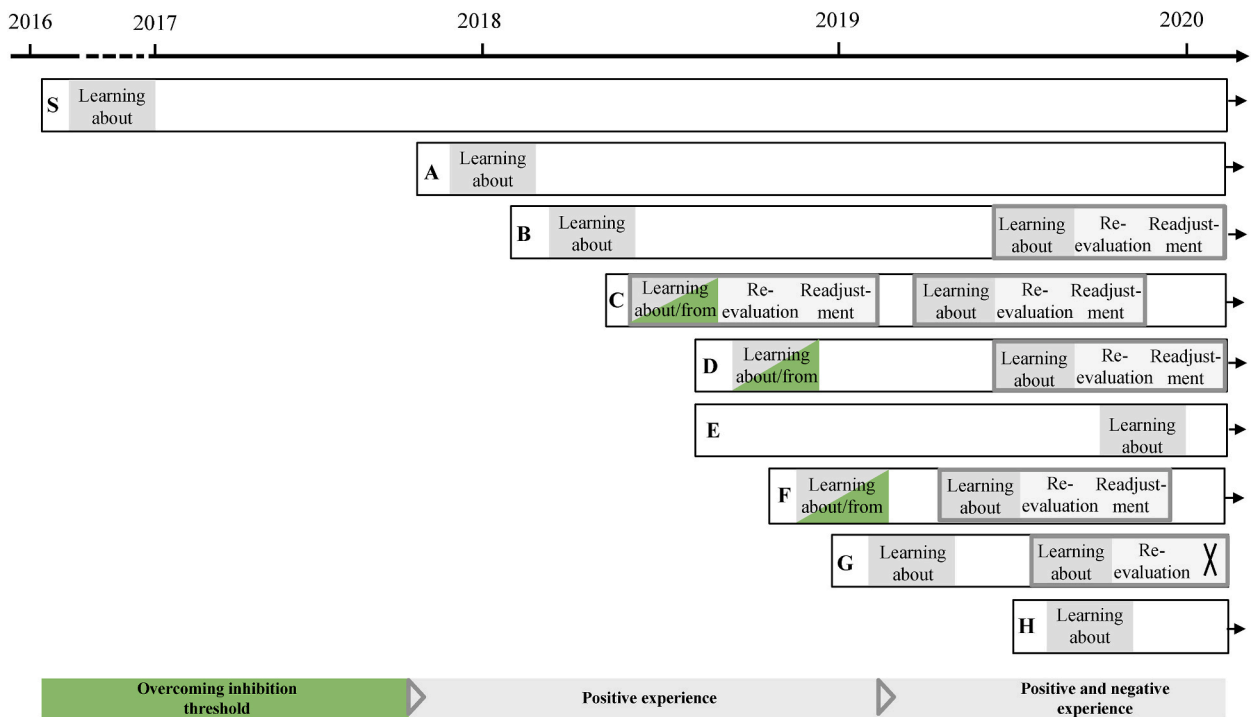


Fig. 3. BIGMEAT timeline of 'learning from' and 'learning about' along distinct alliance learning phases.

perceived as high due to stakeholder expectations, including employees and customers, which is also why the first alliance was never disclosed to the public (Interviews 1; 10; 13). However, with Alliance S, BIGMEAT managers recognized the feasibility of collaborating with and learning from vegan sustainability startups: *"Everyone can learn from the other. It's not that one is bad and the other one is good. Let's just try this experiment"* (Interview 10). Learning was especially facilitated by the pragmatism expressed by both parties, i.e. their ability to look beyond differences in values and missions and focus on the joint alliance objective (Interviews 1; 10; 13; 14; 16; 19). Alliance S created the conditions necessary for forming Alliances A, B and C and thus for entering a second phase marked by positive alliance experiences (Interview 10).

The second phase included acquiring valuable knowledge for BIGMEAT *about* and *from* the alliance partners. Some of these positive experiences continued to occur further in the process whenever BIGMEAT entered alliances with new alternative protein startup partners. In initial positive learning experiences with startup partners, BIGMEAT managers learned *about* the pragmatic approach and collaborative potential of vegan companies and startups (Interview 10; 6), *about* the market potential of *"second generation"*² plant-based products (Interview 6), *about* the products' compatibility with BIGMEAT's existing production know-how (Interviews 1; 8) and customer base, the so called *"flexitarians"*³ (Interviews 5; 9), *about* the products' global sustainability potential (Interviews 4; 5; 2; 9), *about* new markets including the fish, egg and cheese markets (Interviews 10; 11; Informal interview 17), and *about* the potential applications of new technologies such as 3D-printing (Interview 9). Particularly valuable knowledge was generated in the context of BIGMEAT's learning *from* three startups, Startups C, D and F. This type of learning adopted a dual nature and included both product-related and sustainability-related learning. In the former, BIGMEAT managers learned how to develop and produce second generation products through extrusion technologies and novel product ingredients (Interviews 3; 5), the value of a high-emotion branding approach for alternative protein products (Interview 10) and, what was perceived as the most valuable learning, the positioning of such products for proper target group reach (Interviews 8; 10). Concerning the latter, individual managers, in particular BIGMEAT's Board Lead for Alternative Proteins, learned from the startups how business can serve as a powerful vehicle for achieving fundamental change for sustainability (Informal interview 9).

The third learning phase was overwhelmingly marked by negative alliance experiences. In the course of Alliances B, C, D, F and G, BIGMEAT managers had negative experiences with regard to alliance processes relating to what were perceived as bold demands by startup partners, communication misunderstandings and project delays. All this was particularly evident in Alliance C. In the first learning cycle with Alliance C, BIGMEAT had already learned *about* the startup's demand for *"collaboration among equals"* and that it was not willing to *"let go of the reins"* (Interview 10) of strategic product placement decisions. The second learning cycle involved increasing frustration in the BIGMEAT top management team and among various middle managers (Observation 09/2019), which

² Second generation products are in appearance, texture, preparation method and taste almost undistinguishable from the animal-based original.

³ Flexitarians are customers who are keen to reduce meat consumption while still eating (some) animal meat.

resulted in delivery delays (Interviews 5; 8) and what was perceived as uncooperative behavior by the startups (Interview 3; Informal interview 15). The impacts were mostly felt by the sales managers who coordinated interactions between the startups and BIGMEAT's sales partners:

“What is happening right now [in Alliance C] is painful. We are consciously inflicting pain on ourselves. And right now, you need a very, very, very high tolerance limit, because it isn't working out as it should.” (Interview 8)

No.	Finding	Main topic	Relation to prior research
1.2	Learning <i>about</i> and <i>from</i> sustainability startups occurs in three phases marked by (1) overcoming an inhibition threshold, (2) positive experiences and (3) mixed positive and negative experiences.	Subdivision of alliance learning processes into three distinct phases	This subdivision adds to alliance process research (e.g. Heimeriks et al., 2015). The diverging experiences in alliance learning phases specify evolutionary alliance learning paths (e.g. Doz, 1996).

4.3. BIGMEAT's alliance learning outcomes

BIGMEAT's learning *about* and *from* the sustainability startups in the three phases of alliance learning had different outcomes within and beyond organizational boundaries.

Learning about: This type of learning enabled the BIGMEAT top management team to make decisions regarding further alliances, establish processes to ensure efficient alliance handling, and make new structural considerations. The first phase of learning in Alliances S and A helped the leadership team to overcome initial resentment toward vegan startups (Interviews 10; 4; 6) and made them *“open to dealing with technologies that may represent a massive competition to our core business”* (Interview 10). The second phase of valuable learning outcomes, particularly in the context of Alliance C, created a newfound enthusiasm for second-generation plant-based products among BIGMEAT employees (Interviews 10; 7; 6; 3; 4). This was driven by the first taste experience with the startup product: *“I was able to taste it and I said: My goodness, this is a product that can become something”* (Interview 5). The data suggests that initial positive experiences and related valuable knowledge were the main triggers for formulating the new firm strategy of *“growth through diversity”* (Interview 11; Firm magazine 12/2018) and marked the beginning of a deliberate alliance portfolio approach. Valuable learning in Alliance C also facilitated processes and helped avoid pitfalls in subsequent alliances, especially D, E and F:

“Due to the way we learned to work with each other in [Alliance C], a lot of progress is being made here at the firm [BIGMEAT]. Thus, for the next startup, we already know from the outset: Okay, we also have to pay close attention to this or that aspect, we have to approach that differently.” (Interview 4)

BIGMEAT's alliance decisions increasingly shifted from startups for meat analogues (S, A, B, C) to startups that can be placed under a much wider *“protein umbrella”* (Observation November 2018; D, F, G). Engaging with diverse alternative protein startups further away from BIGMEAT's core product range (i.e. meat) stressed the firm's willingness to engage in sustainability-oriented product innovation in the broader alternative protein field. In line with this, the data indicates that learning processes sped up significantly over the third learning phase and BIGMEAT's decisions on alliances were made faster (e.g. F, G, H).

The negative experiences in the third learning phase in Alliances B, D, F and G prompted the top management team to renew financial support for Startup B (Interviews 9; 11), to postpone planned market launches with Startups D and F (Interviews 3; 4; 10), and to eventually terminate Alliance G in January 2020 (Board Discussion 02/2020). Even though experiences were particularly negative with Alliance C and evoked the desire among BIGMEAT managers to become independent from startup demands (Informal interview 15), the benefit of Alliance C in enabling BIGMEAT to change its product portfolio outweighed the frustration (Interview 10). Instances of negative alliance experiences led to the acceleration of BIGMEAT's own plant-based product development (Interview 5; Informal interviews 13; 15). At the organizational level, *“We try to really push our own product development forward now”* (Interview 9). Individuals were also affected by negative alliance experiences: *“[This] spurred me on personally and the same happened with my team, I mean those people working for me”* (Interview 3).

No.	Finding	Main topic	Relation to prior research
2.1	Continuous positive experiences related to valuable knowledge <i>about</i> the startup partners accelerated decisions on alliance partners further away from the core business. Later negative experiences related to learning <i>about</i> startup partners accelerated the established firm's innovation processes.	The changing nature and purpose of learning <i>about</i> over time	The finding extends previous work on alliance learning types (e.g. Inkpen and Currall, 2004) and outcomes of learning <i>about</i> (Doz, 1996) by considering learning over time.

Learning from: Product-related learning *from* the startups prompted BIGMEAT to abandon their previous focus on vegan products serving market niches and instead started to develop second-generation plant-based protein products for the mass market (Interviews 5; 8; 9):

“We increasingly focus on pimping our existing products in terms of marketing and taste, maybe integrating something that the [product of Startup C] has that we haven't had yet.” (Interview 5)

Realizing the boundaries of its own meat focused product development (Interviews 3; 10), BIGMEAT's management first increased collaboration with external product developers and then in early 2020 created new positions in the product development department (Interviews 4; 10; Board discussion 02/2020). This served the future objective to have a separate product development department for alternative proteins: "*The more in-house the better*" (Interview 10). Before engaging in alliances, BIGMEAT's sales manager thought of positioning the alternative protein products with its veggie food service and product brand, targeting vegan or vegetarian consumers (Interview 8). In contrast to this original product placement strategy, BIGMEAT learned from Alliance C to ask retailers to position these products directly in the same aisle as conventional meat products.

"[Startup C] knows today that 92 percent of the customers that buy [products of Startup C] also buy meat. It shows us that the positioning and orientation of [Startup C] is exactly right." (Interview 8)

Based on this learning from Startup C, all new BIGMEAT products will now be positioned in close proximity to animal-derived meat. Concerning product marketing, BIGMEAT managers learned how to implement an alternative protein branding strategy. Before the alliances, BIGMEAT's operations focused on the conventional high-volume meat market, which typically does not involve any brands. In late 2019 and early 2020, BIGMEAT formulated its first social media strategy and planned a separate communication channel for BIGMEAT's own new alternative protein brand (Interview 11; Board discussion 02/2020). This activity was not directly triggered by the alliances, but "*It helps to see, of course, which successes a partner [...] has with which strategy. In terms of social media, [Startup C] is certainly a good example*" (Interview 12). The more knowledge about plant-based protein innovations filtered into BIGMEAT's product development department, the more experimental and ambitious BIGMEAT became in the development of its own plant-based products (Interview 4; Informal interview 9). BIGMEAT now aims at increasing the share of total revenue for alternative protein products from 5% in January 2018 to 25% in 2025 (Media report 08/2019). However, the rapid implementation of alternative protein products was only possible through learning enabled by BIGMEAT's existing expertise and the infrastructure of the conventional meat industry.

Sustainability-related learning that occurred in the context of the three alliances prompted individual BIGMEAT employees to adopt novel perspectives and integrate global sustainability concerns into decision-making (Interview 4; Informal interview 15). BIGMEAT's project team member and trend scouter, for instance, recounts how the interaction with the founder of Startup F gave him a new "*awareness to find alternatives*" and encouraged him to consider global food security concerns. According to him, "*These are perspectives that I have only adopted in the last few years because of such people and companies*" (Interview 4). Similarly, other BIGMEAT managers, after learning about the sustainability potential of the startups' products, began to question the long-term viability of conventional meat production and became more open toward alternative protein solutions (Interviews 3; 5; 8; Informal interview 7). Adopting the startups' approaches to the development, positioning and marketing of BIGMEAT's plant-based product innovations was increasingly seen as a way to combine the goals of increasing sales revenue in the mass market and gaining competitive advantage as well as the proactive goal of contributing to sustainability (Interview 9; Informal interview 9). The data indicate that knowledge spillovers of sustainability perspectives and goals were highly welcomed by the startup owners, who saw BIGMEAT's involvement in the alternative protein field as contributing to their agenda of transforming the market toward sustainability (Interviews 14; 15; 17). The owner of startup A states, for instance:

"We are definitely an ideologically-driven startup [...] Maybe in other ways [BIGMEAT] wouldn't have been exposed to the potential of the ideologically-driven activities [we display in our business]. I think in that sense we are affecting them. And through this, [BIGMEAT] is also exposed to the audiences that very much relate to this ideology. And [BIGMEAT] sees other potential value in that as well. I think it's extremely beneficial for all sides." (Interview 14)

No.	Finding	Main topic	Relation to prior work
2.2	Product-related knowledge for sustainability innovation advanced the established firm's innovation capability. Sustainability-related learning <i>from</i> sustainability startups resulted in changes to perspectives and behaviors of individuals in the established firm, advancing their ambition for corporate sustainability.	The dual nature and purpose of learning <i>from</i> in the context of sustainability innovations	The specification of learning <i>from</i> in the context of sustainability innovations extends work on alliance learning types (Inkpen and Currall, 2004) and outcomes of learning <i>from</i> (e.g. Alvarez and Barney, 2001)

Combined learning over time: The continuous flow of valuable knowledge related to learning *about* the startup's high market potential and the products' compatibility with BIGMEAT's existing expertise, and the occasional occurrence of learning *from*, which was related to developing and marketing plant-based products, coupled with later negative experiences related to alliance processes and coordination resulted in a powerful outcome for sustainability innovation. The combination of different learning types and experiences over time made BIGMEAT's top management eager to find ways to "*extremely expand*" in the alternative protein field while simultaneously avoiding financial risks, dependencies and challenges that come with an increasing number of alliance partners (Informal interview 6). As a result, they decided to co-found a global accelerator platform for plant-based protein products as well as a joint venture for the production and distribution of these products across Europe (Interview 9; 10; 11). With these new activities, BIGMEAT was aiming at the "*accelerated development of strong brands, high quality standards and a wide range of products for a mass market that*

extends far beyond vegan and vegetarian niches” (Press release 02/2020).

No.	Finding	Main topic	Relation to prior research
2.3	The combined effect of alliance learning types and alliance learning experiences over time resulted in sustainability-oriented corporate entrepreneurial activities aiming at broader market impact	The large-scale sustainability impact of accumulated alliance learning experiences	Adds a market perspective to the inter- and intra-organizational perspective on alliance learning outcomes suggested by previous research focused on alliance performance (e.g. Liu and Lui, 2020), alliance decisions (e.g. Heimeriks et al., 2007) learning capabilities (e.g. Schilke and Goerzen, 2010) and corporate innovation (e.g. Kavusan et al., 2016)

The findings show that learning from various startups in strategic alliances continuously increased BIGMEAT’s sustainability innovation in the alternative protein field.

4.4. Process model development

A new process model for alliance-driven learning for corporate sustainability innovation depicts how the findings are sequentially linked (Fig. 4). The grey area encompassing alliance learning processes combines Findings 1.1 and 1.2 on alliance learning types and experiences in three alliance learning phases. The underlying light grey area encompassing alliance learning outcomes combines Findings 2.1, 2.2 and 2.3 on alliance decisions, in-house sustainable product innovation and sustainable mass market transformation. The temporal sequences as well as direct and indirect influences of alliance learning are indicated by dark colored arrows.

In line with Finding 1.2, the conceptual model distinguishes three learning phases in the evolutionary alliance learning process. The different scopes and contents of the learning cycles, which are represented in Finding 1.1, suggest an at least equal importance of learning *about* and learning *from* for corporate innovation. The larger distance between the first and second learning cycles indicates the inhibition threshold identified in Finding 1.2. In line with Finding 2.3, the dark arrows at the top and bottom show how the combination of alliance learning types and experiences can advance and accelerate corporate entrepreneurial activities for sustainable mass market transformation. Such transformation is understood as the replacement of conventional products, services and market structures by superior environmental and social products and services (Hockerts and Wüstenhagen, 2010; Schaltegger and Wagner, 2011). In the case of BIGMEAT, this happened directly through (1) the formation of alliances further away from the core business (Finding 2.1, arrows at top), and (2) the acceleration of in-house product innovation (Finding 2.2, arrows at bottom). The dotted arrows show the indirect transformation outcomes of sustainability learning (Finding 2.2). They visualize how personal learning from startup owners advanced the sustainability ambition of individual managers at BIGMEAT, influencing the firm’s innovation activities and therefore also driving market change. The dark colored areas in the process model indicate those alliance learning characteristics

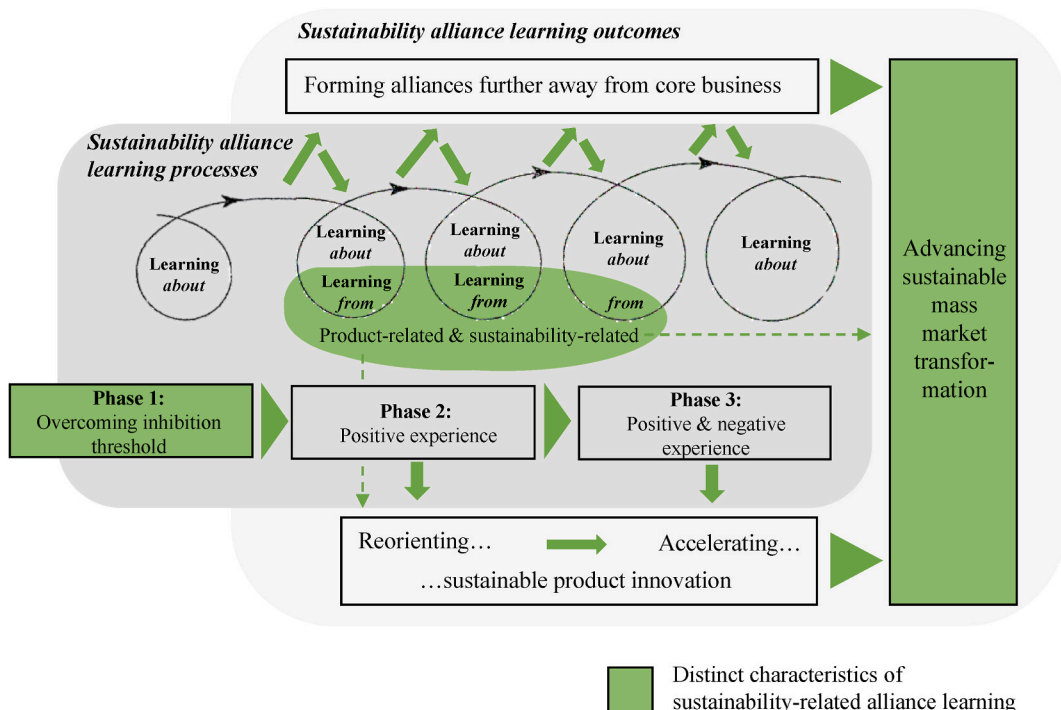


Fig. 4. Process model of alliance-driven learning for corporate sustainability innovation.

that were specific to the sustainability context. The following section elaborates on how these insights help close the research gap identified in this paper.

5. Discussion

Previous research dealing with alliance learning processes and outcomes has described learning as highly evolutionary (Doz, 1996) and has defined two main types of learning, learning *about* and learning *from*, which influence decision-making and the success of alliances or corporate innovation in the established partner firm (Inkpen and Currall, 2004; Das and Kumar, 2007). In this regard, there are some general findings about the temporal occurrence of learning *about* and *from* in the alliance process (Das and Kumar, 2007). So far however, no empirical study has explored alliance learning processes in the context of sustainability innovations, in particular different learning experiences, challenges and outcomes. Our case findings address the research gap by offering insights into the processes and outcomes of an established firm's learning in alliances with sustainability startups. Our study makes important contributions to the existing literature as discussed in the following.

5.1. Characteristics of alliance learning processes and outcomes for sustainability

The study findings are in line with the initially posed assumption that alliance learning processes and outcomes differ in the context of sustainability innovations. Our process model shows the three distinct characteristics of sustainability-related alliance learning (see dark colored areas in Fig. 4). Each of these characteristics extends prior research in alliance learning.

Inhibition threshold: The inhibition threshold identified in the study, which is seen in an initially reduced learning scope and pace, provides a new temporal perspective on differences of learning processes between established firms and sustainability startups. The observed hesitancy and only gradual increase in learning pace over time extends previous alliance learning research that has emphasized the facilitation role of partner familiarity and trust for learning in alliances (Inkpen and Currall, 2004; Nielsen, 2005; Nielsen and Nielsen, 2009). Our study's findings combine insights on alliance learning processes with previous sustainability research, which has pointed to potential complications in alliance learning due to differences between mainstream and sustainability actors (London et al., 2004; O'Mahony and Bechky, 2008; Rondinelli and London, 2003; Stern and Hicks, 2000). In the case of BIGMEAT, extensive learning *about* sustainable startup partners and their collaborative potential (particularly Alliance S) was necessary for the firm to eventually learn *from* the first startup (Alliance C) in later phases of the alliance process. The inhibition threshold experienced in sustainability-oriented alliances can thus help to explain the observed time lag between the first experience of learning *about* and the first experience of learning *from*, and the gradual acceleration of alliance learning over time. This indicates that the more alliances an established firm enters into, the greater the likelihood is to find sustainability partners to learn *from* and to find the one special alliance that becomes the main driver of learning for sustainability innovation.

Dual nature of learning from: By outlining the temporal occurrence and outcomes of sustainability-related learning, our study adds a new dimension to learning *from* that becomes relevant in the context of sustainability innovations and that has not yet been discussed in strategic management literature (Doz and Hamel, 1998; Khanna et al., 1998; Inkpen and Currall, 2004; Inkpen and Tsang, 2007). The adoption from startup owners of new sustainability perspectives by some BIGMEAT managers highlights the relevance of personal interactions for sustainability innovations. This finding relates to Felin et al.'s (2012) microfoundation view of capabilities. The finding that sustainability startup partners welcomed sustainability-related learning at the established firm conflicts with previous alliance learning research. It was previously assumed that accessing and internalizing knowledge from partners constitutes a learning race and struggle for dominance that negatively impacts the relationship between the partner firms (Alvarez and Barney, 2001; Hamel, 1991; Inkpen and Beamish, 1997; Inkpen and Currall, 2004; Van de Ven and Walker, 1984). While this might be true for conventional product-related learning outcomes, the opposite may be true for sustainability-related learning outcomes. As BIGMEAT only internalized sustainability-related knowledge from the three startups that also provided relevant product-related knowledge, our study further suggests that sustainability-related learning *requires* previous valuable product-related learning.

Learning outcomes for market transformation: The identification of alliance learning outcomes *beyond* organizational boundaries extends previous alliance learning research, which has focused on learning outcomes for alliance learning capability and alliance performance (e.g. Kale and Singh, 2007; Liu and Lui, 2020), decisions on alliance formation (e.g. Gulati et al., 2009; Heimeriks et al., 2007), and corporate innovation (e.g. Subramanian and Soh, 2017). The case of BIGMEAT gives indications of alliance learning outcomes that benefit the transformation of mass markets toward sustainability. It is thus in line with previous suggestions that large established companies have significant impact on the marketplace by dedicating resources toward addressing sustainability challenges (Hockerts and Wüstenhagen, 2010). The learning-triggered formation of additional distribution alliances increases the availability of meat alternatives in mainstream distribution channels. Early impacts were observed in the context of Alliance C, with products having reached conventional meat consumers, as well as non-organic retail and food service chains in May 2019, thirteen months after Alliance C was established. Thus, our finding also supports that there is a positive relationship between corporate sustainability innovations and competitiveness (Hall and Vredenburg, 2004; Hermundsdottir-Aspelund, 2021). The learning alliance with BIGMEAT further accelerated the expansion rates of individual startups, thereby increasing their impact on conventional markets. For instance, Startup C's revenue quadrupled between 2018 and 2020. Considering that the goal of sustainability innovations is to solve broader problems relating to planetary boundaries or the United Nations' Sustainable Development Goals (e.g. Johnson and Schaltegger, 2020), market transformation triggered by alliance learning has the potential to contribute to the sustainable development of society as a whole.

5.2. Temporal occurrence and purpose of learning types in specific learning phases

Our process model highlights the study's new findings on the temporal occurrence of learning *about* and learning *from* in the three alliance learning phases, and differentiates the learning type and purpose depending on contextual alliance experiences (see learning cycles, types and phases in Fig. 4). While these findings arise from our sustainability-oriented case study, our findings suggest that they are not necessarily limited to the sustainability context.

The crucial role of learning about: The continual occurrence and far-reaching impact of learning *about* emphasize the crucial role of this type of learning for advancing corporate innovation. This finding is distinct from Das and Kumar's (2007) suggestion that learning *from* dominates learning *about* in the alliance operation phase. In contrast, our empirical study identified the repeated dominance of learning *about* over learning *from* in the alliance process. Furthermore, our findings extend research that has limited the outcomes of learning *about* to alliance-specific processes (Doz, 1996; Ireland et al., 2002). Our study suggests that learning *about* directly accelerates innovation in the established firm, particularly in the later stages of the alliance process. The prevalence of learning *about* enabled BIGMEAT to enter a wide range of alliances with product offers increasingly distanced from BIGMEAT's core business of animal derived meat products. Confirming Grant and Baden-Fuller (2004) knowledge accessing theory, we find that learning *about* can trigger opportunities for strategic re-orientation over time. Our study, however, does not support Subramanian and Soh's (2017) finding that increased partner diversity positively impacts the breadth of the resulting corporate innovation. Even though BIGMEAT acquired knowledge with regard to plant-based meat, egg and dairy as well as cell-based meat, the BIGMEAT product innovations remained focused on plant-based meat substitutes.

Positive and negative experiences: Phase 2 and 3 of our process model suggest that alliance learning involves positive experiences in the early phase and mixed positive and negative experiences in later phases. Indeed, past research has addressed positive experiences related to the acquisition of valuable knowledge (Das and Kumar, 2007) and negative experiences related to learning challenges in alliances between established firms and startups (Barabel et al., 2014; Doz, 1988; Minshall et al., 2010; Pérez et al., 2012). Our case study, however, introduces a novel process perspective on these different experiences within alliances. Most importantly, we show that negative experiences in Phase 3 of the alliance process, despite being detrimental to the alliance process as such, can become key drivers of radical innovation activities in an established firm. In the case of BIGMEAT, negative alliance experiences had a very significant impact due to an aggregation of parallel learning cycles within different alliances. In the case of Alliance C, for example, negative experiences were linked to the startup's strong sales relationships and this resulted in an unanticipated sense of dependency at BIGMEAT. This finding conflicts with previous research suggesting that partner asymmetry implies unequal processes to the detriment of the smaller firm (Barabel et al., 2014; Doz, 1988; Minshall et al., 2010; Pérez et al., 2012; Prashantham and Birkinshaw, 2008).

6. Conclusion, limitations and future research

This study provides empirical insights into the processes and outcomes of alliance learning in the context of sustainability innovation and establishes a conceptual link to their role in fostering market transformation toward sustainability.

The analysis provides valuable contributions to the alliance learning literature by identifying three distinct characteristics of sustainability-related alliance learning. We found that learning in alliances with sustainability startups (1) requires overcoming an inhibition threshold, and is thus initially slow and only accelerates over time, (2) includes not only product-related learning (i.e. development, marketing), but also sustainability-related learning (i.e. perspectives, goals), and (3) can indirectly and directly advance a firm's contribution to sustainable mass market transformation. The case of BIGMEAT shows how sustainability-related alliance learning processes can be separated into three distinct alliance learning phases with positive and negative alliance experiences, in which the temporal occurrence of learning types and their purpose (*about* and *from*) differ. Most importantly, we found the crucial role of learning *about* for advancing corporate sustainability innovation over time, which conflicts with previous research's strong focus on learning *from*.

BIGMEAT constitutes a unique case in the meat industry, and accordingly case research was designed for internal validity, construct validity and reliability (Gibbert et al., 2008). To increase external validity (i.e. transferability) of the findings and therefore our alliance learning process model to other established firms, future research could further investigate processes and outcomes of direct collaborations between established firms and sustainability startups. In addition, the startup perspective could be explicitly explored by analyzing learning cycles and outcomes for small firms collaborating with large firms. These analyses would constitute a valuable addition to the findings presented here. The processes of intra-organizational knowledge diffusion and potentially diverging learning outcomes in different organizational departments or among individual employees have a high impact on corporate innovation. It would therefore be valuable to explore these differences with regard to learning *about* and learning *from* alliance partners and their potential impact on corporate sustainability innovation. Further, it might be worthwhile to investigate to what extent reputational concerns – as those voiced in Alliance S – can hamper corporate engagement with sustainability innovation. Lastly, since our study indicates only the potential for mass market transformation, future longitudinal studies could provide more detailed accounts of actual market changes following alliance processes.

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Author statement

Charlott Hübel: Writing- Original Draft, Investigation, Formal Analysis, Conceptualization Ilka Weissbrod: Writing- Review & Editing, Conceptualization, Formal Analysis Stefan Schaltegger: Supervision, Conceptualization, Writing- Review & Editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Interview details

Table A.1

Details of semi-structured interviews at BIGMEAT and startups

Interview No.	Firm of interviewee	Position of interviewee(s)	Duration of interview
1	BIGMEAT	CEO/Chair	74 min
2	BIGMEAT	CEO of key subsidiaries	47 min
3	BIGMEAT	Project Manager/Product Developer	52 min
4	BIGMEAT	Project Manager/Trend Scouter	47 min
5	BIGMEAT	CEO of international sales firm	45 min
6 (group interview)	BIGMEAT	A: Head of Sustainability Management & PR B: Sustainability Manager & Board Secretary	42 min
7	BIGMEAT	Alliance Coordination Manager	34 min
8	BIGMEAT	Sales Manager	51 min
9	BIGMEAT	Head of Alternative Protein Unit	49 min
10	BIGMEAT	Board Lead for Alternative Proteins	73 min
11	BIGMEAT	Press Spokesperson	47 min
12	BIGMEAT	Marketing Manager	47 min
13	Startup S	Founder/CEO	40 min
14	Startup A	Co-Founder/CEO	52 min
15	Startup B	Co-Founder/CEO	49 min
16	Startup C	Board member	32 min
17	Startup D	Co-CEO/Chair	30 min
18	Startup E	Executive Vice President	36 min
19	Startup F	Co-Founder/CEO	29 min
20	Startup G	Founder/CEO	52 min

Table A.2

Details of informal conversational interviews at BIGMEAT

Interview No.	Interviewee	Date of interview	Interview location/context
1	Board Lead for Alternative Proteins	August 2018	Phone conversation
2	CEO of key subsidiaries	September 2018	Firm headquarters
3	Project Manager	October 2018	Firm headquarters
4	Board Lead for Alternative Proteins	November 2018	Industry event
5	Board Lead for Alternative Proteins	January 2019	Firm headquarters
6	Board Lead for Alternative Proteins	February 2019	Phone conversation
7	Project Manager	March 2019	Press event
8	Board Lead for Alternative Proteins	May 2019	Meeting with potential alliance partner
9	Board Lead for Alternative Proteins	May 2019	Industry event
10	Board Lead for Alternative Proteins	June 2019	Industry event
11	International Sales Manager	June 2019	Industry event
12	Board Lead for Alternative Proteins	July 2019	Firm headquarters
13	Board Lead for Alternative Proteins	August 2019	Firm headquarters
14	Sales Manager	August 2019	Firm headquarters
15	Board Lead for Alternative Proteins	September 2019	Industry event
16	Board Lead for Alternative Proteins	October 2019	Industry event
17	Head of Alternative Protein Unit	October 2019	Industry event
18	Head of Alternative Protein Unit	November 2019	Firm headquarters
19	Marketing Manager	November 2019	Firm headquarters
20	Board Lead for Alternative Proteins	November 2019	Firm headquarters

Appendix B. MAXQDA coding process

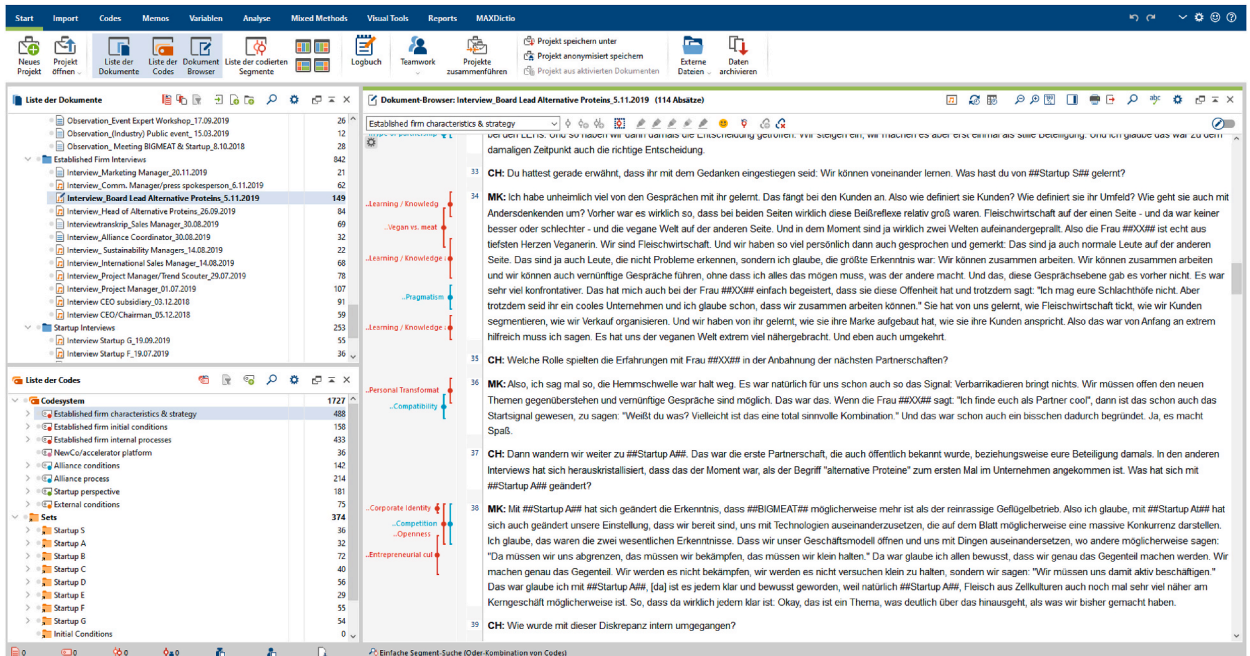


Figure B.1. Example of interview coding with the data analysis software MAXQDA.

Appendix C. Motivations for entering the alliances

Table C.1
BIGMEAT and startup motivations for entering the alliances

Alliance	Articulated motivation for entering alliance	
	BIGMEAT	Startups
S	“We got to know each other through contacts and then started the talks. And we said: You know what? We can actually both learn from each other. Everyone can learn from the other. It’s not that one is bad and the other one good. Let’s just try the experiment.” (Interview 10)	“For me it was more like the pressure is taken away from me ... It was more like saying it is great that it is taken away from me, that you have a partner who would catch you if you stumble. I did wish for such opportunities that they would help you to gain a foothold abroad, but I didn’t know whether everything would really happen that way or whether they really did have the opportunity. This makes it especially great that it worked out too.” (Interview 13)
A	“We have to deal with it, because if we don’t do it, others will. And we cannot understand this technology if we are not involved. And we cannot prevent this technology.” (Interview 10)	“We are definitely an ideologically-driven startup. I think it is one of our advantages. From the start we thought that partnering with the meat industry and with major players like [BIGMEAT] would be extremely important and beneficial to cultured meat firms. [...] We wanted to partner with them, because we believed that, in order to really make an impact, partnering with an existing industry - that would allow us to get the type of [impact]” (Interview 14)
B	“[Alliance B] enables us as [BIGMEAT] to get a taste of a new area and to benefit a little from the startup world.” (Interview 10)	“I would say: innovation meets experience. Especially at the beginning. I think this is extremely fruitful and there should be a lot more of it. [...] Maybe I’m only speaking for myself here, but I think we now know what sustainability means. We try to live accordingly. I think many of the older generation are becoming familiar with the term, but not yet properly. This is why you have to combine innovation and experience.” (Interview 15)
C	“But in the case of [Startup C], when you bite into [the product] for the first time, I thought: This is a completely new league, which we don’t even know in Europe. This is how the idea came up: Can’t we also offer this to our customers, who we already have in the meat sector, and thereby possibly turn it into an extremely attractive product?” (Interview 10)	“Together we can achieve something that one cannot achieve alone, at least not in time. The meat producer cannot bring the product to the consumer if he doesn’t get it from us. We cannot address the consumer in [Europe] because we do not have the infrastructure, the network, the distribution and the cold chain. If our common goal is to bring the product to the European consumer, then we need a partner in Europe who enables us to do this, and so we have an ideal situation.” (Interview 16)

(continued on next page)

Table C.1 (continued)

Alliance	Articulated motivation for entering alliance	
	BIGMEAT	Startups
D	“Doesn’t it make sense to include these areas, as we also have the sales logistics and production skills to cover these products accordingly?” (Interview 10)	“For us, because we have a mission, because time is of the essence, who better to help us speed that up than the firms that are already really well established? [...] I don’t care whether you are looking from animal welfare or environmental degradation or climate change or health care, [for] all of those things, time is not on our side. So, speed to market, speed to innovation, all of that strategic help accelerate and that’s why we partner with them.” (Interview 17)
E	“We are investing in [Startup E] with a small amount to reduce the use of soy as much as possible.”	“It allowed us to accelerate discussions with our partners for the various products. It allowed us to start development of plant two and three. It was very meaningful to us in terms of going from demonstration to pure commercial.” (Interview 18)
F	[Startup F] fits under [BIGMEAT’s] new “protein umbrella.” It is more about “enlarging the pie,” creating completely new categories, and giving customers a choice. (Meeting 10/2018)	“If firms can help us do more good faster, I am going to partner with them. It’s as simple as that.” (Interview 19)
G	The owner of [Startup G] approached [BIGMEAT] and he is “a great guy.” The cheese has a lot of possible uses and can enhance the existing product range. (Informal interview 15)	“Through [BIGMEAT], I have the opportunity to be represented in so many supermarkets at the same time, and discounters too, and thus I can do TV advertising [...] [BIGMEAT] opens the doors for us to bring the product to the midst of society.” (Interview 20)
H	“In the case of [Startup H], it is also a long-term partnership, where still a lot of development has to be put in. But if it is going to happen, it is a really great technology. And we will be a part of it.” (Interview 9)	no startup interview -

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Charlott Hübel is the Robert Bosch Foundation scholar of Management and Entrepreneurship in the interdisciplinary research project “Processes of Sustainability Transformation” at Leuphana University Lüneburg, Germany. Her research focuses on entrepreneurial and managerial approaches and processes through which mainstream firms strategically reorient towards sustainability and contribute to industry transformations. Email charlott.huebel@leuphana.de



Ilka Weissbrod, PhD, teaches and researches at the intersection of Innovation and Strategy in Sustainability Management. 10 years as innovation advisor to international companies large and small and her PhD work at Imperial College London are the foundation of her research themes: business experimentation for sustainability, sustainable business models, and urgency of implementing sustainability-oriented innovation. Ilka is closely involved with business practice through research projects, and in speaker and advisory roles. Email ilka.weissbrod@leuphana.de



Stefan Schaltegger is Professor of Corporate Sustainability Management as well as Founder and Head of the Centre for Sustainability Management (CSM) and the MBA Sustainability Management at Leuphana University Lüneburg, Germany. His research fields in the area of corporate sustainability management cover sustainable entrepreneurship, stakeholder theory, sustainability accounting and management. He has received various research awards and an honorary doctorate and is associate editor or member of the editorial board of international management and sustainability journals. Email stefan.schaltegger@leuphana.de

Entrepreneurship-driven organizational transformation for sustainability: a sensemaking lens

Entrepreneurship-driven transformation

Charlott Hübel

Centre for Sustainability Management, Leuphana Universität Lüneburg, Lüneburg, Germany

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Abstract

Purpose – This paper adopts a sensemaking lens to explore the process of entrepreneurship-driven organizational transformation for sustainability.

Design/methodology/approach – Analysis is based on an in-depth case study of a large European meat company. Sensemaking by top and middle managers is analyzed over the period of 18 months.

Findings – The findings show how, over time, bidirectional sensemaking, that is, sensemaking for and of sustainability-oriented entrepreneurship, directed and accelerated organizational transformation for sustainability. The case company transformed with regard to organizational strategy, structure, operations and identity. The process revealed temporally different involvement of top and middle managers in sensemaking.

Originality/value – This paper offers unique insights into fast and emergent sustainability-oriented change in an established organization within a highly topical context. The results highlight how continuous and increasingly shared sensemaking can help top and middle managers navigate organizational change for sustainability in dynamic environments over time.

Keywords Sustainability, Transformation, Corporate entrepreneurship, Organizational change, Sensemaking

Paper type Research paper

Introduction

To address pressing sustainability challenges and simultaneously remain competitive, established organizations are required to transform toward sustainability in a timely manner (Millar *et al.*, 2012; De Matos and Clegg, 2013). Transformative organizational change can be facilitated and accelerated through sustainability-oriented entrepreneurship, that is, innovative activities that help organizations exploit entrepreneurial opportunities while meeting environmental and social objectives (Miles *et al.*, 2009; Provasnek *et al.*, 2016; Schaltegger and Wagner, 2011). Such innovative activities may include sustainable product, process or business model innovations (Klewitz and Hansen, 2014; Phan *et al.*, 2009) as well as the creation of joint ventures (Espinosa and Suanes, 2011) and spin-offs (Parhankangas and Arenius, 2003). Entrepreneurship-driven changes amount to organizational transformation for sustainability, when sustainability is integrated in essential domains of organizational activity, including strategy, structure, work practices, power distribution, culture and identity (Sroufe, 2017; Müller and Pfleger, 2014; Romanelli and Tushman, 1994).

Pursuing entrepreneurial activities (Hill and Levenhagen, 1995; Bettiol *et al.*, 2012; Dutta and Thornhill, 2014) and embedding sustainability into the organization (Van der Heijden *et al.*, 2012; Hahn *et al.*, 2014) involve high complexities and uncertainties. To manage these processes, there is a need for organizational decision-makers to *make sense* of them (Weick *et al.*, 2005; Lüscher and Lewis, 2008; Maitlis and Christianson, 2014). On the one hand, they need to recognize and conceptualize entrepreneurial opportunities for being able to pursue them (Cornelissen and Clark, 2010, p. 539; Mitchell *et al.*, 2011; Kaffka *et al.*, 2020); on the other hand, they need to interpret activities to be able to deduce appropriate organizational changes (Hill and



Levenhagen, 1995; Bettiol *et al.*, 2012; Dutta and Thornhill, 2014). Due to the dynamism of the entrepreneurial context (Johnson and Bock, 2017; Hill and Levenhagen, 1995) and the status quo challenging nature of sustainability measures (Miles *et al.*, 2009; Hahn *et al.*, 2014), the need for sensemaking might reoccur along an organization's sustainability-oriented entrepreneurial journey. This can have crucial implications for organizational transformation over time, rendering a process perspective important (Langley *et al.*, 2013). This research therefore explores *how managerial sensemaking directs entrepreneurship-driven organizational transformation for sustainability over time*.

The adequacy of the research focus results from two main gaps within the literature. First, there is no research at the intersection of sensemaking, entrepreneurship-driven organizational change and sustainability. While previous studies have analyzed sensemaking for sustainability-oriented organizational change (Van der Heijden *et al.*, 2012) and sensemaking for entrepreneurship-driven organizational change (Corley and Gioia, 2004), to date no study brings these insights together. Second, there is no research that investigates how sensemaking in the context of entrepreneurship-driven organizational change unfolds over the course of time with potentially changing entrepreneurial activities. In this regard, few studies have distinguished different directions of sensemaking involved in entrepreneurial endeavors and organizational change (Brown *et al.*, 2015; Smith and Cao, 2007) but have not yet considered how these types interact over time. Similarly, research has pointed to different roles of top and middle managers in sensemaking for entrepreneurship-driven change (Gioia and Chittipeddi, 1991; Balogun and Johnson, 2004; Lüscher and Lewis, 2008) but lacks consideration of potentially divergent involvement throughout the organization's entrepreneurial journey.

The empirical work constitutes an 18-month case study of a large European meat company that has engaged in entrepreneurial activities in the alternative protein field. Analysis of top and middle manager sensemaking reveals that bidirectional sensemaking, that is, sensemaking *for* and sensemaking *of* sustainability-oriented entrepreneurship, led to increasingly radical entrepreneurial activities and increasingly transformative organizational changes. The findings contribute to the sensemaking literature by (1) specifying the temporal progression of bidirectional sensemaking in entrepreneurial established organizations and (2) outlining the diverging involvement of top and middle managers in sensemaking and their implications over time. The findings contribute to the organizational change literature by showing (3) how continuous bidirectional sensemaking can navigate entrepreneurship-driven transformation and (4) how an accumulation of meaning can result in comprehensible but moderate organizational transformation for sustainability.

The introduction of sensemaking as analytical lens is followed by an outline of the research context and the methods adopted for data collection and data analysis. Next, the findings are presented and thereupon discussed by highlighting key contributions. The concluding remarks include managerial implications, limitations and research recommendations.

A sensemaking lens

Sensemaking has been established as a vital lens for studying organizational change (Weick, 1979; Van de Ven and Poole, 2005). This study analyzes sensemaking at the intersection of entrepreneurship, organizational transformation and sustainability, that is, sensemaking regarding sustainability-oriented entrepreneurship and its implications for organizational transformation. Here, analysis distinguishes between (1) sensemaking *for* sustainability-oriented entrepreneurship, which allows for the pursuit of entrepreneurial activities, and (2) sensemaking *of* sustainability-oriented entrepreneurship, which helps initiate respective organizational changes. Top managers and middle managers adopt crucial roles in sensemaking in both directions (Gioia and Chittipeddi, 1991; Balogun and Johnson, 2004; Lüscher and Lewis, 2008).

Sensemaking for sustainability-oriented entrepreneurship

Research on entrepreneurial cognition proposes that entrepreneurship “starts with imagining the opportunity for novel ventures” in the sense that individual entrepreneurs construct meaning for themselves and others to justify the new path (Cornelissen and Clark, 2010, p. 539; Mitchell *et al.*, 2011; Kaffka *et al.*, 2020). It is argued that such sensemaking *for* entrepreneurship is particularly guided by entrepreneurs’ cognitive frames, which help them to construct meaning of changes in the external and organizational environment (Bettiol *et al.*, 2012; Dutta and Thornhill, 2014). For the context of sustainability, Seidel *et al.* (2013) mention how sensemaking *for* sustainability-oriented entrepreneurship can be triggered by society’s increasing environmental awareness and concomitant increased demand for environmentally friendly products.

Previous research has suggested that top managers adopt a crucial role in sensemaking *for* entrepreneurship, as their belief systems substantially guide sensemaking and entrepreneurial action (Smith and Cao, 2007). However, for top managers in established organizations, as opposed to independent entrepreneurs, sensemaking *for* entrepreneurship can come with challenges. As “embedded agents,” they make sense of new meanings always in relation to existing ones (Garud and Karnøe, 2001; Garud *et al.*, 2007). Hence, becoming entrepreneurial often implies questioning the current interpretive scheme and developing and applying a new one (Hill and Levenhagen, 1995). As sustainability measures can be particularly status quo challenging for conventional organizations (Hahn *et al.*, 2014), it is suggested that a corporate sustainability strategy with clear goals (Arnold and Hockerts, 2011; Kennedy *et al.*, 2017) and sustainability principles that are fully embraced by managers (Miles *et al.*, 2009) can facilitate the pursuit of sustainability-oriented entrepreneurship.

Sensemaking of sustainability-oriented entrepreneurship

The implementation of entrepreneurial activities often confronts organizational members with a new organizational status quo that needs to be interpreted and rationalized, that is, made sense of (Hill and Levenhagen, 1995; Bettiol *et al.*, 2012; Dutta and Thornhill, 2014). Such sensemaking *of* entrepreneurial activities involves asking the basic question of “What is going on?” (Lüscher and Lewis, 2008; Weick *et al.*, 2005; Gioia and Chittipeddi, 1991). The need for sensemaking is particularly high in the context of sustainability innovations, as they usually aim at replacement instead of enhancement (Schaltegger and Wagner, 2011; Magnusson *et al.*, 2003) and thereby call into question long-standing practices and cognitive frames (Hahn *et al.*, 2014). A study by Van der Heijden *et al.* (2012) identified sensemaking for organizational change toward sustainability as an emergent, gradual process, suggesting that such change develops slowly over time. Research has left open the question how this sensemaking-directed change would develop in the dynamic and disruptive context of sustainability-oriented entrepreneurship.

The literature distinguishes different roles for top and middle managers in sensemaking *of* entrepreneurial activities. In their study on identity change during a corporate spin-off, Corley and Gioia (2004) found that top managers’ sensemaking helped them to move from initial ambiguity toward a renewed clarity about the new venture. The literature gives different indications of which organizational changes could support this “renewed clarity”: While innovation management research suggests a structural separation between conventional and innovative units (Gilbert, 2006; De Visser *et al.*, 2010), research on hybrid organizations stresses the potential of “selectively coupling” different business logics (Pache and Santos, 2013). Besides making sense of arising complexity themselves, there is a need for top managers to promote the sensemaking of other organizational members about new developments. Here, research on sense-giving emphasizes the importance of metaphors and narratives as well as process facilitators, including organizational routines and practices (Maitlis and Lawrence, 2007; Gioia and Chittipeddi, 1991; Hill and Levenhagen, 1995).

Middle managers are important recipients of sense-giving, as they interpret and implement organizational change (Lüscher and Lewis, 2008; Balogun and Johnson, 2004). The sense-giving literature describes how sense-giving can impact change recipients, particularly pointing to negative or undesired outcomes. On the one hand, recipients could “normalize” the change by making it fit to existing logics, thereby avoiding sensemaking altogether (Ashforth and Kreiner, 2002). On the other hand, they could engage in negative sensemaking, meaning that they discover inconsistencies between their professional identity and the proposed change, and thereby experience temporal identity instability (Conroy and O’Leary-Kelly, 2014) and resist change (Nag *et al.*, 2007). Previous organizational change research has outlined that managers’ resistance of or support for sustainability-oriented organizational change is strongly dependent on their lived experiences, interpersonal interactions as well as personal beliefs and perceptions (Cherrier *et al.*, 2012; Harris and Crane, 2002; Stoughton and Ludema, 2012; Stokes and Harris, 2012). Khan (2018) thus suggests that, to shape sensemaking positively in sustainability-related initiatives, top managers should focus on continuous informal communication practices with employees. In this regard, Maitlis (2005) argues that if both leaders and employees engage in sense-giving, they can jointly create a unitary account with consistent actions.

Linking the two directions of sensemaking

Combining sensemaking *for* and *of* entrepreneurship is a matter of temporality. While sensemaking *for* is future-oriented, sensemaking *of* occurs after an event has passed. In this regard, Brown *et al.* (2015), in their conceptual paper on sensemaking in organizational studies, have differentiated prospective and retrospective sensemaking. The authors encourage research to further unpack prospective sensemaking and to “foreground the practices of strategy and processes of change” (p. 272). Smith and Cao (2007), who conceptualized an entrepreneurial perspective on the firm-environment relationship, give a first indication of linking the two directions of sensemaking in the entrepreneurial context: They state how top managers’ belief systems encourage sensemaking, resulting in entrepreneurial action, and how entrepreneurial action, in turn, can lead to ambiguity, learning and potential changes in top managers’ belief systems. However, the study does not explore respective progressions over time. In a more recent paper, Zhang (2016) found how managers’ perceptions can act as mediator between external developments and organizational change, thereby suggesting a co-evolutionary perspective of organizational change over time.

To date, no study has combined the two directions of sensemaking, sensemaking *for* and sensemaking *of*, to analyze entrepreneurship-driven organizational transformation, not least in the context of sustainability. By combining the two introduced sensemaking lenses to analyze organizational change for sustainability in the entrepreneurial context and by distinguishing the involvement of top and middle manager sensemaking over time, this study can offer novel insights into the role of sensemaking in introducing and navigating sustainability-oriented change in established organizations.

Methods

This paper studies the case of the entrepreneurship-driven transformation for sustainability of a large, family-run European meat product producer, “BIGCO” (Yin, 2017). Analyzing the “temporal progressions” of top and middle managers’ sensemaking *for* and *of* entrepreneurial activities over a period of 18 months, this study can be placed in the field of process studies (Langley *et al.*, 2013, p. 1). However, as the investigation is also concerned with the extent of resulting organizational transformation, that is, the outcome of sensemaking, it includes certain elements of a consequential or outcome analysis (Van de Ven and Huber, 1990). The following sections introduce the case context and detailed data collection and analysis methods.

Case context

Conventional meat producers have been facing challenges related to environmental impacts, animal welfare, working conditions and consumer health (Steinfeld *et al.*, 2006). Additionally, there has been a growing consumer trend toward vegetarianism, with up to one-third of the population in some Western European countries choosing to consume limited amounts of meat (Statista, 2020). At the same time, technological advances have made it possible to re-create the taste and texture of animal-based products using plant proteins, mycoproteins and animal cells (Van der Weele *et al.*, 2019). Since 2015, start-ups have entered the market offering highly innovative, environmentally and ethically sound meat substitutes (Shapiro, 2018). As these products have the potential to fundamentally disrupt the established meat industry, some meat producers like BIGCO have begun to seize entrepreneurial opportunities in the alternative protein field, thereby orienting toward sustainability-related value propositions. BIGCO has formed alliances with start-ups for cell-based, insect-based, plant-based and 3-D-printed protein solutions; has engaged in collaborative plant-based product innovation; and has co-founded an accelerator platform and a joint venture for the distribution of sustainable protein products. The entrepreneurial activities are part of the company’s strategy to secure its competitiveness and long-term survival.

Data collection

Data were collected for 18 months, from August 2018 until February 2020 (Figure 1), starting nine months after BIGCO’s first entrepreneurial activities and two months after the activities had been formalized through a separate board and business unit. To reconstruct BIGCO’s whole entrepreneurial journey, interviewees were asked to recall the pre-entrepreneurial and first entrepreneurial phase, and this recall was used as retrospective data (Pettigrew, 1990).

As shown in Table 1, data collection comprised semi-structured interviews (Wengraf, 2001) and ethnographic interviews (Munz, 2017) with top and middle managers, participant observation (DeWalt and DeWalt, 2002) and documents (Prior, 2003), with each data source fulfilling a different purpose during the analysis. Interviewed top managers include the CEO and chairman, the board lead for alternative proteins (former head of M&A) and the CEO of key BIGCO subsidiaries. Interviewed middle managers include managers from sales, marketing, project management, product development, communication, sustainability management and the director for alternative proteins.

Data analysis

Data analysis was based on qualitative techniques (Miles and Huberman, 1984; Morse, 1994) and included three main steps. In step one, a coding process conducted with the qualitative data analysis software program MAXQDA generated first-order descriptive, process and emotion codes (Saldaña, 2015). This first analysis phase was an ongoing process that started

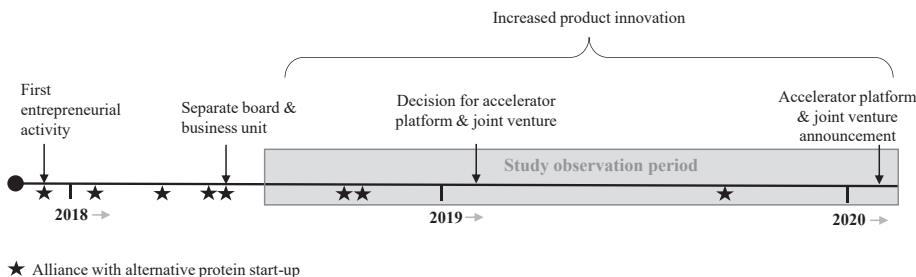


Figure 1. BIGCO’s entrepreneurial activities and study observation period

Data types	Sources	Use in the analysis
Interviews	12 semi-structured interviews with top and middle managers 20 ethnographic interviews with top and middle managers	<ul style="list-style-type: none"> • Reconstruct the entrepreneurial process • Investigate sensemaking processes • Investigate organizational transformation • Supplement formal interviews • Gain deeper insights into personal reflection (i.e. sensemaking)
Balanced participatory observation	11 events (press events, meetings, industry events)	<ul style="list-style-type: none"> • Examine shared sensemaking • Investigate organizational transformation
Documents	61 publicly available documents 8 internal documents	<ul style="list-style-type: none"> • Examine external communication of entrepreneurial activities and organizational transformation

Table 1.
Data types, sources
and use in the analysis

after the first formal interviews and that was based on an iterative approach, which required going back and forth between the data, (i.e. interviews, observation and documents) and the literature (i.e. insights from sensemaking, corporate entrepreneurship and organizational transformation research). The resulting 59 codes were subsumed under four overarching code categories:

- (1) *Initial conditions*: It includes codes related to the company characteristics *before* the initiation of entrepreneurial activities (informed by [Bettiol et al., 2012](#); [Lounsbury et al., 2019](#); [Miles et al., 2009](#)).
- (2) *Sensemaking*: It includes codes related to ambiguity and rationalization efforts as expressed by top and middle managers (informed by [Weick, 1995](#); [Lüscher and Lewis, 2008](#); [Gioia and Chittipeddi, 1991](#)).
- (3) *Entrepreneurial activities*: It includes codes related to product, process and business model innovation activities, collaborations with start-ups and new venture formation (informed by [Phan et al., 2009](#); [Morris et al., 2011](#); [Miles et al., 2009](#); [Klewitz and Hansen, 2014](#)).
- (4) *Organizational transformation*: It includes codes related to changes to strategy, structure, work practices, power distribution and identity (informed by [Romanelli and Tushman, 1994](#); [Orlikowski, 1996](#)). The exclusive focus on top and middle managers and limited observation period did not allow for the identification of culture changes. However, the category includes changes to managers' personal perceptions, which give first indications of culture changes for sustainability (informed by [Stoughton and Ludema, 2012](#); [Stokes and Harris, 2012](#)).

In step two, the timeline of BIGCO's entrepreneurial activities was reconstructed. In line with [McMullen and Dimov's \(2013\)](#) notion of the "entrepreneurial journey," which allows for subdividing activities into phases as part of a dynamic process, BIGCO's entrepreneurial journey could be divided into a pre-entrepreneurial phase and three ensuing, partly overlapping entrepreneurial phases ([Table 2](#)).

Codes and respective text sections for the four categories were ordered chronologically along the entrepreneurial phases, with a clear demarcation of top and middle manager sensemaking. The findings will be presented accordingly. In step three of the data analysis, a presentation and group meeting with four key BIGCO managers in late February 2020 served to validate the study's findings. This measure did not result in any additional codes or categories.

	Pre-entrepreneurial phase	1st entrepreneurial phase	2nd entrepreneurial phase	3rd entrepreneurial phase	Entrepreneurship-driven transformation
Time period	Until 12/2017	12/2017–09/2018	07/2018–09/2019	02/2019–02/2020	
Entr. activities		Forming alliances with start-ups for cell-based meat and insect-based meat analogues; plant-based meat analogues, initiating/intensifying own product innovation	Forming further alliances with start-ups for plant-based fish, egg and cheese products	Co-founding a global accelerator platform for protein solutions and a sustainability-focused joint venture for the distribution of protein products across Europe	

Table 2. BIGCO's entrepreneurial phases

Findings

The findings show that along three phases of increasingly radical entrepreneurial activities in the alternative protein field, BIGCO went through transformative changes to strategy, structure, power distribution, work practices, identity and personal perceptions. As shown in Figure 2, transformation was directed by managerial sensemaking *for* and *of* sustainability-oriented entrepreneurship. The temporal occurrence and intensity of sensemaking by individual top and middle managers differed in the process. The following sections detail managers' sensemaking along the three entrepreneurial phases.

Pre-entrepreneurial phase

Being considered among employees as the company's main "visionary" (ethnographic interview 10/2018) and someone who is "incredibly open for new paths" (Interview 9), BIGCO's

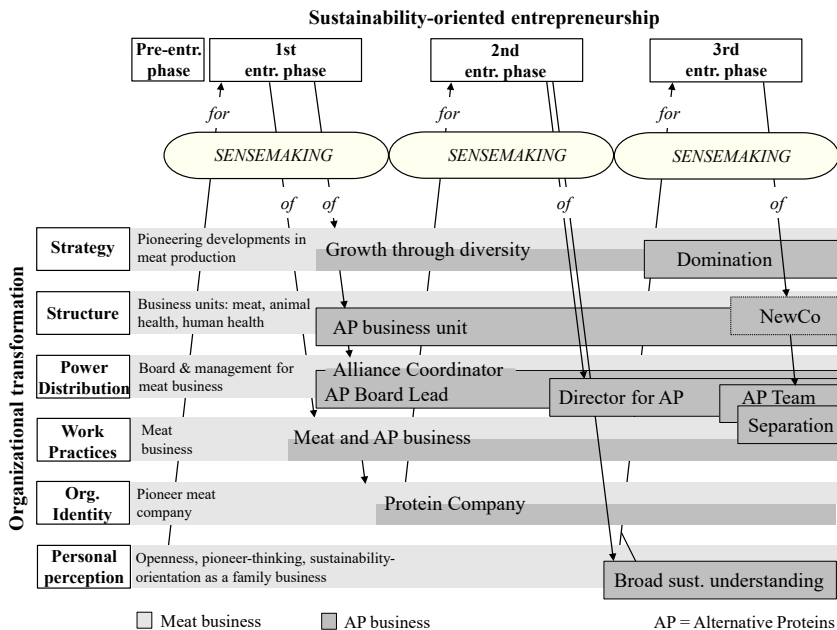


Figure 2. Sensemaking directing BIGCO's entrepreneurship-driven organizational transformation for sustainability

CEO was the first to engage in sensemaking *for* sustainability-oriented entrepreneurship in the alternative protein field:

Veganism is a topic which develops over time. Why should not we do it? We are in the convenience area [. . .] Whether I produce animal protein or plant protein, this is pretty much the same. I have the know-how to process the raw material into end products. Why should not we have a look at the vegan field, when the niche is big enough? (Interview 1)

The CEO particularly “*ogled*” with the topic of cultivated meat, seeing it as an important trend that has to be dealt with (Interview 1). According to the CEO, exploring the alternative protein was in accordance with the general sustainability and innovation orientation of the company (Interview 1). Thus, the CEO instructed the then head of M&A to search for partners in the emerging cultivated meat and plant-based industry. The head of M&A, however, was “*surprised, why we should deal with [the cultivated meat] topic at all*” and perceived the plant-based field as “*an obscure corner in a market niche with hitherto low potential to dissolve the boundaries towards flexitarianism*” (Interview 10). Following discussions with BIGCO’s CEO and extensive research, however, the former head of M&A grew increasingly interested in the topic and started to wonder, too, whether “*we have to adapt somehow to remain sustainable*” (Interview 10).

First entrepreneurial phase

In late 2017 and early 2018, the former head of M&A kick-started three strategic alliances between BIGCO and start-ups for cultivated meat, insect-based meat analog and plant-based meat analog. Middle managers from sales and marketing, despite becoming involved in the operational aspects of the partnerships, largely reacted to the new developments with indifference (Interviews 5; 8; 12):

Things you do not know, you naturally always consider with a big question mark [. . .] Well, perhaps you google it once, but then for a few weeks it’s gone again. [The alliance activities] were known, but it did not really make us [sales managers] think that it would go anywhere. (Interview 5)

In contrast, BIGCO’s top management engaged in extensive reflections and identified enormous potential of the alternative protein field. Particularly, the CEO and former head of M&A had realized that the start-ups’ products were perfectly compatible with BIGCO’s existing expertise, infrastructure and customer base and provided an opportunity for additional business growth (Interviews 1; 10). These realizations were specifically driven by decisive experiences in meetings between the top management team and the start-ups:

For me, trying the product [cultivated meat] for the first time was one of the greatest experiences. In this moment, we left the PowerPoint world, tasted the product and realized: This exists. This is no gibberish of scientists, it is reality [. . .] This was a pivotal moment for me (Interview 10).

Making sense *of* the first entrepreneurial activities made the top management team feel the need to formulate a company vision that would cover the new activities in the alternative protein field (ethnographic interview 5/2019; board discussion 2/2020): “*Actually, our aim is to become provider of high quality proteins. Not necessarily limited to meat*” (Interview 1). To account for activities in both areas, meat and alternative proteins, and to align identity with strategy, BIGCO’s top management introduced the new strategic claim “growth through diversity” and created a separate business unit for alternative proteins (Interviews 1; 2; 11). Seeing the need to give sense of the new strategy and attaching more importance to it (Interview 11), a former sales employee was appointed alliance coordinator and the former head of M&A was appointed board lead for alternative proteins in July 2018 (Interviews 1;10). In terms of work practices, the CEO considered different options:

In textbook fashion, you would need to create a separate company [. . .].But I do not know whether this is the right way, as we definitely have people who are able to think dichotomously. (Interview 1)

Thus, he decided to have relevant employees in sales, marketing and product development work on meat and alternative proteins topics simultaneously. The approach should emphasize the integral character of BIGCO's new identity and ensure authentic internal transformation (ethnographic interview 05/2019; Interview 10; board discussion 02/2020).

Second entrepreneurial phase

BIGCO's new identity and strategy triggered further sensemaking *for* entrepreneurship in the top management team, particularly among the board lead for alternative proteins and CEO:

The initial thought was: Who are we? Meat. And what do we want to include? Meat substitutes. [. . .] But then we said: Well, if we define ourselves as protein provider, there are still certain areas, fish and eggs, which we have not covered yet. (Interview 10)

Accordingly, the board lead for alternative proteins initiated further alliances with start-ups for plant-based fish, egg and cheese products, resulting in a diversified alliance portfolio "*covering all areas*" relevant for flexitarians (Interview 10). At the same time, however, he weighed the risk of becoming too dependent on alliance partners and therefore considered investing more energy on applying the acquired product know-how internally (ethnographic interviews 08/2019; 09/2019). Consequently, in-house plant-based product innovation was increased. Here, for the CEO, it was crucial to focus on plant-based instead of vegetarian products, as otherwise "*topics such as laying hen production and killing of male chicks catch up with you again*" (Interview 1).

The new entrepreneurial activities triggered further sensemaking. Due to the increased impact on in-house activities and expressed doubts about the direction of change by some employees, the CEO felt the need for an increase in employee communication:

I continuously explain to employees – not all, but most of those who need to know – why I do what I do. [I explain that] the vegan topic or alternative protein products stabilize the company and that there is nothing to be afraid of (Interview 1)

To support the CEO's efforts to "*widen the thinking of employees*" (Interview 2) and achieve their acceptance, the top management team started to establish key figures in the company in August 2019. They appointed a new Director for Alternative Proteins – a former slaughterhouse manager who had joined the company two years earlier (Interviews 9; 10). Besides these power distribution changes, the second entrepreneurial phase also triggered crucial changes in personal perceptions. The data assert that increased interactions with the alternative protein community made BIGCO's middle managers become increasingly interested in alternative proteins (Interviews 4; 5; 7; 8; 10) and prompted few managers from project management and product development to start considering global sustainability issues (Interviews 3; 4). BIGCO's project manager and trend scouter, who had joined BIGCO three years before, recounts how he became interested in global food security:

I never really thought about, how I can provide food so that everyone on this planet has enough. These are perspective that I only adopted because of such people [start-up owners] and such companies [alternative protein start-ups]. (Interview 4)

Sustainability-related reflections among individual middle managers were further encouraged by the new director for alternative proteins, who had a passion for innovations and sustainability (Interview 9; ethnographic interview 10/2019). Particularly the board lead for alternative proteins, due to repeated and close interactions with the start-up

partners, began to adopt new views on food security and resource efficiency and became increasingly enthusiastic about driving organizational change toward alternative proteins (ethnographic interviews 11/2018; 02/2019; 05/2019; Interview 10). However, some sales managers, who did not fully grasp the immediacy of the induced changes, still saw a shift in organizational identity toward protein provider, something that will only become relevant later: “*Maybe in the future, as a vision for 2050*” (Interview 8).

Third entrepreneurial phase

The newly gained enthusiasm for the alternative protein field prompted BIGCO’s board lead for alternative proteins to engage once again in sensemaking *for* new entrepreneurial activities:

There is no vehicle worldwide, where you can invest, if you want to position yourself broadly in the alternative protein field. It does not exist [...] There is no platform yet, which combines industry know-how with new products. (Interview 10)

Since BIGCO’s activities were too small to found a separate spin-off company (ethnographic interview 01/2019), the board lead drove the decision of BIGCO’s top management team to opt for a “*hybrid model*” (Interview 10): co-founding a global accelerator platform for plant-based product innovations and a joint venture for the distribution of respective products across Europe.

The diversity of entrepreneurial activities triggered further sensemaking *of* these activities, which, for the first time, explicitly included middle managers (see Figure 3). To encourage shared sensemaking, the board lead for alternative proteins and the director of alternative proteins initiated regular team meetings with people from sales, production, marketing and product development (Interviews 9; 10). The questions posed by different managers and discussed during these exchanges concerned potential future partnerships (ethnographic interview 10/2019), the roles of the accelerator platform and the new venture (Interview 11) and implications of the new activities for branding (Interview 12), product development (Interview 4) and structural integration (Interview 9).

According to the board lead for alternative proteins, finding answers to these questions “*is by far the greatest challenge that we face right now, because it is getting emotional.*” (Interview 10). Above all, the top management team’s plans to turn BIGCO into a “*food company with two*

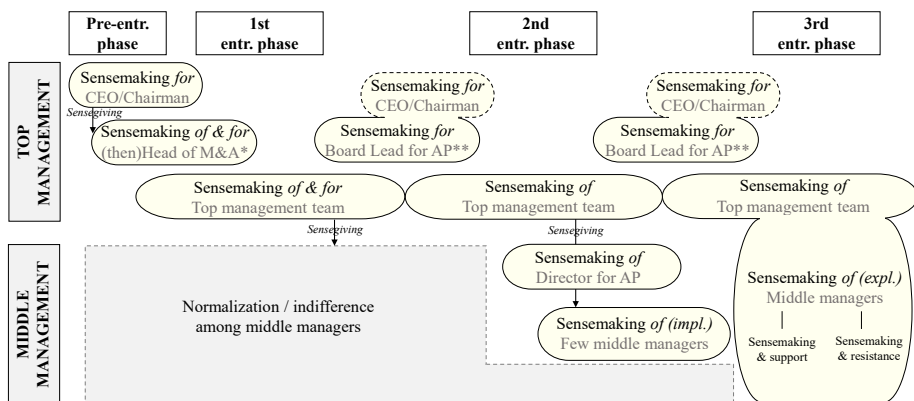


Figure 3. Sensemaking by BIGCO’s top and middle managers over time

* Previous position of Board Lead for AP
 ** AP = Alternative Proteins

divisions” (Interview 10) with an alternative protein brand on equal footing with BIGCO’s hitherto ubiquitous meat brand was met with resistance by some marketing and sales managers (ethnographic interviews 10/2019; 11/2019a; 11/2019b; Interview 9). The marketing manager, for instance, rejected the idea altogether: “*The [meat] brand already radiates trusts and I do not have to try building a new brand with a modest use of funds.*” (Interview 12). Some sales managers shared this skepticism and thought of the transformation as a change from “*[meat brand], the slaughter company to [meat brand], the protein company.*” Concerning the speed and direction of organizational transformation, the director for alternative proteins observed two opposing camps:

Many [long-term employees] react with fear, you can see it. And others, especially the young, enthusiastic and involved employees want to move things forward and find the topic really exciting. (Interview 9)

For some long-term employees, no longer regarding the meat brand as a synonym for BIGCO “*requires an insane change in thinking*” (Interview 9). The difficulty of getting long-term employees on board, including some managers from marketing and sales, made the top management team realize that cognitive integration would be more difficult to achieve than initially thought (ethnographic interview 11/2019; board discussion 02/2020). They thus considered creating new positions in the alternative protein unit to take pressure off current employees still working in both areas (board discussion 02/2020). As of February 2020, the data indicate that tensions have decreased and that BIGCO’s overarching identity with separate sub-identities finds broader acceptance (board discussion 02/2020).

Summary of findings

Along three entrepreneurial phases, managerial sensemaking directed BIGCO’s transformation in essential domains of organizational activity. Two findings are of particular importance. First, continuous sensemaking *for* and *of* sustainability-oriented entrepreneurship adopted a bidirectional nature, resulting in increasingly radical entrepreneurial activities and increasingly impactful organizational change over time. While sensemaking was initially limited to the top management team, particularly to the CEO and the board lead for alternative proteins, it became a shared process among top and middle managers in late phases of BIGCO’s entrepreneurial journey. The late explicit involvement of middle managers in sensemaking revealed resistance by some managers and led to temporal tensions regarding organizational change. Second, continuous sensemaking rendered transformation toward sustainability highly emergent over a short period. Notably, the fast pace of change did not imply radicality in terms of replacement and renewal. Rather, overarching claims aimed to achieve compatibility with business as usual and, thus, comprehensible evolution instead of disruption.

Discussion and contribution

By adopting a sensemaking lens to examine the process of entrepreneurship-driven organizational transformation for sustainability, this process study contributes to the sensemaking and organizational change literature.

The findings contribute to the entrepreneurial and organizational sensemaking literature by shedding light on temporal progressions of managerial sensemaking in dynamic contexts. While previous research has begun to conceptualize different directions of sensemaking (Brown *et al.*, 2015; Smith and Cao, 2007), this study identifies the dynamic interaction of prospective and retrospective sensemaking as a bidirectional, highly emergent process. It suggests that the continuous alternation between directions of sensemaking can help managers to navigate entrepreneurship-driven change for sustainability, with sensemaking by involved managers becoming increasingly concerned with sustainability issues over time. In addition, the analysis

provides insights into managers' diverging involvement in the two directions of sensemaking. The findings generally confirm entrepreneurial sensemaking research by showing that sensemaking *for* entrepreneurship remained limited to "lead entrepreneurs" at top management level (Dutta and Thornhill, 2014; Smith and Cao, 2007). However, the board lead's sensemaking *for* entrepreneurship only occurred after the CEO had given sense to the board about new developments. This finding suggests that mutual sense-giving among the same hierarchical level can be fruitful, if not necessary, for initiating and advancing change. This study further contributes to the literature by detailing progressions of middle manager sensemaking *of* entrepreneurial activities and organizational change over time – from initial "normalization" (Ashforth and Kreiner, 2002) through "negative sensemaking" (Conroy and O'Leary-Kelly, 2014) to "renewed clarity" (Corley and Gioia, 2004). Here, the individual "sensemaking paths" of middle managers differed substantially: While relatively new and innovation-oriented employees welcomed change for sustainability and started to engage in respective reflections in the second entrepreneurial phase, long-term employees from sales and marketing engaged in sensemaking only once processes had been formalized and eventually voiced their resistance. This finding suggests that support for or resistance to sustainability-oriented change is not only dependent on experiences or personal beliefs (Cherrier *et al.*, 2012; Harris and Crane, 2002; Stoughton and Ludema, 2012; Stokes and Harris, 2012), but also on managers' ability for implicit sensemaking, which, in turn, depends on the degree of cognitive attachment to established routines and professional identities. Here, an earlier integration of skeptical managers in explicit sensemaking might have allowed for a more seamless transition and a unitary account as mentioned by Maitlis (2005).

This study further contributes to research on organizational change for sustainability by identifying particularities of the entrepreneurial context. While Van der Heijden *et al.* (2012) found sensemaking for sustainability-oriented organizational change to be a long-term process, the case of BIGCO shows that alternating between sensemaking *for* and *of* sustainability-oriented entrepreneurial activities can significantly speed up transformation. This finding is highly relevant considering the urgency of many of today's sustainability challenges and the mounting pressures for companies to transform (Millar *et al.*, 2012). However, in contrast to suggestions by innovation management research (Gilbert, 2006; De Visser *et al.*, 2010), BIGCO managers decided against the structural and cognitive separation of the two business units and in contrast to conceptualizations by sustainability innovation research (Schaltegger and Wagner, 2011; Magnusson *et al.*, 2003), BIGCO's entrepreneurial activities did not lead to the replacement of the established meat business. In fact, BIGCO largely became entrepreneurial and transformed *without* calling into question the current interpretive scheme or way of doing business (Hill and Levenhagen, 1995). Instead, BIGCO's new abstract core strategy and identity allowed for the coexistence of seemingly contradictory business foci. This accumulation of meaning was due to continued sensemaking of new meanings in relation to the established business (Garud and Karnøe, 2001; Garud *et al.*, 2007). This meaning-making was facilitated by the top management's understanding of BIGCO as an already sustainability-oriented company (Kennedy *et al.*, 2017; Miles *et al.*, 2009). Only with rising tensions in the last entrepreneurial phase did BIGCO's top management team decide to increase cognitive and operational separation of the two business units, aiming for a "selective (de-) coupling" of logics as suggested by Pache and Santos (2013). As this shows, continuous bidirectional and shared sensemaking of top and middle managers allowed for the successful management of organizational transformation. At the same time, however, the focus on sensemaking in relation to established meanings might have impeded more radical change for sustainability.

Conclusion

This study explored how managerial sensemaking directs processes of entrepreneurship-driven organizational transformation for sustainability over time. The case results suggest

that (1) bidirectional sensemaking *for* and *of* entrepreneurial activities helps managing and accelerating organizational transformation for sustainability, (2) a processual accumulation of meaning allows for overarching, integrative claims balancing the old and the new and (3) managers' diverging "sensemaking paths" can be aligned through explicit and shared sensemaking of top and middle managers concerning both structural and cognitive aspects.

Limitations and future research

This study comes with certain limitations, indicating possible directions for future research. Limitations regard the generalizability of findings and the scope of analysis. Questions of generalizability arise, as this study was based on a unique case with an exceptional setting. Thus, further investigations of entrepreneurial organizations in industries confronted with different sustainability challenges are encouraged. Further research is needed to investigate long-term impacts on different organizational domains. For instance, longitudinal studies could provide a richer picture of organizational culture changes that go beyond individual-level perceptions. To gain even more comprehensive insights, future research could investigate multilevel interactions of sensemaking that include both intraorganizational dynamics and interactions between the organization and the institutional environment, thereby combining this study's analysis focus with the foci of Zhang (2016), Khan (2018) or He and Baruch (2009).

Managerial implications

The study's results have important implications for management. First and foremost, they emphasize the necessity for an early formalization of shared sensemaking in sustainability-oriented change that goes beyond individual sensemaking by few organizational change agents (as e.g. analyzed by Van der Heijden *et al.*, 2012). By including relevant middle managers early on and considering their divergent experiences and beliefs, reflections about new sustainability requirements, disembedding from established routines and support for transformation can be facilitated. To encourage collective sensemaking, top managers could, for instance, initiate change workshops (Ala-Laurinaho *et al.*, 2017), in the context of which participants can share future visions, capture rising tensions and jointly develop practices that correspond with the new organizational reality. Software-based concept mapping (Faily *et al.*, 2012) and/or the introduction and use of strategic linguistic terms and phrases (Jalonen *et al.*, 2018) could further facilitate collective sensemaking. The results also show that, due to continuous sensemaking in relation to established meanings, the outcome of transformation for sustainability was comprehensible but less radical. For instance, all of BIGCO's new positions were filled by internal employees. To advance more *fundamental* change for sustainability, an early cognitive, operational and structural separation of the two business units could be facilitated by the recruitment of external staff with specific expertise in sustainability innovations and their management.

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Corresponding author

Charlott Hübel can be contacted at: charlott.huebel@leuphana.de

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Annex

- I. Author contributions to dissertation papers and publication status
 - II. Presentations related to this dissertation
 - III. Declaration
-

I. Author contributions to dissertation papers and publication status

(§16 of cumulative dissertation guideline)

No.	Short title	Author contributions	Author status	Weighting factor	Publication status
1	Industry Actor Barriers	CH: Conceptualization, literature review, investigation, formal analysis, writing original draft StS: Supervision, conceptualization, paper development, review & editing	Co-author with pre-dominant contribution	1.0	Published in <i>Sustainable Production and Consumption</i> Single-blind peer review IF: 8.921 VHB JQ3: n.r. (SJR: 1.361)
2	Innovation Management	SDS: Conceptualization, literature review, formal analysis, writing original draft CH: Conceptualization, literature review, substantial paper development StS: Supervision, conceptualization, review & editing	Co-author with equal contribution	1.0	To be submitted Targeted journal: <i>Research Policy</i>
3	Alliance Learning	CH: Investigation, literature review, formal analysis, conceptualization, writing original draft IW: Conceptualization, formal analysis, review & editing StS: Supervision, conceptualization, review & editing	Co-author with pre-dominant contribution	1.0	Published in <i>Long Range Planning</i> Double-blind peer review IF: 7.825 VHB JQ3: B (SJR: 3.239)
4	Managerial Sense-making		Single author	1.0	Published in the <i>Journal of Organizational Change Management</i> Double-blind peer review IF: 2.07 VHB JQ3: n.r. (SJR: 0.505)
				SUM:	4.0

CH = Charlott Hübel; IW = Dr. Ilka Weissbrod; SDS= Jun.-Prof. Dr. Samantha Dijkstra-Silva;
StS = Prof. Dr. Dr. Stefan Schaltegger

II. Presentations related to this dissertation

Date	Conference / Colloquium	Type of contribution	Title of contribution
Dec. 14 2017	PoST Research Colloquium	PhD Outline Presentation	The Role of Entrepreneurship in Transforming the Meat Industry
March 12 2018	CSM Research Retreat	Paper Presentation	The Transformation of the Meat Industry – Barriers and Scopes of Action
June 12-14 2018	9 th International Sustainability Transition Conference	Speed Talk (Co-presenter)	Understanding „Processes of Sustainability Transformation” – an inter- and transdisciplinary project
Dec. 14 2018	CSM Research Retreat	Paper Presentation	Barriers to a Sustainability Transformation of the Meat Industry: An Analysis of Lock-ins from an Industry Actor Perspective
Feb. 6-8 2019	Leverage Points 2019 Conference	Speed Talk + Poster Presentation	The Role of Sustainability Pioneers in Transforming the Meat Industry
July 14 2019	CSM Research Retreat	Paper Presentation	Experience meets innovation - How alliances between a meat producing incumbent and alternative protein pioneers might advance the sustainability transformation of the meat industry
Oct. 24-25 2019	Gem. Herbsttagung der Wissenschaftlichen Kommissionen Nachhaltigkeitsmanagement und Produktionswirtschaft	Paper Presentation	Experience meets innovation: How alliances between a meat producing incumbent and alternative protein pioneers can advance a sustainability transformation of the meat industry
Oct. 21-23 2019	CSM + IQD Research Colloquium „Sustainability Management“	Paper Presentation	Experience meets innovation: a case study on alliance learning between a mainstream company and sustainability startups
July 2-4 2020	36th EGOS Colloquium 2020	Paper Presentation	The impact of entrepreneurial activities on established organizations over time: An identity change perspective
July 06 2020	PoST-Colloquium	Paper Presentation	The role of entrepreneurial incumbents in transforming (the meat) industry: Developing first ideas for the framework paper
Oct. 09 2020	CSM Research Retreat	Paper Presentation	Entrepreneurship-driven organizational transformation for sustainability - a sensemaking perspective
Feb. 16-17 2021	PoST Final Event	PhD Overview Presentation (Co-presenter)	Companies in and for transformation: Industry Actors' Agency

III. Declaration

(§16 of cumulative dissertation guideline)

I avouch that all information given in this appendix is true in each instance and overall.

Charlott Hübel