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## Special track: European agrifood business in transition towards social responsibility

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*Special track: European agrifood business in transition towards social responsibility*

## Editorial

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This special IFAMA Europe track of the IFAMR is devoted to the topic of transition towards social responsibility of European agrifood businesses. Thanks to the complex requirements of sustainability at various levels (Dentoni and Peterson, 2011; Dentoni *et al.*, 2012) in a context of a diversified organizational and institutional landscape, European agrifood companies actively search for new ways of innovation towards social responsibility. The necessity to better understand the innovation processes for sustainability implemented by agrifood companies has been frequently emphasized in the management literature (Barth *et al.*, 2017; Blok and Lemmens, 2015; Lubberink *et al.*, 2017; Tell *et al.*, 2016). These innovation trends can be summarized around two axes.

The first axis questions the strategic intertwining and convergence between technological opportunity and the organization of the agrifood chains (Bigliardi and Galati, 2013; Carayannis *et al.*, 2018; Golembiewski *et al.*, 2015; Kalaitzandonakes *et al.*, 2018). The strategic convergence leading to a reconfiguration of the bioeconomy has been acknowledged (Boehlje and Bröring, 2011; Golembiewski *et al.*, 2015). The food-water-energy nexus (Mohtar and Daher, 2012), concomitantly with the systemic view of innovation (Fearne *et al.*, 2012), brings expanded strategic opportunities. Similarly, there is probably the possibility of collaborations among the quadruple helix of partners (Carayannis *et al.*, 2018; Kalaitzandonakes *et al.*, 2018) that will drive successful strategies in the future. From that point of view, the specificities of the European context (Sarkar and Costa, 2008), notably thanks to its organizational diversity (Martino *et al.*, 2017) and to the originality of its informal and formal organizations and policy devoted to innovation (Batterink *et al.*, 2010; Touzard *et al.*, 2015), serve as active drivers of technological and organizational transformation.

The second axis puts forward the learning dimensions of the innovation processes (Bossle *et al.*, 2016; Hinrichs, 2014; Olsen, 2015). The move of companies and of partnering research/policy organizations towards design activities constantly drives the players toward upstream activities. The objective of innovation strategies is to promote an innovative continuum (Lubberink *et al.*, 2017), i.e. transformations in the design of complete innovation processes integrating new stakeholders, new activities and new partners (Kalaitzandonakes *et al.*, 2018; Meynard *et al.*, 2017; Procopio Schoen, 2017; Wognum *et al.*, 2011). This focus on design induces renewed roles of organizational learning: types of knowledge, integration of science, technology and management, new categories of intermediaries and of devices for collaboration (Abdirahman *et al.*, 2014; Deiters and Schiefer, 2012). The innovation strategies of agrifood companies move toward a reconfiguration

of their knowledge-based activities and partners (Colurcio *et al.*, 2012; Meynard *et al.*, 2017; Procopio Schoen, 2017).

The articles presented in this track are in line with these trends, with a focus on specific topics, such as partnerships and relational advantages at a network level, the need for organizational innovations at a supply chain level, the importance of evaluation criteria, and behavioral issues linked to innovation strategies, with case and sector perspectives from various European countries.

The first article ‘Development of sustainable resource ties in the agrifood industry: the case for the Polish fruit and vegetable industry’ by Wisniewska-Paluszak and Paluszak (2021), contributes to the overall discussion on the relational resources – in particular, attempts to recognize inter-firm investments in the agrifood industry. It is grounded in an integrative approach which combines relational and resource-based views. The goal is to find out if and how relational investments contribute to a sustainable relational advantage of business relationships in the agrifood industry. On this basis, a model of resource-based sustainable relational advantages in agrifood business relationships was executed. It was found that relational investments aimed at optimization of supply and provision, as well as food safety and social responsibility, create and sustain a relational advantage. Those investments that include technology and ecology implicate an unexploited relational advantage. Subsequent human, financial and real capital investments implicate a temporary relational advantage. Consequently, the implementation of an integrative approach to investigating the development potentially sustainable resources that tie in the agrifood industry is necessary.

The second article, ‘Sustainable demand-supply chain: an innovative approach for improving sustainability in agrifood chains’, is proposed by Filippi and Chapdaniel (2021). Increasing price volatility and the decrease in both raw material prices and farmers’ incomes, all underline the depths of the French agricultural crisis. How should the relationships within agrifood supply chains be envisaged in order to obtain greater sustainability combined with better added-value distribution? This article introduces a new approach for supply chain organization and management: the sustainable demand-supply chain. The article mobilizes both management, organization, and innovation literature, together with a case study based on data from farmers, cooperatives, and distributors in the pork sector. The article develops a modelization of sustainable demand-supply chains. The results show that new relationships need to be implemented between all stakeholders, including consumers, both to share information and to define their new added-value distribution. The results identify the key points of this new supply chain coordination and indicate policy recommendations for organizational innovations.

The third article, ‘Conception and evaluation of a structural equation model to measure the reputation of German horticulture’, by Isaak *et al.* (2021), focuses on the reputation of a sector seen as an important strategic resource. The aim of this article is to develop a measurement model for the horticulture sector. Reputation is a latent variable and is represented by formative and reflective indicators. A theoretically elaborated model is evaluated and completed with the help of experts, and the segments that influence reputation, are identified. The quality assessment of the formative indicators, using multiple regression, and the reflective indicators, using an explorative factor analysis, led to a model with a total of 15 indicators. With the help of open questions, it is possible, to specify the indicators already considered or to include them in the model as new indicators. A reputation map shows the interaction between the reputation of horticulture and that of the individual segments. This shows a much greater influence of the service segments on the sector reputation compared to the production segments.

The fourth article, ‘Innovation behavior of agri-food small and medium-sized enterprises: the case of Europe’s emerging economies’, by Kussainova *et al.* (2021), examines the innovative behavior of agri-food firms located in Central and Eastern Europe. In the literature, empirical analyses on innovation activities of firms focus on various case studies from around the world. However, very few studies explore the innovation of small and medium sized enterprises from Central and Eastern European agri-food sector. The analysis uses the logit estimation method and firm-level data, which are obtained from ERBD-World Bank Business

Environment and Enterprise Performance Survey. Results suggest that firms that spent some proportion of their financial budget on research and development, had workforce training programs, and bought fixed assets, are more likely to launch product, process, organizational, and marketing innovations.

The guest editor would like to thank the editorial board and more particularly the editor-in-chief Dr. Kevin Chen and former editor-in-chief, Dr. Michael Gunderson, for giving me the opportunity to launch this special track. I would also like to say thank to all the authors and the reviewers for their work which has led to publishing this special IFAMA Europe track of IFAMR.

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*Special track: European agrifood business in transition towards social responsibility*

## **Development of sustainable resource ties in the agrifood industry: the case for the Polish fruit and vegetable industry**

### **RESEARCH ARTICLE**

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### **Abstract**

This paper contributes to the overall discussion on the relational resources then, in particular, attempts to recognize inter-firm investments in the agrifood industry. It is essentially grounded in an integrative approach which combines relational and resource-based views. Our goal in this paper is to find out if and how relational investment contributes to a sustainable relational advantage of business relationships in the agrifood industry. Producers, processors and traders who undertake investments in conjunction with their contractors were queried. The main areas of these investment activities and the potential of a sustainable relational advantage are explored. On this basis, a model of resource-based sustainable relational advantage in agrifood business relationships was executed. It was found that relational investments aimed at optimization of supply and provision as well as food safety and social responsibility create and sustain a relational advantage. Those aimed at technology and ecology implicate an unexploited relational advantage. Subsequent human, financial and real capital investments implicate a temporary relational advantage. The added value of this study lies in the implementation of an integrative approach to investigating the development potential of sustainable resource ties in the agrifood industry.

**Keywords:** relational investments, relation-specific resources, sustainable relational advantage, agrifood industry

**JEL code:** Q13, L66, Q01, M14, L14

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## 1. Introduction

Resources are the main subject of research for different economic and management theories. The reasons for the huge interest of economists and managers in resources are their overall characteristics, i.e. scarcity and the ability of turning profits. These features make them extremely valuable for firms and the overall economy. Different resource-based views are looking for ways to optimize resource inputs and profits of separate firms, industries or economies (Bain, 1959; Barney, 1991; Porter, 1990). However, particularly in recent years economists have noticed that resources have a relational nature (Dyer and Singh, 1998; Gulati, 1999; Håkansson and Snehota, 1995). They found out that by itself, a single economic resource is passive and without any value. This means that resources provide the building blocks for the structure and process of economic relationships. They have the potential to generate economic value only through interaction with other resources and the way that a resource interacts with other ones defines its nature.

Since then some economists have tried to relate traditional resource-based paradigms to relation-based theories (Das and Teng, 2000; Duschek, 2004; Ritala and Ellonen, 2010). They are refocused within a new analytical unit – the relationship. The relationships or ties are recognized to turn advantages to the economic units. Continuous interaction constitutes the context within which the interactions endow the resources with meaning and role. There is an important shift in focus away from the way an economic unit allocates and structures its internal resources towards the way it relates its own resources to those of its contractors. The relationship relates the internal and external resources and increases their combined effectiveness. It permits economic units both to access and to develop resources in the long term (Håkansson and Snehota, 2006; Håkansson *et al.*, 2009).

Accordingly, a body of research on relational resources has arisen (Abrahamsen and Håkansson, 2015; Baraldi and Strömsten, 2006; Baraldi *et al.*, 2012; Harrison and Håkansson, 2006). It highlights the importance of external complementary resources and capabilities that can be used to achieve more effective and innovative configurations that a single firm cannot achieve alone. However, firms should be willing to invest in relational resources and capabilities which are complementary to their internal resources. These investments may band resources, relationships and partners from alternative uses by alternative users. In this way they may become specific or unique to a relationship. Idiosyncratic or relation-specific investments create cost savings and/or increased revenues that are due to specialization benefits and relational rents. They are a source of competitive advantage and/or opportunism threats and/or enduring relationships and thus increasing trust, commitment and cooperative behavior (Dyer, 1996; Williamson, 1991).

A body of research seeks explanations of the drivers of specific investment allocations (Ebers and Semrau, 2015; Lu *et al.*, 2012; Yeung *et al.*, 2013) in the agrifood industry (Li *et al.*, 2017). Among other things they identify asymmetries, learning and acquisition of market knowledge, business relationship satisfaction or environmental uncertainty as the allocation factors but in general they do not discuss relational advantages at all. Furthermore, studies embracing the agrifood industry which is, in its nature, one of the most relative and integrative industrial structures, are quite rare. Responding to this gap, this paper seeks to explain if and how the relational investments contribute to the sustainable relational advantage of business relationships in this industry. To develop its core theoretical argument, it draws on relational theory (Dyer and Singh, 1998) and resource-based view (Barney, 1991) trying to amalgamate the relational paradigm with the theory of sustained competitive advantage. These theories can help illuminate the study question, because they provide insights into specific-resource endowments and the advantages thereof.

On this base, the model of resource-based sustainable relational advantage in agrifood business networks was executed. Consistent with these arguments, empirical findings from a survey of 866 buyer-supplier relationships in fruit and vegetable processing, which is a typical agrifood industry, reveal that inter-firm investments aimed at optimization of supply and provision, food safety and social responsibility led to the generation of relation-specific resources which create the potential of a sustainable relational advantage.

While technological and ecological developments imply an unexploited relational advantage, subsequent human, financial and real capital investments imply only a temporary relational advantage.

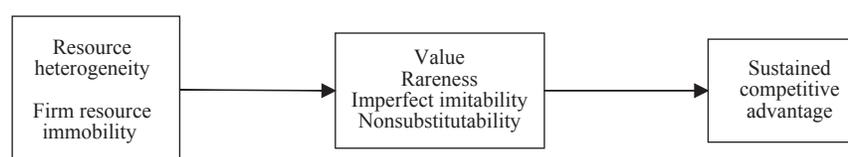
With these findings, the present study contributes to filling an important research gap by offering a theory-based explanation for the potential of the sustainable relational advantage of relational investments. As a further contribution, this study highlights how a resource-based view can enrich relational and network theory in helping to explain the development potential of resource ties among and across firm boundaries.

## 2. Theoretical background

Since the 90s, the resource-based view is one of the most important ideas in strategic management. Wernerfelt (1984) stated that resource means anything which could be thought of as a strength or weakness of a firm. The author underlines that the growth strategy of a firm involves striking a balance between exploitation of existing resources and the development of new ones. As Wernerfelt (1995) stated, strategies which are not resource-based are unlikely to succeed. Barney's (1991) classification of a firm's resources includes three categories: physical, human and organizational capital. He assumed that a firm's resources are heterogeneous and immobile. This means that most industries are characterized by at least some degree of resource heterogeneity and immobility. If one assumes that resources are homogenous and mobile then it cannot be expected that they are the source of competitive advantage. If resources are heterogeneous and immobile then some of them hold the potential of sustained competitive advantage. For this, Barney's model assumes that they need to have four attributes (VRIN criteria): (1) value, in the sense that they exploit opportunities; (2) rareness among a firm's current and potential competition; should be (3) imperfectly imitable and cannot be strategically equivalent substitutes for this resource; (4) nonsubstitutable, that are valuable but neither rare or imperfectly imitable (Barney, 1991: 105-106). Under the resource-based view there is a substantial relationship between resource heterogeneity and immobility, value, rareness, imperfect imitability, nonsubstitutability, and sustained competitive advantage (Figure 1).

According to Barney's (2001) further clarifications, the value of a firm's resource is exogenous and is determined by the competitive environment – market conditions. The rareness is the number of firms that possess the particular valuable resources – it is less than the number of firms needed to generate perfect competition dynamics in an industry. The imperfect imitability comes from unique historical circumstances characterized by casual ambiguity and social complexity in which the resource has been obtained and its imitation is costly. The nonsubstitutability means that there cannot be strategically equivalent substitutes for the resources that are themselves either not rare or imitable.

While Prahalad and Hamel (1990) introduced the notion of core competence as a corporate critical resource which may be reallocated by corporate management. Core competences are the collective learning in the organization, especially how to coordinate various production skills and integrate multiple streams of technologies. It is also organization of work and the delivery of value. It is communication, involvement, and a deep commitment to working across organizational boundaries. Core competence does not diminish with use. Unlike physical assets, which deteriorate over time, competencies are enhanced as they are applied and shared (Prahalad and Hamel, 1990: 81). Core competence more explicitly refers to the significance of the cooperative utilization of external resources. Therefore, economists utilized the concept of core competencies



**Figure 1.** Assumptions and attributes of the potential of sustained competitive advantages (Barney, 1991: 112).

for establishing sustained competitive advantage in the firms' collaborations and partnerships (Hamel, 1991; Hamel *et al.*, 1989).

At the time, Williamson (1985, 1991) discussed an asset specificity as the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value. The author differentiated among site, physical-asset, human asset, brand name capital, dedicated assets and temporal specificity. In consequence, firms invest in specific assets. These transaction-specific investments could lead to hold up situations, but on the other hand, may lower transactional and operational costs. Later on, in his early research Dyer (1996) discussed transaction-specific investments and the influence of Williamson's asset site, physical and human specificity on the firm's performance measures, proving three factors influence efficacy of transaction-specific investments as a source of competitive advantage, i.e. institutional/contracting environment, industry uncertainty or volatility and product/task interdependence.

Then, Dyer and Singh (1998) confirmed that the formation of inter-organizational relationships, as a separate source of competitive advantage, can facilitate firms. Different methods of interacting with suppliers, customers or even rivals are identified as sources of relational advantages. The relational view shows that the firm's critical resources may extend beyond its boundaries and may be embedded in inter-firm resources and routines. The authors identified four potential sources of interorganizational advantage: relation-specific assets, knowledge-sharing routines, complementary resource/capabilities, effective governance. Relational rents are possible when alliance partners combine, exchange, or invest in idiosyncratic assets, knowledge, and resources/capabilities, and/or they employ effective governance mechanisms that lower transaction costs or permit the realization of relational rents through the synergistic combination of assets, knowledge, or capabilities.

After the relational view came into existence, one recent criticism of resource-based view is that it falls back only on a traditional firm-focused explanation of the development of sustained competitive advantage based exclusively on firm's internal resources. Nonetheless, the newest studies show that internal development is limited, especially for competences, intangible and non-tradable assets considering in particular the cost and time for some resources' internal development. As well, Barney and Clark (2007: 168-171) conclude that there are numerous reasons why it might be very costly for a firm to create a particular capability of its own. Since, it may depend on historical conditions that no longer exist, be path-dependent, socially complex or the ways of creating it may not be fully known. Collaborative arrangements are used to overcome the limitations on resources and capabilities as well as to use new technological opportunities. Furthermore, recently possible openness which means using firm-external ideas results from low cost information and knowledge exchange in the digital economy (Schoder *et al.*, 2019).

Therefore, the primary level of analysis for the search on relational advantage is no longer a firm but should be the network of a firm's relations. The relational view draws attention to interfirm cooperation as a source of relational advantage by taking interfirm relationships as the unit of analysis. It focuses solely on the relationship level, which is its main distinction with respect to earlier studies. It can provide an independent explanatory set that identifies competitive advantage caused by differences in the attributes of the relationships themselves and not, for example, the resources of a single firm (Ritala and Ellonen, 2010). Due to the focus on resources as the primary object of analysis, the relational view could be seen, in principle, as a 'complementary extension' of the resource- and competence-based approach aiming at a conceptual anchoring of sustained competitive advantage in network resources (Duschek, 2004: 61).

Further, a body of literature focuses on explaining cooperation as the way to access and acquire valuable resources that are needed (Mowery *et al.*, 1996). Some authors use the transaction cost and resource-based rationales to emphasize cost minimization and value maximization of a firm through pooling and utilizing valuable resources. This approach assumes that certain resources are not perfectly tradable on the market, as they are either mingled with other resources or embedded in organizations. Hence, mergers, acquisitions, and strategic alliances are variously employed. There are two motives for firms to use strategic alliances: to obtain

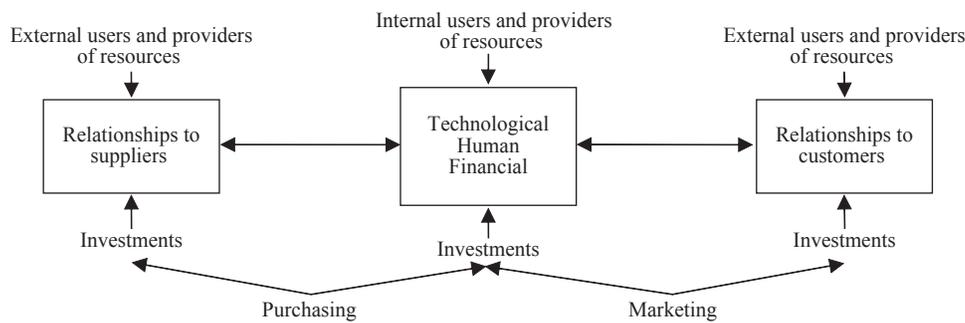
others' resources and to retain and develop one's own resources by combining them with others' resources (Das and Teng, 2000: 36-37). While all resource-based theories focus mainly on the focal firm's internal resources and capabilities, they also seem to include an assumption that cooperative interfirm relationships are a source of complementary resources and capabilities that can be used to achieve an optimal resource configuration. The main rationale behind interfirm cooperation from the resource-based perspective is the value-creation potential of different firms' resources and capabilities that are pooled together to create a greater competitive advantage than a single firm could achieve (Ritala and Ellonen, 2010).

Since the 1990s, another important approach for the relational view was developed – the network approach (Håkansson and Snehota, 1989). It was applied to strategic management and, later on, the central issues of resource dimension were also characterized for network management by Håkansson and Snehota (1995). They concluded that firms develop and share resources, such as goods and services, manufacturing facilities, finance, technology, knowledge and personnel. The substance of a relationship in terms of resources can vary greatly and the resource ties that arise in a relationship have different consequences; they affect the availability of resources and the innovativeness of a company. Later, the authors wrote that over recent years they have seen the resource-based view of strategy, and the concern for capabilities and knowledge, take a central place in strategy research (Håkansson and Snehota, 2006: 272).

The network approach is being developed in explanations of different strategic capabilities of network investments and resources (Baraldi and Strömstern, 2006; Gadde *et al.*, 2002; Harrison and Håkansson, 2006; Hart, 1995; Johanson and Mattson, 1985; Mugera, 2012; Waluszewski, 2004) also in food supply (Claro, 2004; Gadde and Amani, 2016). In its framework economic resources provide the building blocks for the structure and process of business. By itself, a single economic resource is passive and without value. The ways that a resource interacts with other resources define the nature of that resource and have the potential to generate economic value (Håkansson *et al.*, 2009: 65). A business relationship relates the resources of the two participants and allows their combined effectiveness to be increased. Business relationships permit companies both to access and to develop resources (Håkansson and Snehota, 1995). As well, Jarillo (1988) highlighted that inter-firm interactions imply investments to build relationships, which gives consistency to the network. The investments made by the firms in their relationships lead them to try, at least over the short run, to use the 'voice' (face-to-face) mode of negotiation, instead of the pure 'exit' (no negotiation).

Baraldi *et al.*'s (2012) research admitted that the idea of resource heterogeneity is present in independent firms and in a firm as a part of an interacting network. In the second case, resources are interdependent across firms. The value of a resource is dependent on its connections to other resources in resource networks. Resource use is dynamic and can be changed over time – this is the result of heterogeneity assumption in the network approach. Moreover, combining resources implies heterogeneity, resources with special interfaces are difficult to combine effectively with other resources. If a network member can utilize the heterogeneity potential of its counterparts, his own resources will become more valuable. Creating and developing resources rather than economizing on resources may be the primary purpose of a business enterprise. The resources of the firm are heterogeneous in the meaning that their value depends on which other resources they are combined with. So, they must be evaluated in different combinations and arrangements (Håkansson and Snehota, 1995: 134). From a network perspective, firm-internal resources are combined with external resources accessed through others – suppliers, customers (Figure 2).

The assumption of resource heterogeneity in business relationships led to the transfer of the resource-based assumptions to relational and network studies (Gold *et al.*, 2010; Rašković and Makovec, 2013; Rudawska, 2010; Vargas and Mantilla, 2014). They revealed that competitive advantage lies in resources and intangible assets which are born and developed within the inter-firm relationships built in a network environment. Rudawska (2010) presents some empirical evidence showing the crucial role of inter-firm trust and commitment as a competitive advantage factor. The researched organizations credit effective inter-firm communication and the satisfaction resulting from the mutual respect and recognition as the components of value offerings.



**Figure 2.** Balance of resource ties to different users/providers (Håkansson and Snehota, 1995: 187).

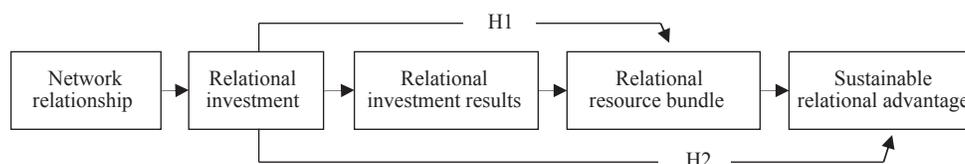
Rašković and Makovec (2013) indicate that relationships are key intangible organizational resources and confirm with empirical findings the trust-commitment theory for buyer-supplier relationships.

Finally, the network approach embeds resources in business relationships underlying the dependency of internal and external resources of a firm. A business relationship is the locus for the generation, maintenance and further development of strategic resources. Firms operate on a set of internal resources, resource bundles in business relationships and resource configurations in business networks. Heterogeneity, social complexity and path dependency are the main characteristics of relational resources. Business partners anticipate transferability as well as particularity of some of the resources. The above discussed resource-based, relational view as well as network approach were used in defining the following research analytical framework.

### 3. Analytical framework

The literature review shows that despite broad contributions to the literature in recent years, theoretical discussion linking inter-firm networking in the area of investments and resources with relational advantage is still limited. Our goal in this paper is to find out if and how relational investments contribute to the sustainable relational advantage of business relationships in the agrifood industry. The logic model of resource-based sustainable relational advantage is presented in Figure 3.

The literature findings led to amalgamate resource-based and relational views. In the present study we use the rationales of resource-based and relational views to study the directions and results of relational investments. The choice of this theoretical background to study inter-firm investments was driven mainly by the fact that they focus on particularity and uniqueness of intra- and inter- firm resources and capabilities. This would not be possible without drawing on the joint resource pool. The relation-specific resources give the network partners the sustainable relational advantage within the scope of the cooperation and as well as outside of it. Thus, on the theoretical background the following is assumed: (1) firms are embedded in network relationships; (2) relational investing creates relational investment results; (3) relational investment results engender a relational resource bundle and a sustainable relational advantage.



**Figure 3.** The logic model of resource-based sustainable relational advantage.

Firms can gain a better advantage by utilizing complementarities than by operating individually. The notion of complementary resources is also an implicit assumption in the resource-based theories with respect to interfirm cooperation (Ritala and Ellonen, 2010). With relational investments, firms are given long-term access to complementary and difficult to transfer resources and the possibility of a network-specific resource pool. Complementary but scarce resources and capabilities can be used jointly in the creation of unique new products, services, or technologies. Furthermore, creating knowledge-sharing routines among firms also increases the potential for relational advantages. The advantages generated by specific relational assets are exploited by means of long-standing safeguards and a high volume of transactions between cooperating parties.

Relational investment results in specific relational resources which, according to the traditional resource-based view, cannot be redeployed to alternative uses or by alternative users, are valuable and rare, imperfectly imitable and nonsubstitutable. Dyer and Singh (1998) identified four relation-specific barriers to imitation and substitution. Two of them characterize relational resources, i.e. interorganizational asset interconnectedness and resource invisibility. They relatively refill the Barney's model attributes of imperfect imitability and nonsubstitutability in the relational option. Further attributes of firm resources, i.e. value and rareness are also easily transferable into the relational view. Relational investments obviously are undertaken to exploit new opportunities and in this sense are valuable. They are also rare among the investing partners' current and potential competitors for the reason of partners' scarcity or institutional environments. Within this concept, relational advantage needs relational investments. In other words, relational resources must be characterized as assets with high specificity and uniqueness. Therefore, we hypothesized that:

**H1:** Relational investment results in a specific relational resource bundle.

The sustainable relational advantage is a relational extension of the resource-based notion of sustained competitive advantage. Relational advantage is also sustainable because inter-firm relationships offer a vast number of barriers to imitation, such as: inter-organizational asset interconnectedness, partner scarcity, resource indivisibility or the institutional environment. In previous resource-based studies competitive advantage was defined as the ability of a firm to outperform its industry, that is to earn a higher rate of profit than the industry norm (Ritala and Ellonen, 2010). In the relational context this poses an important question of competition dynamics in inter-firm relationships. Alberts (2017) suggests three network competition forms which can generate benefits for their member firms. They are network formation, network composition and network governance. Network resources creation changes the competition dynamics in network composition. On the network level the main concern is if the network possesses the critical type, quality and quantity of resources. On the member level the main concern is if the member resources are needed and valued in the network (Alberts, 2017: 105).

Taking into account relational views, relational rents generally arise when network partners exchange (material and immaterial) resources and/or invest in inter-firm resource relations, and/or use governance mechanisms which lower transaction costs and/or enable the realization of 'added value' by a synergetic combination of (material and immaterial) resources (Duschek, 2004). So, the relational advantage is defined as above normal profits or interorganizational quasi rents which are fundamentally generated in inter-firm relationships. Accordingly, they cannot be generated by one of the participating firms alone, but only within the scope of the joint, idiosyncratic contributions of the specific partners of cooperation.

Generally, in previous resource-based studies the sustainability of the competitive advantage is based on factors preventing competitors from imitating a firm's resources (Mazur and Kulczyk, 2013; Oliver, 1997). As Reed and DeFillippi (1990) proved that specificity in a firm's skills and resources can generate casual ambiguity in competency-based advantage and thus raise barriers to imitation. Also, in inter-firm relationships different types of ambiguities may occur, as for example: linkage ambiguity, inherent ambiguity concerned with the resource itself, bundles of co-existing resources, path dependency. Social complexity and behavioral aspects like identification, willingness and ability to imitate resources are key limitations for competitors (Jonson and Regnér, 2008) as well as timing of resource development (Pacheco-de-Almeida and Zemsky, 2007).

Foon and Nair (2010) mentioned the network itself, an intangible resource, as a source of competitive advantage including network identity as an antecedent of trust; communication as an antecedent of both trust and organizational learning; commitment as the result of both trust and organizational learning; and, lastly, both trust and commitment result in sustainable competitive advantage. As well, King (2007) mentioned tacitness, complexity and interconnectedness as main characteristics of inter-firm competencies. Therefore, taking into account knowledge gained thus far, we think that:

**H2:** Relational investment results in sustainable relational advantage.

It is worth noting that, alongside the resource-based and relational theories, a general view of a firm's positioning was developed as the industrial organization. It is based on the structure-conduct-performance paradigm assuming that a firm's performance depends upon the conduct of the buyers and sellers in the market. They depend on the market structure determined by the number and size of the sellers (Porter, 1980, 1981). The strategy of the firm is to adapt to the industry environment by seeking an attractive position in the market. Success results from an attractive market position and related market power due to the selection of either the strategy of a lower cost base or product differentiation. Its sustainability depends on the changes in industry structure which are relatively slow for matured markets (Porter, 1991). Then, the competitive advantage comes from a dominant position over suppliers, buyers and competitors instead of internal or external valuable resource generation (Porter, 1985). The industrial organization's competitive advantage comes from a dominant position over rivals instead of idiosyncratic partnerships with suppliers, buyers or competitors.

The resource stocks of the networking partners are subject to an ongoing process of reproduction and change. Sustainable relational advantage needs relational specific investments. It is worth noting that processes of relational resource development differ in different industries. In this study our interest focuses on relational resources instead of market positioning of the firm which is dominating the industrial organization's thinking. Industrial organization's rationales are not being used endogenously, but we refer to the industry structure as the exogenous/constant context of the studied relationship. Therefore, in the next part of this paper the overall structural context of the exemplified industry influencing the studied resource ties is discussed.

#### **4. The context of the fruit and vegetable industry**

Porter (1980) states that differences in products and buyers create industry segments. There are five competitive forces determining industry competitiveness: threat of mobility, rivalry, buyer and supplier power, as well as threat of substitution. He also defined a fragmented industry as an industry with a large number of small or medium size firms where no firm has a significant market share or strong influence on the industry. They are characterized by low overall entry barriers, the absence of economies of scale, high transportation and inventory costs, no advantage of size when dealing with buyers or suppliers, high product differentiation, exit barriers, newness. Developing a competitive strategy in these industries is connected mainly with overcoming fragmentation by creating economies of scale, standardizing diverse market needs, neutralizing or splitting off the aspects that are most responsible, making acquisitions for a critical mass, recognizing industry trends early, backward integration to lower costs.

Agri-food industry segments are examples of a fragmented industry structure, including the fruit and vegetable industry. Fruit and vegetables are characterized by the need for intensive cultivating and perishability when fresh. Perennial crops have implications for investment. The fruit and vegetable sector contribute mostly to food and nutrition security (Joosten *et al.*, 2015; Traill and Pitts, 1998). A little research shows that, in the fruit and vegetable industry, the agri-food business networks may have different resource profiles. They may differ for agri-food producers', processors' or distributors' networks. The research by Sauvée (2002) shows, for example, that the investments in a specific input provider for organic vegetable farming appear to be a strategic resource and complementary investments are made in human capital, complete information and traceability systems tracking the products' origins. Also, for vegetable processors human capital seems to

be of key importance. The diversity of the participants and the intensity of interactions between them are beneficial to the development of a variety of relationships between them based on sustainable resource ties.

This study is carried out in the Polish fruit and vegetable industry which has undergone an important transformation in recent years. Fruit and vegetable products are an important part of agrifood production in Poland. It plays a major role in ensuring food security and nutrition for a wide segment of the population. In Poland, the fruit and vegetable industry can be regarded as typical of the agrifood sector. It has distinctive production features, and the supply chain is linked to its natural, technical and infrastructural requirements. The businesses within the sector have various structures, but most of them are micro-businesses, and fewer are small and medium sized enterprises. Traditionally, fruit and vegetables are sold by specialist greengroceries who purchase them from wholesalers who in turn purchase them from individual farmers. As well, prepared and processed fruit and vegetables are a significant part in the market. The processing sector is far more concentrated than the fresh market. Processed products are mainly sold through supermarkets (Kapusta, 2002).

Some results of earlier empirical research show that the convergence of domestic and international markets and equalization of competitive conditions decreased the competitive potential of the Polish fruit and vegetable producers and forced them to make significant improvements. First of all, the applied forms of competition, where maintaining low cost is rated the most important, reaffirm fragmentation of the industry. Secondly, to strengthen producers in the industry they must adapt to the qualitative requirements of the international market and high qualitative competitiveness of products. Thirdly, the innovative disadvantage of enterprises is mainly a result of continuous fragmentation in the industry and fall in investments (Wiśniewska, 2012).

It is worth noting that cost and price advantages are slowly ceasing to be a primary source of building competitive advantages for food producers, particularly for fruit and vegetable producers from Poland. A decisive factor for competitiveness of the Polish fruit and vegetable industry is the importance of non-price sources of competitive advantages (Szczepaniak, 2014a). With the processes of convergence of the Polish economy within the EU market, the importance of cost and price advantages in the fruit and vegetable industry is decreasing, hence the importance of the effective low-price competition strategy clearly declined in favor of the effective quality competition strategy (Szczepaniak, 2014b). This tendency requires the Polish producers, retailers and distributors to seek new sources of competitive advantage, other than prices, to enable them to improve their competitive position in the European and global markets. Nowadays, domestic and export markets are regarded as having increased value and rising awareness from consumers. It requires supply chain integration and strong business relationships within the supply and value chains (Wiśniewska-Paluszak and Paluszak, 2019b).

The competitiveness of the Polish food sector is also growing due to cooperation in the form of cluster initiatives, including common fruit and vegetable clusters and producer groups. Cluster group companies operating in the same region, with similar scopes of activity which, despite being competitors, establish cooperation to leverage synergy effects: they prepare joint offerings, conduct joint promotional activities, develop joint distribution channels, etc. Food clusters are the third most numerous groups of clusters in Poland (PIFIA, 2011).

On the demand side, Polish consumers are changing their eating habits and are becoming aware of quality fruit and vegetables and they are obtaining knowledge from corporate social responsibility reports. Therefore, the non-price factors are gaining in importance in consumers' decisions. On the supply side, producers, retailers and distributors are more sensitive and responsive to the expectations of consumers who intend to buy not only cheaper products but to buy more expensive, environment-friendly and safe food of very high quality (Wiśniewska-Paluszak and Paluszak, 2017).

Polish consumers and producers, retailers and distributors take part in relations as stakeholders on the ground of corporate social responsibility and they are creating intangible assets in the social network and business network. They are contributing to building interpersonal ties and mutual trust and are able to cooperate for

the multidirectional and mutual benefit of their networks and are seeking to share value in the networks (Wiśniewska-Paluszak and Paluszak, 2019b).

Polish consumers and producers, retailers and distributors take part in the mutual catching-up process on the demand and supply sides of green market economy. In this economy, demand and supply sides interplay to create economic, social and ecological added value. In this sense, competitiveness and competitive advantage requires multidirectional and mutual relations to create crucial added and shared value between stakeholders on both the demand and supply sides, but not only competition in order to exclude rivals.

This why the green market economy is becoming a social market network aiming at long-term shared value for stakeholders, not just short-term profit for shareholders. Shared value is an economic, social and ecological added value which it is created in the network for the stakeholders of the network, but not only for the shareholders (Wiśniewska-Paluszak and Paluszak, 2019a). Shared value requires a broader perspective than just economic. Also needed are social and ecological benefits for stakeholders. This understood shared value may thus ensure sustainable competitive advantage for producers, retailers and distributors and other stakeholders.

## 5. Sample and method

The theoretical background of a resource-based view determined the use of the VRIN's criteria. Although, its use in practice is quite problematic. This discussion brings important leads for methodological framing of this study (Brahma and Chakraborty, 2011; Kraaijenbrink *et al.*, 2010; Lockett *et al.*, 2009; Miller, 2019; Priem and Butler, 2001). The most challenging part of this research lies in the measurement of unobservable constructs and using proxy variables for such measures common in resource-based research. Most scholars suggest adopting qualitative methods of measuring latent constructs and using indicator variables. Barney and Clark (2007: 222) suggest a way that researchers can measure the potential of resources to create value: by measuring the value created by the strategies the firm creates and implements using its resources.

Whether to conduct a single-industry or multi-industry study is also a difficult question for researchers. A single-industry study provides a rich context of examining resources and capabilities critical to a particular market, whereas a multi-industry study provides greater generalizability. As Miller (2019) stated, the resource-based theory needs to be developed for a particular context because resources and their characteristics can only be clearly valued and measured in a particular setting. The time period of analysis may also pose a challenge to the researcher in terms of cost and time because the examination of the sustained competitive advantage involves a longitudinal approach (Brahma and Chakraborty, 2011).

In the present study, we intend to test the relational investment activities as a source of sustainable relational advantage. We decided to continue to study a single agrifood industry but, in the present study, the unit of analysis is the inter-firm relationship constituting investment activities. The data for this study were gathered through a direct questionnaire conducted with the firm managers. Unless noted otherwise, the items used in the study rely on the 5-point Likert scale anchored on 'very important' to 'unimportant'. This case study is of a qualitative nature.

Supplementary Table S1 displays the characteristics of the sample. In October 2017 the study invited eighteen profiled entities to participate in the survey. The purposive sample selection has been used. It was aimed at the most representative sample for the studied industry. The invited firms declared all together 962 buyer-supplier relationships. Within these companies, the resulting sample comprises data on seven entities (40% of total sample) which declared accomplished or intended investments undertaken within 866 buyer-supplier relationships (90% of total sample). As we can see, the investing entities have many more extensive business relationships than non-investing ones. The resulting sample is comprised of three producers, one processor, one wholesaler and two retailers. Most of the surveyed businesses are microenterprises (1-9 full-time employees) and one is small enterprise (10-49 full-time employees). The sample consists of organizations

of diverse age from 1 to 23 years of activity. Five of the investing entities participate in different formal forms of integration. Among them are supply chains (four), producer groups: occasional cooperation (two) and status (one), cooperatives (two), contracting (two), strategic alliance (one), and cluster (one).

Supplementary Table S2 displays the variables and indicators used in this study. The literature review and the practice show that in these times seven investment areas are particularly salient in the agrifood industry: food safety and social responsibility, human capital, organization of supply and provision, ecology, financial capital, technology, and real capital (Abdirahman and Sauvée, 2014; Abdirahman *et al.*, 2014; Lazzarini *et al.*, 2001; Lefebvre *et al.*, 2012; Lu *et al.*, 2008). In the empirical setting of this study, relational investments into food safety and social responsibility include, for example, investments into early warning and withdrawal system. Relation-specific investments into human capital comprise, for example, investments into development and staff exchange programs while relational investments into optimization of supply and provision comprise, for example, investments into logistics and distribution hubs and so on.

The literature study together with the pre-study interviews with managers and industry experts determined the VRIN's indicators. We decided to define them by empirically testable assertions in form of positive sentences depicting the most expected relational results in certain area of relational investments. As did Barney and Hesterly (2018) we assumed that the VRIN's criteria are multiplicative, not additive, since all relational results must be positive for certain relational investments. Investments with positive assessments are considered as those creating sustainable relational advantage. Relational investments with negative assessments suggest unexploited relational advantage (one negative assessment) or temporary relational advantage (two negative assessments). Relational investments assessed only as valuable indicate relational parity and those with four negative assessments show relational disadvantage.

To evaluate the survey outcomes, common methods of descriptive statistics are used. The research results were mostly presented in relational values. Firstly, the queried entities were asked to indicate accomplished and intended investments undertaken in conjunction with contractors. These indications are regarded together as positive. Their percentage share in total indications was computed. Subsequently, the ratio of positive responses (accomplished and intended) to total responses was compared with the ratio of positive to negative responses (not accomplished and not intended) (Sabey *et al.*, 2018). In this way the main investment areas of the queried entities have been investigated.

Secondly, the queried entities were asked to evaluate the relational results of accomplished investments undertaken in conjunction with contractors. The number of given ranks were related to the total number of ranks. The percentage shares of each rank were compared. Subsequently, the ratio of positive ('very important' and 'important') to total responses was compared with the ratio of negative ('less important' and 'unimportant') to positive responses (Sabey *et al.*, 2018). According to evaluation of all VRIN's criteria the potential of sustainable relational advantage was investigated.

Last but not least, the  $\rho$ -Spearman's ordinal correlation coefficient is estimated (Equation 1). The calculation of rank correlation is tested with the independence  $t$ -test of  $\rho$ -Spearman (Equation 2). To assess correlation of certain variables the following scale is used: strong |1.0-0.61|, medium |0.6-0.31|, weak |0.3-0.00| (Sobczyk, 2007: 118).

$$\rho = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n(n^2 - 1)} \quad (1)$$

where,  $d_i$ -rank difference of converted values of variables  $x_p, y_i$  ( $i = 1, 2, \dots, n$ ) (Kenkel, 1984: 754; Sobczyk, 2007: 117-118).

$$t = \rho \sqrt{\frac{n-2}{1-\rho^2}} \tag{2}$$

where, *n* is number of observations (Gajek and Kałużska, 2000: 118; Kenkel, 1984: 754; Sobczyk, 2010: 284).

The level of probability is evaluated with the *P*-value. In this research it is the probability (assuming H0) of a test statistical value equal to actually observed value. Very small *P*-values indicate strong conclusive evidence for rejecting the null hypothesis (H0) and support the research hypothesis (H1). We assumed that:

$$H0 = P \leq 0 \tag{3}$$

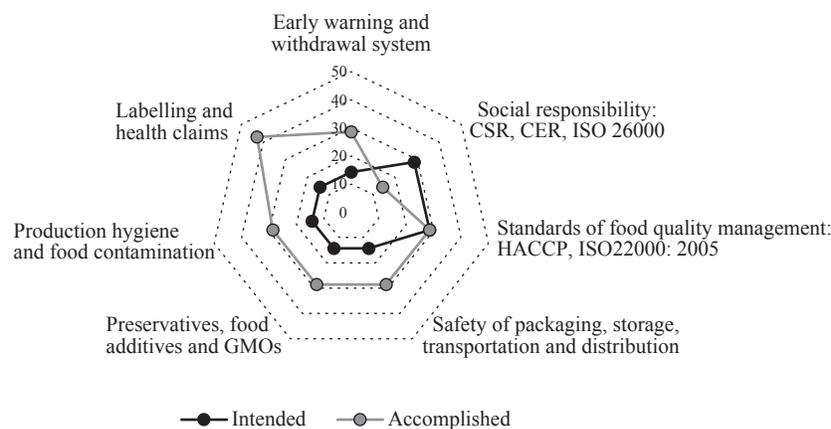
$$H1 = P > 0 \tag{4}$$

The *P*-value is called the attained significance level of a statistical test. Statistical significance implies only that a null hypothesis can be rejected with a specified low risk of error (Hildebrand and Ott, 1996: 260-263). The 95% confidence interval is assumed for the research population. Confidence intervals express that allowance for error (Hildebrand and Ott, 1996: 226). All the statistical measures were computed on Statistica ver. 13.1. software (StatSoft Polska, Kraków, Poland).

### 6. The main areas of relational investments

The first aim of the query was to identify the areas of relational investments. The queried businesses were asked to evaluate 44 types of investment activities assigned to seven investment areas. The 308 variables were received in the query for investment areas evaluation. The accomplished investments in conjunction with contractors inform on the past directions of the resource developments. The intended investments in conjunction with contractors inform on the directions of future resource developments. The sample entities indicated that they have invested in conjunction with their contractors. They undertake relational investment activity. Most of the positive indications (accomplished and intended) were assigned to investments in food safety and social responsibility (31%), human capital (29%), optimization of supply and provision (25%), and ecology (24%). Somewhat fewer indications were assigned to investments in financial capital (17%), technologies (16%), and real capital (11%).

The highest level of accomplished investments in food safety and social responsibility is indicated for labelling and health claims (45%). The highest level of intended investments is indicated for standards of



**Figure 4.** Relational investments in food safety and social responsibility in the fruit and vegetable firms (n=49, in %).

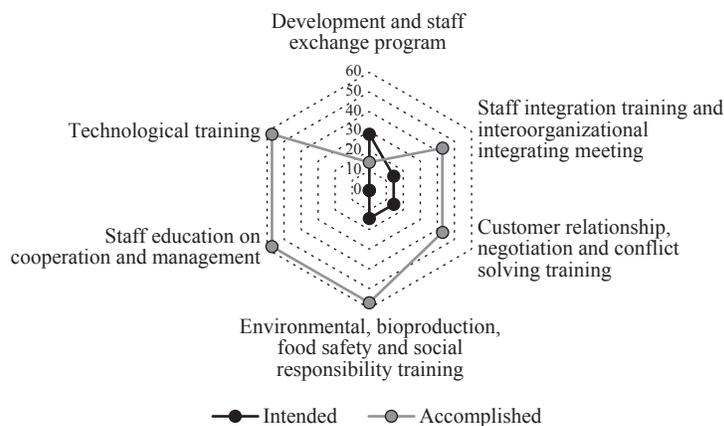
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food quality management and social responsibility (30%). The rest of the specified directions of investments are equally important for the responding entities (Figure 4).

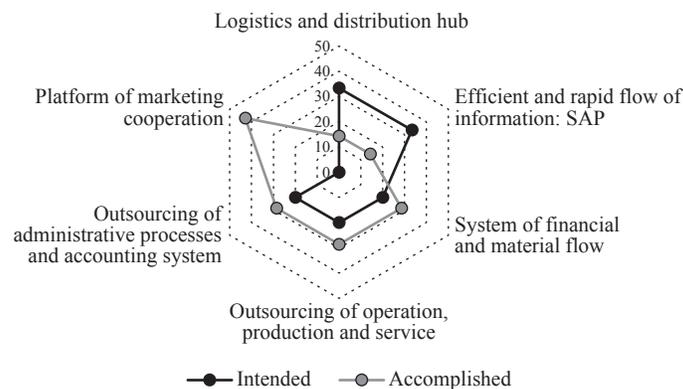
There are three most important relational investments in human capital accomplished by the queried entities which received almost 60% of indications: technological training, staff education on cooperation and management as well as environmental, bio-production, food safety and social responsibility trainings. The last one is also intended in the future by almost 15% of the queried entities (Figure 5).

The most often made relational investment to optimize supply and provision was building a platform of marketing cooperation (43%). The second most accomplished relational investments were connected with outsourcing and implementation of coordination and synchronization of financial and material flow system. They are also indicated by 20% intended in the future. The most intended investments in this direction are implementation of efficient and rapid flow of information such as systems applications and products as well as establishing specialist logistics and distribution hubs, which received over 30% of acceptance in the query (Figure 6).

Accomplished investments in ecology are mostly centered in construction or reconstruction of sewage plants, reduction of chemicals, fertilizers, and plant protection as well as implementation of a system of flow and



**Figure 5.** Relational investments in human capital in the fruit and vegetable firms (n=42, in %).



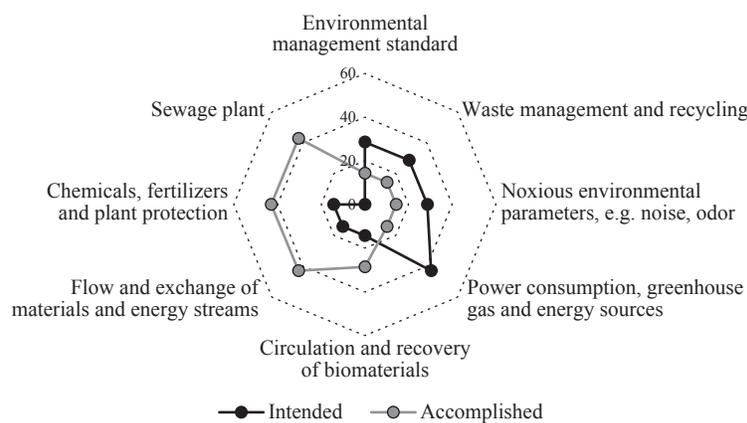
**Figure 6.** Relational investments in optimization of supply and provision in the fruit and vegetable firms (n=42, in %).

exchange of materials and energy streams – 43%. The most often intended investment is the purchase or installation of technology for reducing power consumption, greenhouse gas or replacement energy sources (Figure 7).

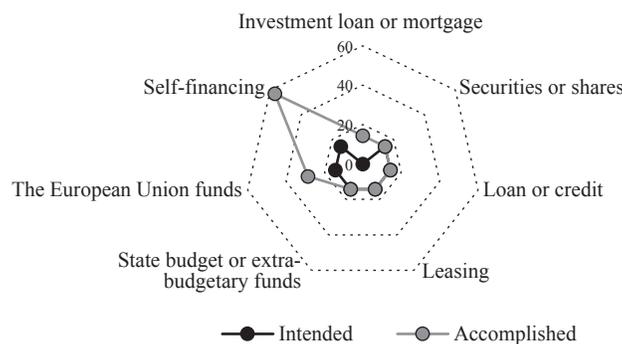
The queried entities had already made investments or planned to invest in more traditional ways, i.e. in financial and real capital and technologies. The most indicated accomplishments are self-financed from their own funds (57%) or European Union funds (29%). Investment loans or mortgages are not intended. The indications for the other forms of financial capital investments are above 14% (Figure 8).

Next, often relational investments are technologies. The most often accomplished are implementations of new technologies (43%) and the most often intended is purchase or creation of non-patented technical knowledge (43%). Also, to purchase patent, license, know-how, new technology or production facilities are of interest to future investors. Some of the respondents seem to be innovative in relationships since they have undertaken resource and development activities also in bio-resources and bioproducts and creation of proprietary new technology (Figure 9).

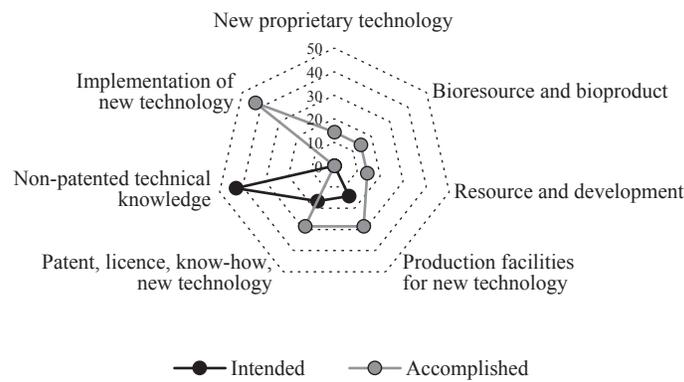
The least indicated investments undertaken in conjunction with contractors are in real capital. The most accomplished are purchases of machinery and equipment and the most intended are constructions of office buildings (28%). About 14% of responses show accomplished and intended investments in land (Figure 10).



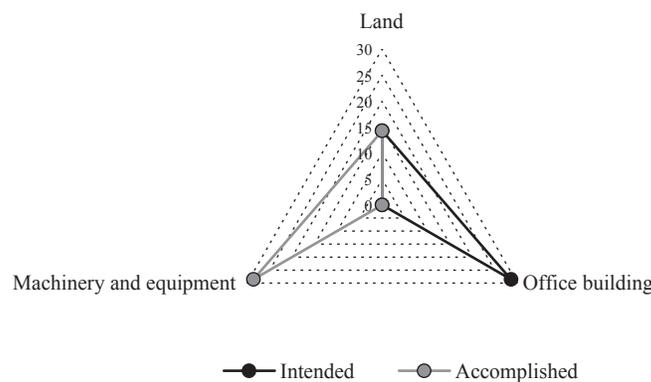
**Figure 7.** Relational investments in ecology in the fruit and vegetable firms (n=56, in %).



**Figure 8.** Relational investments in financial capital in the fruit and vegetable firms (n=49, in %).



**Figure 9.** Relational investments in technology in the fruit and vegetable firms (n=49, in %).



**Figure 10.** Relational investments in real capital in in the fruit and vegetable firms (n=21, in %).

When pooling together all assessments of accomplished investment areas we can see the ones most and least often used. The most often accomplished investments in the queried entities are in: self-financing, environment, bio-production, food safety and social responsibility training, technological training, and staff education on cooperation and management. The least often accomplished investments were: (1) office; (2) production and service building and non-patented technical knowledge; (3) land (Figure 11).

The same analysis for intended investments shows that the most often intended relational investments in the queried entities were: power consumption, greenhouse and energy sources as well as non-patented technological knowledge. The least often intended relational investments are: machinery and equipment, production and service buildings, staff education on cooperation and management, technological trainings, new proprietary technology, implementation of new technology, research and development, bio-resources and bioproducts, sewage plants, platforms of marketing cooperation and investment loans or mortgages (Figure 12).

These findings identify the main areas and types of accomplished and intended investments in the queried businesses. We can see that areas of accomplished and intended investment differ significantly. It shows that relational investing is a dynamic process of generating specific relational resource bundles. The respondents indicated that most of the mutually accomplished investments were connected with self-financing and staff trainings. The firms most often intend to invest in reduction of power consumption and greenhouse gas, new energy sources as well as non-patented technical knowledge. It seems to be consistent with the current requirements and changes in the agrifood industries where the problems of food safety and social responsibilities increase technological and social pressures. On the other hand, it seems that future mutual investments aim at cost reduction in connection with environmental protection.

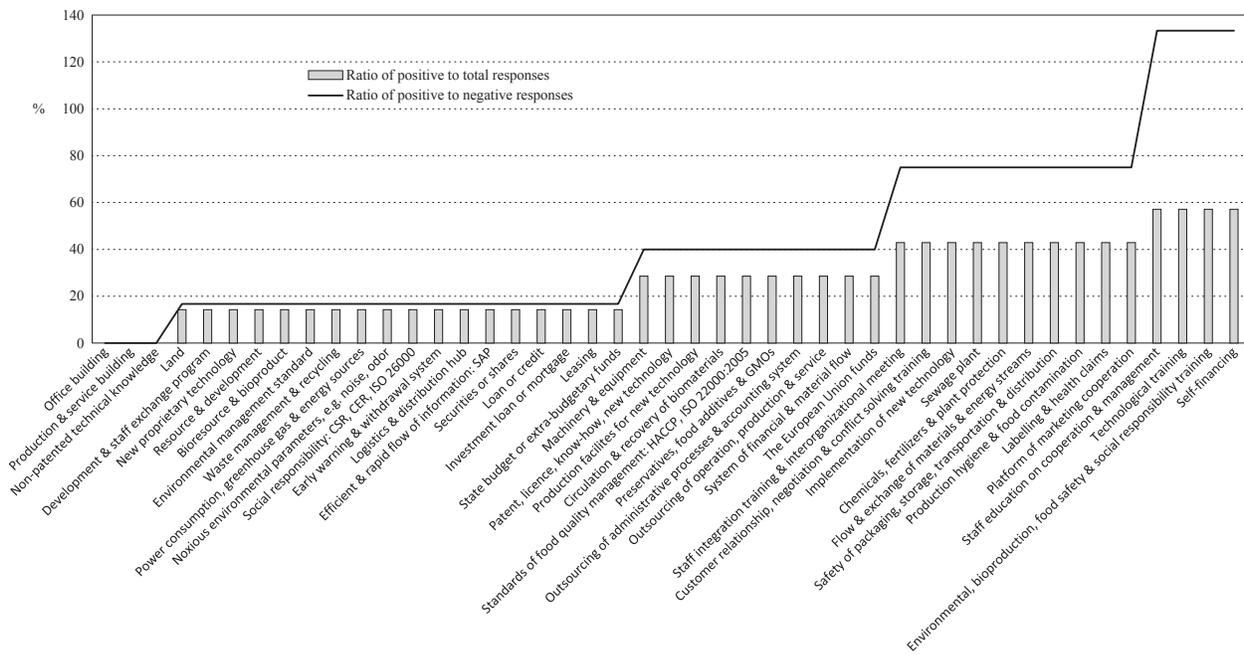


Figure 11. Accomplished relational investments in the fruit and vegetable firms (n=308, in %).

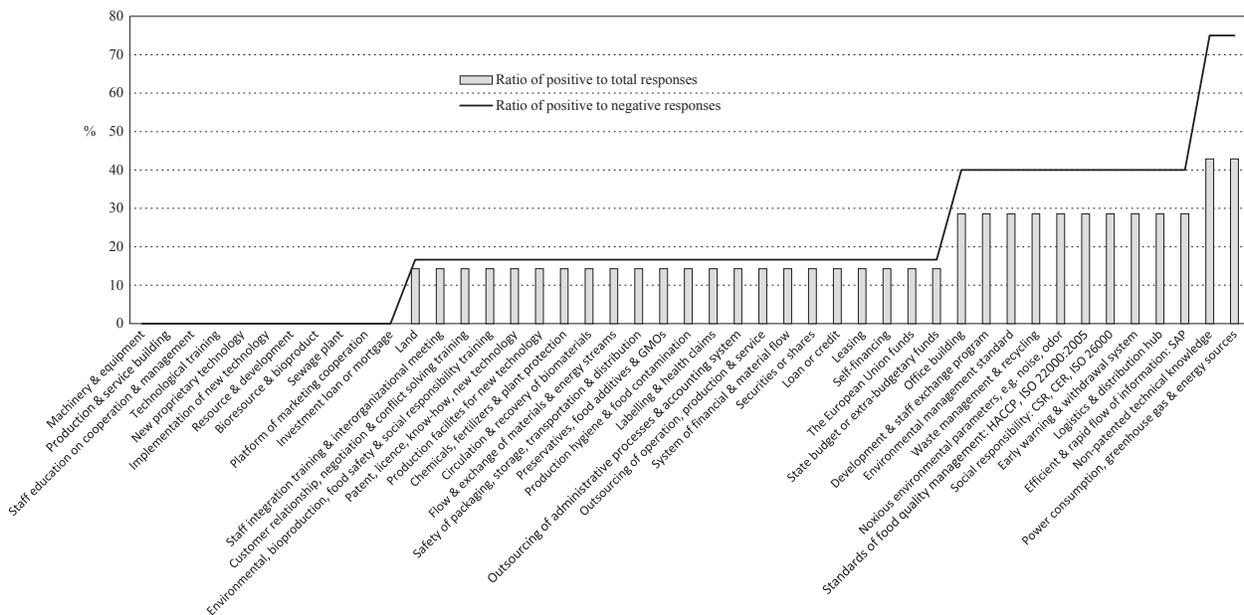
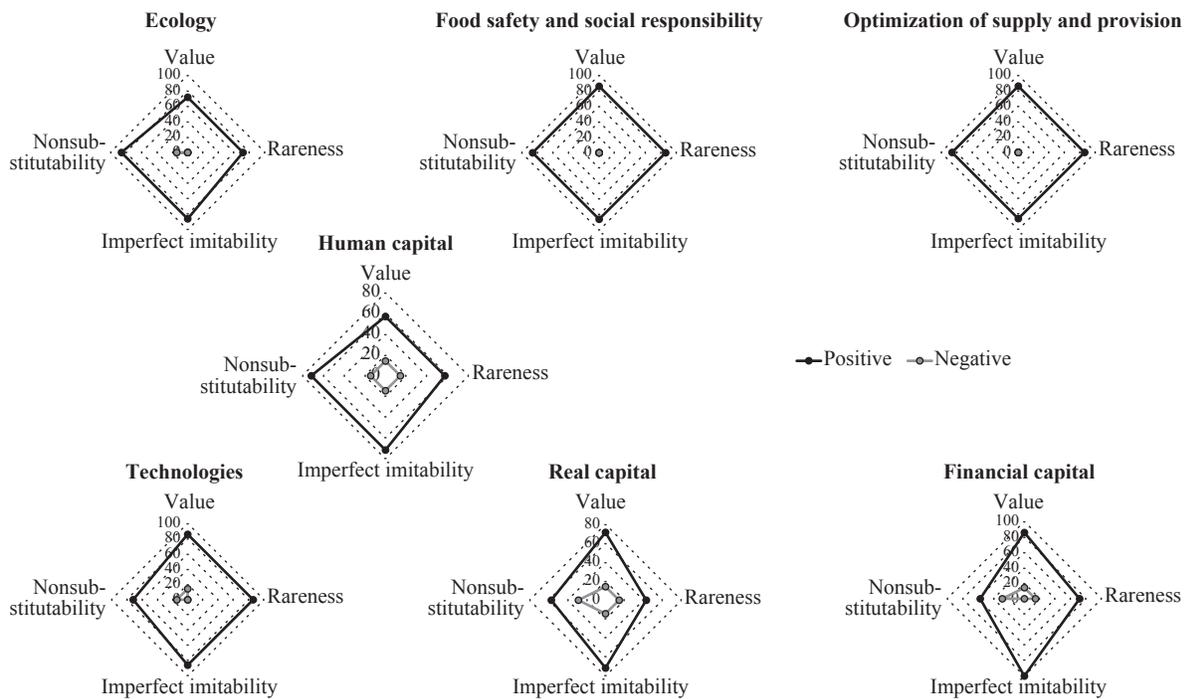


Figure 12. Intended relational investments in the fruit and vegetable firms (n=308, in %).

### 7. The potential of sustainable relational advantage

The second aim of the query was to evaluate the potential of sustainable relational advantage. The queried businesses were asked to evaluate VRIN’s indicators for mutual investments in seven areas. The query got 196 indications. It is worth noting that in total positive indications exceed the negative ones and the same tendency is observed for each area of mutual investments (Figure 13). It seems that in general relational investments are evaluated very positively, but this does not mean that all of them lead to sustainable relational

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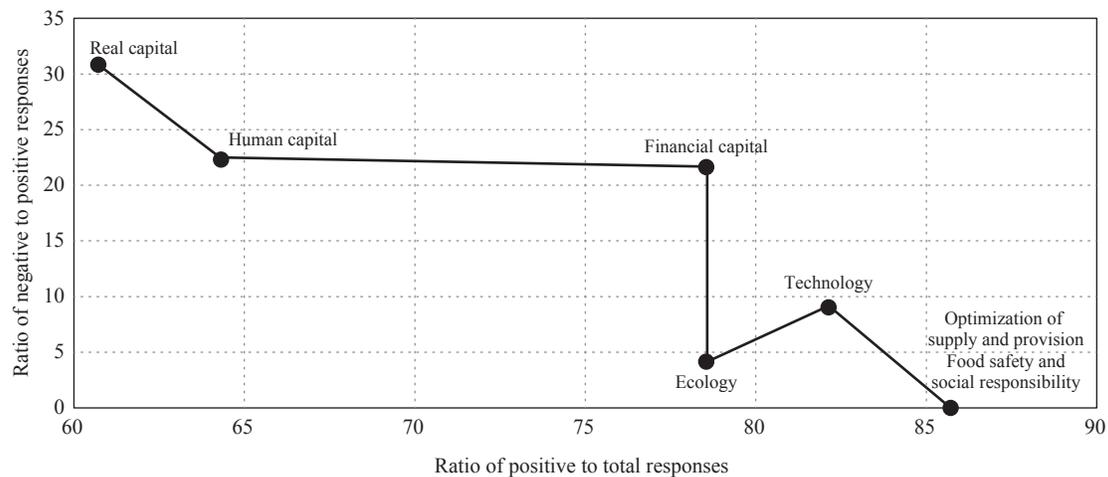
**Figure 13.** The evaluation of the VRIN's criteria in different areas of relational investments in the fruit and vegetable firms (n=196, in %).

advantage since VRIN's criteria are not additive. Some of them bring on unexploited or temporary relational advantage. It is worth noting that none of the relational investments is assessed as creating neutral or negative results, i.e. relational parity or disadvantage.

The average highest evaluation was granted parallel to relational investments in food safety and social responsibility as well as optimization of supply and provision. Value indicators for both of them are assessed equally as the highest. Therefore, relational investments in these areas imply sustainable relational advantage.

The second ranked are technological investments and third ecological. For technological investments the highest assessed variables are rareness, value and imperfect imitability and for ecological investments value, nonsubstitutability and imperfect imitability. Therefore, relational investments in the area of technology and ecology imply unexploited relational advantage. Ranked fourth are financial capital and human capital, and fifth real capital investments. The lowest assessment is given to the rareness and nonsubstitutability of financial, real and human capital. Therefore, these resources are assessed as the least heterogeneous and immobile ones. They are not specific enough for the branch and they are not perceived as a source of long-term advantage. It follows that human, financial and real capital investments imply temporary relational advantage.

It is worth noting, that the valuation of VRIN's indicators measured by the ratio of positive to total responses is above 60% for all areas of relational investment (Figure 14). The highest level of the ratio was reached equally by relational investments in the area of optimization of supply and provision as well as food safety and social responsibility (86%). Furthermore, for these areas of relational investments negative evaluation, measured by the ratio of negative to positive responses, equals zero. These relational investments were not negatively assessed at all. It means that for joint investments in these two areas the VRIN's indicators are positively verified. We may conclude then that they encounter sustainable relational advantage since all evaluations are positive which fulfills the assumption that the VRIN's criteria are multiplicative, not additive.



**Figure 14.** The potential of sustainable relational advantage in the fruit and vegetable firms (n=196, in %).

The VRIN's indicators in the other areas of relational investments were verified by the respondents positively as well as negatively. The technological and ecological investments are highly positively assessed as well at around 80% or more of positive to total responses. Furthermore, they received negative scores but ratio of negative to positive responses is lower than 10%. In this study they cannot be included into the group of sustainable relational advantage creators even if the relational results of both areas of relational investments are very highly accepted in the queried firms. This analysis confirms unexploited relational advantage in these areas of relational investments. Third ranked are relational investments in financial capital with 79% of positive to total responses, but with 22% ratio of negative to positive responses. The fourth group consists of relational investments in human and real capital. Their value is positively evaluated by respondents at 64 and 61% respectively. The ratio of negative to positive responses is 23 and 31% respectively. The temporary relational advantage has been confirmed for these areas.

Next, the research hypothesis is verified with the correlation analysis. Table 1 reports on correlations in the studied relational investment areas. Hypothesis 1 suggests a positive association between relational investments and specific relational resource bundles. Showing high correlations between relational investments in four out of seven analyzed areas the analysis provides confirming evidence for Hypothesis 1. It is confirmed, particularly with the assessments of the experienced businesses aged over 20 years. Their average evaluations have higher values of correlation coefficients in comparison to the whole sample. 31 out of 42 calculated coefficients are verified positively at  $P < 0.05$ . For the other 11 the null hypothesis ( $H_0$ ) is not rejected at  $P < 0.05$ . In these 11 cases the  $P$ -value should be greater than 0.05 to support the research hypothesis ( $H_1$ ) for all the firms' eleven positive correlation coefficients measured. For the businesses over 20 years old, 20 positive correlation coefficients are measured.

The highest correlation coefficient is measured for relational investments in the areas of optimization of supply and provision, food safety and social responsibility with ecological investments (0.96). As well, relational investments in the area of optimization of supply and provision are highly correlated with food safety and social responsibility investments (0.94). Ecological and technological investments receive a high correlation coefficient (0.92). Considering the findings, we may conclude that, in the queried sample, there are four areas of relational investments which determine the relational resource bundle: food safety and social responsibility, optimization of supply and provision, ecology and technology. The statistical analysis provides confirming evidence that the relational resource bundle conjoins resources in the most desired areas of relational investments.

**Table 1.** The association between the VRIN’s indicators evaluations for different areas of relational investments in the fruit and vegetable firms according to the firms’ age ( $\rho$ -Spearman’s ordinal correlation coefficient, n=196).<sup>1</sup>

Variables		Real capital		Human capital		Technology		Ecology		Food safety and social responsibility		Optimization of supply and provision		Financial capital	
		a	b	a	b	a	b	a	b	a	b	a	b	a	b
Real capital	a	1		0.69		–		–		–		–		–	
	b		1	0.96		0.81		0.89		0.96		0.85		0.94	
Human capital	a			1		–		–		0.56		–		–	
	b				1	0.93		0.96		–		0.94		0.96	
Technology	a					1		0.70		0.53		0.73		0.53	
	b						1	0.92		0.93		0.88		0.92	
Ecology	a							1		0.64		0.69		0.51	
	b								1	0.96		0.96		0.94	
Food safety and social responsibility	a									1		0.56		0.46	
	b										1	0.94		0.95	
Optimization of supply and provision	a											1		–	
	b												1	0.85	
Financial capital	a													1	
	b														1

<sup>1</sup> a = all firms; b = firms aged over 20 years; correlation coefficients statistically significant at the level  $P < 0.05$ ; – correlation coefficients not statistically significant.

Table 2 shows the correlation results for VRIN’s indicators. Correlation coefficients are measured for the average evaluations of VRIN’s indicators. Correlation analysis supports Hypothesis 2 which proposes that relational investment results in sustainable relational advantage. First of all, twelve calculated coefficients are verified positively at  $P < 0.05$ . Therefore, for all correlation coefficients the null hypothesis (H0) is rejected at  $P < 0.05$ . In all cases the research hypothesis (H1) is supported by the  $P$ -value. In all cases its value is over 0.60 – the correlation is strong. It is worth noting that the highest level of measured coefficients is found for experienced businesses aged over 20 years. In their case all correlations are strong and over 0.80.

**Table 2.** The association between the average evaluations of VRIN’s indicators in the fruit and vegetable firms according to the firms’ age ( $\rho$ -Spearman’s ordinal correlation coefficient, n=28).<sup>1</sup>

Variables		Value		Rareness		Imperfect imitability		Nonsubstitutability	
		a	b	a	b	a	b	a	b
Value	a	1		0.62		0.67		0.62	
	b		1		0.85		0.81		0.95
Rareness	a			1		0.60		0.64	
	b				1		0.85		0.87
Imperfect imitability	a					1		0.72	
	b						1		0.83
Nonsubstitutability	a							1	
	b								1

<sup>1</sup> a = all firms; b = firms aged over 20 years; correlation coefficients statistically significant at the level  $P < 0.05$ .

The highest correlation coefficients for all evaluations are reported for nonsubstitutability with imperfect imitability (0.72) and for imperfect imitability and value (0.67). The value is highly correlated with nonsubstitutability (0.95) and rareness (0.85) and rareness is highly correlated with nonsubstitutability (0.87) and imperfect imitability (0.85). The highest correlated attributes are nonsubstitutability with value (0.95) and rareness (0.87). Considering the findings, we may conclude that the statistical analysis provides confirming evidence that the evaluations of VRIN's indicators are highly correlated with each other, which means that relational investments have the potential of sustainable relational advantage.

## 8. Discussion

Earlier research demonstrates that competitive advantage and network relationships matter for the outcomes the businesses generate from their activities (Wiśniewska, 2012; Wiśniewska-Paluszak and Paluszak, 2019b). To date, however, research has mainly focused on one particular activity – relational investments as a source of relational advantage. It seeks to explain if and how relational investments contribute to the sustainable relational advantage of business relationships. Results are consistent with the broad notion of resource-based and relational theory that valuable resources create, and some of them sustain, relational rents. This article argues that relational investments generate specific relational resource bundles and sustainable relational advantage.

One significant implication of this research relates to the model of resource-based sustainable relational advantage in agrifood business relationships. Consistent with its arguments, empirical findings reveal that inter-firm investments aimed at optimization of supply and provision, food safety and social responsibility led to the generation of relation-specific resources which create the potential of sustainable relational advantage. Similarly, technological and ecological developments imply unexploited relational advantage. Subsequent human, financial and real capital investments lead to only temporary relational advantage. With these findings, the study at hand further extends extant theorizing by highlighting that relational investments are both a source of relation-specific resources and relational rents (Table 3).

The latest empirical studies investigating the link between the resource heterogeneity and the patterns of customer-supplier relationships show that the participants who see the resource as homogeneous have limited interaction and little or no resource relationships, whereas the participants who see the resource as heterogeneous have a much more extensive interaction and closer resource ties (Abrahamsen and Håkansson, 2015). These research results are consistent with the earlier observations since they find that those businesses which undertake relational investments have a huge number of business relationships in comparison to non-investing ones.

Resources are critical in business relationships not only in order to secure access to and transfer of existing resources but also for the development of resources. Heterogeneity in resources means that companies seek to utilize the development potential of their resources (Håkansson and Snehota, 1995). Thus, there are relationships where both parties make mutual investments. The results might be adaptations and increased interdependence where breaking relationships and building new ones will be costly and often counterproductive (Abrahamsen and Håkansson, 2015). Also confirmed by Sauvée and Coulibaly's (2007) research is that managers should consider neither the direct ownership nor the control of key resources, but should instead focus on mutually interrelated power network relationships. Achieving equilibrium between partners leads to avoiding the main pitfalls, such as hold up problems over key resources or brand goodwill.

Malak-Rawlikowska's (2018) research shows that specific investments may lead to hold up situation in the food supply chain because it may reduce bargaining power and increase additional inter-dependency, for example by limiting the freedom to change suppliers. The results of the present study, however, suggest that relational investments may be, first of all, the source of sustainable relational advantage. Considering the findings, results of relational investments in some areas are assessed fully positively in the queried sample with no negative answers at all. This means that the advantages from specific investments in some areas, for

**Table 3.** Relational advantages of investment areas in agrifood business relationships in the fruit and vegetable industry.

Area of relational investment	VRIN's criteria	Relational advantage
Food safety and social responsibility	value rareness imperfect imitability nonsubstitutability	sustainable
Optimization of supply and provision	value rareness imperfect imitability nonsubstitutability	sustainable
Technology	value rareness imperfect imitability	unexploited
Ecology	value nonsubstitutability imperfect imitability	unexploited
Human capital	nonsubstitutability imperfect imitability	temporal
Financial capital	value imperfect imitability	temporal
Real capital	value imperfect imitability	temporal

the queried businesses they are food safety and social responsibility as well as optimization of supply and provision, may overcome the threat of opportunistic behavior and breaking of relationships.

Gold *et al.*'s (2010) research finds that the challenge of incorporating comprehensive sustainability goals into corporate behavior due to the worldwide growth of environmental and ethical awareness induced the necessity of collaboration among entire supply chains and networks. Collaboration on social and environmental issues has a distinct opportunity to give a competitive edge over rivals. Substantial investments must be made by the firms beforehand and allotted to ecological and societal concerns. Vargas and Mantilla (2014) also use resource-based tools to study organizational capabilities of firms to adopt to implement sustainability initiatives and sustainable supply chain management through a literature review. They also concluded that to respond to sustainability concerns firms require interconnected and reinforcing types of relational or inter-organizational capabilities. This study's results further show that in particular relational investments in the area of environmental and social responsibility have the potential of sustainable relational advantage. This means that collaboration and interconnected, reinforcing types of relational or inter-organizational capabilities are not only required but they are also advantageous for the partners willing to invest mutually in environmental and social issues.

Recent studies are connected with drivers of close, long-term buyer-supplier relationships. Ebers and Semaru (2015) researched drivers of specific investments between buyer and supplier. The authors found that the allocation of these investments depends on power balances and trust. With this study's findings we highlighted that the allocation of relational investments depends on the expected relational advantage. In the queried sample the most relational investments were undertaken in the areas assessed as having the potential of sustainable relational advantage. The most intended relational investment activities are in the areas of food safety and social responsibility, optimization of supply and provision, ecology and technology. The least intended relational investment activities are in the areas of financial and real capital which are assessed as the least sustainable.

Other authors found that the specific investments of manufacturers and distributors both independently and interactively enhance manufacturers' acquisition of market knowledge from their distributors. In addition, manufacturers' absorptive capacity positively moderates the effect of specific investments on manufacturers' learning from distributors (Li *et al.*, 2017). With these research findings, most of the accomplished relational investments in the area of human capital aimed at development of technological training, staff education on cooperation and management, environmental, bioproduction, food safety and social responsibility training. This means that in the queried sample the development of knowledge acquisition and absorption is an important factor of relational advantage increasing. However, this research also shows that according to the queried assessments, investments in human capital bring only temporary relational advantage. This means that learning and knowledge acquisition and absorption is a continuous business task, but not one which implies sustainable relational advantage.

Next, the research shows that supplier partnership improves the operational cost performance of manufacturers and that its effectiveness is contingent on specific investments (Yeung *et al.*, 2013). Lu *et al.* (2012) proved that specific investments of Chinese agrifood small and medium-sized enterprises inter-personal trust improve the relationship satisfaction conceptualized as a positive effect on the focal firm's contentment in relationships with other parties like suppliers or buyers. With these research findings, relational investments in the area of optimization of supply and provision by fulfilling the VRIN's criteria are the sources of sustainable relational advantage.

This study displays a number of limitations that indicate additional opportunities for future research. Data collection for this study relied on key informant information provided by eighteen representatives investigated, all of whom declared they have business relationships with their contractors – suppliers, customers and others. The results of the query show that the fruit and vegetable industry entities are engaged not only in the pure exchange in the market with their contractors which means that they perceive their resources as not being homogenous but partially heterogeneous and immobile. However, 60% of them declared no interaction in investments. This means that their business relationships are not intended to create resource ties with their contractors and they limit their network to current, operational, short-term interactions.

The operationalization of resource-based constructs is a major problem in the research. The indicators used are highly industry and investment area specific, so that most of the measures developed cannot be used for cross-industry studies. No general survey measures for the codified resource constructs have been established in this study, principally because these constructs remain non-codifiable.

## 9. Research and managerial implications

This paper is grounded in the issue considering inter-firm investments as determinants of value increase. The resource-based sustainable relational advantage model has been executed in the present study. It assumes that continuous interaction with other business entities comprising relational investments constitutes the context within which the interactions endow the resources with meaning and a role. Any attempt to develop a business requires the shift in focus away from the way it allocates and structures its internal resources towards the way it relates its own resources to those of its contractors constituting its context. Although our resource-based and relational rationale relied on research to offer a new insight into relational and resource-based theories, they need to be confronted with further research and other theoretical backgrounds such as industrial theories. There is a body of research on resource ties, but they still have to be done in different industrial subsystems, in particular for agrifood industries. Future research may also bring the possibility of cross-industry comparisons of different areas and relational advantages of inter-firm investment activities and resources.

The resource-based sustainable relational advantage model proposed here is also a call to managers to focus on relational investments and relational resource bundles. The model may be used by managers to assess their firm's strengths and weaknesses in relational investment strategies. They can use it to evaluate relational

relevance in the context of well-known VRIN's criteria, i.e. value, rareness, imitability and substitutability. However, managers should, in addition, carefully assess the aspects of each unique cooperative relationship in which the firm is engaged. In so doing, they will gain an understanding of the potential and the limitations of its relationship network.

An important task for management is to control the balance and coordination of the relational investments in the various relationships of the firm. Business managers need to manage resources in business relationships and networks to reach the optimal bundles and configurations. The bigger the investments in relation-specific assets, the more potential for creating relational advantages. However, according to our findings, not all relational investments may create a sustainable relational advantage. Some of them may provide just unexploited or temporary relational advantage as well as relational parity or even relational disadvantage. It is worth knowing that among the studied areas of relational investments in the agrifood industry there is none assessed as leading only to relational parity or relational disadvantage.

According to our study, relational investment means to invest in conjunction with business partners like suppliers, customers and even competitors. It definitely means to combine resources to increase their value. It leads to setting up resource ties. A typical investment cycle takes time and effort to build up relationships while benefits tend to lie ahead in time. Costs and revenues tend to appear at different times. That is why the queried respondents with long business experience assessed relational investments as highly positive. Resource ties in business relationships that are better utilized and more difficult to substitute are stronger. They create and sustain relational advantages.

We have noted that among queried entities only 40% accomplished or intended investments in conjunction with their contractors. Their extensive interaction is based on an assumption of heterogeneity and immobility of resources, and they set up relationships with a greater degree of adaptation between the contractors. Examples of this may be that the counterparts have developed food safety and traceability systems together to increase their social responsibility or have developed common storage or transport activities to optimize costs of supply and provision. This type of interaction is direct and requires an active attitude, willingness to cooperate and investment in the relationship from both parties. They develop long-term relationships where they share resources.

This empirical study shows that businesses may, and do, develop resources and resource combinations in relationship with others because it is in such relationships that the use of resources is dealt with. Relationships activate and develop specific resource elements and different resource bundles. The study also confirms that resources are not entities given once and for all but variables. In the queried entities the accomplished and the intended investments represent different directions. Resource development is a long-term, dynamic and changing process.

In addition, our study informs managers that sustainable advantageous relational investments are connected with food safety, social responsibility and optimization of supply and provisions. They are the main directions of investing in relation to external users and providers of resources like suppliers and buyers. The sustainable relational advantage results directly from relational investments. They are assessed as very highly heterogeneous and immobile in the studied businesses. Therefore, these investments are made in business relationships. The other investments – technological and ecological are directly connected with the above mentioned but, they are rather internally provided resources since they indicate unexploited relational advantages. There are three nonspecific investments areas – human, financial and real capital in relational investing. They provide just temporary relational advantage. They are of less interest to be acted on by external providers because of their higher homogeneity.

We attempt in this article to provide an argument for the sustainable relational advantage of relational investments. We also develop the argument if and how relational resources across firms are heterogeneous and if and how they have the potential of becoming a sustainable relational advantage in the sense that they

create long-term values for firms involved in combining them. The strategy of resource acquisition and use by combining them with business partners' resources is a way to achieve sustainable relational advantage in business networks.

The results of the study show that resources are not a given, but network participants must develop them and decide on their investment strategies. Especially in business relationships, resource ties require co-specialization and learning over time. So, they undertake investments in conjunction with their contractors. Implemented in this study was an integrative approach which combines resource-based and relational views. It is assumed that, to attain sustainable relational advantage, networking partners implement value creating strategies by creating valuable, rare, imperfectly imitable and nonsubstitutable relational resources.

In this paper these values are measured with resource-based theory indicators. It is assumed that these attributes enable business partners to implement investment strategies that improve not only the value of the resource combinations but develop also sustainable resource ties in business networks which means long-term and satisfying business relationships with external users and providers of resources like suppliers, buyers or competitors. The tentative insights from resource-based and relational theories will hopefully provide the impetus for a new way of thinking about relational investments and resources.

## Supplementary material

Supplementary material can be found online at <https://doi.org/10.22434/IFAMR2019.0149>

**Table S1.** The sample.

**Table S2.** Variables and indicators.

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*Special track: European agrifood business in transition towards social responsibility*

## **Sustainable demand-supply chain: an innovative approach for improving sustainability in agrifood chains**

### **REVIEW ARTICLE**

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### **Abstract**

Increasing price volatility and the decrease in both raw material prices and farmers' incomes, all underline the depths of the French agricultural crisis. How should the relationships within agrifood supply chains be envisaged in order to obtain greater sustainability combined with better added-value distribution? This article introduces a new approach for supply chain organization and management: the sustainable demand-supply chain. The paper mobilizes both management, organization and innovation literatures, together with a case study based on data from farmers, cooperatives and distributors in the pork sector. The originality of the paper lies in its modelization of sustainable demand-supply chains. The results show that new relationships need to be implemented between all stakeholders, including consumers – both to share information and to define their new added-value distribution. The results identify the key points of this new supply chain coordination and indicate policy recommendations for organizational innovations.

**Keywords:** contract, sustainable supply chain, agrifood, organizational innovation, supply chain management  
**JEL code:** L2, O13, Q13

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## 1. Introduction

Increasing price volatility and the decrease in both raw material prices and farmers' incomes, all underline the depths of the French agricultural crisis in meat, cereals or dairy products. These sectorial crises reveal the weakness of French agriculture competitiveness and the lack of coordination in the agrifood supply chains. How should the relationships within those supply chains be envisaged to obtain greater sustainability together with better added-value distribution?

This article introduces a new approach for supply chain organization and management: the sustainable demand-supply chain (SDSC). SDSC analyzes flows between stakeholders, especially farmers, processors, distributors and consumers in order to ensure better added-value creation and distribution for all. The objective is to discuss the conceptualization of SDSC within the innovation system approach, including what concerns its multilevel dimensions. How can SDSC be conceptualized, measured and developed?

The SDSC approach mobilizes two main concepts, extended demand and creating/sharing added value, which together require shared supply chain governance. SDSC is an innovative approach using two concepts: (1) extended demand, comprising demand expressed by customers and either stakeholders; and (2) the demand-supply chain (DSC), a co-creative group of stakeholders which creates and shares added-value. The SDSC approach introduces new form of governance in order to ensure sustainable commitment. This avoids conflicts and the destruction of added value by stiff competition. SDSC, like supply chain management, improves coordination between stakeholders, using both information technology and indicators to share value and to integrate the new forms of contract. In this perspective we have, on the one hand, technical problems and, on the other, relationship problems. In the present contribution, we focus on the second dimension.

The paper mobilizes both management, organization and innovation literatures (Chassagnon, 2011; Elzen *et al.*, 2004; Ketchen and Hult, 2007; Lazzarini *et al.*, 2011; Wieczorek and Hekkert, 2012) in order to better understand how to analyze and measure the added value created by SDSC. The case study used to illustrate the paper employs data from farmers, cooperatives and distributors in the pork sector. This sector is particularly interesting because, even if pig farmers perform well technically, they are losing their market shares in both national and international markets. The case study details both the data collection (definition and type of data), and the data analysis (qualification of data, triggers, individual and global performance). In order to model the flow between stakeholders, new collaborative traceability tools are needed (based on the new EPCIS standard of GS1 (GS1, Paris, France)) and simulation-optimization.

The originality of the paper lies in using SDSC to propose a modelization of sustainable demand-supply chains. The results show that new relationships need to be implemented between all stakeholders – both to share information and to define their new added-value distribution. Modelization is needed in order to show how flows of products move, and how selling prices reveal the added-value allocation. The results identify the key points of this new supply chain coordination and suggest organizational innovations. The paper concludes with the need for public policy makers to authorize the use of new contractual tools.

## 2. Context and theoretical background

Agrifood sectors are often defined through their production components, but without including the distributors. They have, of course, strong impacts on production, especially via distributor brand product specifications, particularly when these incorporate specific environmental or social objectives (Berger *et al.*, 2015). Supply Chains management or *filière* are renewal concepts due to societal pressure to face sustainability versus market competition.

## 2.1 Agrifood supply chains for sustainability

The concept of supply chain management, whether between production and distribution or between production actors, is not very developed in many agrifood sectors. When the chain is managed, this is almost always done independently of demand management, as is also often the case in non-agrifood sectors (Kusi-Sarpong *et al.*, 2019). It should be noted, however, that as the different forms of leverage to create value are linked; the supply and demand changes need to be jointly managed. This is done at actor level, through sales and operation planning, even though this process is not yet widely implemented.

Usually each actor tries to maximize profits on an individual basis, however illusory that approach may prove to be. But it is even more absurd to try to optimize environmental or social results at a single actor level. We often see individual actors working on different topics without any attempts at coordination. Inevitably, the results are too atomized to be valorized for consumers or other stakeholders and sometimes, even, the results cancel out each other.

One consequence of this is that actors share very little information, restricted for the most part to ordering and invoicing information. Even those traceability information systems that are put in place are very often basic, in house-solutions, merely set up to exchange data between actors.

Another characteristic of the agrifood sector concerns the metric used in strategic environmental topics. Usually, individual actors establish their own specific Life Cycle Assessment (LCA) on different products. As these LCAs are rarely shared between actors, and are built on different domain and different leading data, it is hard to define a common strategy and common criteria focused on environmental aspects. A similar problem exists for defining social criteria. Another difficulty in promoting work carried out on environmental aspects is the LCA product approach. The actions of certain environmental actors are made independently of their products. These actions could be discussed between actors, constituting part of a common environmental strategy, and thereby creating value (Gereffi *et al.*, 2005). One final characteristic is that currently it is the agrifood sector organizations themselves which often promote price volatility and speculations. That makes it hard to create a circular economy or to develop short supply chains (Marsden *et al.*, 2000).

## 2.2 Theoretical proposals to take supply chains problems into account

The literature in economics, management, organization and logistics focuses on different aspects of supply chains. Various authors have analyzed how firms coordinate and build an supply chain as an organizational and productive entity. For these scholars, the main theoretical economic contributions are:

- The theory of the nexus of explicit contracts: the nature of the firm is based on the organization of a bundle of various different contractual arrangements (Alchian and Demsetz, 1972; Fama, 1980; Jensen and Meckling, 1976). This nexus of explicit contracts leads scholars to suggest ways of reconciling opposing interests.
- The theory of property rights: the firm as a collection of non-human assets, which argues that firms arise when market contractual relationships fail (Grossman and Hart, 1986; Hart, 1995; Hart and Moore, 1990), with organization relationships being analyzed via a property rights reading.
- Transaction cost economics: the firm as a governance structure of contracts (Coase, 1937; Williamson, 1975, 1985). Using the transaction cost point of view, the integration into supply chain is considered as a way to reduce costs and opportunistic behaviors.

Consequently, coordination between stakeholders needs to be supported by technical tools, contracts and organizational arrangements. Together with management and organization literature, supply chain mobilizes supply chain analysis (vertically organized, sequential transactions) and network analysis (horizontal bonds between companies). Referring to the literature, Nasueilli *et al.* (2015: 3) argue that supply chains should be treated as complex adaptive systems, and they propose to exploit some of the concepts, tools and techniques used in the study of complex adaptive systems to characterize and model supply-chain networks. Lazzarini

*et al.* (2001) suggest that supply chain analysis should study the vertically organized sequential transactions, which represent the successive stages of creating value along the supply chain. However, network analysis is not particularly concerned with vertically organized links, but rather with horizontal bonds between companies in particular industries or groups (Surana *et al.*, 2005). That is why Lazzarini *et al.* (2001) introduce the concept of netchain analysis:

‘a netchain is a set of networks comprised of horizontal ties between firms within a particular industry or group, which are sequentially arranged based on vertical ties between firms in different layers. Netchain analysis interprets supply chain and network perspectives on inter-organizational collaboration with particular emphasis on the value creating and coordination mechanism sources. The recognition and accounting of these simultaneous interdependencies is crucial for a more advanced understanding of complex inter-organizational relations.’

A netchain is a network formed by a set of networks composed of horizontal bonds between firms within a particular segment and arranged sequentially according to vertical ties between firms in different layers, or in different segments. Netchain analysis draws an explicit distinction between horizontal bonds (in the same layer) and vertical links (in different layers), mapping out how agents in each layer are related to other agents and to agents in the other layers (Ketchen and Hult, 2007). The question of the power in supply chain management (Cox *et al.*, 2001; Ireland and Webb, 2007; Reimann *et al.*, 2017) reinforces the perspectives for renewing complex relationships in food chains. Supply chains are becoming increasingly complex (Gereffi *et al.*, 2005; Rastoin and Ghersi, 2010), and intensified competition in the end markets has started to create a situation where cooperation requirements between companies are increasing, and old mechanistic operations management solutions are becoming obsolete (Gold and Schleper, 2017; Ketchen and Hult, 2007). Although a network approach to supply has been extensively acknowledged in supply chain literature, the supply chain concept focuses on supply and considers the effects of demand to be an exogenous factor (Rezaee *et al.*, 2015). This is why we need to create a new approach in order to work more efficiently and create more value, in order to satisfy the economic environmental and social expectations of the consumer and all stakeholders (Nieuwenhuis *et al.*, 2019), combined with a fair distribution between everybody. This is the main objective of the SDSC approach.

### 3. SDSC approach: an innovative mix of sustainability and new governance

This part describes the SDSC approach and its associated tools, clearly pointing out their innovative aspects.

#### 3.1 SDSC approach perception

There are two major considerations in the SDSC approach. One is to place sustainable development at the very heart of strategy. The second, resolutely innovative in nature, is to promote joint management of the demand and supply chain (both at actor and inter-organizational level). The SDSC approach is based on two concepts: specified extended demand and DSC. This section explains these two innovative concepts.

##### ■ *A need for coherence in sustainability strategy at the sector level*

The consideration of environmental and social objectives requires coherence through the whole chain (Gold and Schleper, 2017). In consequence, it also encourages and facilitates collaboration among actors. For example, a life cycle analysis is made at the inter-organization level: actors must collaborate to collect and aggregate data. These data must be coherent, and actors must define coherent improvement actions. The choice of stakeholders, that has to be taken into account in the strategy, has also to be discussed among the actors (this discussion is part of the SDSC approach and is described below, together with the specification of extended demand). Another positive advantage is that such essential environmental and social discussions between actors also incite them to re-think their individual economic optimization, allowing them to discover a more lucrative organization at a global level.

### ■ *Promotion for joint management of the demand and the supply chain*

This joint management of the demand and supply chain takes place at both intra-organizational and inter-organizational level. It can be applied to different areas. For example, in pricing and promotional campaign management: sudden changes in prices (up or down) have consequences on sales levels and must be decided in terms of production and logistic capacities. This joint management approach avoids spending on advertising when there are no products to sell, or in case of waste due to large returns of unsold products. This joint management begins with sharing forecasts in order to establish coherence within the whole chain, (avoiding the whip effect, for example, and also easing the definition of common scenarios for demand variations). It can also help in organizing the donation of short best-before date food to charity, free of charge. The joint management could also consist in finding value from co-products (with new profits and a decrease in waste), or by designing promotional packaging to ease the promotion and reduce workers' fatigue (for example, ready-to-sell displays), or classical supply chain optimization by transport pooling (full trucks, less CO<sub>2</sub>).

### 3.2 *The main concepts of the SDSC approach*

The need for coherence between actors on environmental and social aspects and the joint management of supply chain and demand imply deep changes in the sector organization and governance. To better understand and implement the SDSC approach, two operational concepts has been developed in the next section: the 'specified extended demand' and the 'demand-supply chain'. The SDSC acceptance is also eased by specific tools that develop DSC confidence; these are detailed in the last part.

#### ■ *The specified extended demand*

The main idea is to take in consideration not only consumers' expectations, but also those of stakeholders. These expectations concern specification of the product and its associated services; the price, of course, but also environmental and social aspects. This expectations analysis is split into two steps: first, the consumer demand is analyzed, and secondly the expectations of the supply chain stakeholders. A choice is subsequently made regarding the various consumer and stakeholder demands to be kept and specified. The specification can be made by one or several actors.

In the SDSC approach, 'consumer demand' has various components: the product description (including services). Additional requests may arise regarding packaging, use, end of life, information on production and supply chain characteristics, actors' remunerations. This consumer demand can be explicit or implicit. And it is sometimes hard to pin down exactly. The specification of consumer demand is a strategic process (made by an actor or group of actors) according to the actors' possibilities and their strong desire to innovate. This specification consists mainly in choosing demand components which will be satisfied or partially satisfied (or even refused), subsequently followed by integrating additions or modification based on actors' innovations. All that has then to be translated into functional specifications and a set of sustainable development criteria (economic, social, environmental); these criteria are quantified, and the measurement and calculation methodology are given.

'Associated demands' describe the demands of other stakeholders' in connection with consumer demand. These demands concern the main supply chain actors bringing the product or service to the consumer, but also joint supply chains actors (for co-products, reverse supply chain, ONG for food distribution). Associated demands also take into account one or more other stakeholders (state, local authorities, NGOs, associations, labor unions, sector representatives).

Global 'specified demand' is based on both consumer demands and these associated demands. The overall process is still the same: choice of demand components to be satisfied or partially satisfied (or even refused), additions or modification based on actors' innovations, followed by translating all of that into functional specifications and a set of sustainable development criteria (economic, social, environmental); again, these criteria are quantified, and have to be coherent with the previous ones regarding consumer demand.

■ Demand-supply chain

Extended demand is specified by a set of actors who share the same target vision. We propose to call this co-creative group of stakeholders the DSC. This DSC does not usually include all the supply chain actors but only those who decide to work together and agree on the specified extended demand to be satisfied. The DSC actors can be certain members of the main supply chain, but also those handling co-products, waste, energy, as well as others who, each in their own way, contribute to a responding to the specified extended demand; such as actors managing environmental or social information.

The question (which is also a strategic one) is how to identify those actors who will constitute the DSC. This could be done in different ways. Sometimes there is a particularly innovative actor in a sector, who first defines the specified extended demand, and then looks for partners to set up the DSC. Sometimes a ‘DSC’ is already in place, due to historical connections, and the extended demand is done all together; the DSC may then be extended at a later stage, with actors attracted by the DSC performance.

Once the DSC is constituted and the extended demand specified, the question then arises: how should the DSC be organized and managed in order to satisfy the specified extended demand? This general question can be split into three. Firstly, what are the levers of action to create value and how can they all be operated together? Secondly, what information systems and tools are necessary to support DSC operations and provide information to consumers and stakeholders? And lastly, how should risk, profit and loss, as well investment aspects, be shared among DSC members via the corresponding multilateral contracts?

Figure 1 give an example of a DSC: the French pork sector application, which is described in Section 4. This DSC is constituted of the same actors (but necessarily not all of them) of different supply chains and different organizations (for example, Terrena, an agricultural cooperative and Système U, a distribution cooperative). The main supply chain is composed of an animal food plant, breeders, a cutting plant, a transformation plant, distribution platforms, stores and customers. Closed loops exist, for example: agricultural producer à soyameal for breeders à manure used to fertilize the fields of agricultural producers.

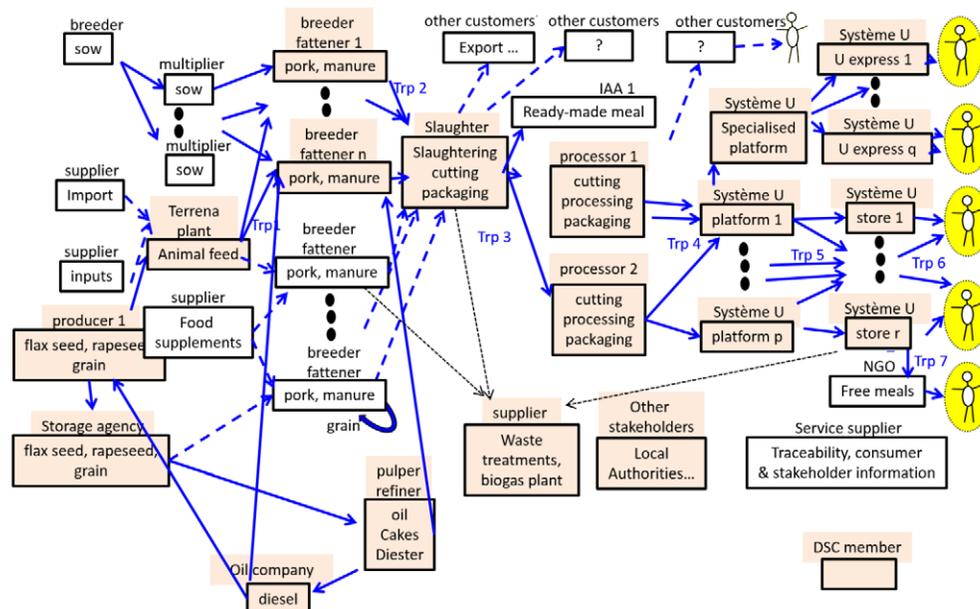


Figure 1. Example of a demand-supply chain: the French pork application.

Other supply chains focus on the valuation of co-products or could have social objectives, such as the distribution of unsold articles through NGOs. The goal of the SDSC approach is not to optimize the main supply chain, but to satisfy a specified extended demand as defined by a DSC. This means optimizing the main supply chain, but also the other connected supply chains on which the DSC members want to interact, not only from the economic point of view but also in terms of the sustainable development criteria defined by the DSC.

### 3.3 Useful tools for confidence within demand-supply chain

The final utility of DSC tools is to help in creating value and sharing it fairly between customers and other stakeholders. But their most important role is to create confidence within the DSC, and to enable people to work together in a different way, thereby creating a new sector governance. So, the way of co-creating these tools is even more important than their quality *per se*, especially in the early days of SDSC approach implementation. For example, the most useful DSC tool is one helping decision-making by easing the joint management of the supply chain and demand. This could be built up from scratch but there is a more innovative way to do it. And this way also helps management change within the sector by co-creating a first level of confidence. This tool could be derived from a traceability tool.

The idea is to first ask actors to implement a new inter-operable traceability tool based on the new GS1 standard (EPCIS). This implementation is often a first opportunity to accept to share electronic data between actors' information systems. As these exchanged data are not conflictual, the traceability system could be operational rather quickly. This first system increases the confidence between actors and could also create value for each and every one of them. Trustworthy and rapid information on ingredient origins and elaboration processes could be valuable for customers or local authorities. This traceability tool could also be upgraded in ways not typically associated with the SDSC approach.

Besides traceability data, other sustainable data, such as economic, social and environmental data, could be recorded in the same EPCIS format. So, the whole DSC now has a shared database with traceability data, and economic, social and environmental additional data. Specific tools can be derived from this database, as described in Figure 2:

- Calculation modules for sustainable criteria: fossil fuel energy, CO<sub>2</sub>, local employment, work fatigability.
- Simulation tools for jointly optimizing the supply chain and demand by operating levers on production, logistic and demand (with calculations on economic, environmental and social impacts based on previous calculation modules).
- Performance measurement tools at DSC and actor level on economic, environmental and social dimensions. This tool proposes a distribution value between DSC actors (including the customer) and forms the basis for new forms of contractualization within the DSC.
- Supply information tools for availability of information for customers and other stakeholders, but also for added-value information for other customers (as done by Microsoft, Google, Amazon for their captured data).

Of course, all these tools have access filters, and not all the data are accessible by everybody.

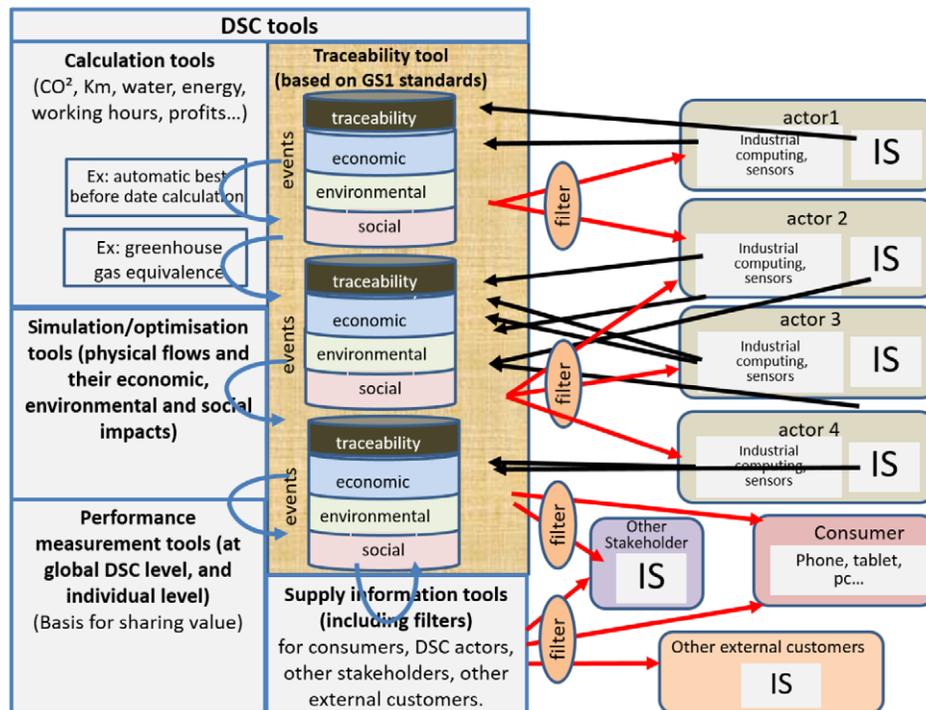


Figure 2. Demand-supply chain tools.

#### 4. Application to French pork sector

This part describes a case study on an SDSC approach application to the French pork sector called Pork ‘nouvelle agriculture<sup>®</sup> U<sup>®</sup>’

##### 4.1 Introduction Pork ‘nouvelle agriculture<sup>®</sup> U<sup>®</sup>’

Nouvelle agriculture<sup>®</sup> and U<sup>®</sup> are two brands. The former belongs to the French cooperative ‘Terrena’, the latter to the French distributor ‘Système U’. The Pork ‘nouvelle agriculture<sup>®</sup> U<sup>®</sup>’ is described on Terrena website<sup>1</sup>:

‘Terrena and the Système U supermarket chain have signed a partnership involving the production and marketing of La Nouvelle Agriculture<sup>®</sup> pork. Système U will market fresh products coming from 50,000 pigs fed on Bleu-Blanc-Coeur<sup>2</sup> (Omega 3) feed, without GMO and of French origin. The contracts have been signed for a three-year, renewable period. The pig producers agree to set-up a plan reducing the use of antibiotics. 24 product references will be marketed.’

This partnership is innovative in itself. Both brands are clearly shown on the punnets. The product specifications have been made together (the two actors have thus discussed product characteristics, but also the environmental and social aspects they want to promote. Terrena and Système U, both SDSC chair sponsors, wanted to experiment the SDSC approach on their pork partnership. The different project phases are described in the next paragraph.

<sup>1</sup> <http://www.terrena.fr/en/la-nouvelle-agriculture-products>

<sup>2</sup> Bleu-blanc cœur. Available at: <http://www.bleu-blanc-coeur.org> (in French)

#### 4.2 Pork SDSC approach agenda and data

- The first phase consisted in mutual discovery for all actors. They exchanged their way of doing business and their concerns about environmental and social job contexts. They also detailed their strategies and their associated improvement plans. As this phase was not particularly innovative, it has not detailed in this paper (a classical first phase for a project: team building, brainstorming, for example the Lego serious play<sup>®</sup> was used).
- The second phase was the ‘extended demand specifications’, which meant the analyses of consumer and other stakeholder expectations, the actors’ choices on what to take into consideration and the innovations they wanted to include in their response. The next paragraph explains the pork SDSC approach objectives, which the actors finally defined during this strategic phase.
- The third one was data analysis throughout the whole chain in order to find levers to create value. This would give the basis for modeling interactions within the DSC.
- During the fourth phase, actors chose the levers they wanted to use and how they could use them in a coordinated and efficient manner. A dedicated tool prototype was made at this time.
- The fifth phase is still in progress. The new combined management of demand and supply chain is being tested and the benefits measured.

##### ■ *Pork SDSC approach objectives (phase 2)*

The main objective is to create added value and redistribute it fairly between all stakeholders (consumers, Terrena, Système U, local authorities, French state, NGOs). Besides the product specification, the main extended demand criteria specified in the second phase of SDSC approach are the following. The most important one is economic: to guarantee the DSC actors’ sustainability (in particular, that of breeders); and to increase the global margin of all DSC actors (farmers, breeders, slaughterhouse, transformation units, animal feed plant, carriers, Système U platforms and stores). All of this is subject to one constant constraint: to keep consumer sale prices at market levels.

The second objective is to decrease waste (in particular material waste, down-gradings, etc.) The third one is to promote the ‘local’ aspect (especially local employment). The last two objectives are to increase product quality by a better production and supply chain organization (focused on product specifications regarding non-GMOs, antibiotics, Bleu-Blanc Coeur specification) and to increase animal welfare (breeding conditions, transport, slaughterhouse stress, etc.).

Of course, the general objectives of a SDSC approach are also mandatory. The first one is to have a transparent model, accepted by all DSC members. This model eases the supply chain design but also constitutes the kernel of a simulation tool (economic, but also environmental and social). The simulation has different horizons: six months, one month and daily for the supply chain and demand management.

The model can also automatically calculate transfer prices for DSC actors (by, for example, using revisable fixed prices in order to fight against price volatility and speculation). The final general objective for this model is to serve as the basis for a business agreement. In order to achieve all these objectives, there is a need to establish new governance between Terrena and Système U, and also inside the two organizations.

##### ■ *Pork supply chain and demand data analysis (phase 3)*

Large data analysis has been conducted. The aim was to identify the more pertinent levers to create value, particularly those which have consequences in other places along the chain. These interactions were captured in a representative model succinctly described in the next paragraph.

Out of all the millions of analyzed data (daily level), the most useful category was that which gave details for each breeding unit: pig births (and accidental deaths), pig shipment to slaughterhouse (number of hogs,

morphologic and quality characteristics, transfer prices), and production costs (mainly animal feed costs). Slaughterhouse data has also been analyzed: entries, production lot details (number and weight of pieces by category, with their associated quality characteristics) and stock level by category. The transformation process has been also examined using transformation unit data: entries, production details (mainly punnets) quantity and weight, and stock levels by category (inputs and outputs).

For System U platform and stores (details at store level): ordered quantity and weight by article, sales by article, transfer and selling prices, promotion campaigns and stock level by category (platform and stores). Consumer's complaints were also available.

Thanks to all this data, the order process throughout the entire chain could be analyzed and the flow organization (material and informational flow). It should be noted that, very often, information is only shared between two actors, with nobody having the global flow vision. Another example regards the yearly forecast made and discussed between Terrena and Système U, but without any other forecast being exchanged during the year, except the figures for promotion campaigns.

#### 4.3 Pork SDSC model and results

##### ■ *A simple SDSC model*

The descriptive model has been voluntarily simplified in order to be easily understood, and adopted by all the actors, and also to have fairly simple easy-to-use derive tools. The main data and explanatory variables bound by equations are the supply chain demand data. The main supply chain data are: (1) birth and death in breeding unit; (2) number of available pigs to send to slaughterhouse per breeding unit; (3) number of available meat pieces produced at slaughterhouse; (4) available final products for sales; (5) stocks all along the chain. The main demand data are sales forecasts (including promotion), selling prices, quantity and price promotions. The model can calculate the downgrading forecast at slaughterhouse, transformation unit and stores.

Based on this model, a simulation tool has been developed, which calculates the adequacy between forecast demand and supply, and the resultant associated downgrading. The main adjustment levers are 'supply' or 'demand' ones. Supply chain levers are the number of births, advance or delay in sending hogs to slaughterhouse. The main demand levers are: (1) store assortments; (2) selling prices; (3) quantities; and (4) prices for promotion campaigns.

##### ■ *Three first results of pork SDSC approach*

Three benefits brought by the SDSC approach can already be seen. The first one is a change in the order process throughout the chain: it now flows more harmoniously and has virtuous consequences on production organization (at slaughterhouse and transformation units). The second benefit is a better organization for animal collection tours for the slaughterhouse, which improves animal welfare, meat quality and the slaughterhouse organization (animal rest durations). The third one is better adequacy between supply and demand and, consequently, a decrease in downgrading both in slaughterhouse and transformation units (this result is a combination of more flexible production and more judicious promotion campaigns).

The next expected results concern a new way of contractualization: fixed prices (with revision mechanisms) for all transfer prices within the DSC. The transfer prices are then calculated by the agreed model. Another area of expected improvement is the integration of new actors in the DSC in order to have a better material balance. This means the DSC, with different actors able to buy and sell all parts of a pig. Système U, for example, does not currently sell all pig parts in its stores.

## 5. Discussion

As an innovative approach, SDSC combines various characteristics, such as a range of different actors, extended demand and a need for a new SDC governance. Future points to be discussed mean that: (1) in order to build confidence between actors, the contractual tools have to change. The two-party contract must be replaced by multipartite agreements; this particular point is described in section 5.1; (2) the competition rules have to be respected, and the European administration does not particularly appreciate multipartite agreements in any one sector. Evolution is also expected in this area, in order to reconcile international competition rules with the will to build a global organization: waste decrease and local employment development for example. The final discussion point considers the SDSC approach's limits, areas of improvements and possible technological aids.

### 5.1 New expected contractual tools

The DSC is composed of several actors. In order to perpetuate the business connections among them, it is important to have contractual relations. The initial idea was to have a global contract signed by all the actors (Figure 3), but this is not acceptable for the lawyers. Due to the competition authority, the common rule is usually to have two-party contractors.

One solution that has been found is to have several parallel classical contracts (as described in Figure 4) at an upper level. These contracts are bound together by reference to a unique common model, and by engagement towards the other DSC actors.

Other contracts (as described in Figure 5) are necessary within the organization in order to guarantee the upper-level contracts. This two-level contractual organization does offer one solution, but new contractual tools have to be invented to ease this need of new types of contract. Incidentally, new business economy very often implies three actors: (1) a buyer; (2) a seller; and (3) a platform, in which case the two-party contracts are also not relevant.

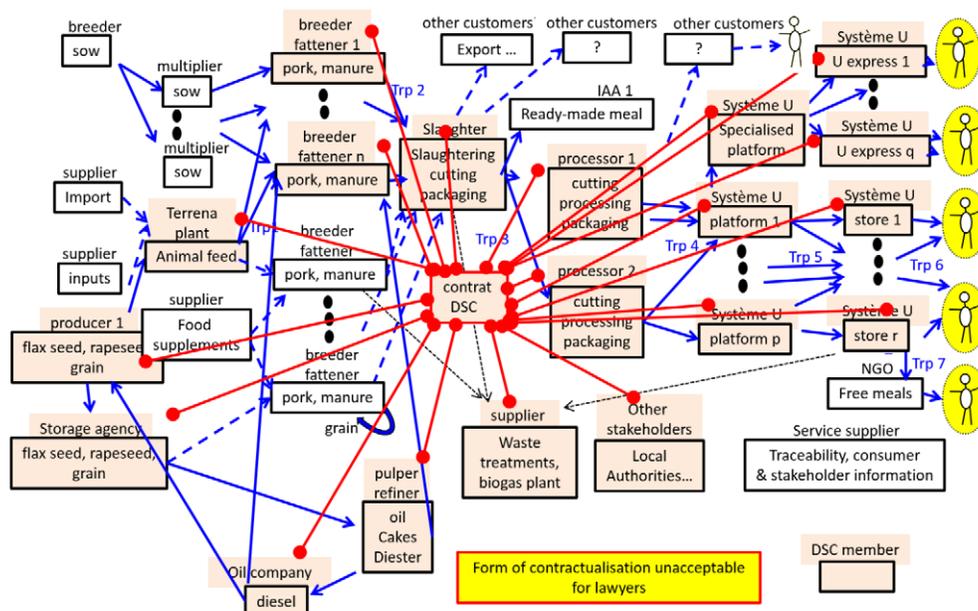


Figure 3. First idea of contractualization.

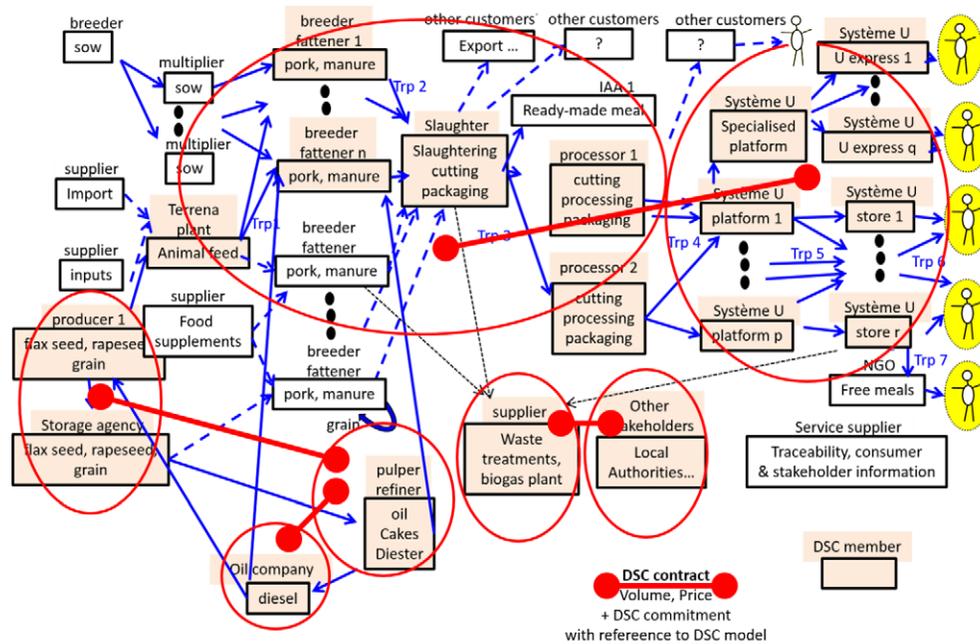


Figure 4. Alternative contracts at upper level.

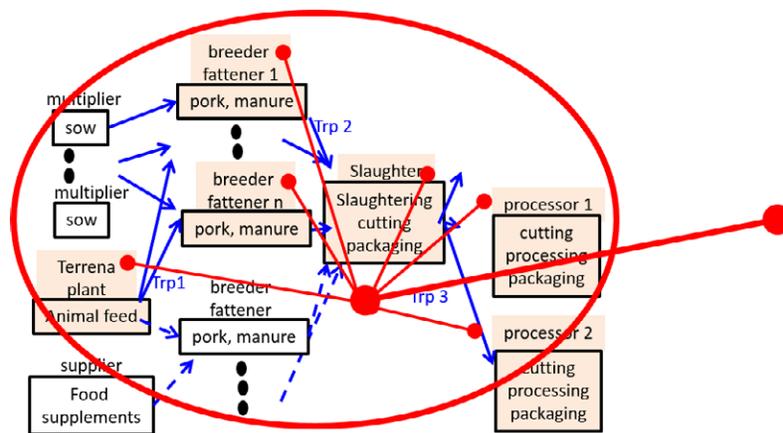


Figure 5. Example of contracts within an organization.

■ *Contracts and governance*

In France, contractualization between agrifood actors participates in the new French agricultural policy via the Loi de Modernisation (Legifrance, 2010). This law seeks to promote contractual arrangements between all of stakeholders in order to reduce asymmetric information and to rebalance powers in favor of producers. Faced with distribution players, the law<sup>3</sup> suggests contractual commitments in dairy, meat, fruit and vegetables. France opted for contractualization between producers and their buyers via the Loi de Modernisation. This contractualization policy aims at encouraging the different stakeholders to establish agreements to fix prices and quantities. The goal of these purchasing contracts is to smooth out price variations in order to avoid any excessive rise in costs between the different parties, including consumers, in the supply-chains (Filippi, 2015).

<sup>3</sup> See Arts. 221 and 222 of CMO.

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Unfortunately, French contractualization has failed to stabilize farmers' incomes. The main explanation is not only due to the difficulty of contracting between stakeholders for five years on price and volume, but also to the need to avoid conflicts with the competition authority. This is especially related to the fact that the contracts are signed between unorganized producers. The weaknesses of the collective organization, the producer organization, leads to a non-rebalance of power inside supply chains, together with an ensuing risk of failures related to the fall of price remuneration and farmer incomes (Haut and Raison, 2015). As explained by Royer and Gouin (2016), the institutional context suggests two types of enforcement, private and public: public enforcement, which is based on contract has to be reinforced by private enforcement, using the incitation of cooperative mechanisms (Hadfield, 2005). In this situation, SDSC offers various advantages in terms of sustainability, collective governance and mutual commitments. The governance of SDSC, combining both types of contract as agreement tools reflecting the common perspective.

### 5.2 The SDSC approach: limits, areas of improvement and conditions

The SDSC approach presents different kind of limits and areas of improvement:

- Respect of competition rules. World Trade Organization rules regarding free product circulation and free worker movement could raise problems when the organization of circular flows and guaranteeing local employment are to be envisaged. If the SDSC approach turns out to be very successful, the percentage of business made through DSC is going to grow and may reach a level that is too high for competition authorities. It should not be forgotten that public policy makers have to authorize the use of new contractual tools.
- SDSC approach applicability to all agrifood sectors. The approach seems to operate in the two sectors currently being tested (pork and vegetal oil) but must be validated in other sectors. In particular, the metamodel used to describe the sector must be consolidated. Big data modelization could also modify sector modelization.
- DSC tools development and operators. These tools could be expensive to develop. Is the cost affordable for one or several DSC members, or must the development and operation be mutualized by a third party? Data ownership and data valorization may then become a big issue.

The SDSC approach is also realistic with possible technological aids. One might ask the question: is the implementation of the SDSC approach realistic? The answer is yes if the stakeholders have a real desire to create additional value through better collaboration. This collaboration can be helped by new tools based on blockchain (Luo *et al.*, 2018). The blockchain can first of all strengthen trust between the actors (Saber *et al.*, 2019). It can allow everyone to remain in control of their data. Each actor remains the owner of his data and filters the data he wants to transmit. It can also transmit more confidential data to a third party who can help manage the optimizations of the global collaboration. The blockchain facilitates the sharing of information between actors because this is the first important problem to solve when you want to set up a collaboration (Zeng *et al.*, 2017). This has been verified in the experiments that have been carried out. The setting up of a blockchain has allowed the information sharing which has allowed to generate value. The blockchain is the guarantee for the actors but also for the final consumer that the data have not been modified and that they are therefore binding on their authors (which guarantees the quality of the data and also makes it easier to settle any subsequent disputes). This also limits the risks of collusion between actors.

## 6. Conclusions and future perspectives

Sustainability is associated with the idea that independent units, i.e. farmers and firms, work together in order to create added value and to share it. The goal is to avoid conflicts or create common/collective goals. The competitiveness of SDSC is that this collective organization contributes to creating better and sustainable added value for all members, including customers. So far, the SDSC approach has been tested in only two sectors. The experiment must be enlarged to other sectors. Further experimentation, a broader SDSC approach must be tested. For example, a DSC composed of two sector actors: the animal and agricultural sector. Agriculture gives seeds to make the oil and meal that can be part of animal feed, the manure is used

in agriculture and we can think about more circular economy with diester production from oil, which is incorporated in fuel engines used in the fields. The experiment must also be tested on other sectors in order to validate its benefits. The associated tools must also become generic as far as possible. It is interesting to note that the blockchain is a tool that can help in the implementation of the SDSC approach. In addition, ‘SDSC generic tools’ are emerging. Indeed, a blockchain solution provider is currently developing specific SDSC add-on modules to facilitate the implementation of this approach for its customers. However the question of who, in future, will manage these tools (and associated data) is also a very important one. Big data must be used in future SDSC models. It is obviously a good idea for discovering new levers for value creation and making tools more accurate. But models must not become a black box. There is the temptation to have an increasingly sophisticated model in order to have more accurate tools to manage demand and supply but – if they become too complex – the actors will not be able to understand and validate them. Over sophistication could allow a loss of confidence to creep in, ultimately thwarting successful coordination between actors.

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*Special track: European agrifood business in transition towards social responsibility*

## **Conception and evaluation of a structural equation model to measure the reputation of German horticulture**

### **RESEARCH ARTICLE**

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### **Abstract**

The reputation of a sector is an important strategic resource. The aim of this article is to develop a measurement model for the horticulture sector. Reputation is a latent variable and is represented by formative and reflective indicators. A theoretically elaborated model will be evaluated and completed with the help of experts (n=102), and the segments that influence reputation will be identified. The quality assessment of the formative indicators, using multiple regression, and the reflective indicators, using an explorative factor analysis, led to a model with a total of 15 indicators. With the help of open questions, it was possible, to specify the indicators already considered or to include them in the model as new indicators. A reputation map shows the interaction between the reputation of horticulture and that of the individual segments. This shows a much greater influence of the service segments on the sector reputation compared to the production segments.

**Keywords:** horticulture, reputation, formative, reflective, reputation measurement

**JEL code:** Q13

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## 1. Introduction

Horticulture is a branch of agriculture which deals with the principles and practices of growing vegetables, fruits and flowers (Lal, 2008: 19). Horticulture as a sector is characterized by great heterogeneity. It can be divided into the areas of horticultural production, services and trade. Horticultural production is further subdivided into the fruit, vegetable, ornamental plant and nursery segments. A large number of different products are produced in these segments. The service and retail segments include garden and landscaping, cemetery horticulture, retail and floristry. Public green areas, such as parks or garden shows, can also be regarded as horticultural products.

The reputation of horticulture as a sector among stakeholders can only be speculated upon. As early as the 1990s, expert circles already pointed to the early development of image improvement activities for horticulture in order to consolidate the standing and position of horticulture (Storck, 1992). Ludwig-Ohm and Dirksmeyer (2013: 30) report a frequently observed skepticism among the population particularly towards horticultural production systems. Technological progress in production has led to a gap between the consumer's ideas and actual production methods. Today, more than ever, environmental aspects are perceived by consumers and can therefore also influence purchasing decisions for horticultural products (Meyerding, 2016: 132). In addition, many horticultural products have confidence characteristics (e.g. taste) that cannot be tested at the point of sale. Trust in these products can be influenced by the reputation of the sector (Weigelt and Camerer, 1988). Due to the lack of differentiation of the products, the sector's reputation can also be damaged by opportunistic behavior of individual producers (Winfrey and McCluskey, 2005: 207). A bad reputation can result in a decline in sales and thus influence the economic success of a company. Bitsch *et al.* (2014: 110) were able to show that the occurrence of foodborne illnesses leads to economic losses and a reputation damage.

In combination with customer loyalty and identification, reputation can lead to an improvement in the intention to buy and the willingness to pay, thus influencing sales in the sector (Keh and Xie, 2009). Reputation is therefore an important strategic resource for companies. This influences communication with stakeholders and legitimizes entrepreneurial action (Sageder *et al.*, 2018: 351-352). Nevertheless, no measurement approach is known that captures the reputation of horticulture in all its diversity. Only on the basis of a measurement approach it will be possible to formulate concrete recommendations for the entire sector and the individual segments on how reputation can be influenced. This missing measurement approach will be elaborated in this publication.

An approach for reputation measurement based on a literature research is to be adapted by experts with the aim of carrying out a consumer survey in the following step. The validation of the indicators of a structural model by experts is the declared aim of the present work. These indicators have been used in non-sector-specific measurement systems for companies and sectors, which requires adaptation to the specific characteristics of horticulture. Besides, validation by experts is necessary, because the model should be corrected for possible incompleteness and unsuitable indicators should be eliminated (Rossiter, 2002: 308-309; Schwaiger, 2004: 57; Straub, 1989: 150; Zinnbauer and Eberl, 2004: 9). The main research question that should be answered in this paper is, what indicators describe the reputation of horticulture.

With the help of the experts, the interaction between the reputation of horticulture and the reputation of the individual segments can also be investigated. The second research question is whether the reputation of horticulture is mainly influenced by segments and what is the relative contribution of the segments to the sector's reputation from an expert perspective. With the help of experts, it will be examined whether certain sectors have a higher presence in the minds of consumers (society). It is assumed, for example, that visiting public parks or creating private gardens by the horticultural and landscaping contractors, this segment makes a higher contribution to the reputation of the entire sector.

## 2. Theoretical framework

Reputation is defined by Fombrun as ‘a perceptual representation of a company’s past actions and future prospects that describes the firm’s overall appeal to all of its key constituents when compared with other leading rivals’ (Fombrun, 1996: 72). This has been the most commonly used definition since the mid-1990s. (Wartick, 2002: 374). As also stated in this paper, reputation in scientific research is mostly understood and treated as a synonym for the terms reputation and standing (Hautzinger, 2009: 13-15; Helm, 2007c: 20; Liebert, 2009: 38-39; Schwalbach, 2003: 227). The frequently used German term ‘Ruf’ is described by Breyer (1962) as a short, clear, characteristic and (relatively) constant statement about an object of opinion (Breyer, 1962: 63 cited after Helm, 2007b: 20). Reputation at sector level is understood in the sense of Helm (2007c: 270) as an opinion that dominates in the public eye. Simply put, reputation was defined here as the recognized performance and willingness of the company to perform, which other authors also call ‘organizational performance’ (Boyd *et al.*, 2010: 2; Fombrun and Shanley, 1990: 255; Helm, 2007c: 46; Roberts and Dowling, 2002: 1078). Following Hautzinger (2009: 34), this view of corporate reputation is transferred to the sector. The sector’s reputation is thus understood as the public recognition perceived by stakeholders of the sector’s performance and willingness to perform (Luoma-aho, 2008: 450). Performance includes all the activities of a sector, in terms of both economic and social factors (Lins *et al.*, 2017: 1820).

Reputation is a latent construct that is not directly observable in this form (Joreskog and Goldberger, 1975: 631). Only through its relationships to observable (to be interrogated) variables, which are also called indicators or items, does it become measurable (Fornell and Bookstein, 1982: 441; Helm, 2007c: 130; Joreskog and Goldberger, 1975: 631; MacMillan *et al.*, 2005: 222). The construct reputation thus forms the latent variable, which in turn, is described by the variables assigned to it – the indicators or items. The complexity of the construct is shown in the literature through the lack of consensus on which aspects the reputation actually covers and in the multitude of approaches to reputation measurement (Davies *et al.*, 2001: 114-115).

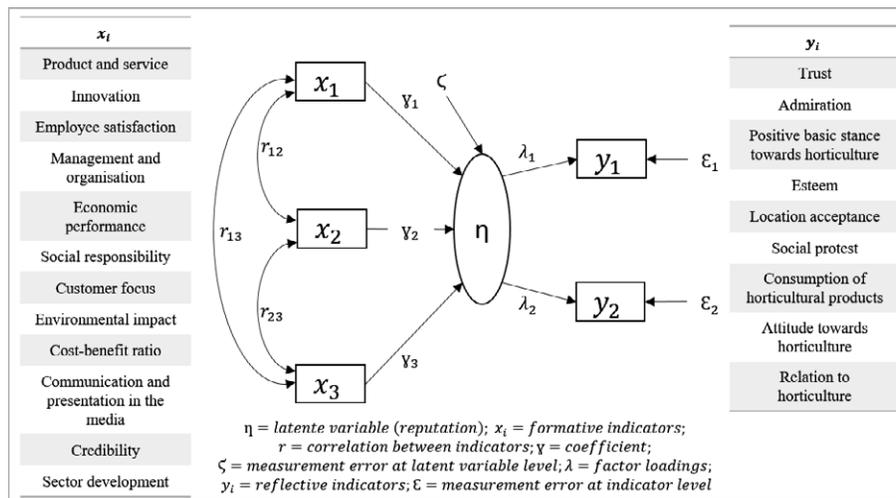
The multiple indicators and multiple causes (MIMIC) model were selected as the approach to reputation measurement (Figure 1). This model makes it possible to evaluate the indicators used as a whole (i.e. taking into account their interrelations) and requires the inclusion of reflective indicators in addition to the formative ones (Diamantopoulos and Winklhofer, 2001: 272; Hauser and Goldberger, 1971: 95-97; Joreskog and Goldberger, 1975: 631). The formative indicators represent the direct causes of the latent variable, while the variable is indicated by one or more reflective indicators (Diamantopoulos and Winklhofer, 2001: 272).

## 3. Research method

In the first research stage, the literature analysis, fundamental findings on reputation as a latent variable and on the measurement of reputation were first collected and incorporated into a theoretical model for measuring reputation.

Systems for measuring corporate reputation, such as the reputation quotient or the fortune system, are already being used in business. A reputation measurement at sector level, using the example of the automotive sector, on the other hand, was only carried out within the framework of a scientific study. Based on these existing measurement approaches for companies as well as for sectors, indicators from eight systems were analyzed, compared, tabulated and subsumed. The indicators were brought together in the form of a MIMIC model (Figure 1).

In the second stage of the study described here, the model is validated, as the results of empirical studies have shown that many country- and sector-specific peculiarities have to be taken into account (Wiedmann *et al.*, 2007: 14). To validate and supplement the set of indicators, qualitative and quantitative methods were combined in a questionnaire in the form of a mixed method approach. The indicators summarized in the model were quantitatively tested on a 7-point Likert scale with regard to their suitability for horticulture. The structure of the questionnaire follows the study by Hautzinger (2009). The global measure required for the statistical



**Figure 1.** Proposed structural model for measuring the reputation of the horticultural sector (adapted from Diamantopoulos and Winklhofer, 2001: 272).

quality check – the assessment of the reputation by the experts – was also determined on the basis of a 7-point Likert scale.

The interaction between the reputation of the segments and the reputation of the sector was also quantitatively analyzed in this part. By asking two questions with changing perspectives regarding the influence on the reputation, the importance of the different segments was also examined on a 7-point Likert scale. The explorative character of the study could be fulfilled by open questions. The use of qualitative methods in the form of open questions served to complete the set of indicators as well as to identify further areas that have a major influence on the reputation of horticulture.

The questionnaire was available online and was created using LimeSurvey (version 2.6.6). The evaluation of the closed questions was done by IBM SPSS Statistics 25 (IBM, Armonk, New York, NY, USA) and the evaluation of the open questions by MAXQDA Analytics Pro 2018 (VERBI GmbH, Berlin, Germany). In the third stage, the structural model is then used to survey the reputation among consumers.

### 3.1 Quality criteria of formative indicators

The reputation of a sector is defined as publicly recognized performance and willingness to perform. Based on this definition, the formative indicators represent the performance of a sector and thus justify the reputation of a sector (Helm, 2005: 99). The formative indicators can be regarded as building blocks of the reputation construct and their change leads to a change in reputation.

The evaluation of the formative indicators in the construct is based on multiple regression (Diamantopoulos *et al.*, 2008: 1205). The regression coefficient gives information about the validity of the indicators regarding the construct.

The set of indicators represents the construct (Steinmann, 2013: 136). Strong multicollinearity – a linear interdependence of indicators – should be excluded, since each individual indicator should contribute independently to reputation. The variance inflation factor (VIF) can be used to describe the strength of the dependence of a single indicator on the other construct indicators. A VIF value of one illustrates the complete linear independence of the indicators (Gujarati, 2004: 351), while a VIF value  $>10$  is considered critical (Diamantopoulos *et al.*, 2008: 1212). In order to avoid distortion in a small sample, the VIF value  $>3.3$  is defined as the limit value, as has already been the case in other studies (Diamantopoulos and Siguaw, 2006: 270; Hautzinger, 2009: 228).

A *t*-test can be used to determine the significance of the indicators for the construct. However, a value of non-significance does not automatically result in the elimination of an indicator. Different views are expressed in the literature on dealing with non-significant indicators (cf. Diamantopoulos and Siguaw, 2006: 270; Helm, 2005: 251). For this work, the correlation with the global measure is used as the elimination criterion (Helm, 2007c: 298). Correlation with the global measure ensures that there is a connection between the indicator and the latent variable (Diamantopoulos and Winklhofer, 2001: 272).

### 3.2 Quality criteria of reflective indicators

The reflective indicators represent the sector's reputation. Reputation can thus be described as a function of reflective indicators and a change in reputation results in a change of the assigned reflective indicators.

The indicator reliability provides information on the suitability of the indicator for the description of the latent variable. The unidimensionality can be proven by explorative factor analysis and the reliability of the indicator for the construct is described by the height of the indicator loadings. An indicator loading of 0.7 is considered acceptable (Huber *et al.*, 2003: 89; Schöps, 2012: 181). This limit can be used to ensure that the variance of an indicator caused by the construct is higher than the variance caused by the measurement error. Indicators that do not reach this loading are eliminated from the construct. The loadings are tested for significance by a one-sided *t*-test at 5% level ( $>1.645$ ) (Huber *et al.*, 2003: 35).

The construct reliability (CR) can also be called factor reliability or internal consistency and is the degree of explanation for the relationship between the indicators and the construct. To ensure that the indicators reflect the construct as well as possible, a strong correlation between the indicators is desired. A value of  $>0.7$  is targeted for a strong link or high homogeneity of the indicators (Hautzinger, 2009: 235; Huber *et al.*, 2003: 35).

Another measure of the internal consistence is Cronbach's alpha with a limit of 0.7 (Peterson, 1994: 388). However, Nitzel (2010: 26) points out that Cronbach's alpha tends to underestimate internal consistence, which is why both CR and Cronbach's alpha are used as quality criteria in the following.

A further validity check can be carried out with the use of the average variance extracted (AVE). This describes the ratio of the measurement portion explained by the latent variable to the measurement error. For this purpose, at least half of the variance of the indicators of a construct should be explained by the latent variable (Hautzinger, 2009: 235; Johanna Schöps, 2013: 69).

In addition, discriminant validity can be used to examine the differences between the indicators of this construct and those of another construct. According to the Fornell-Larcker criterion, the AVE should be higher than any correlation of this latent variable with another latent variable (Fornell and Larcker, 1981: 45; Nitzl, 2010: 27).

### 3.3 Reputation characteristics specific to horticulture

The evaluation of the free texts is based on a qualitative content analysis according to Mayring and is based on the methodology for inductive category formation. The statements of the experts on the formation of upper categories are used. If further differentiation appears to make sense, the upper categories are segmented into further subcategories (Mayring, 2014: 106). At this point, the experts were asked to name other characteristics that had not been adequately addressed or completely disregarded so far, and which have a decisive influence on the reputation of horticulture in society. The aim of this approach is to identify horticultural-specific characteristics to supplement the construct and to further specify the indicators collected from the literature.

First, the category system was defined (selection criterion) and the level of abstraction fixed (depth), which is used as a guideline in the further course of category formation. In an iterative process, statements, sentences

or individual words (keyword-like enumerations) were subsumed under already existing categories or new categories were created from the material, taking into account category definitions and abstraction level.

A formative reliability test was carried out by revising the categories according to 50% of the material. The summative reliability test was finally fulfilled by a final passage through the material.

### 3.4 Sample structure

The target group of the survey are experts who work as consultants in the horticultural sector. Consultants are closely linked to the sector and represent an interface between the internal and external viewpoints. The internal view of the sector includes extensive knowledge of the special features of the sector that they have collected through their professional experience. On the other hand, their employment or self-employment as consultants enables them to take an external perspective of the sector. Besides they are not economically directly dependent on the success of the horticultural business and can independently assess sector-specific characteristics. Additionally, the consultants can also evaluate characteristics of horticulture from a consumer perspective.

The contact data of associations, institutes, chambers of agriculture and consulting firms were determined by online research. The approach was differentiated according to federal states. The experts (132) were contacted via email with a link to the survey and a request to forward the study. With this procedure a distribution could be achieved by a snowball effect. After 14 days, a second email was sent as a reminder. The survey took place from the beginning of May to the middle of July 2018.

A total of 102 questionnaires, fully completed by experts, were collected in this way. 77% of the experts carry out their work in associations, research institutes, teaching and research institutes or public authorities. 41% of the respondents are active in cross-divisional consulting services regardless of the segments. Some respondents are only active in one segment of the sector (agriculture 8%; retail and floristry 3%). 15% of the respondents are active in vegetable growing, 11% in fruit growing, 10% in gardening and landscape construction and 9% in ornamental horticulture.

## 4. Results

The quality assessment of the formative and reflective indicators was carried out with the help of the global measure. The global measure, which raises the reputation of the sector from the perspective of the experts irrespective of the indicators, indicates a slightly positive trend ( $\mu=4.4$ ) ( $n=102$ ). However, the distribution also shows that only eight surveyed experts rated the reputation as very bad (1) or bad (2). On the other hand, according to the assessment of 6 experts, the sector's reputation is even very good (7).

As reputation is a collective image created through interaction with third parties, the experts were not given a definition of the indicators (Petty and Cacioppo, 1983: 143). Thus, the following evaluation of the indicators only reflects the respondents' understanding of the indicators, which is shaped by the public.

### 4.1 Quality testing of formative indicators

All indicators which are directly related to corporate activities and in their sum reflect the sector activities, form the reputation of the sector and can thus be operationalized in a formatively effective direction. The formative link thus describes a cause-effect relationship between the observations (indicators) and the latent construct (reputation).

Overall, the formative indicators make only a negligible weak contribution to the regression equation (Table 1). The indicator 'Environmental impact' has the highest effect on reputation and is the only one which has a

**Table 1.** Quality testing: regression of formative indicators (n=102).<sup>1</sup>

Indicators	Mean value <sup>1</sup>	Estimated coefficient	t-value	VIF <sup>2</sup>	Correlation with the global measure
Innovation	3.775	-0.098	-0.95	1.340	0.471
Customer focus	5.169	0.177	1.33	1.419	0.177
Employee satisfaction	3.674	-0.152	-1.51	1.400	0.165
Economic performance	3.596	-0.006	-0.04	2.184	0.336
Sector development	3.584	0.144	1.05	2.423	0.146
Social responsibility	4.685	0.057	0.54	1.592	0.392
Environmental impact	5.674	-0.235	-1.9**	1.645	0.157
Communication and presentation in the media	5.157	0.124	1.24	1.421	0.129
Critical values		>0.1	>1.645 (one-tailed test)	<3.3	>10% probability of error

<sup>1</sup> 1 = 'not very influential' and 7 = 'very influential'; \*\* = 5% significance level.

<sup>2</sup> VIF = variance inflation factor.

statistically significant influence on the construct. The negative regression coefficient clearly shows that, in this construct, an increase in environmental pollution leads to a deterioration in the reputation of horticulture.

The indicators 'Innovation', 'Employee satisfaction' and 'Economic performance' also have a negative coefficient. An increase in the respective indicator results in a deterioration of reputation by the level of the coefficient. Since the contribution of the indicators 'Innovation' and 'Economic performance' to the regression equation is very small (<0.1), the interpretation of the negative coefficient can be neglected. However, the negative coefficient of the indicator 'Employee satisfaction' indicates a deterioration of the reputation with increasing employee satisfaction. This surprising connection can probably be attributed to the rather secondary importance of the indicator 'employee satisfaction' for the experts.

The external validity – the correlation of the indicators with the global measure – ensures that the indicators are of relevance to the construct. The indicators 'Product and service', 'Cost-benefit ratio', 'management and organization' and 'credibility' were excluded from the formative construct due to a missing correlation with the global measure (reputation of horticulture).

#### 4.2 Quality testing of reflective indicators

The reflective indicators evoked the observations in reality from the non-measurable construct (Helm, 2007c: 130). The reflective indicators present the consequences of reputation, which in turn is made up of the sum of the effects of the formative indicators (Diamantopoulos and Winklhofer, 2001: 272-273). The cause-effect relationship here thus runs from the construct in the direction of its indicators.

The indicator reliability can be tested on the basis of the factor loadings. The construct reputation explains a large share of the indicator's variance: 'Positive basic stance towards horticulture', 'Esteem', 'Location acceptance', 'Attitude towards horticulture', and 'Relationship to horticulture' (Table 2). For the indicator 'Consumption of horticultural products', the share of declared variance by construct is just below the required limit of 0.7. Since the common variance between indicator and construct (with over 0.5) is still higher than the variance of the measurement error, this indicator should continue to be taken into account due to its high content relevance. All indicator loadings fulfil the quality criterion of one-sided significance. The indicators 'Trust', 'Admiration' and 'Social protest' were eliminated from the construct because the factor loadings were too low. The reliability of the still considered indicators in the construct can be described as good with

**Table 2.** Quality testing: factor analysis of reflective indicators (n=102).

Indicators	Mean value <sup>1</sup>	Factor loadings	t-value	AVE <sup>2</sup>	CR <sup>2</sup>	Cronbachs alpha	Fornell-Larcker
Positive basic stance towards horticulture	4.677	0.793	27.448				
Esteem	4.248	0.821	25.383				
Location acceptance	4.022	0.806	25.894				
Consumption of horticultural products	5.188	0.694	37.490	0.66	0.9	0.849	0.0974 < AVE (r <sup>2</sup> =0.3122 2=0.0974)
Attitude towards horticulture	4.632	0.805	28.364				
Relation to horticulture	4.907	0.764	28.291				
Critical values		>0.7	>1.645 (one-tailed test)	>0.5	>0.7	>0.7	R <sup>2</sup> <AVE

<sup>1</sup> 1 = 'not very influential' and 7 = 'very influential'.

<sup>2</sup> AVE = average variance extracted; CR = composite reliability.

an alpha value of 0.849. However, CR, which is used as a further instrument to ensure internal consistency, also exhibits a strong link (homogeneity) between the indicators and the latent variable. In contrast to the formative indicators, as already mentioned the reflective indicators must correlate strongly enough with each other. The convergence validity described by the AVE shows that a 66% share of variance is explained by the reflective measurement model. Thus, the declared share of variance due to reputation is higher than the measurement error. Using the Fornell-Larcker criterion it can be shown that the average variance of the construct reputation is higher than the squared correlation with another construct. In this way, the validity of the indicators for the construct 'reputation' can be assumed.

#### 4.3 Identification of reputation characteristics specific to horticulture

The reputation indicators tested for their quality (see Sections 4.1 and 4.2) do not take into account any specific characteristics of horticulture due to their originating from existing reputation measurement systems (see Section 3). This is partly due to the universal orientation of the measurement systems, which are oriented towards sectors or companies that have little in common with the horticultural sector. Since sector-specific characteristics must be taken into account when measuring reputation (Wiedmann *et al.*, 2007: 14), an open question is asked about specific reputation characteristics of the horticultural sector. As a consequence of the results, the construct should be extended accordingly by newly acquired features or through further specification of the already included indicators.

The procedure described in Section 3.3 resulted in a total of eight main categories (characteristics). Table 3 shows seven of these categories. The category 'Events & holidays/special occasions' has been omitted due to the unique naming. For each subcategory with  $n \geq 4$  mentions, two statements are presented, which are rated as particularly significant for the respective characteristic or represent the diversity of the statements well. Subcategories with fewer mentions are characterized by one statement.

A total of 57 respondents provided information on this question. The answers to these free text questions were very detailed and well-founded. From the category 'Job description & profession' (n=17) two subcategories could be formed. Here it proved to be useful to differentiate between negative (n=5) and positive (n=6) associations with the occupational profile. In this way, the many facets of the statements could be precisely contrasted. The heterogeneity of the perceptions is reflected in the almost equal number of positive and negative statements. The importance of the category for reputation formation is also highlighted by the largest number of responses. However, it must also be considered that the frequency of mentions does not provide a reliable indication of

**Table 3.** Summary of reputation characteristics specific to horticulture (n=57).

Subcategories (n)	Coded text passages/coding
1 <sup>st</sup> : Job description & profession (17)	
Negative (5)	1 <sup>st</sup> : ‘Necessity (grows everywhere by itself), greed for profit (inject everything dead so that they earn as much money as possible).’ 2 <sup>nd</sup> : ‘Poor working conditions, unhealthy, pesticidal contaminated work [...]’.
Positive (6)	1 <sup>st</sup> : ‘Professional expertise, conviction, lifeblood [...]’ 2 <sup>nd</sup> : ‘[...] complexity of the profession, study is required, indicates high wages for the workforce.’
2 <sup>nd</sup> : Products & services (15)	
Product attributes (7)	1 <sup>st</sup> : ‘[...] Products that are generally perceived as pretty and appealing.’ 2 <sup>nd</sup> : ‘[...] unhealthy [...] products contaminated with pesticides, both, in gardens and gardening and landscape construction.’
Prices (4)	1 <sup>st</sup> : ‘Reasonable prices [...]’ 2 <sup>nd</sup> : ‘[...] overpriced prices in season [...]’.
Product-related quality characteristics (3)	1 <sup>st</sup> : ‘Freshness [...]’.
Quality characteristics of services (2)	1 <sup>st</sup> : ‘Customer service/Quality of cemetery gardeners and florists [...]’.
3 <sup>rd</sup> : Characteristics of consumers (14)	
Knowledge & perception (10)	1 <sup>st</sup> : ‘Knowledge and familiarity with horticultural and agricultural production outside the sector tends towards zero. This lack of knowledge increasingly creates fears and incomprehension, especially with regard to food production. For this reason, the reputation of horticulture is primarily shaped by social opinion leaders outside the sector.’ 2 <sup>nd</sup> : ‘[...] Innovations are hardly noticed in society. Barriers that prevent gardeners from innovating are also not perceived (prices, esteem).’
Interest & relationship (5)	1 <sup>st</sup> : ‘Garden experience at home [...]’ 2 <sup>nd</sup> : ‘Contact to individual growers. Relationship to horticulture or your own garden.’
Consciousness & responsibility (2)	1 <sup>st</sup> : ‘Broad range of consumption in everyday life; effect, use of horticultural products in life (e.g. health effect, fitness, by buying ecological products; the purchase of ecological products makes it possible to assume responsibility in society).’
4 <sup>th</sup> : Media presence & public relations work (14)	
	1 <sup>st</sup> : ‘Call for help to society in crisis situations (e.g. Russia embargo; lack of harvest workers; weather-related failures): intensively marked.’ 2 <sup>nd</sup> : ‘Professional competence of the representatives, social commitment (local market garden actively communicates with the public, can be visited, invites school classes and kindergarten groups to visit and leads to the plant...).’
5 <sup>th</sup> : Management methods & production systems (12)	
Plant protection & fertilization (7)	1 <sup>st</sup> : ‘How it is farmed; as organically farmed fruit and vegetable cultivation shapes the landscape for the customer and negatively affected spray agents are not associated with it.’ 2 <sup>nd</sup> : ‘Use of fertilizers and pesticides.’
Principles of action & production factors (5)	1 <sup>st</sup> : ‘[...] sustainability, conservation of resources.’ 2 <sup>nd</sup> : ‘[...] foils; monocultures [...]’.
Production methods (3)	1 <sup>st</sup> : ‘Organic or conventional.’

**Table 3.** Continued.

Subcategories (n)	Coded text passages/coding
6 <sup>th</sup> : Social responsibility/dealing with nature/environment (9)	1 <sup>st</sup> : 'Nutrition of the population is a high commodity!' 2 <sup>nd</sup> : 'Ecological awareness/responsibility.'
7 <sup>th</sup> : Social impacts (4)	1 <sup>st</sup> : 'Effects of horticulture on the lives of citizens.' 2 <sup>nd</sup> : 'Membership/honorary office in organizations/associations.'

the relevance of the indicators. It is possible that a less frequently mentioned category is also important to respondents, but the respondents did not think of this issue when answering the free text question.

Four further categories could be identified with similar frequencies: 'Products & services' (n=15), 'Characteristics of consumers' (n=14), 'Media presence & public relations work' (n=14), and 'Management methods & production systems' (n=12). Except for the category 'Media presence & public relations work', it was possible to create further subcategories for each of the categories mentioned.

At least two ('Products & services' > 'Quality characteristics of services' (n=2)) and a maximum of 10 text passages ('Characteristics of consumers' > 'Knowledge & perception' (n=10)) could be assigned to these subcategories. With a total of four subcategories ('Product attributes' (n=7), 'Prices' (n=4), 'Product-related quality characteristics' (n=3), 'Quality characteristics of Services' (n=2), the 'Products & services' subcategory has the largest number of subcategories. In this way, the extensive subdivision underlines the relevance of the category in terms of content for the reputation of the sector. The text passages of the characteristic 'Media presence & public relations work', on the other hand, proved to be so heterogeneous and so diverse that the formation of further subcategories did not appear to be effective. The relevance of the category to reputation is nevertheless underlined. When using this indicator to measure reputation, the questions for the survey should be formulated with particular care. Here it is important to prevent different images and to create a uniform understanding of the indicator. The attributes 'Social responsibility/dealing with nature/environment' (n=9) and 'Social impacts' (n=4) represent effects that go beyond horticultural production. Compared to other sectors (except agriculture), they play a special role in horticulture through the use of natural resources, above particular in the form of outdoor production and the design of public facilities (e.g. urban greening).

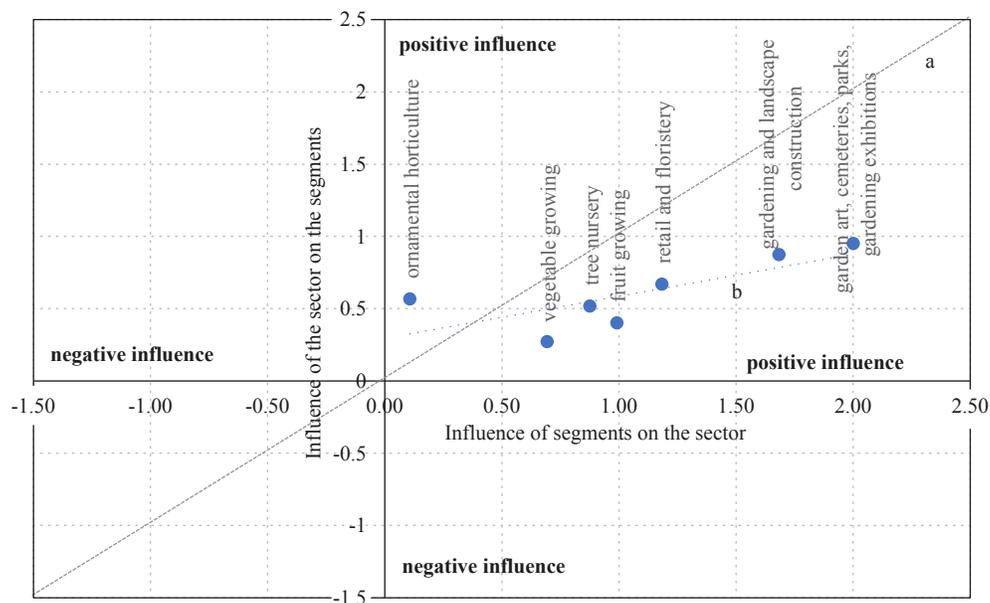
The characteristics surveyed correspond in part to the indicators already examined in Sections 4.1 and 4.2. Most surveys referred to the characteristic – 'Job description & profession' (n=17) – which has not yet been taken into account in this form in the measurement model. The category cannot be clearly differentiated with regard to its direction of action. In addition to text passages that refer to the description of the various horticultural occupations, activities or work processes, it also contains ideas on the part of the stakeholders regarding the company culture, and the behavior/traditions of the sector (e.g. family businesses). It is not always clear whether respondents represent their personal opinions or whether they represent prejudices within society, the job description or the profession. For example, text passages that refer to the attractiveness of working conditions and the level of wage payments must, by definition, be operationalized formatively in the construct. In contrast, text passages that represent prejudices from the consumer's point of view should be assigned to the construct in a reflective direction. In this case an assignment to the category 'Characteristics of consumers' > 'Knowledge & perception' would be conceivable. The characteristic 'Products & services' also has an important impact on the reputation of the experts (n=15). The product characteristics (n=7) and the prices (n=4) are of particular relevance here. The indicator was eliminated in Section 4.1 due to a lack of correlation with the global measure. The renewed inclusion of the indicator here by the experts on the open question points to a possible misinterpretation by them in the evaluation in the form of a closed question (cf. Section 6). In particular, the resumption of the indicator should be based on the subcategories, whereby the product characteristics in particular have proven to be particularly relevant (n=7). The interfaces to other

categories, such as the linking of pesticide-polluted products with the category ‘Management methods & production systems’ > ‘Plant protection & fertilization’, must not be neglected when measuring reputation. The subcategories of the characteristic ‘Characteristics of consumers’ are largely covered by the indicators of the reflective direction of action in Section 4.2. However, the experts emphasize the importance of the characteristic ‘Knowledge & perception’ (n=10). The cause-and-effect relationship between consumer ‘knowledge’ and ‘relationship’ (see Table 3) and the reputation construct cannot be conclusively clarified here. However, an inclusion in the measurement model should take place in any case (Hümmer, 2015: 70). The additions to the reputation construct for horticulture shown in Table 3 should be taken into account for further work. This should be done regardless of whether they are operationalized as an additional indicator or as a specification of an existing indicator in the construct.

#### 4.4 Reputation map – interaction of the reputation of the segments and the sector

Horticulture as a sector is characterized by a high degree of heterogeneity. Due to this heterogeneous composition of the sector, the reputation of horticulture from the consumer’s point of view can only be determined on the basis of individual segments or product groups. To get a first understanding of the impact of horticultural segments in the public, the experts were asked to characterize the interaction. This way the reputation map can help to better understand and illustrate the interactions between horticulture as a whole and the various segments from the expert’s points of view (Figure 2).

The horticultural segments can be shown to have an influence on the reputation of horticulture (X-axis of the reputation map). But the reputation of the segments themselves is also influenced by the reputation of the sector (Y-axis). If an influence can be seen in equal parts, there is an equilibrium (a). Ornamental horticulture is the only segment that is influenced more by the reputation of the sector (0.57) rather than its own reputation impacting upon the sector (0.11). The influence of ornamental horticulture on the reputation of horticulture is therefore negligible. All other segments have a stronger influence on the sector’s reputation than their own individual reputations. The influence of horticultural production (fruit growing, vegetable growing, ornamental horticulture and tree nurseries) on the reputation of horticulture is smaller than the influence of service horticulture (retail and floristry, gardening and landscape construction, garden art, cemeteries, parks, gardening exhibitions).



**Figure 2.** Reputation map (n=102).

and gardening exhibitions) on it. The segments gardening and landscape construction (1.67) and garden art,

cemeteries, parks and garden exhibitions (2) have a much more positive influence on the sector's reputation than the retail and floristry segments (1.18).

In horticultural production, the influence of fruit growing on the sector's reputation (0.99) is most strongly perceived. Vegetable growing, which is the second segment in the food industry of horticulture, has a smaller influence on the reputation of horticulture than fruit growing (0.69).

A comparison between the segments, on the basis of the linear balancing lines (b), shows that service horticulture benefits more from the sector than horticultural production (vegetable growing, fruit growing, tree nurseries).

## 5. Discussion

The experts interviewed here are consultants in horticulture, so they have an internal and external view of the industry. However, the answers are mainly influenced by the experience they have gained in their daily work with gardeners. This means that the reputation, which was considered slightly positive by the experts, cannot be interpreted as a reputation among consumers.

A large number of indicators described in the literature for reputation measurement have been tested by experts for horticulture. There is disagreement in the literature about whether not significant indicators should be removed from the model (Diamantopoulos and Sigauw, 2006: 270). Within a formative construct, the elimination of an indicator could lead to a falsification of the theoretically derived construct (Seltin and Keeves 1994: 4356 cited after Steinmann, 2013: 136). Since the examined indicators show only a very low multicollinearity (VIF), low coefficients ( $<0.1$ ) as well as the missing significance can be neglected. Due to the almost independent indicators, the effects (coefficients) can be interpreted as a direct result of the respective indicator on the reputation and an elimination does not appear to be necessary.

The limit value of the regression coefficient is also not reached in other empirical studies (Hautzinger, 2009: 231; Helm, 2007a: 245). Especially at Helm (2007a: 246), economic indicators (corporate success, financial performance) have only a weak weight. Steinmann (2013: 136) also points out that the often low regression coefficients for formative indicators may not be misinterpreted.

The indicator 'Product & service' was eliminated due to the missing correlation with the global measure. In contrast, Raithel and Schwaiger (2015: 947) describe a combination of good reputation, product and service quality and positive customer behavior. For horticulture, the indicator is of particular importance, as contact between consumers and the sector takes place solely via the product and the service (Ludwig-Ohm and Dirksmeyer, 2013: 33). The peculiarity – in comparison to other sectors – is reflected in the lack of perception of producers of food products in the food retail trade. With a share of 92.4% of fresh fruit and 91.4% of fresh vegetables, supermarket chains are the dominant sales channel for fruit and vegetables in Germany (AMI, 2019a,b). There the products are not differentiated by brands or companies, but above all by their quality and country of origin. Furthermore, the overall quality of horticultural products cannot be tested at the point of sale by the consumer at the product. In this case, the reputation represents an expectation of the quality of the products (Shapiro, 1982). Thus, the quality of the products and the reputation of the sector influence each other. In contrast, consumer groups who buy horticultural products through direct sales are much more aware of the producer. This means that the distribution channel also has a major influence on the perception of the product and the sector as a whole.

It should also be noted that a lack of knowledge on the part of the consumer regarding the affiliation of products to horticulture can be a substantive reason for eliminating the indicator from the construct. This applies to products that can be grown on both agricultural and horticultural farms, as is the case with field vegetables. If products are not linked to the sector, the reputation cannot be influenced by the product or

the service. In order to be able to take into account the relevance of the indicator in terms of content in the construct, the written additions and explanations of the indicators by the experts are used (cf. Section 4.3).

The literature also describes indicators influenced by reputation. These were also tested for their suitability to be used for measuring reputation in horticulture. There are hints in the literature that a lack of consumer confidence and transparency within the sector is a problem for cooperation in horticulture (Ludwig-Ohm and Dirksmeyer, 2013: 238). However, the indicator 'Trust' was removed from the construct during quality testing because the factor loading was too low. It is possible that experts are currently perceiving higher level of confidence in security of supply than was the case in the past (2012) (Kantar Emnid, 2017: 20). In contrast, Giampietri *et al.* (2018: 166) show for short food supply chain that 'trust might drive solid relationships between producers and consumers and overcome consumer confusion, building new loyalty [...]'. But trust is formed on the basis of the farmer's reliability and by his/her reputation (Offer, 1997: 451). This underlines the fact that trust and reputation are closely interrelated.

The indicator 'Admiration' was also no longer included in the construct. Fombrun *et al.* (2015: 7) refer to qualitative studies which show that admiration by stakeholders is generated by good deeds on the part of companies. To this end, Wiedmann (2012: 76) hypothesizes that production output, innovative strength and performance can lead to admiration and appreciation. In this way, the indicator 'Admiration' continues to be captured by formative indicators (e.g. innovation or product and service) in the construct. In addition, the time within the year at which the reputation measurement is executed is also important. The perception or, in particular, admiration of products or services is closely linked to seasonal availability (e.g. regionally grown vegetables or fruit). Asparagus, for example, is very present for many German consumers in spring. Horticultural services can also be used only seasonally (e.g. flowering parks, services in private gardens). Holidays and special occasions (e.g. birthdays, mothers' day) increase the consumer's perception of horticulture (e.g. buying bouquets of flowers) (Schimmenti *et al.*, 2013: 168). On holidays and special occasions, cut flowers are mainly sold through direct sales (Batt and Pool, 2004: 83).

Perhaps trust and admiration are a matter of course for the experts due to their daily work with gardeners. In the literature, it is clear, that these indicators have a close relationship to reputation (Berens and Van Riel, 2004).

The indicator 'Social protest', which also had to be eliminated from the construct, was classified as a reflective indicator according to Albersmeier and Spiller (2010: 266). Accordingly, reputation must be understood as the cause of social protests. In turn, the performance (formative indicators) of a company or a sector are regarded as the cause of reputation. Wiedmann and Buxel (2005) describe the reputation as a reservoir of goodwill that offers potential support in times of crisis and can protect against social protests. Social movements such as protests and boycotts can pose a threat to a company and lead to a deterioration of its reputation, despite simultaneous efforts to create a positive image (Basedeo *et al.*, 2006; McDonnell and King, 2013: 390).

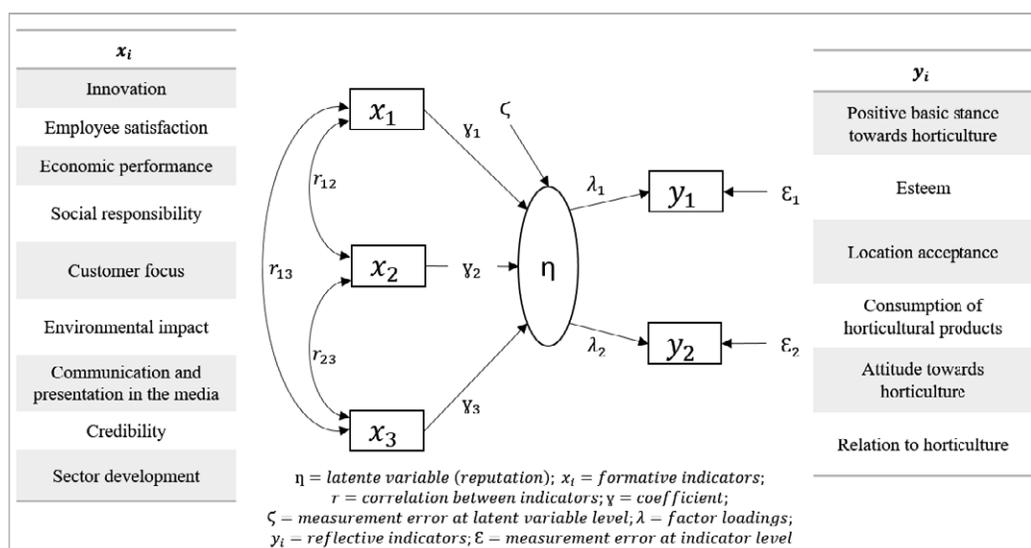
In addition to the indicators determined for reputation measurement in horticulture, the importance of the segments for the reputation of horticulture was determined. In the field of horticultural production, fruit growing has the greatest influence on the reputation of the entire horticultural sector. The service horticulture segments have an even stronger influence on reputation of the entire horticulture sector.

As shown, the contribution of individual segments to the reputation of the sector is very heterogeneous. There are various reasons for this. On the one hand, the achievements of service horticulture are directly visible to society; on the other hand, the products of horticultural production are sold through intermediaries – such as the food retail trade for fruit and vegetables – which means that there is no direct contact with the producer. The concentration in food retailing has led to the development of wholesale food retail chains with enormous purchasing power. They procure fruit and vegetables directly from large farms or buy the products from cooperatives, which have an estimated market share of 40% (Bijman *et al.*, 2012: 16). As a result of this

development, the consumer has no contact with producers along the value chain, which is why the influence of fruit and vegetable cultivation on the reputation of the sector is only slight. In addition, negative media reports, such as those that occur in food scandals, can have a negative impact on the trust and reputation of the horticultural food industries (Bitsch *et al.*, 2014: 109-110). In contrast, service horticulture as a whole has positive attributes and is less affected by negative reporting. Priego *et al.* (2008: 13) show that there is a positive attitude towards public greening in Germany. This study also shows that public green spaces are used significantly more frequently for leisure activities in Germany than in Spain and Chile (Priego *et al.*, 2008: 14-16). These positive links between horticulture and society's leisure activities can have a positive influence on the reputation of the entire sector.

## 6. Summary and outlook

Reputation is a latent construct quantified by formative and reflective indicators. The indicators 'Innovation', 'Customer focus', 'Economic performance', 'Sector development', 'Social responsibility', 'Environmental impact' and 'Communication and presentation in the media' could be identified as the causative factors for the reputation of horticulture (formative side). A correlation with the global measure could be demonstrated for these indicators, which legitimizes their inclusion in the measurement model. They are complemented by the indicators 'Positive attitude to horticulture', 'esteem', 'Location acceptance', 'Consumption of horticultural products', 'Attitude towards horticulture' and 'Relationship to horticulture', the reflective side of the construct. The reflective characteristics show the consequences of the reputation in reality, which are directly reflected in the behavior of consumers towards the sector (Figure 3). These indicators, which originate from other sectors and companies, are supplemented by horticultural-specific reputation characteristics. Developed on the basis of an open question to the experts, eight characteristics emerged within the framework of inductive category formation, of which a total of seven are taken into account. 'Job description & profession', 'Products & services', 'Characteristics of consumers', 'Media presence & public relations work', 'Management methods & production systems', 'Social responsibility/dealing with nature/environment' and 'Social impacts' must be included to complete the construct. The formed categories could to a large extent be subdivided into further subcategories. These provide indications of the main focuses that should be set for a reputation measurement and that should help to interpret the characteristics logically. The subcategory 'Characteristics of consumers' > 'Knowledge & perception' represents the most frequently mentioned of all subcategories (n=10) and should be adequately mapped according to its possible characteristics. The Reputation Map shows the interactions



**Figure 3.** Validated structural model based on quantitative answer on the expert survey (Adapted from Diamantopoulos and Winklhofer, 2001: 272).

between the reputation of the segments and the reputation of their sector. The service and retail segment proved to be particularly relevant to the reputation of horticulture. On the other hand, the horticultural production segments had only a minor influence on the sector's reputation.

With the results of the present study, a statistically validated model for reputation measurement could be developed and adapted to horticulture. In contrast to what could be expected from the literature research, the experts estimate the reputation of horticulture in society as slightly positive.

The extent to which the horticultural-specific reputation characteristics should be combined with the indicators from the quality test must be examined in detail before a final reputation measurement among consumers is carried out. Some of the indicators can be adapted, others can be specified more precisely and others newly created. In a step preceding the reputation measurement, the determination of the direction of effect, of the characteristics generated specifically for the sector, represents an important task. A misinterpretation of these leads to incorrect and inaccurate assumptions in the model, which in turn can lead to a distortion of the results. Other empirical studies have also pointed to the importance of processes of adaptation and specification of the indicators (Hautzinger, 2009: 202; Helm, 2007c: 273). Both studies use multi-stage pre-tests to ensure that the indicators are assigned to the construct in terms of content. During this adjustment process, care should be taken to ensure that, by and large, the indicators completely reflect the content of the reputation construct (Diamantopoulos and Siguaw, 2006: 271). Once this procedure is complete, the resulting construct can be used to measure the reputation of the horticultural sector. For latent constructs, a measurement using multi-item scales is recommended in the literature (Diamantopoulos and Siguaw, 2006; Schwaiger, 2004: 57). The indicators are operationalized by several items or statements and serve as a basis for the development of a consumer survey. A survey of consumers requires their knowledge of the horticultural sector and its products. In this way, 'knowledge' and the availability of information influence the assessment of the respondent of the company or sector to be evaluated (Newbury, 2010: 392). A survey of consumers should therefore be based on the results of the reputation map. Finally, the results of a consumer study can serve as a basis for deriving recommendations for action for the sector. The indicators identified here represent the key parameters of reputation. The impact of these indicators on the reputation of horticulture can only be determined after the consumer survey. Knowledge of the influence of the individual indicators enables producers to influence the reputation of the sector.

## Supplementary material

Supplementary material can be found online at <https://doi.org/10.22434/IFAMR2020.0009>

**Questionnaire** for horticultural consultants

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*Special track: European agrifood business in transition towards social responsibility*

## **Innovation behavior of agri-food small and medium-sized enterprises: the case of Europe's emerging economies**

### **RESEARCH ARTICLE**

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### **Abstract**

This paper examines the innovative behavior of agri-food firms located in Central and Eastern Europe. In the literature, empirical analyses on innovation activities of firms focus on various case studies from around the world. However, very few studies explore the innovation of small and medium sized enterprises from Central and Eastern Europe's agri-food sector. The analysis uses the logit estimation method and firm-level data, which are obtained from ERBD-World Bank Business Environment and Enterprise Performance Survey. Results suggest that firms that spent some proportion of their financial budget on research and development, had workforce training programs, and bought fixed assets are more likely to launch product, process, organizational, and marketing innovations.

**Keywords:** innovation drivers, Central and Eastern Europe, agri-food sector, firm-level data

**JEL code:** O31, M21

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## 1. Introduction

Innovation can be defined as the use of novel or ameliorated product, process, organizational or marketing practices in a firm's workplace organization, business operations or its relations with other external entities (OECD and Eurostat, 2005). Technological progress and innovation have always been an area of interest for human civilization from the use of fire in prehistoric times to the modern age's computers, cars, cell phones, satellites, etc.

Innovation is commonly split into four types: product, process, organizational and marketing innovation (OECD and Eurostat, 2005). According to the United Nations (UN) (2013), Joseph Schumpeter put forward the argument that technical advances and dynamic innovation activities mainly originate in large enterprises that have robust capacities in research and development (R&D), even though Schumpeter acknowledged the role of new entrepreneurs in the development of a country's economy.

Innovation is a critical factor for both the advancement and development of the economy because it serves as a basis for productivity gains, new employment opportunities and new firms (OECD, 2015). In addition, innovation-based economies have a higher resilience, greater productivity, and more ability to adjust to changing circumstances. They also have a higher capability to support better standards of living (OECD, 2015). Kafetzopoulos *et al.* (2015) showed that Greek firms' process and product innovations directly and positively influence the firm's competitive advantage. Based on the empirical analysis of data on British small and medium-sized enterprises (SMEs), Laforet (2013) found that organizational innovativeness is associated with job environment, leadership position in the market, better business margins, and better productivity.

As reported by OECD (2009), entrepreneurs and SMEs are critical participants in a country's economy, and they are considered to be important engines of growth, income, innovation activities and jobs. Small and medium-sized enterprises are independent businesses that are not subsidiaries and that employ a smaller number of employees than some given level (OECD, 2006, 2009). In this study, the term 'R&D' (in-house or through the use of external firm services) indicates that the firm systematically engages in creative work to accumulate knowledge (EBRD and World Bank, 2018b).

The objective of this article is to examine the driving forces of innovation activities by SMEs in Central and Eastern European countries by empirically analyzing data from firms that conduct their business in the agri-food sector. The following countries are considered in the empirical analysis: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, Georgia, Hungary, Latvia, and Lithuania, the Former Yugoslav Republic (FYR) of Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Serbia, the Slovak Republic, Slovenia and Ukraine.

In the Central and Eastern European region, the agricultural sector plays a more crucial role as a part of the overall economy compared to developed countries (Klomp, 2014). As pointed out by Klomp (2014), from fifteen to twenty% of Central and Eastern Europe's overall employment and gross domestic product, in comparison to the European Union's two to three%, was traditionally represented by the agricultural sector (Table 1).

The contribution of this article to the literature on SME innovation is that this paper adds critical insight into the innovation drivers in Central and Eastern Europe's agri-food SME sector. The article is organized in the following way: The next section of the paper presents the literature review on innovation. Section 3 discusses the methodology and presents the empirical framework. Section 4 introduces the data and outlines the summary statistics. Section 5 reports the results and the conclusion is presented in Section 6.

**Table 1.** Vegetable and fruit export values (in 1000 US\$) by year and rank in the Central and Eastern European Region (adapted from FAOSTAT, 2018).

Country	Year	Value (1000 US\$)	Rank
Poland	2010	2,886,523	1 <sup>st</sup>
	2013	4,198,735	1 <sup>st</sup>
Hungary	2010	715,636	2 <sup>nd</sup>
	2013	841,407	3 <sup>nd</sup>
Lithuania	2010	690,485	3 <sup>rd</sup>
	2013	1,256,197	2 <sup>rd</sup>
Montenegro	2010	12,512	23 <sup>rd</sup>
	2013	12,075	23 <sup>rd</sup>

## 2. Literature review

### 2.1 Innovation studies

Academic studies have focused on a broad variety of issues in the field of innovation analysis, including productivity (e.g. Friesenbichler and Peneder, 2016; Tevdovski *et al.*, 2017) and economic factors (e.g. Ghazalian and Fakih, 2017). Friesenbichler and Peneder (2016) found that both indirect and direct exporting activities and an increase in the proportion of employees with higher education contribute to an increase in R&D. Furthermore, Friesenbichler and Peneder (2016) highlighted that innovation and business competition simultaneously and independently influence the sampled firms' productivity using ERBD-World Bank Business Environment and Enterprise Performance Survey (BEEPS) V data. Tevdovski *et al.* (2017) analyzed productivity and innovation determinants of firms in three countries (Romania, Germany and Bulgaria). The authors found that product innovation positively influences workforce productivity in all sampled countries, whereas process innovation only has a positive influence on workforce productivity in two out of the three countries.

Another area of topic that has been investigated heavily is the drivers of innovation processes. For example, studies on enterprise innovation has been conducted in Australia (Bhattacharya and Bloch, 2004; Rogers, 2004), the Netherlands (Fortuin and Omta, 2009), Croatia (Božić and Mohnen, 2016), Italy (Capitanio *et al.*, 2010; Ciliberti *et al.*, 2016), India (Ali *et al.*, 2017), the United Kingdom (UK) (Laforet and Tann, 2006), and Europe (Barata and Fontainha, 2017; Minarelli *et al.*, 2015). Laforet and Tann (2006) highlighted that customer orientation, market anticipation, novel techniques of working and engagement of business leaders in new product and process development are determinants of manufacturing SMEs' innovation. They concluded that the leading challenges to SMEs include insufficient skills/knowledge, workforce training, financial constraints, networking, and consumer dependency.

Klonowski (2012) examined the innovation activities in Polish manufacturing SMEs using primary data and found that many SMEs have problems with commercialization. Rogers (2004) employed a probit approach to identify the drivers of innovation in Australia's firms. Barata and Fontainha (2017) explored drivers of construction industry's product and process innovation in Europe using the probit estimation.

Božić and Mohnen (2016) used probit and multivariate probit approaches to investigate the innovation drivers of Croatian manufacturing and service SMEs and found that in terms of non-technological innovativeness, service and manufacturing SME firms differ greatly. They postulated that [in-house] R&D is a driver of product innovativeness for both manufacturing and service SME firms. Another result of the study was that service SMEs have a lower likelihood of launching technological innovations. They also found that manufacturing SME firms have a higher likelihood of being present in foreign market places, tend to be larger in size, and

have greater gains from public assistance in R&D. They also argued that public-provided funding is the critical driver of manufacturing SMEs' process innovation and service SMEs' product innovation.

## 2.2 Innovation studies on the agri-food sector

Some studies have been particularly interested in analyzing driving forces and obstacles for innovation activities in the agri-food sector. Using a sample of food processing firms from the Netherlands, Fortuin and Omta (2009) identified the chain's unequal distribution of power as a determinant of innovation. Capitanio *et al.* (2010) found that Italy's food firms are more focused on innovation if they sell more of their products/services in targeted distribution channels. The findings of the study (Capitanio *et al.*, 2010) underlined that process innovation is more associated with enterprise size and financial factors, whereas organizational aspects, like human capital's quality characteristics, are becoming more critical in a firm's novel product development.

Ciliberti *et al.* (2016) assessed the innovation determinants of Italian enterprises from industries such as pharmaceutical and food by employing a Community Innovation Survey (CIS). They stressed that the food industry's organizational capability and external drivers are beginning to play a more significant role in the innovation process. Another result of the paper was that internal R&D has a larger importance for the pharmaceutical industry than for the food industry. Minarelli *et al.* (2015) assessed the factors of innovation activities in food and beverage firms from the SME sector located in several European Union countries, finding that process, product and market innovations are closely connected.

Some studies (e.g. Ali *et al.*, 2017) did not find a significant influence of firm age on innovation. Rogers (2004) showed that R&D expenditure is positively related to innovation in the overall manufacturing sample. Expenditure on R&D can be used as an indicator of innovation input, despite the fact that it may or may not result in innovation (Mateut, 2018). As discussed by Friesenbichler and Peneder (2016), an increase in R&D expenditures raises the probability of success for innovations. Knowledge is a crucial element of both technological advances and innovation, and an important source of this knowledge is R&D (Bhattacharya and Bloch, 2004).

Adult education and regular training can be critical in helping economies and enterprises achieve higher levels of competitiveness, easing workforce skill shortages and improving an ageing labor force's productivity levels (Kupets, 2018). Kupets (2018) showed that firms that have international contacts and firms that are innovative have a higher likelihood of investing in employee training. Moreover, in comparison to firms that have no training, Kupets (2018) found that a higher proportion of training enterprises have characteristics such as a satisfactory financial business performance, a common location in a home country's capital city and the presence of international contacts.

Additionally, in the food sector, Ciliberti *et al.* (2016) stressed that employee training pertaining to innovation activities is a significant determinant of innovation in CIS 2004 data, but not in CIS 2010 data. They indicated that there is a positive relationship between the acquisition of assets (i.e. software, equipment and machinery) and product and process innovation. Ali *et al.* (2017) employed formal training as one of the covariates in their work and found that certification and product innovation have a positive relationship, but training have no effect on the launch of product innovation.

Recently, Mateut (2018) indicated that exporters and those with access to foreign capital have significantly higher innovation. Ghazalian and Fakih (2017) asserted there is an association between exporting activities of the firm and a rise in R&D activities. Barata and Fontainha (2017) documented that in comparison to regional and local-oriented businesses, international-oriented firms are more engaged in innovation.

Using BEEPS IV, Mateut (2018) posited that innovation and government-provided subsidies are positively related in their sample from emerging countries. Moreover, on average, firms that obtained subsidies had more

innovation activity (Mateut, 2018). Ghazalian and Fakhri (2017) found no significant association between R&D activities and public subsidies. Using data from the entire sample, Tevdovski *et al.* (2017) found that funding from the European Union or national sources significantly affect R&D engagement.

Hölscher *et al.* (2017) highlighted that newly admitted EU members (Central and Eastern European countries) and older members (Western European countries) do not differ to a large extent in their implementation of state support policies in industries such as finance and steel. They mentioned that without accounting for measures implemented during the financial crisis, members of the EU distributed fifty-four billion euros toward the assistance of domestic industries in the year 2013.

Moreover, one of the greatest hurdles that SMEs (notably, innovative firms) still face with respect to their establishment, business expansion, and survival is access to finance (OECD, 2009). Similarly, Beck and Demirci-Kunt (2006) reported SME firms are more pressured by various obstacles (access to finance is one of these obstacles) than large enterprises. Another explanatory variable that was included in the model was location. Capitanio *et al.* (2010) showed that location is positively related to product innovativeness of food firms.

### 3. Empirical model

Following Ali *et al.* (2017), this study employs both the chi-square test and the logit models in its empirical investigation of innovation drivers. Hayashi (2000) stated that in the case when the outcome variable has two values (one and zero), this specific type of a qualitative response model is referred to as a binary response. As pointed out by Hayashi (2000), the logit regression is defined as:

$$\begin{cases} f(y_t = 1 | x_t; \theta_0) = \Lambda(x_t' \theta_0), \\ f(y_t = 0 | x_t; \theta_0) = 1 - \Lambda(x_t' \theta_0), \end{cases} \quad (1)$$

Where  $y_t$  is the outcome variable,  $x_t$  is a vector of independent variables, and  $\theta_0$  is the true value of an estimated parameter. Here,  $y_t$  is product, process, organizational or marketing innovation.

As stated by Hayashi (2000), in the logit regression, the cumulative density function is represented by  $\Lambda$ :

$$\Lambda(v) \equiv \frac{\exp(v)}{1 + \exp(v)} \quad (2)$$

According to Hayashi (2000), assuming that  $\{y_t, x_t\}$  is independent and identically distributed, the log likelihood of the logit regression is defined as a summation of the log likelihood of each observation  $t$ :

$$Q_n(\theta) = \frac{1}{n} \sum_{t=1}^n \{y_t \log \Lambda(x_t' \theta) + (1 - y_t) \log [1 - \Lambda(x_t' \theta)]\} \quad (3)$$

The methodology of this empirical analysis is based on the study by Ali *et al.* (2017). However, this study expands upon the work of Ali *et al.* (2017) in these ways: (1) this study looks at Central and Eastern Europe; (2) this study examines not just product innovation, but also process, organizational and marketing innovation; and (3) there are differences in the independent variables used.

To analyze the drivers of product, process, organizational and marketing innovation of agri-food firms in emerging economies, the following empirical model is employed:

$$\begin{aligned} y_i = & \beta_0 + \beta_1 \text{Age} + \beta_2 \text{R\&D} + \beta_3 \text{Training} \\ & + \beta_4 \text{Work Experience} + \beta_5 \text{Fixed assets} + \beta_6 \text{Certification} \\ & + \beta_7 \text{Direct exporting} + \beta_8 \text{Subsidies} + \beta_9 \text{Government contract} \\ & + \beta_{10} \text{Location} + \beta_{11} \text{Access to finance} + \varepsilon \end{aligned} \quad (4)$$

## 4. Data description

The article's firm-level data on Central and Eastern European agri-food firms comes from the BEEPS V. The specific name of the dataset used is BEEPS V and MENA ES, 2012-2016 (EBRD and World Bank, 2018a). BEEPS's goal is to assess private-sector firms' opinions about their operating environment through the collection of firm-level data from a statistically representative sample (EBRD and World Bank, 2018a). The BEEPS V survey was conducted in thirty countries (in addition to Russia's thirty-seven regions) between 2011 and 2014 (EBRD and World Bank, 2018a).

The classification of firms as agri-food is based upon the works of Ali *et al.* (2017), the United Nations (UN, 2002) and specifically the survey's 'd1a2' variable. The following values of the survey's 'd1a2' variable were assumed to belong to the agri-food sector: 111, 122, 140, 1511-1593, 1600, 2010, 2412, 2421, 2921, 2925, 5100 (only 1 observation), 5121, 5122, 5211, 5220, and 5520 (see UN (2002) for code descriptions). In an effort to make the survey data useful, responses in BEEPS such as 'refused', 'does not apply,' and 'do not know' were dropped.

This study's description of variables are based on the BEEPS V's manual (EBRD and World Bank, 2018b). 'Product innovation' is a dummy variable that equals one if the firm has launched novel or refined services or products in the past three years, and 0 otherwise. 'Process innovation' is a dummy variable which represents whether the firm has introduced novel or refined supply or production techniques intended for the firm's services or products in the past three years. 'Organizational innovation' is a dummy variable which indicates whether the firm has launched novel or refined management or organizational changes in the past three years. 'Marketing innovation' is a dummy variable equals to one if the firm has launched novel or refined methods of marketing in the past three years.

In order to construct the 'age' variable, the paper uses the same approach as described by Friesenbichler and Peneder (2016). Using data from BEEPS V, Friesenbichler and Peneder (2016) stated that 2013 was the year the questionnaire was administrated in all countries, except in the case of Russia, where 2012 was the year of the questionnaire's administration. Friesenbichler and Peneder (2016) computed the 'age' variable in their study by subtracting the starting year of the firm's business operations (BEEPS V's 'b5' variable) from the year of the questionnaire. BEEPS V's spending on R&D is a 'yes', 'no' or 'don't know' question, and as mentioned earlier, the study's 'don't know' answers are dropped, thus, the 'R&D' variable is a dummy, which is equal to one if the firm had expenditures on R&D (external or in-house) in the past three years, and zero otherwise. 'Training' is a dummy variable equals one if the firm had training programs that were intended for the firm's full-time workforce in the past fiscal year, and 0 otherwise. 'Work experience' is a continuous variable which indicates the top manager's years of work experience in the industry. The 'fixed assets' dummy variable equals one if the firm bought fixed assets (i.e. vehicles, buildings, land, equipment or machinery) in the past fiscal year, and 0 otherwise.

'Certification' is a dummy variable equals one if the firm has an internationally accepted certification, and 0 otherwise. In this study, the 'certification' variable's 'otherwise' answer choice includes both 'no' and 'still in process' answers. Following Gërguri-Rashiti *et al.* (2017), a direct exporting variable is used in the model. The 'direct exporting variable' is the percentage of overall sales of the firm in the past fiscal year. The 'subsidies' variable is a dummy which indicates whether the firm has obtained subsidies from the government or the EU in the past three years. 'Government contract' is a dummy variable equal to one if the firm has tried or received a contract with the government in the past year, and 0 otherwise. 'Location' is a dummy variable that equals one if the firm operates in the country's capital, and 0 otherwise.

In the BEEPS V data, 'access to finance' is defined as whether the firm sees it as a hindrance to its business operations, and it is measured on a Likert scale from 0 ('no' hindrance) to 4 ('very severe' hindrance). Here, 'access to finance' is a dummy variable that is equal to one if access to finance is a 'very severe' or 'major' hindrance and zero if it is 'moderate', 'minor' or not a hindrance to the firm's business operations.

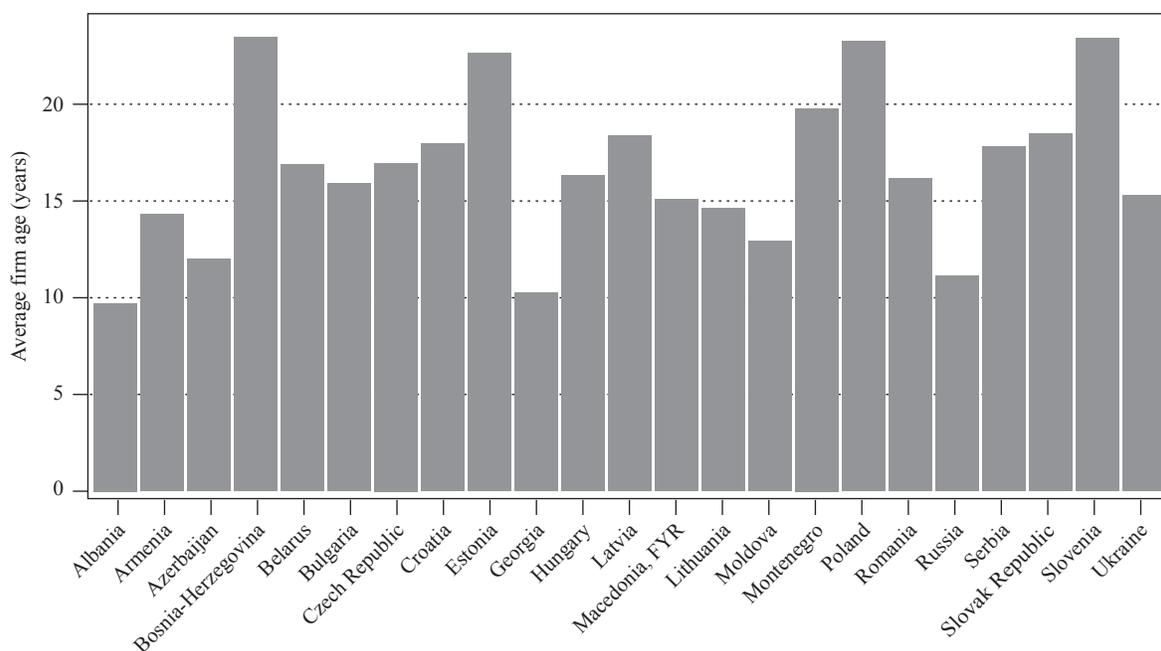
#### 4.1 Summary statistics

Table 2 reports summary statistics of agri-food firms under study. The average firm age in the full sample is 14, with the minimum age of 1 and the maximum age of 149. However, in the case of SMEs, the average age of firms is 13, with the minimum age of 1 and the maximum age of 118. The smallest and the largest average age of agri-food firms in the overall sample are in Albania (9 years), and Belarus (23 years), respectively (Figure 1). From Table 2, in both samples, top managers' work experience in the industry ranges from 1 to 60 years, with an average of 15 years. The average value of direct exporting as a part of overall annual sales

**Table 2.** Summary statistics for agri-food firms.<sup>1</sup>

Variable	All (Obs.=2,237)				SMEs (Obs.=1,942)			
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
Product innovation	0.238	0.426	0	1	0.223	0.417	0	1
Process innovation	0.198	0.399	0	1	0.181	0.385	0	1
Organizational innovation	0.206	0.405	0	1	0.183	0.387	0	1
Marketing innovation	0.247	0.431	0	1	0.227	0.419	0	1
Age (years)	14.798	12.670	1	149	13.638	9.462	1	118
R&D	0.094	0.292	0	1	0.080	0.271	0	1
Training	0.340	0.474	0	1	0.305	0.461	0	1
Work experience (years)	15.533	9.180	1	60	15.508	9.041	1	60
Fixed assets	0.397	0.489	0	1	0.364	0.481	0	1
Certifications	0.193	0.395	0	1	0.166	0.372	0	1
Direct exporting (%)	3.614	14.601	0	100	2.640	12.648	0	100
Subsidies	0.094	0.292	0	1	0.079	0.270	0	1
Government contract	0.099	0.299	0	1	0.090	0.286	0	1
Location	0.186	0.389	0	1	0.186	0.389	0	1
Access to finance	0.183	0.387	0	1	0.180	0.384	0	1

<sup>1</sup> R&D = research and development; SD = standard deviation; SMEs = small and medium-sized enterprises.

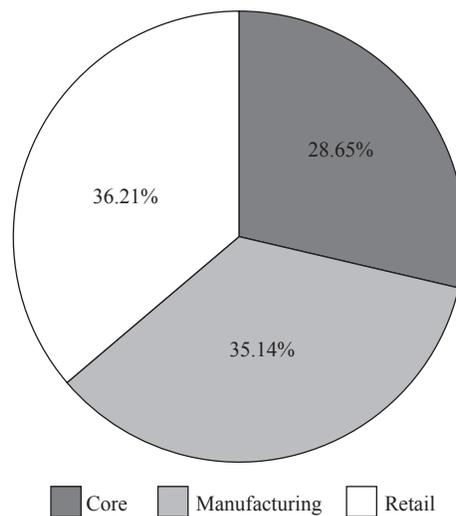


**Figure 1.** Average age of agri-food firms (full sample), by country (adapted from EBRD and World Bank, 2018a).

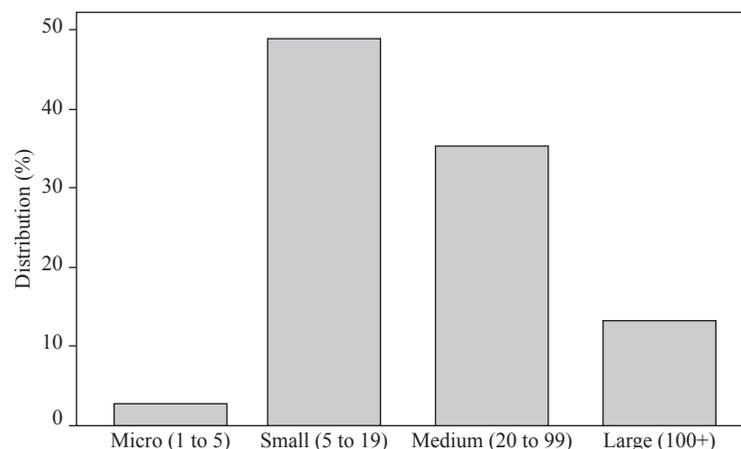
of agri-food firms in the full sample is 3.6%, and the mean value of direct exporting as a part of overall annual sales of agri-food firms in the SME sample is 2.6%.

In the full sample, 9.4% of agri-food firms had expenditures on R&D, while in the SME sample, 8% of agri-food firms had R&D spending. 34% of firms in the full sample and 30.5% of SMEs had employee training programs. Moreover, approximately 40% of all firms and 36.4% of SMEs bought fixed assets. In the full sample, 19.3% of agri-food firms have certifications. 9.4% of firms in the full sample, and 7.9% of SMEs has obtained subsidies from the government or the EU. 9.9% of firms in the full sample and 9% of SMEs have received or tried to receive a contact with the government. With regard to location, 18.6% of firms in both samples have business operations in their home country's capital city. Additionally, 18.3% of firms in the full sample, and 18% of SMEs reported that access to finance was a severe/major hindrance to firms' business operations.

EBRD and the World Bank (2015) note that the core portion of BEEPS is answered by all firms regardless in which sectors these enterprises operate. As a result, it can be concluded that out of the total sample, 35.1% are manufacturing firms (Figure 2). The distribution of business sizes of agri-food firms located in Central and Eastern European countries is plotted in Figure 3. Small firms account for the largest portion of the whole sample, followed by medium firms, large firms, and micro firms.



**Figure 2.** The Modules of BEEPS V (adapted from EBRD and World Bank, 2018a).



**Figure 3.** Distribution of firm sizes in the agri-food sector (adapted from EBRD and World Bank, 2018a).

## 5. Empirical results

### 5.1 Chi-Square and variance inflation factor tests

Following Ali *et al.* (2017), this study utilizes the chi-square test on four types of innovation. As shown in Table 3, the implementation of product innovation is significantly different in large firms and SMEs (chi-square =17.736,  $P=0.000$ ), which is in line with Ali *et al.* (2017). Large agri-food firms are more engaged in product innovation than SMEs.

The estimation results show the implementation of process (chi-square =26.098,  $P=0.000$ ), organizational (chi-square =46.640,  $P=0.000$ ) and marketing innovations (chi-square =32.292,  $P=0.000$ ) is significantly different in large firms and SMEs. It turns out that large firms are more engaged in the launch of process, organizational and marketing innovations than SMEs.

The logit model estimates were checked for multicollinearity (Table 4). The variance inflation factor (VIF) test results show that independent variables do not seem to have a multicollinearity issue (all of the VIFs are less than 2.0). Table 5 reports the results of the logit model, where product, process, organizational and marketing innovations are outcome variables. Table 6 presents the marginal effects pertaining to the above-mentioned logit model.

### 5.2 Product innovation

The logit model for product innovation with the SME sample had a Pseudo  $R^2$  of 0.13, and the full sample's Pseudo  $R^2$  is 0.14 (Table 5). The first model (SMEs) has a lower Akaike Information Criterion (AIC) value than the second model (full sample), which is an indication that the first model has a better fit. 79.66% of the observations in the SME sample were correctly predicted, and 79.17% of the responses in the full sample were correctly predicted.

**Table 3.** Chi-square test: innovation types.<sup>1</sup>

	Large firms		SMEs		$\chi^2(\text{df})$
	Frequency	%	Frequency	%	$P\text{-value}$
<b>Product innovation</b>					
No	196	66.44	1,508	77.65	17.736***
Yes	99	33.56	434	22.35	0.000
Total	295	100	1,942	100	
<b>Process innovation</b>					
No	204	69.15	1,590	81.87	26.098***
Yes	91	30.85	352	18.13	0.000
Total	295	100	1,942	100	
<b>Organizational innovation</b>					
No	190	64.41	1,586	81.67	46.640***
Yes	105	35.59	356	18.33	0.000
Total	295	100	1,942	100	
<b>Marketing innovation</b>					
No	183	62.03	1,502	77.34	32.292***
Yes	112	37.97	440	22.66	0.000
Total	295	100	1,942	100	

<sup>1</sup> \*\*\* is significant at 1%. SMEs = small and medium-sized enterprises.

**Table 4.** The variance inflation factor (VIF) test results for the logit models.<sup>1</sup>

Independent variables	VIF (SMEs)	VIF (All)
Age	1.2	1.13
R&D	1.1	1.14
Training	1.12	1.16
Experience	1.2	1.11
Fixed assets	1.1	1.14
Certifications	1.1	1.14
Direct exporting	1.04	1.07
Subsidies	1.07	1.1
Government contract	1.05	1.05
Location	1.02	1.02
Access to finance	1.01	1.01

<sup>1</sup> R&D = research and development; SMEs = small and medium-sized enterprises.

**Table 5.** Logit estimates on innovation types using the sample of agri-food firms.<sup>1,2</sup>

	Product innovation		Process innovation		Organizational innovation		Marketing innovation	
	SMEs	All	SMEs	All	SMEs	All	SMEs	All
Age	0.014** (0.006)	0.007 (0.004)	0.010 (0.007)	0.007 (0.004)	0.007 (0.007)	0.008* (0.004)	0.007 (0.006)	0.008* (0.004)
R&D	1.472*** (0.191)	1.620*** (0.169)	1.659*** (0.192)	1.733*** (0.169)	2.192*** (0.200)	2.086*** (0.176)	1.901*** (0.198)	1.853*** (0.175)
Training	0.508*** (0.126)	0.446*** (0.116)	0.804*** (0.134)	0.721*** (0.124)	1.054*** (0.136)	1.038*** (0.123)	0.689*** (0.125)	0.720*** (0.115)
Work experience	0.003 (0.007)	0.002 (0.006)	-0.004 (0.008)	-0.005 (0.007)	-0.007 (0.008)	-0.007 (0.007)	-0.007 (0.007)	-0.008 (0.006)
Fixed assets	0.802*** (0.122)	0.724*** (0.113)	0.662*** (0.133)	0.630*** (0.123)	0.623*** (0.136)	0.654*** (0.124)	0.845*** (0.122)	0.868*** (0.113)
Certifications	0.538*** (0.148)	0.459*** (0.133)	0.481*** (0.162)	0.412*** (0.143)	0.183 (0.171)	0.148 (0.148)	0.201 (0.158)	0.108 (0.139)
Direct exporting	0.008** (0.004)	0.005 (0.003)	0.002 (0.005)	0.006* (0.004)	-0.000 (0.005)	0.000 (0.004)	-0.006 (0.005)	-0.002 (0.004)
Subsidies	0.351* (0.198)	0.376** (0.172)	0.145 (0.216)	0.046 (0.186)	0.119 (0.224)	0.115 (0.189)	0.304 (0.204)	0.224 (0.177)
Government contract	0.457** (0.185)	0.307* (0.167)	0.724*** (0.190)	0.682*** (0.169)	0.236 (0.206)	0.199 (0.180)	0.240 (0.192)	0.302* (0.168)
Location	0.188 (0.152)	0.110 (0.140)	-0.289 (0.180)	-0.212 (0.160)	0.041 (0.174)	0.180 (0.153)	-0.191 (0.161)	-0.107 (0.146)
Access to finance	0.049 (0.152)	0.040 (0.139)	0.007 (0.166)	0.066 (0.149)	0.168 (0.165)	0.170 (0.148)	-0.000 (0.154)	0.033 (0.139)
Constant	-2.433*** (0.154)	-2.237*** (0.136)	-2.536*** (0.166)	-2.462*** (0.148)	-2.555*** (0.169)	-2.540*** (0.150)	-2.066*** (0.149)	-2.091*** (0.134)
Pseudo R <sup>2</sup>	0.132	0.137	0.153	0.164	0.180	0.191	0.141	0.157
Log likelihood	-895.506	-1,060.209	-778.234	-930.895	-758.905	-920.852	-892.297	-1053.223
LR $\chi^2$ (11)	272.47***	336.13***	281.8***	364.76***	332.47***	434.29***	293.73***	393.39***
AIC	1,815.012	2,144.419	1,580.468	1,885.790	1,541.811	1,865.705	1,808.595	2,130.445
Correctly classified	79.66%	79.17%	83.16%	82.61%	84.81%	83.24%	80.84%	79.88%
Observations	1,942	2,237	1,942	2,237	1,942	2,237	1,942	2,237

<sup>1</sup> \*, \*\*, \*\*\* are significant at the 10, 5, and 1%, respectively; the standard errors of the logit are presented in parentheses.

<sup>2</sup> AIC = Akaike information criterion; LR = likelihood ratio; R&D = research and development; SMEs = small and medium-sized enterprises.

**Table 6.** Logit marginal effects (at the mean) on innovation types using the sample of agri-food firms.<sup>1,2</sup>

	Product innovation		Process innovation		Organizational innovation		Marketing innovation	
	SMEs Marginal effect	All Marginal effect	SMEs Marginal effect	All Marginal effect	SMEs Marginal effect	All Marginal effect	SMEs Marginal effect	All Marginal effect
Age	0.002** (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001* (0.001)	0.001 (0.001)	0.001* (0.001)
R&D	0.232*** (0.031)	0.271*** (0.029)	0.210*** (0.026)	0.238*** (0.025)	0.277*** (0.028)	0.292*** (0.027)	0.303*** (0.033)	0.315*** (0.031)
Training	0.080*** (0.020)	0.074*** (0.019)	0.102*** (0.017)	0.099*** (0.017)	0.133*** (0.017)	0.146*** (0.017)	0.110*** (0.020)	0.122*** (0.019)
Work experience	0.000 (0.001)	0.000 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Fixed assets	0.126*** (0.019)	0.121*** (0.019)	0.084*** (0.017)	0.087*** (0.017)	0.079*** (0.017)	0.092*** (0.017)	0.135*** (0.019)	0.148*** (0.019)
Certifications	0.085*** (0.023)	0.077*** (0.022)	0.061*** (0.020)	0.057*** (0.020)	0.023 (0.022)	0.021 (0.021)	0.032 (0.025)	0.018 (0.024)
Direct exporting	0.001** (0.001)	0.001 (0.001)	0.000 (0.001)	0.001* (0.000)	-0.000 (0.001)	0.000 (0.001)	-0.001 (0.001)	-0.000 (0.001)
Subsidies	0.055* (0.031)	0.063** (0.029)	0.018 (0.027)	0.006 (0.026)	0.015 (0.028)	0.016 (0.027)	0.048 (0.032)	0.038 (0.030)
Government contract	0.072** (0.029)	0.051* (0.028)	0.092*** (0.024)	0.094*** (0.023)	0.030 (0.026)	0.028 (0.025)	0.038 (0.031)	0.051* (0.029)
Location	0.030 (0.024)	0.018 (0.023)	-0.037 (0.023)	-0.029 (0.022)	0.005 (0.022)	0.025 (0.021)	-0.030 (0.026)	-0.018 (0.025)
Access to finance	0.008 (0.024)	0.007 (0.023)	0.001 (0.021)	0.009 (0.020)	0.021 (0.021)	0.024 (0.021)	-0.000 (0.024)	0.006 (0.024)
Observations	1,942	2,237	1,942	2,237	1,942	2,237	1,942	2,237

<sup>1</sup> \*, \*\*, \*\*\* are significant at the 10, 5, and 1%, respectively; the standard errors of the logit are presented in parentheses.

<sup>2</sup> R&D = research and development; SMEs = small and medium-sized enterprises.

For SME firms, the estimated coefficients of age and direct exporting are significant at the 5% level, but in the case of the full sample, the coefficients are insignificant. It can be concluded that for every 1% increase in direct exporting as a proportion in overall sales, the agri-food SMEs are 0.1% more likely to introduce product innovation.

In both samples, the coefficients of R&D have positive signs, and they are statistically significant, suggesting that compared to firms with no R&D spending, firms with R&D expenditures are more likely to introduce some form of product innovation. In the SME sample, the agri-food firms with formal training are 8% more likely to have product innovation compared to the agri-food firms with no training programs available for their workforce. There is a positive correlation between the acquisition of fixed assets by the agri-food firms in Central and Eastern European countries and product innovation. Moreover, subsidies and product innovation are positively linked, and a contract with the government positively affects the introduction of product innovation in the agri-food firms.

Another variable that is significant in both samples is the variable certifications. In the full sample, having internationally accepted certifications has a positive and statistically significant impact on the product innovation of agri-food firms, which is in line with the work of Ali *et al.* (2017). For the SME sample, the

agri-food firms that have certifications are 8.5% more likely to have product innovation compared to the agri-food SMEs that do not have certifications. For both samples, the coefficients associated with work experience, location and access to finance are not significant, meaning that these variables do not have a statistically significant influence on the launch of product innovation by the surveyed agri-food firms.

### 5.3 Process innovation

The Pseudo  $R^2$  for the logit model for process innovation is 0.153 for SMEs and 0.164 for the entire sample (Table 5). The first model's Akaike information criterion (AIC) value is lower than the second model's AIC value, which suggests that the former model has a better fit than the latter model. Yet there wasn't much difference in their predictions: 83.16% of observations were correctly classified in the first model and 82.61% in the second model. In both models, the estimated coefficients of firm age, work experience of top managers, the presence of subsidies, a firm's location, and a firm's access to finance are not statistically significant.

Both models had significant positive coefficients for the firm's R&D expenditures, training programs, purchase of fixed assets, presence of certifications, and a contract with the government. For the full sample, a 1% increase in the proportion of direct exports in overall sales increases the probability of process innovation by 0.1%.

### 5.4 Organizational innovation

The logit model for organizational innovation correctly classified 84.8% of the observations for SMEs and 83.2% for all firms (Table 5). The SME model has a much better fit (AIC value of 1,541.811 vs 1,865.705) and a Pseudo  $R^2$  of 0.18 vs 0.19.

Both models have three common drivers of organizational innovation – R&D, purchase of fixed assets, and formal training. The estimated coefficients of these variables are positive and significant. This could be explained by the fact that in order to make some changes in the organizational structure, agri-food firms may need to invest in training of their full-time employees. Moreover, for the full sample, older agri-food firms are more likely to have organizational innovation.

### 5.5 Marketing innovation

The last logit involves marketing innovation (Table 5), where 80.84% of the observations were correctly classified in the SME sample, while 79.88% of the observations were correctly classified in the full sample. The SME model has a better fit than the full model (these the AIC statistics). The explanatory power of the logit model has a Pseudo  $R^2$  of 0.14 and 0.15, respectively, for the SMEs and full sample.

In the full sample, five determinants of marketing innovation can be identified: firm age, R&D, training of the workforce, purchase of fixed assets and a contract with the government. In both samples, the estimated coefficients of R&D, employee training, and fixed assets are highly statistically significant. This indicates that agri-food firms with R&D expenditures, training opportunities, and those that purchased some fixed assets are more likely to have marketing innovation compared to firms with no R&D spending, training programs, and those firms that did not acquire fixed assets.

Furthermore, the R&D variable has the most influence on the marketing innovation in both samples. In the full sample, older agri-food firms have a higher likelihood of marketing innovation. This could be due to the fact that older firms may have more experience in implementing innovative marketing techniques compared to younger counterparts.

To summarize, in the case of SME firms only, there is no relationship between organizational and marketing innovations and firm age, which is inconsistent with the results of Lefebvre *et al.* (2015), who found a

negative and significant linkage between age and organizational innovation and marketing innovation. Product, process, organizational and marketing innovation in both samples have three common drivers: (1) R&D expenditures; (2) the presence of training programs for their workforce; and (3) the purchase of fixed assets. Furthermore, the estimated coefficients of managerial work experience, firm location and a firm's access to financial resources are not significant in product, process, organizational, or marketing innovation models in either sample. That is, factors such as work experiences of top managers in the industry and the location of agri-food firms in a capital city do not have an influence on four types of innovation.

## 6. Conclusions

The global food sector must innovate in order to address the challenges of population growth and climate change, and improve food quality and quantity. This study provides key insights on how food and agribusiness small and medium scale enterprises in the Central and Eastern Europe are responding to the changing business environment and competing with large firms through innovation. An understanding of product innovation adopted by food and agribusiness SMEs may help in designing a better policy framework for SMEs. An analysis of factors affecting the level of adoption of innovations may help the firms to better formulate their business strategy and enable them to complete in the emerging market environment efficiently and effectively.

By employing a logit estimation and using BEEPS V data, this study broadens the understanding about the innovation factors of SMEs that operate in Central and Eastern Europe's agri-food sector. This study contributes to the limited number of empirical studies in the academic literature on innovation of SMEs, looking at factors influencing the innovation processes of agri-food SMEs located in the emerging economies of Europe. The main result of this analysis is that firms that spent some proportion of their financial budget on R&D, had workforce training programs and acquired fixed assets are more likely to launch product, process, organizational, and marketing innovations. Results of the study are important for stakeholders, academic researchers, and policymakers since the research identifies factors that impact the innovation activities of Central and Eastern Europe's agri-food SMEs, and could help determine areas that need further improvements and support.

The implication of the study is that the attention of agribusiness managers and policymakers should be devoted to acquiring more fixed assets, workforce training and R&D in the agri-food sector. The main challenge is to access sufficient financial and technological resources that allow investment in these technologies in order to upgrade and modernize the agri-food SMEs. Furthermore, Governments and policymakers should be aware of these effective innovation drivers, including subsidy considerations in order to promote and help in the innovation processes and efforts. There should be continuing monitoring of the innovation processes and innovation activities of the agri-food sector, given the fast changes in information processing, distribution channels, technologies and methods of production, and storage of products.

Food and agribusiness SMEs can uplift the agricultural economy, generate employment and strengthen export earnings, but face stiff competition from giant global multinational companies with significant resources for R&D to innovate. This is clear from the analysis that innovation is more prominent in large enterprises compared to SMEs. However, SMEs are more diversified, implying that SMEs have better potential for innovation, if proper policy support can be provided to SMEs. By improving the quality of products through innovation, SMEs will certainly be able to compete more effectively with the large firms. There is an urgent need for building the business capacity of SMEs in order to enable them to strengthen their capabilities to achieve competitive advantage through innovation.

One of the caveats of the paper is that causal statements cannot be made since the dataset is cross-sectional (Barata and Fontainha, 2017; Lefebvre *et al.*, 2015). Another limitation of the study is the small sample size. Furthermore, because of the nature of BEEP V data, it was not possible to include a lot of continuous variables in the estimated logit model. It is suggested that future studies include more quantitative variables with the use of a large sample of primary data if available.

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