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Willingness to implement innovative solutions for creating information-based added value in food value chains

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ABSTRACT

Due to the increasing consumer awareness about global sustainability issues, rising interest in sustainable development postulates and their translation into practical solutions can also be observed in markets linked to food industry. More and more food business organizations are now focused on how to increase the integrity and transparency of the value chain and one of the areas where these postulates can be implemented is the development of information-based value chains. Thus the purpose of this study is to clarify the internal antecedents and discuss external barriers behind the process of implementing innovative solutions in food value chains to improve information-based added value for customers. Thus CATI was conducted on a sample of 157 companies operating within the food industry.

Results show a strong correlation between producers' willingness to implement information-based innovations to increase added value created from a value chain and (a) their innovativeness, (b) sustainable development oriented strategy and (c) orientation towards consumer cooperation. In order to explain the issues connected with practical implementation of the above mentioned solutions, qualitative results from analysis of 24 in-depth interviews with food systems organizations were referred to. Cost of implementing intelligent packaging technology on a mass scale appears to be the main barrier that holds back the creation and implementation of smart tags in food value chains, but it is worth mentioning that also the lack of consumer awareness.

1. Introduction

Competitive advantage is perceived as the ability of enterprises to develop and discover new market spaces, in the face of challenges connected not only to a high market volatility and competitive processes but also to sustainable issues. Flexibility and integrity are essential ingredients of competitiveness, and to achieve this advantage companies must be innovation-oriented, consumer-oriented and sustainable simultaneously.

Today's consumers are increasingly aware of their rights, needs, and global issues affecting the world such as climate changes and its impact on human life and economic activities. Concern about their own health and the future of human beings is pushing consumers to make increasingly conscious decisions and adopt a sustainable consumption style. Despite the fact that sustainable has not become a norm yet in our societies, this positive trend towards this aspect should be considered by

stakeholders of for the food sector as an important determinant of development strategies.

In a knowledge-based economy, information about the way in which food is produced and processed is an important factor of competitiveness for companies also because it constitutes a noticeable argument in the consumer's decision-making process. Therefore information-based added value, provided to the consumer along with the product, can become an important factor for competing in the market. Companies keep implementing various technologies in order to capture data from different stages of the logistics chain (Kusiak, 2017). Smart and wireless technologies make it possible to combine physical products with digital added value (Nocella et al., 2022; Saunila et al., 2019; Yoo, 2010) providing benefits to both stakeholders in logistics chains and ultimately to consumers. The demand for such technologies is the basis for the emergence of sustainable innovative solutions in the context of information-based added value creation. Saunila et al. confirmed the

Abbreviations: CATI, Computer Assisted Telephone Interview; CO, Customer Orientation.

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relationship between the propensity to implement smart technologies and sustainable development (Saunila et al., 2019).

Food systems entities take into account and widely describe the implementation of sustainability goals in their non-financial reports (Olofsson and Mark-Herbert, 2020). It can be noted that consumers' willingness to pay for information-based added value to sustainable food products has also received increasing attention (Zhang et al., 2012). It is very important that companies, when designing innovative solutions for value chains and considering their benefits and costs, understand consumers' expectations and preferences regarding the usefulness of traceability systems. This is because consumer trust to food quality, safety and certification are key factors in terms of "willingness to pay" for food products (Massaglia et al., 2019; Violino et al., 2019; Zhang et al., 2012). In the food sector information-based-value-added services should be linked not only to product characteristics, production methods, but also to environmental (Sundmaeker et al., 2016).

When customers show a proactive culture and adopt a responsible behaviour for sustainability issues this is an extra value to spread innovation along food supply chains (Ayuso et al., 2006; Ketata et al., 2015). The role of innovation in the success or even survival of a company has gained the attention of many researchers (Hughes and Morgan, 2006; Lee et al., 2019; Rosenbusch et al., 2011), and many authors suggest that there is a confirmed connection between customer orientation and customer collaboration and organizational performance (Kirca et al., 2005; Morgan et al., 2009; Olson et al., 2005). To summarize, a research gap can be observed in the incomplete understanding of the impact of internal organizational factors, such as orientation towards sustainability, innovativeness, and cooperation with consumers on the willingness and capability of companies in the food sector to implement innovative solutions that enhance information-based value creation in their supply chains. While the role of smart technologies and sustainable practices in supply chain management is the subject of growing research, there are currently no comprehensive studies that integrate these elements with consumer-oriented innovation and the specific internal factors within businesses that drive these initiatives. Therefore, the purpose of this study is to clarify the predictive role of internal antecedents, such as orientation toward cooperation with consumers, innovation, and sustainability, in triggering organizations' willingness to implement innovative solutions to increase information-based value creation in sustainable supply chains. This goal is associated with addressing two fundamental research questions:

RQ1. How factors such as a sustainability-oriented strategy, innovativeness, and orientation towards cooperation with customers influence a company's willingness to adopt innovative solutions that enhance information-based added value in the food industry.

RQ2. What are the barriers and challenges to implementing information-based innovations in food value chains that affect the gap between organizational willingness to implement information-based solution to the value chain and their real decisions in this regard (the organizational willingness-behavior gap)

To address these two questions, the results of two studies were utilized. The importance of internal organizational factors in predicting an organization's willingness to deploy information-based added value was verified by the first study and subsequent a quantitative analysis (Study 1). The second study, an in-depth qualitative interviews, revealed the barriers and challenges perceived by entities within such value chains (Study 2).

The structure of the paper is as follows. The introduction is followed by a literature review section. Its aim is to clarify the issues concerning the particular internal antecedents of the propensity to create information-based added value: orientation towards sustainability, innovativeness, orientation towards cooperation with customer. From the individual theoretical analyses and identified gaps, research hypotheses are derived. Afterwards a description of the methodology

comes as well as a presentation of the research results. Conclusions and discussion form the final part of the article. Here the contribution to science is summarized. They also indicate limitations and directions for further research.

2. Literature review

2.1. Sustainability oriented strategy as an antecedent behind willingness to implement information-based innovation

Sustainable entrepreneurship is focused on identifying and transforming marketing opportunities into a new sustainable value for the community and environment, while taking into account issues connected with costs, risks, and uncertainties (Cohen and Winn, 2007). Sustainability is centered around three main principles that constitute its pillars: environmental integrity, economic prosperity, and social equity (Ford and Despeisse, 2016; WCED, 1987; Zemigala, 2019). All principles are equally necessary and if even one of them cannot be realized then economic development will not have the features of sustainability (Bansal, 2005). The literature on this notion has made a significant contribution to the conceptualization of these three dimensions (Criado-Gomis et al., 2017; Ford and Despeisse, 2016; Grębosz-Krawczyk et al., 2021; Nidumolu et al., 2009). Environmental integrity ensures equal access to resources and opportunities for all people today and in future (Choi and Ng, 2011). Economic prosperity addresses the creation and distribution of goods and services that will help people to raise the quality of life around the world, social equality states that everyone is entitled to equal treatment and no one shall be discriminated against in political, social or economic life for any reason (Adamik et al., 2021; Bansal, 2005). Thus, sustainable behavior or sustainable development is a paradigm which can serve as a reference for developing solutions that can tackle environmental and social challenges. The key to these solutions is to meet both present and future needs addressing international issues such as climate change, pollution, environmental degradation, inequality and world peace.

Orientation towards sustainable development represents an essential component of business philosophy and organizational culture (Hernández-Perlines and Ibarra Cisneros, 2018). It reflects the willingness and inclination of companies to take innovative, proactive and risky actions while thinking about society, planet but also about profit (Ameer and Khan, 2020; Hernández-Perlines and Ibarra Cisneros, 2018). This orientation makes managers understand that these areas should be treated actually as an investment, but also a commitment and an opportunity for long-term performance in the market (Criado-Gomis et al., 2017).

Sustainable entrepreneurship may be also discussed taking into account innovativeness which provides real benefits to a larger portion of society and stakeholders (Cohen and Winn, 2007; Wagner et al., 2007). It is commonly mentioned in the literature that market orientation constitutes a philosophy that is then mirrored in organizations strategy directed to meet customer needs by operating with information from customers which is then used to create value that responds to customer wants and expectations (Liang et al., 2020). Thus this information has the chance to be recognized by the market, and is positively perceived by consumers and as a results products are more likely to be chosen (Liang et al., 2020).

Sustainable development is becoming more widespread, forcing a shift in thinking about business models, processes and products (Nidumolu et al., 2009). This is motivating more and more companies to integrate sustainability concepts into all areas of their business (Belz and Cyfert, 2017), supply chains (Du et al., 2016), and product development, but these notions must also be transmitted to stakeholders via employee training (Chowdhury and Morey, 2019; Liang et al., 2020; Zakrzewska-Bielawska and Agnieszka, 2018).

Sustainable oriented companies that co-create value with stakeholders working along supply chains will not only be cost effective but

may expect positive ROI (Mehrpouya and Chowdhury, 2018). This is because customers as well as other stakeholders are really willing to support companies known for their sustainability strategies (Ayuso et al., 2006), while they can react with aggressiveness if companies “misbehave” in the area of sustainable development (Ketata et al., 2015).

In recent years, the growing concerns about food safety issues such as food borne pathogens, pesticides and chemicals, toxins produced by fungi and so on, has increased consumer interest and attention towards the traceability of supply chains that can enhance food quality reducing the risk of consuming products that contain hazardous agents (Zhang et al., 2012). Companies are aware that these data must be transmitted along supply chains (Massaglia et al., 2019; Violino et al., 2019; Zhang et al., 2012) and working hard to convey this information from the farm to the fork. Therefore, if an enterprise considers comprehensive sustainable development as a moral responsibility, then the tendency to implement solutions that promote the creation of information-based added value becomes more obvious. Hence the following hypothesis is proposed for verification:

Hypothesis 1. There is a positive correlation between the level of the company's orientation towards sustainable development and the level of willingness to implement solutions for creating information-based added value in food supply chains.

2.2. Innovativeness as an antecedent behind willingness to implement information-based solution to the value chain

Innovativeness is the ability of companies to create and implement innovations (Zakrzewska-Bielawska and Agnieszka, 2018) which have a significant impact on companies' performance and their competitive advantage (Aksoy, 2017; Hogan et al., 2011; Zastempowski, 2022). The direct relationship between innovativeness and firm competitiveness is often emphasized in several studies (Clark and Guy, 1998; Guan et al., 2006; Lii and Kuo, 2016; Yam et al., 2011; Zeschky et al., 2014) where innovation is perceived as a key factor of economic growth, a source of sustained success for companies and plays a significant role in competition (Lii and Kuo, 2016; OECD, 2010). Innovativeness is recognized as a decisive factor in creating social welfare (Crossan and Marina, 2010; Medrano and Olarte-Pascual, 2016; Zastempowski and Cyfert, 2021). To ensure continuous growth, companies should constantly improve products, processes and business models (Brand et al., 2019; Dziurski et al., 2021; Klimas, 2019), which in a highly competitive environment are the key elements to create innovation that in turn is becoming a key objective for all success-oriented companies (Lipit, 2006).

Globalization, increased competition, acceleration of technological transformation, rising of customer demand, as well as rapidly changing environmental conditions challenge companies for innovation management (Edvardsson et al., 2018; Kraus et al., 2019; Roy and Cohen, 2017; Schneider, 2019). Innovation may be defined as a successful transformation of novel ideas into new products, as well as into processes or business models and structures (Amabile, 1988; Zastempowski, 2022). Schumpeter (1960) defined innovation as discontinuous ventures of combinations of productive factors that did not exist nor were used before. Oslo (OSLO Manual, 2018) instead did not narrow the term innovation only to absolute novelties of global scope, but he included novelties regarding enterprises, industry departments, national economies and the world economy. According to Oslo (OSLO Manual, 2018), innovations can be divided into: product when a significant improved or entirely new produce is implemented; process when a significant improved or entirely new solution for process is applied; marketing when a new solution, method or technique of organization is introduced within the business environment.

Innovative changes can be initiated by internal sources of a company or by external sources which translates into two models: supply-side and demand-side. According to the supply model, innovativeness is initiated

by science and technology and new solutions can be created independently from consumers' needs because the formation of certain wants and expectations will appear after the creation of the innovation. Instead, for the demand model innovativeness is determined by the market because consumers initiate and push companies towards the creation of new solutions (Klincewicz, 2011). This is known as demand-driven innovation because consumers have an impact on shaping the offer of companies. These two models are difficult to disentangle, as discoveries in science contribute to the emergence of new needs, which in turn led to the emergence of demand-supply models. The reasons for which economic agents working along supply chains create and implement innovations can be explained by the possibility of reducing costs, improving quality, entering new markets, enriching offerings, optimizing material consumption, reducing energy consumption, and adapting to current regulatory requirements with the expectation for return of investments and certain benefits (Boehlke et al., 2020).

Sustainable innovativeness of an enterprise is expressed in constant undertaking of innovative initiatives in various areas of activity and building permanent competitive advantage based on innovations. The ability to create and implement innovative solutions is currently the primary measure of a company's performance on the market. Published research results clearly encourage companies to engage more in innovation activities in order to build or strengthen their market advantage (Talke et al., 2011; Yang et al., 2012; Yeung et al., 2007). Many authors suggest that a correlation between innovation and firm performance is visible (Hughes and Morgan, 2006; Iranmanesh, 2021; Rosenbusch et al., 2011). Since organizations operate in the rapidly changing environment, innovation determines competitive advantage, firm performance (Calantone et al., 2002; Hughes and Morgan, 2006) and finally organizational success (Iranmanesh, 2021). It requires the focus on permanent improvement of a company's capabilities to explore opportunities for meeting customer expectations and ensure consumer satisfaction (Boly et al., 2014; Forsman and Helena, 2011). Competitiveness in the area of innovation comes down to the implementation of an innovative strategy of action, openness to cooperation, openness to new ideas of customers, or the formation of pro-innovative attitudes of employees. Innovations are the driving force of economic progress, a special tool of entrepreneurship, expressed in the continuous search for new ideas and opportunities or anticipation of customer needs.

Strategy of innovation is determined by the competitive environment (Dyer and Singh, 1998), and is based on its resources and competencies (Dyduch and Bratnicki, 2018). The pace of innovations implemented or introduced by a company as well as its types depend on its innovation orientation (Siguaw et al., 2006). A pro-innovation culture is crucial here since it drives the continuous search for and implementation of innovation (Siguaw et al., 2006; Škerlavaj et al., 2010; Valencia et al., 2010). Innovation culture is perceived as a contextual factor which plays an cardinal role in shaping a company's innovation capability (Akgün et al., 2010; Škerlavaj et al., 2010). Creation and commercialization of innovation requires not only technical competence, but also industry experience, relational competence, market knowledge and marketing skills (Aarikka-Stenroos and Sandberg, 2012), as well as leeway in exchange of ideas between all parties engaged (from customers to managers). A pro-innovation orientation is a necessary requirement for companies to realize innovation and thus become more competitive (Petrakis et al., 2015).

The literature highlights the issues governed by an organization's innovative orientation such as: openness to accept challenges, trust, support for creativity, exploration of new ideas and solutions and risk taking or autonomy of action (Bessant and Joe, 2015; Sukawati and Putu Astawa, 2017). Creating innovation requires an exchange of complex information about customer needs, plans and technologies, which may also be proprietary. (Rindfleisch and Moorman, 2001). The exchange of this type of information requires a two-way approach and mutual trust, which can be built by creating positive relationships and an honest

approach in sharing information about the product, manufacturing methods, but also about the supply chain (Kumar et al., 2008; Lilien et al., 2010; Sim et al., 2007).

Therefore, it can be summarized that when a company is innovation-oriented, has a clear objective and well-defined strategy, and pursues a high level of innovation it will also be interested in traceability solutions for food movements throughout its chain. With the above considerations in mind, the following hypothesis is posed:

Hypothesis 2. There is a positive correlation between the level of the company's orientation towards innovation and the level of willingness to implement solutions for creating information-based added value in food value chains.

2.3. Orientation towards cooperation with customers as an antecedent behind willingness to create information-based added value

Customer orientation (CO) constitutes an organisation's approach to their business, focused on the market and is described as a determination to collect and process data in order to meet customer needs (Atuahene-Gima and Ko, 2001; Feng et al., 2019). Its effectiveness depends on both internal and external factors (Gaur et al., 2011; Kalamas et al., 2014). Customer orientation as a basis for marketing philosophy (Adams et al., 2019) indicates listening to customers' opinions in order to understand their decision making process and provide superior value as a result (Narver and Slater, 1990). CO can also be described as a set of beliefs and rules that ensure the focus to customers' interests (Deshpande and Zaltman, 1982). Customer knowledge and market competencies are necessary for the success of innovative products (Bonner, 2010; Kim et al., 2015). This is supported by the fact that companies are not able to create and offer innovations by only responding to the preferences of current customers, since they may be unable to think outside the box and express more advanced desires. As rightly noted (Czakon, 2020), in order to quickly respond to market needs and establish appropriate relationships, you must have a clearly defined goal and choose the right partners. Attention to this problem resulted in the introduction (Narver et al., 2004) of the proactive market orientation, which aims to understand the hidden needs of customers.

Following Narver et al. (Narver et al., 2004), two types of customer orientation can be identified: responsive and proactive. Responsive orientation refers to the supplier's ability to respond effectively to meet articulated customer needs, whereas proactive orientation is connected with supplier's ability to continually discover latent customer needs, envisage future ones and offer ideas before customers even realize that they have needs in this particular field. A customer-centric company is one that has the willingness and ability to identify, understand and respond to expressed customer needs and wants. More and more companies are proactively identifying and anticipating the needs of current and future customers, gathering and processing the acquired knowledge and consequently using it to respond effectively to the identified needs, thereby creating greater value for buyers (Atuahene-Gima and Kwaku, 1996). Anticipating customer expectations is extremely important for the success of business outcomes (Stanko and Bonner, 2013).

Positive performance and higher levels of competitiveness have been identified in companies which understand customers' latent needs (Olson et al., 2005). Empirical studies confirm a positive relationship between customer orientation, and organizational performance (Kirca et al., 2005; Kohli and Jaworski, 1990; Morgan et al., 2009). Customer orientation makes it more likely that company's offerings perfectly meet the needs of the market, and allows products to be adopted by customers more quickly and effectively (Danneels, 2002).

Both researchers and business practitioners are increasingly tending to engage in collaborations, particularly with customers who are interested in co-creating value (Czakon et al., 2020; Liczmańska-Kopcewicz et al., 2020; Marczewska, 2014; Thomke and von Hippel, 2002). Customers are increasingly involved at various stages of product innovation

creation (E. Fang, 2008; Gruner et al., 2000). Embedding a proactive culture of openness for collaboration with customers, exploring customer expectations, and demonstrating a high degree of interactivity facilitates innovative product development. Analyzing the impact of customer interaction and involvement in new product development can provide information that may help to understand the course of market changes and therefore be critical to market success (Narver et al., 2004).

The concept of customer involvement in the innovation process is fairly new and has a relatively short history (Brodie et al., 2013; van Doorn, 2010; Neulinger et al., 2020), it is a comparatively well-developed idea in the business and management science (McNeill and Venter, 2019; Pansari and Kumar 2017). Research in recent years confirms the strategic importance that customers themselves can have in enhancing innovation and buyer benefits (Bagozzi and Dholakia, 2002; Wiśniewska et al., 2022). Users are considered an valuable source of innovation and there seems to be a preference in recent years to include them in the innovation process (Liu and Laperche, 2015). Thus, consumers and their knowledge contribute significantly to the creation of innovations with a high degree of market adaptation. Acquired user knowledge increases the likelihood of successful innovation (Chatterji and Fabrizio, 2014; von Hippel, 1988). Tether (2002) states that value co-creation with customers can be beneficial, especially regarding incremental or radical innovations.

Customers provide the company with their knowledge and experiences (Appiah-Adu and Singh, 1998; Gronum et al., 2012; von Hippel, 2005), with their integration into the innovation process providing the company with new ideas and new insights. Companies seeking to better understand the needs of a broad group of buyers engage with both existing and potential customers as well as those who have opted out. Through this collaboration, the company is assured that it is responding to the needs of the market, thus avoiding potential losses due to errors in the creation of the offer (Gronum et al., 2012).

The consumer plays a special role in each of the stages of product design, both in the area of initiation of the creation process, testing, as well as implementation into production and then sales. In addition, it is emphasized that improving the creation of customer value through collaboration will contribute to building or strengthening the advantage of the company by enabling the implementation of innovations which will be adopted by the market faster and more effectively (Hills et al., 2003; Weerawardena and O'Cass, 2004). Consumers decide whether an offer will gain market acceptance, so it is information from them or even cooperation in creating an offer which can provide the knowledge needed. A customer-oriented enterprise must take efforts to understand its target market in order to create and offer effective value for customers (Levitt, 1980). Product development processes based on user collaboration can be more effective than innovations in which the user had no input (von Hippel, 2005). Information obtained from customers reflects their wants and desires, customer collaboration can therefore be seen as a solution for getting access to the most important information about customer needs and wants (Gruner et al., 2000). Research also shows that by focusing on future customer desires organizations are able to create innovations relevant enough to effectively influence customer preferences and choices (Weerawardena and O'Cass, 2004).

It is argued that improving the ability to create consumer value by engaging customers in co-creation will increase a company's competitive advantage by creating offerings which better meet customers' requirements for understanding the value (Vlachos et al., 2009). Suggest that an important outcome of commitment to sustainability is gaining customer trust and that customer orientation and willingness to build trust influences firms' propensity to implement food movement traceability systems throughout the supply chain. Accordingly, we pose the following hypothesis:

Hypothesis 3. There is a positive correlation between the level of the company's orientation towards cooperation with customers and the level of willingness to implement solutions for creating information-

based added value in food value chains.

3. Methodology

The purpose of presented paper is to clarify the internal antecedents and discuss external barriers behind the process of implementing innovative solutions in food value chains to improve information-based added value for customers. Internal factors and their correlations with organizations' willingness to create innovation-based added-value in the value chain have been considered with regard to three fields: sustainability-oriented strategy, innovativeness and orientation towards cooperation with customers. As the mere willingness do not apparently translate into actions, some obstacles need to be discussed.

In this paper, results from a quantitative study are presented (Study 1), namely those which addresses the problems of relationship between companies' orientation towards sustainable development (which consists of economic, ecological and environmental aspects), orientation towards innovations (product, marketing, technological and organizational) and customer orientation (acquiring information from the customer and co-creating with the customer) and the propensity of food companies to create information-based addend value in food value chain. The questionnaire was divided into three parts. The first one concerned innovation orientation, and here the respondents assessed the levels of orientation towards product, marketing, organizational and technological innovations on a 7-point Likert scale. The second group of questions concerned the area of orientation towards sustainable development. The respondents commented on the strength of their orientation towards ecological, economic and social goals. The last group of questions concerned customer orientation. Here, the focus on obtaining information and cooperation was verified. The dependent variable is willingness to create information-based added value in the value chain.

Statistical measures for data analysis are used with pivot tables to present the research results.

The survey was conducted between September 2019 and January 2020 interviewing representatives of the management of food companies randomly selected which constituted research units. The eligibility criterion for participation in the study was the introduction within the company of any innovation during the last three years. Participants were interviewed using a standardized computer-assisted telephone interviewing (CATI) and in total 157 companies took part in this survey. The characteristics of these companies included in the final sample are illustrated in Table 1.

The examined variables taken to validate the three hypotheses were evaluated every on a 7-point scale.

First, attention is focused on whether there is a relationship indicated in hypothesis 1, namely how much influence on the propensity of the surveyed companies to engage in the implementation of innovative solutions to create or increase information-based added value in food value chains the assessment of their orientation towards sustainable development has. In order to confirm the validity of hypothesis 1, statistical analysis of the relationships between the relevant variables was carried out.

In order to explain the issues connected with practical implementation of solutions providing information based added value, qualitative results from analysis of 24 in-depth interviews with food systems organizations were referred to (Study 2). The interviews were conducted from April to June 2020 with food and beverage industry stakeholders in

Belgium, Finland, Iceland, Israel, Poland, Spain and the UK within the framework of the EIT-Food project SMART-TAGS (<https://www.eitfood.eu/projects/smart-tags-for-improving-consumer-interaction-in-food-value-chain-2020>). Stakeholders covered different parts of food value chains, and that were as follows: Smart Tag Manufacturers, Packaging Company, Retailers and Producers. Four product categories were taken into account while this interviews: meet, sugar, fish and beverages. Conclusion from this study are considered as a supportive for quantitative survey.

4. Research results from Study 1

The food and beverage industry constitutes in the EU a large production sector, (taken into account both, the annual turnover which is 1,2 Euro, as well as from the perspective of the employment market). It is also worth mentioning that this industry is built mostly by small and medium-sized (99%) (Bykowski, 2020).

Food and beverages are products of rather low price and are considered as frequently used goods. The competition is very broad. All the trends regarding price change, consumer adapting behaviour are of high importance for these producers. On the basis of the literature review it can be concluded that a strong relationship occurs between the functioning of enterprises in accordance with the concept of sustainable development, the level of their innovation, customer orientation and the propensity to purchase for creating information-based added value.

The IBM SPSS Statistics version 24 software package was used for statistical analyses. Some basic, descriptive statistics are presented in Table 2.

The reliability coefficient Cronbach's alpha for the analyzed group of factors was 0.931 which confirmed the internal consistency of the variables. The model took into account the correlation between orientation towards sustainable development and the willingness to implement solutions aimed at creating information-based added value. The orientation towards sustainable development is a construct which consists of the average ratings of each respondent of statements regarding the level of orientation towards social goals, orientation towards economic goals and orientation towards environmental goals. Values of Spearman's rank correlation coefficient is presented in Table 3.

A positive and statistically significant relationship between analyzed variables has been confirmed with the Spearman's rank correlation coefficient, which that an increase in the level of sustainability orientation (economic, environmental and social objectives) is connected with an growth of the level of willingness to engage in implementing innovative solutions to create or increase information-based added value in food value chains. The correlation coefficient between the sustainability orientation and the level of propensity to use solutions that create information-based added value to engage among food companies is 0.721**. That should be interpreted as the existence of a reasonably strong relationship.

At the next stage, in order to validate the second hypothesis, a statistical analysis was conducted, that addressed the relationships occurring between the level of innovation orientation (which consists of: orientation to product, marketing, technological and organizational innovations) and the propensity of the surveyed companies to engage in the implementation of solutions for improving information-based addend value. The reliability coefficient of Cronbach's alpha for the group of variables was 0.928 which confirmed the internal consistency of the analyzed group. Values of Spearman's rank correlation coefficient are presented in Table 4.

The results of Spearman's rank correlation coefficient indicate a statistically significant relationship. The positive nature of the correlation should be interpreted in the way that an increase in the level of orientation towards innovations (product, marketing, technological and organizational) is connected with an increase in the level of willingness to apply solutions for creating information-based added value in food value chains. The correlation coefficient between the degree of

Table 1
Characteristics of the enterprises surveyed (N = 157).

Enterprise size:	frequency	percentage %
- small (10–49 employees)	61	40.56
- medium (50–249 employees)	54	34.96
- large (over 250 employees)	42	24.48

Source: elaborated by the authors based on the results of the study conducted.

Table 2

Descriptive statistics of the variables examined (N = 157).

Variable	Range	Min.	Max.	Average	M	D	Standard deviation	Variance
Orientation towards sustainable development	4,00	3,00	7,00	5,72	6	6	0,890	0,792
Orientation towards economic goals	4,00	3,00	7,00	5,81	6	6	0,914	0,835
Orientation towards ecological goals	5,00	2,00	7,00	5,8216	6	6	0,990	0,981
Orientation towards social goals	5,00	2,00	7,00	5,46	6	6	1,065	1,135
Orientation towards innovation	4,00	3,00	7,00	5,92	6	6	0,892	0,796
Orientation towards product innovation	5,00	3,00	7,00	5,87	6	6	0,927	0,860
Orientation towards marketing innovations	5,00	2,00	7,00	5,62	6	6	0,944	0,891
Orientation towards technological innovations	4,00	3,00	7,00	5,72	6	6	0,890	0,793
Orientation towards organizational innovations	4,00	3,00	7,00	5,87	6	6	0,934	0,873
Orientation towards customers	4,00	3,00	7,00	5,93	6	6	0,921	0,848
Orientation towards obtaining information from customers	4,00	3,00	7,00	5,88	6	6	0,894	0,799
Orientation towards co-creation with customers	3,00	4,00	7,00	5,83	6	6	0,921	0,848
willingness to create information-based value for customers	4,00	3,00	7,00	5,89	6	6	0,917	0,841

Source: elaborated by the authors based on the results of the study conducted.

Table 3

Correlation between orientation towards sustainable development and the willingness to implement solutions aimed at creating information-based added value.

			Orientation towards creating information-based added value
Spearman's rho	Orientation towards sustainable development	Correlation coefficient Significance (two-sided) N	0.721^a 0.0001 143
Spearman's rho	- orientation towards economic goals	Correlation coefficient Significance (two-sided) N	0.698 ^a 0.0001 143
Spearman's rho	- orientation towards ecological goals	Correlation coefficient Significance (two-sided) N	0.761 ^a 0.0001 143
Spearman's rho	- orientation towards social goals	Correlation coefficient Significance (two-sided) N	0.634 ^a 0.0001 157

^a Correlation significant at 0.01 (two-sided).

Source: elaborated by the authors.

orientation towards innovation and the strength of willingness to implement these solutions is 0.888**, which indicates a reasonably strong relationship.

Further on, to answer the target question and confirm the validity of the third hypothesis, a statistical analysis of the relationships occurring between the level of customer orientation (which consists of customer knowledge acquisition orientation and co-creation orientation) and the willingness of the surveyed companies to engage in solutions for information-based added value in food value chains was conducted. Cronbach's alpha reliability coefficient for the analyzed group of variables adopted the value of 0.948. This result confirmed the internal consistency here and again, Spearman's rank correlation coefficient is presented in Table 5.

Again, a positive effect of the validations process has been noted. The Spearman's rank correlation coefficient indicated a statistically significant relationship and the positive nature of the correlation means that an increase in the level of customer orientation (obtaining information from the customer and co-creating with the customer) is linked with an increase in the level of willingness to use solutions to build information-based added value in food value chains. The correlation coefficient between the level of innovation orientation and the level of willingness to

Table 4

Correlation between orientation towards innovation and the willingness to create information-based added value.

			Orientation towards creating information-based added value
Spearman's rho	Orientation towards innovation	Correlation coefficient Significance (two-sided) N	,888^a ,000 143
Spearman's rho	orientation towards product innovations	Correlation coefficient Significance (two-sided) N	,715 ^a ,000 143
Spearman's rho	orientation towards marketing innovations	Correlation coefficient Significance (two-sided) N	,563 ^a ,000 143
Spearman's rho	orientation towards technological innovations	Correlation coefficient Significance (two-sided) N	,668 ^a ,000 143
Spearman's rho	orientation towards organizational innovations	Correlation coefficient Significance (two-sided) N	,618 ^a ,000 157

^a Correlation significant at 0.01 (two-sided).

Source: elaborated by the authors.

engage in the above-mentioned technologies is 0.758**, which indicates a reasonably strong relationship.

5. Quantitative findings (Study 1) and the willingness-behavior gap explanation (Study 2)

Quantitative studies allowed for positive verification of all three hypotheses, thus confirming that there is a positive correlation between the level of the company's orientation towards innovation, sustainable development and cooperation with customers and the level of willingness to implement solutions for creating information-based added value in food value chains.

The summary of verification of the hypotheses is demonstrated on Fig. 1

Despite the high willingness to implement solutions that contribute to the creation of information-based added value for customers, there are still barriers that prevent innovative, customer-oriented and sustainable companies from massively implementing such solutions. This

Table 5

Correlation between orientation towards customers and the willingness to implement solutions for creating information-based added value.

			Orientation towards creating information-based added value
Spearman's rho	Orientation towards customers	Correlation coefficient	,758 ^a
		Significance (two-sided)	,000
		N	143
Spearman's rho	Orientation towards obtaining information from customers	Correlation coefficient	,833 ^a
		Significance (two-sided)	,000
		N	143
Spearman's rho	Orientation towards co-creation with customers	Correlation coefficient	,926 ^a
		Significance (two-sided)	,000
		N	157

^a Correlation significant at 0.01 (two-sided).

Source: elaborated by the authors.

was also confirmed by in-depth interviews conducted with food and beverage industry stakeholders in Belgium, Finland, Iceland, Israel, Poland, Spain and the UK within the framework of the EIT-Food project SMART-TAGS. Participants, representing multiple industry sectors (e.g. fish, beverages, etc.) and covering various business roles (e.g., marketing, research and development, etc.) were interviewed to express opinions and experiences about the use of innovative smart labels such as QR codes, biosensors, freshness indicators and so on. Among the functionalities of this solutions, some noteworthy are these connected with providing data about: storage conditions, microbial quality of food or presence of pathogenic bacteria as well as on concentration of carbon dioxide, oxygen, hydrogen sulphide. Worth mentioning is also a role of providing product and manufacturer information connected with product identification. Facilitating inventory control or stock reordering as well as simplifying checkout constitute other functions that improve value chain processes through information management (Biji et al., 2015; Brockgreitens and Abbas, 2016). Research shows that smart labeling is available or even has been already commercially implemented (Biji et al., 2015; Chowdhury and Morey, 2019; Z. Fang et al., 2017; Ghaani et al., 2016; Mohebi and Marquez, 2015; Müller and Schmid, 2019), but as far as intelligent packaging is concerned, not many solutions are to be found in the market.

According to the view of stakeholders, the diffusion of these innovative labels along food supply chains are constrained by the cost incurred by companies and by consumers' lack of knowledge. They were concerned that the cost to adopt the technology would have been high for many companies especially for the introduction on the market of more complex and expensive smart labels such as radio frequency indicators.

I think it's mainly the cost because you need a smart tag for every package and then you need thousands and thousands or even millions a year and then the cost is going quite quickly. For example, the Radio Frequency Indicator tags, it's something you have to buy per package and then also it's not the easiest thing to recycle. But are consumers even aware that smart tags exist and if so, do they know what their advantages are?

The cost of adopting smart tags was coupled with lack of consumer awareness about innovative labels. This is a barrier because consumers do not understand or simply ignore the benefits of these innovative labels and stakeholders do not know what to communicate or offer to them. Most stakeholders emphasized that this barrier could be removed educating consumers via social marketing campaigns. They agreed that the adoption of innovative labels can only be successful if the whole value chain or industry will standardize and use smart tags in the long run. This point was taken a step further and some participants suggested that the government would need to step in as there are innovative labels that can help to deliver benefits for the health of consumers and of the environment.

"I think if the government takes it as a project and try to educate and try to make it a new labelling we have to sign, the sugar act for example. People will get used to looking at it for all products and not just beverages. It might then have a value because if one or two company does it, it's not enough and very expensive to educate the market".

Other barriers might be also represented by issues related to B2B because of the necessity of investing in time and new relationships along food supply chains. Some value chains are made up of dozens of organizations in different countries and thus having to buy-in for smart tags concepts along the supply chain can become a massive task.

6. Discussion, conclusion and practical implications

Based on the results presented in previous sections, it can be concluded that there is a significant, positive connection generally, between customer orientation and the willingness to implement solutions that create information-based added value in organizations. A complementary perspective is provided by Zhao et al., who highlighted traceability and information security need in the blockchain applications what logically resonates with the idea of developing information-based added value (Zhao et al. 2019). In details, there was found that the more companies engage customers in the product or service co-creation process, the more inclined they are to launch innovative, information-based solutions. These findings highlight how crucial it is to keep customers' requirements in mind while promoting innovation and value development in companies.

Notwithstanding the organisations' willingness to implement information-based solution, significant obstacles prevent the broad adoption of innovations. According to the issues highlighted by insights gathered from in-depth interviews conducted with stakeholders, although there is a clear desire to use smart labels—such as QR codes and biosensors—for tracking food quality and storage conditions among other functions (Biji

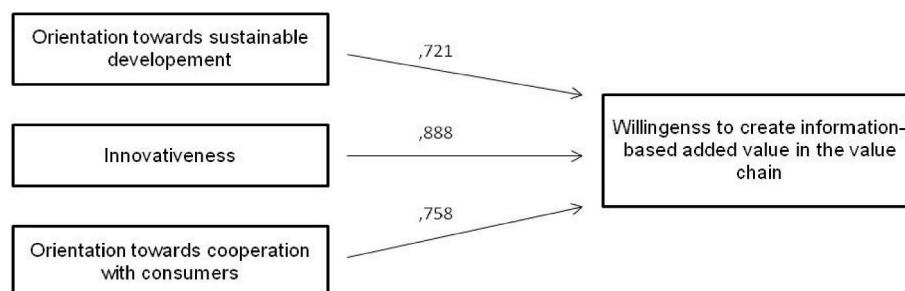


Fig. 1. Circumstances affecting the implementation of innovative solution to increase information-based added value in sustainable value chains - verified.
Source: Own study

et al. 2015; Brockgreitens and Abbas 2016; Htun et al. 2023) there are challenges in real-world implementation. The main obstacle that has been found is cost, which affects customers as well as businesses, especially when it comes to implementing more complicated labeling like radio frequency indications. Equipping every package with a smart tag has significant price implications, which are made worse by the widespread use of these tags in sectors like food and beverage. Zhao et al. similarly identified some challenges in implementing blockchain technology, including high costs, storage capacity, scalability issues, and a lack of skills (Zhao et al. 2019).

Taking these conclusion into account, several practical actions might be recommended. First of all, due to the strong correlation between co-creation and the acceptance of novel ideas, increasing client involvement in product development is essential. Crowdsourcing, beta testing, and online feedback systems could help achieve this. Furthermore, it is necessary to bridge the knowledge gap among consumers about smart labels. This may be achieved by launching extensive educational campaigns, potentially in association with government and industry organizations. Additionally, it's important to address the cost barrier, especially for smaller businesses. Some tactics would be to join industrial consortia for bulk purchasing, make government funding more available, or subsidize improved labeling technologies. Furthermore, creative thinking is required to create affordable smart labeling solutions, with an emphasis on less costly yet effective substitutes. Overcoming supply chain complexity and obstacles also need industry standardization and cooperation. Government assistance and regulation, such as laws requiring or promoting the use of smart labels in particular industries, can be extremely important. By taking these actions, companies can better navigate challenges and seize the opportunities that arise from the strong correlation between customer focus and creative, information-based solutions.

7. Contribution to the theory and limitations

Relevant information is, on the one hand, an important organizational resource and a factor building a competitive advantage, but also, on the other hand, an important added value for customers. The result of the study is significant because it links such enterprise characteristics as innovativeness, orientation to sustainable development and cooperation with customers with creating information-based added value for customers. However, it is still important to remember about the limitations of the conducted research. First of all, the survey covered companies which have implemented any innovation in recent years, which means that there is no reference sample. The second important issue which may affect the results of the survey is related to the declarative nature of the respondents' answers (they were not asked about the facts, but about their willingness).

We believe that the conclusions from both studies contribute to the clearer image of the reality - on the one hand showing the willingness of enterprises to implement innovative solutions for the value chain, focused on creating information-based addend value (sine qua non), on the other hand however the existence of barriers are disclosed that limit these activities in practice (a lack of sufficient condition in the environment). This means that the necessary condition for improvement of improvement of consumer value by relevant information is met. What is still to be focused on now, according to qualitative research, is raising consumer awareness so that this value is noticed and appreciated. Each investment involves costs, but consumers might be willing to participate in these costs if they interpret the impact of this information value on their quality of life.

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CRediT authorship contribution statement

Katarzyna Liczmańska-Kopcewicz: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing; **Agnieszka Wiśniewska:** Conceptualization, Data curation, Formal analysis, Investigation, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing; **Giuseppe Nocella:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing.

Declaration of competing interest

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

Data availability

The authors do not have permission to share data.

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References

- Aarikka-Stenroos, Leena, Sandberg, Birgitta, 2012. From new-product development to commercialization through networks. *J. Bus. Res.* 65 (2), 198–206.
- Adamik, Anna, Liczmańska-Kopcewicz, Katarzyna, Pyplacz, Paula, Wiśniewska, Agnieszka, 2021. Involvement in renewable energy in the organization of the IR 4.0 era based on the maturity of socially responsible strategic partnership with customers—an example of the food industry. *Energies* 15 (1), 180. <https://www.mdpi.com/1996-1073/15/1/180>. (Accessed 11 January 2022).
- Adams, Pamela, Freitas, Isabel Maria Bodas, Fontana, Roberto, 2019. Strategic orientation, innovation performance and the moderating influence of marketing management. *J. Bus. Res.* 97, 129–140.
- Akgün, Ali E., Keskin, Halit, Byrne, John C., 2010. Procedural justice climate in new product development teams: antecedents and consequences. *J. Prod. Innovat. Manag.* 27 (7), 1096–1111.
- Aksoy, Hasan, 2017. 'How do innovation culture, marketing innovation and product innovation affect the market performance of small and medium-sized enterprises (SMEs)?'. *Technol. Soc.* 51, 133–141.
- Amabile, Teresa M., 1988. A model of creativity and innovation in organizations. In: *Research in Organizational Behavior*, vol. 10.
- Ameer, Farah, Khan, Naveed R., 2020. Manager's age, sustainable entrepreneurial orientation and sustainable performance: a conceptual outlook. *Sustainability* 12 (8), 3196.
- Appiah-Adu, Kwaku, Singh, Satyendra, 1998. Customer orientation and performance: a study of SMEs. *Manag. Decis.* 36 (6), 385–394.
- Atuahene-Gima, Kwaku, Ko, Anthony, 2001. An empirical investigation of the effect of market orientation and entrepreneurship orientation alignment on product innovation. *Organ. Sci.* 12 (1), 54–74.
- Atuahene-Gima, Kwaku, 1996. Market orientation and innovation. *J. Bus. Res.* 35 (2), 93–103.
- Ayuso, Silvia, Rodríguez, Miguel Ángel, Ricart, Joan Enric, 2006. Responsible competitiveness at the "Micro" level of the firm - using stakeholder dialogue as a source for new ideas: a dynamic capability underlying sustainable innovation. *Corp. Govern.* 6 (4), 475–490.
- Bagozzi, Richard P., Dholakia, Utpal M., 2002. Intentional social action in virtual communities. *J. Interact. Market.* 16 (2), 2–21.
- Bansal, Pratima, 2005. Evolving sustainably: a longitudinal study of corporate sustainable development. *Strat. Manag. J.* 26 (3), 197–218.
- Beiz, Grzegorz, Cyfert, Szymon, 2017. *Strategiczna i Organizacyjna Odnowa Przedsiębiorstw*. Uniwersytet Ekonomiczny, Wrocław.
- Bessant, John, Joe, Tidd, 2015. *Zarządzanie Innowacjami*. PWN, Warszawa.

- Biji, K.B., Ravishankar, C.N., Mohan, C.O., Srinivasa Gopal, T.K., 2015. Smart packaging systems for food applications: a review. *J. Food Sci. Technol.* 52 (10), 6125–6135.
- Boehlike, Jerzy, et al., 2020. XXIII European Research Studies Journal Searching for Factors of Accelerated Economic Growth: the Case of Ireland and Turkey.
- Boly, Vincent, Morel, Laure, Assielou, N'Doli Guillaume, Camargo, Mauricio, 2014. Evaluating innovative processes in French firms: methodological proposition for firm innovation capacity evaluation. *Res. Pol.* 43 (3), 608–622.
- Bonner, Joseph M., 2010. Customer interactivity and new product performance: moderating effects of product newness and product embeddedness. *Ind. Market. Manag.* 39 (3), 485–492.
- Brand, Marco, Tiberius, Victor, Bican, Peter M., Brem, Alexander, 2019. Agility as an innovation driver: towards an agile front end of innovation framework. *Rev. Manag. Sci.* 15, 157–187.
- Brockgreitens, John, Abbas, Abdennour, 2016. Responsive food packaging: recent progress and technological prospects. *Compr. Rev. Food Sci. Food Saf.* 15 (1), 3–15.
- Brodie, Roderick J., Ilic, Ana, Juric, Biljana, Hollebeck, Linda, 2013. Consumer engagement in a virtual brand community: an exploratory analysis. *J. Bus. Res.* 66 (1), 105–114.
- Bykowski, Piotr J., 2020. Sektor Produkcji Żywności I Napojów W Krajach UE – Stan Aktualny I Przyszłość, vol. 74. *Przemysł Spożywczy* T nr.
- Calantone, Roger J., Tamer Cavusgil, S., Zhao, Yushan, 2002. Learning orientation, firm innovation capability, and firm performance. *Ind. Market. Manag.* 31 (6), 515–524.
- Chatterji, Aaron K., Fabrizio, Kira R., 2014. Using users: when does external knowledge enhance corporate product innovation? *Strat. Manag. J.* 35 (10), 1427–1445.
- Choi, Sungchul, Ng, Alex, 2011. Environmental and economic dimensions of sustainability and price effects on consumer responses. *J. Bus. Ethics* 104 (2), 269–282.
- Chowdhury, E.U., Morey, A., 2019. Intelligent packaging for poultry industry. *J. Appl. Poultry Res.* 28 (4), 791–800.
- Clark, John, Guy, Ken, 1998. Innovation and competitiveness: a review. *Technol. Anal. Strateg. Manag.* 10 (3), 363–395.
- Cohen, Boyd, Winn, Monika L., 2007. Market imperfections, opportunity and sustainable entrepreneurship. *J. Bus. Ventur.* 22 (1), 29–49.
- Criado-Gomis, Ana, Cervera-Taulet, Amparo, Iniasta-Bonillo, Maria Angeles, 2017. Sustainable entrepreneurial orientation: a business strategic approach for sustainable development. *Sustainability* 9 (9).
- Crossan, Mary M., Marina, Apaydin, 2010. A multi-dimensional framework of organizational innovation: a systematic review of the literature. *J. Manag. Stud.* 47 (6), 1154–1191. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-6486.2009.00880.x?casa_token=vfhLoLF29QoAAAAA:vTU_bjxLDjiAEvULPaElsRYfm8v_PTNWscjd9UgT9BzfW5Jo2_2YbZ3tDj2vzQUO7QEpfVgVSAfVT. (Accessed 4 November 2021).
- Czakon, Wojciech, 2020. *Krótkowzroczność Strategiczna Menedżerów*. Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego. <https://ruj.uj.edu.pl/xmlui/handle/11661/261786>. (Accessed 6 June 2022).
- Czakon, Wojciech, Klimas, Patrycja, Mariani, Marcello, 2020. Behavioral antecedents of competition: a synthesis and measurement scale. *Long. Range Plan.* 53 (1), 101875.
- Danneels, Erwin, 2002. The dynamics of product innovation and firm competences. *Strat. Manag. J.* 23 (12), 1095–1121.
- Deshpande, Rohit, Zaltman, Gerald, 1982. Factors affecting the use of market research information: a path analysis. *J. Market. Res.* 19 (1), 14.
- Du, Shuili, Yalcinkaya, Goksel, Ludwig, Bstieler, 2016. Sustainability, social media driven open innovation, and new product development performance. *J. Prod. Innovat. Manag.* 33, 55–71.
- Dyduch, Wojciech, Bratnicki, Mariusz, 2018. Strategizing corporate entrepreneurship for value creation and value capture. *Int. J. Contemp. Manag.* 17 (1), 7–26.
- Dyer, Jeffrey H., Singh, Harbir, 1998. The relational view: cooperative strategy and sources of interorganizational competitive advantage. *Acad. Manag. Rev.* 23 (4), 660–679.
- Dziurski, Patryk, Mierzejewska, Wioletta, Sopińska, Agnieszka, Wachowiak, Piotr, 2021. Managing innovation in the context of the bright and dark sides of innovation – conclusions from the study. In: *Critical Perspectives on Innovation Management*. Routledge, New York, 137–53. <https://www.taylorfrancis.com/books/9781003203841/chapters/10.4324/9781003203841-10>. (Accessed 20 November 2021).
- Edvardsson, Bo, et al., 2018. Examining how context change foster service innovation. *J. Serv. Manag.* 29 (5), 932–955.
- Fang, Eric, 2008. Customer participation and the trade-off between new product innovativeness and speed to market. *J. Market.* 72 (4), 90–104.
- Fang, Zhongxiang, Zhao, Yanyun, Warner, Robyn D., Johnson, Stuart K., 2017. Active and intelligent packaging in meat industry. *Trends Food Sci. Technol.* 61, 60–71.
- Feng, Taiwen, Wang, Dan, Lawton, Alan, Luo, Ben Nanfeng, 2019. Customer orientation and firm performance: the joint moderating effects of ethical leadership and competitive intensity. *J. Bus. Res.* 100, 111–121.
- Ford, Simon, Despeisse, Mélanie, 2016. Additive manufacturing and sustainability: an exploratory study of the advantages and challenges. *J. Clean. Prod.* 137, 1573–1587.
- Forsman, Helena, 2011. Innovation capacity and innovation development in small enterprises. A comparison between the manufacturing and service sectors. *Res. Pol.* 40 (5), 739–750.
- Gaur, Sanjaya S., Vasudevan, Hari, Gaur, Ajai S., 2011. Market orientation and manufacturing performance of Indian SMEs: moderating role of firm resources and environmental factors. *Eur. J. Market.* 45 (7), 1172–1193.
- Ghaani, Masoud, Cozzolino, Carlo A., Castelli, Giulia, Farris, Stefano, 2016. An overview of the intelligent packaging technologies in the food sector. *Trends Food Sci. Technol.* 51, 1–11.
- Grębosz-Krawczyk, Magdalena, Zakrzewska-Bielawska, Agnieszka, Glinka, Beata, Glińska-Noweś, Aldona, 2021. Why do consumers choose photovoltaic panels? Identification of the factors influencing consumers' choice behavior regarding photovoltaic panel installations. *Energies* 14 (9), 2674. <https://www.mdpi.com/1996-1073/14/9/2674>. (Accessed 9 November 2021).
- Gronum, Sarel, Verreyne, Martie-Louise, Tim Kastelle, 2012. The role of networks in small and medium-sized enterprise innovation and firm performance. *J. Small Bus. Manag.* 50 (2), 257–282.
- Gruner, Kjell E., Homburg, Christian, Gruner, Kjell E., Homburg, Christian, 2000. Does customer interaction enhance new product success? *J. Bus. Res.* 49 (1), 1–14.
- Guan, Jian Cheng, Yam, Richard C.M., Mok, Chiu Kam, Ning, Ma, 2006. A study of the relationship between competitiveness and technological innovation capability based on DEA models. *Eur. J. Oper. Res.* 170 (3), 971–986.
- Hernández-Perlines, Felipe, Ibarra Cisneros, Manuel Alejandro, 2018. The role of environment in sustainable entrepreneurial orientation. The case of family firms. *Sustainability* 10 (6).
- Hills, Barlow, Stacey, Sarin, Shikhar, 2003. From market driven to market driving: an alternate paradigm for marketing in high technology industries. *J. Market. Theor. Pract.* 11 (3), 13–24.
- Hogan, Suellen J., Soutar, Geoffrey N., McColl-Kennedy, Janet R., Sweeney, Jillian C., 2011. Reconceptualizing professional service firm innovation capability: scale development. *Ind. Market. Manag.* 40 (8), 1264–1273.
- Htun, Nyi Nyi, Wiśniewska, Agnieszka, Giuseppe, Nocella, Santa Cruz, Elena, Peracaula-Moner, Aniol, Vehmas, Kaisa, Hakola, Liisa, Liczmańska-Kopcewicz, Katarzyna, Bridgett, Lee, Verbert, Katrien, 2023. Smart Tag Packaging Technologies: A Qualitative Investigation of Consumers' Needs and Expectations. *Packag. Technol. Sci.* 36 (7), 595–613.
- Hughes, Mathew, Morgan, Robert E., 2006. Deconstructing the relationship between entrepreneurial orientation and business performance at the embryonic stage of firm growth ☆. *Ind. Market. Manag.* 36, 651–661, 2007.
- Iranmanesh, Mohammad, et al., 2021. The impacts of organizational structure on operational performance through innovation capability: innovative culture as moderator. *Rev. Manag.* 15, 1885–1911.
- Kalamas, Maria, Cleveland, Mark, Laroche, Michel, 2014. Pro-environmental behaviors for three but not for me: green giants, green gods, and external environmental locus of control. *J. Bus. Res.* 67 (2), 12–22.
- Ketata, Ihsen, Sofka, Wolfgang, Grimpe, Christoph, 2015. The role of internal capabilities and firms' environment for sustainable innovation: evidence for Germany. *R D Manag.* 45 (1), 60–75.
- Kim, Jaesu, Kim, Kyung Hoon, Garrett, Tony C., Jung, Heonsoo, 2015. The contributions of firm innovativeness to customer value in purchasing behavior. *J. Prod. Innovat. Manag.* 32 (2), 201–213. <https://onlinelibrary.wiley.com/doi/10.1111/jpim.12173>. (Accessed 12 September 2021).
- Kirca, Ahmet H., Jayachandran, Satish, Bearden, William O., 2005. Market orientation: a meta-analytic review and assessment of its antecedents and impact on performance. *J. Market.* 69 (2), 24–41.
- Klimas, Patrycja, 2019. *Relacje Współtworzenia Innowacji W Ekosystemach: Kontekst Ekosystemu Gamingowego*. Wydawnictwo C. H. Beck, Warszawa.
- Klineciewicz, Krzysztof, 2011. *Dyfuzyja Innowacji: Jak Odnieść Sukces W Komercjalizacji Nowych Produktów I Usług*. Wydawnictwo Naukowe Wydziału Zarządzania Uniwersytetu Warszawskiego, Warsaw.
- Kohli, Ajay K., Jaworski, Bernard J., 1990. Market orientation: the construct, research propositions, and managerial implications. *J. Market.* 54 (2), 1–18.
- Kraus, Sascha, Roig-Tierno, Norat, Bouncken, Ricarda B., 2019. Digital innovation and venturing: an introduction into the digitalization of entrepreneurship. *Rev. Manag. Sci.* 13 (3), 519–528.
- Kumar, V., Venkatesan, Rajkumar, Werner, Reinartz, 2008. Performance implications of adopting a customer-focused sales campaign. *J. Market.* 72 (5), 50–68.
- Kusiak, Andrew, 2017. Smart manufacturing must embrace big data. *Nature* 544 (7648), 23–25.
- Lee, Ryeowon, Lee, Jong Ho, Tony, C., Garrett, 2019. Synergy effects of innovation on firm performance. *J. Bus. Res.* 99, 507–515.
- Levitt, Theodore, 1980. Marketing success through differentiation of anything. *Harv. Bus. Rev.* 58, 83–91.
- Liang, Xiaobei, Hu, Xiaojuan, Hu, Meng, 2020. Truly sustainability or hypocrite: the effects of corporate sustainable orientation on consumers' quality perception and trust based on evidence from China. *Sustainability* 12 (7), 2735.
- Liczmańska-Kopcewicz, Katarzyna, Pyplacz, Paula, Wiśniewska, Agnieszka, 2020. Resonance of investments in renewable energy sources in industrial enterprises in the food industry. *Energies* 13 (17), 4285. <https://www.mdpi.com/1996-1073/13/17/4285>. (Accessed 19 August 2020).
- Lii, Peirchi, Kuo, Fang I., 2016. Innovation-oriented supply chain integration for combined competitiveness and firm performance. *Int. J. Prod. Econ.* 174, 142–155.
- Lilien, Gary L., et al., 2010. Calculating, creating, and claiming value in business markets: status and research agenda. *Market. Lett.* 21 (3), 287–299.
- Lipit, M., 2006. Patterns in innovation: goals and organization life cycle. *Hum. Resour. Plann. Soci. J.* 163–171. June.
- Liu, Zeting, Laperche, Blandine, 2015. The knowledge capital of SMEs: the French paradox. *J. Innov. Econ.* n°17 (2), 27–48.
- Manual, O.S.L.O., 2018. Guidelines for Collecting, Reporting and Using Data on Innovation. OECD.
- Marczewska, Magdalena, 2014. The role of competitors and customers in the development of environmentally sound technologies. *J. Entrepren. Manag. Innov.* 10 (2), 39–61. <http://jemi.edu.pl/vol-10-issue-2-2014/the-role-of-competitors-and-customer-in-the-development-of-environmentally-sound-technologies>. (Accessed 14 December 2021).
- Massaglia, Stefano, et al., 2019. Consumer preference heterogeneity evaluation in fruit and vegetable purchasing decisions using the best–worst approach. *Foods* 8 (7).

- McNeill, Lisa, Venter, Brittany, 2019. Identity, self-concept and young women's engagement with collaborative, sustainable fashion consumption models. *Int. J. Consum. Stud.* 43 (4), 368–378.
- Medrano, Natalia, Olarte-Pascual, Cristina, 2016. The effects of the crisis on marketing innovation: an application for Spain. *J. Bus. Ind. Market.* 31 (3), 404–417.
- Mehrpourya, Afshin, Chowdhury, Imran, 2018. Re-Thinking the CSP-CFP Linkage : Analyzing the Mechanisms Involved in Translating Socially-Responsible Behavior to Financial Performance. Jouy-en-Josas : HEC Paris.
- Mohebi, Ehsan, Marquez, Leorey, 2015. Intelligent packaging in meat industry: an overview of existing solutions. *J. Food Sci. Technol.* 52 (7), 3947–3964.
- Morgan, Neil A., Vorhies, Douglas W., Mason, Charlotte H., 2009. Market orientation, marketing capabilities, and firm performance. *Strat. Manag. J.* 30 (8), 909–920.
- Müller, Patricia, Schmid, Markus, 2019. Intelligent packaging in the food sector: a brief overview. *Foods* 8 (1).
- Narver, John C., Slater, Stanley F., 1990. The effect of a market orientation on business profitability. *J. Market.* 54 (4), 20–35.
- Narver, John C., Slater, Stanley F., MacLachlan, Douglas L., 2004. Responsive and proactive market orientation and new-product success. *J. Prod. Innovat. Manag.* 334–347.
- Neulinger, A., et al., 2020. 'Engagement and subjective well-being in alternative food networks: the case of Hungary. *Int. J. Consum. Stud.* 44 (4), 306–315. *International Journal of Consumer Studies*, 44(4).
- Nidumolu, R., Prahalad, C.K., Rangaswami, M.R., 2009. Why sustainability is now the key driver of innovation. *Harv. Busin. Rev.* September, 57–64.
- Nocella, Giuseppe, Wu, Junjie, Cerroni, Simone, 2022. The use of smart biosensors during a food safety incident: consumers' cognitive-behavioural responses and willingness to pay. *Int. J. Consum. Stud.* <https://onlinelibrary.wiley.com/doi/10.1111/ijcs.12833>. (Accessed 6 June 2022).
- OECD, 2010. Business Clusters: Promoting Enterprise in Central and Eastern Europe - OECD.
- Olofsson, Linnea, Mark-Herbert, Cecilia, 2020. Creating shared values by integrating UN sustainable development goals in corporate communication—the case of apparel retail. *Sustainability* 12 (21), 8806.
- Olson, Eric M., Slater, Stanley F., Hult, G. Tomas M., 2005. The performance implications of fit among business strategy, marketing organization structure, and strategic behavior. *J. Market.* 69 (3), 49–65.
- Pansari, A., Kumar, V., 2017. Customer engagement: the construct, antecedents, and consequences. *J. Acad. Market. Sci.* 45 (3), 294–311. <https://link.springer.com/content/pdf/10.1007/s11747-016-0485-6.pdf>. (Accessed 20 August 2021).
- Petrakis, Panagiotis E., Kostis, Pantelis C., Valsamis, Dionysis G., 2015. Innovation and competitiveness: culture as a long-term strategic instrument during the European great recession. *J. Bus. Res.* 68 (7), 1436–1438.
- Rindfleisch, Aric, Moorman, Christine, 2001. The acquisition and utilization of information in new product alliances: a strength-of-ties perspective. *J. Market.* 65 (2), 1–18.
- Rosenbusch, Nina, Jan, Brinckmann, Bausch, Andreas, 2011. Is innovation always beneficial? A meta-analysis of the relationship between innovation and performance in SMEs. *J. Bus. Ventur.* 26 (4), 441–457.
- Roy, Raja, Cohen, Susan K., 2017. Stock of downstream complementary assets as a catalyst for product innovation during technological change in the U.S. Machine tool industry. *Strat. Manag. J.* 38 (6), 1253–1267.
- Saunila, Minna, Nasiri, Mina, Ukko, Juhani, Rantala, Tero, 2019. Smart technologies and corporate sustainability: the mediation effect of corporate sustainability strategy. *Comput. Ind. Ind.* 108, 178–185.
- Schneider, Sabrina, 2019. How to approach business model innovation: the role of opportunities in times of (No) exogenous change. *R D Manag.* 49 (4), 399–420.
- Schumpeter, Joseph A., 1960. *Teoria Rozwoju Gospodarczego*. Wydawnictwo Naukowe PWN, Warszawa.
- Siguaw, Judy A., Simpson, Penny M., Enz, Cathy A., 2006. Conceptualizing innovation orientation: a framework for study and integration of innovation research. *J. Prod. Innovat. Manag.* 23 (6), 556–574.
- Sim, Edward W., Griffin, Abbie, Price, Raymond L., Vojak, Bruce A., 2007. Exploring differences between inventors, champions, implementers and innovators in creating and developing new products in large, mature firms. *Creativ. Innovat. Manag.* 16 (4), 422–436.
- Škerlavaj, Miha, Song, Ji Hoon, Lee, Youngmin, 2010. Organizational learning culture, innovative culture and innovations in south Korean firms. *Expert Syst. Appl.* 37 (9), 6390–6403.
- Stanko, Michael A., Bonner, Joseph M., 2013. Projective customer competence: projecting future customer needs that drive innovation performance. *Ind. Market. Manag.* 42 (8), 1255–1265.
- Sukawati, Tjokoda Gde Raka, Putu Astawa, I., 2017. Improving performance by harmonious culture approach in internal marketing. *Polish J. Manag. Stud.* 16 (1), 226–233.
- Sundmaeker, Harald, Verdouw, Cor, Wolfert, J., Freire, Luis Perez, 2016. Internet of food and farm 2020. In: Vermesan, O., Gistrup, P. Friess (Eds.), *Digitising the Industry-Internet of Things Connecting Physical, Digital and Virtual World*. River Publisher, Denmark, pp. 129–151.
- Talke, Katrin, Salomo, Søren, Alexander, Kock, 2011. Top management team diversity and strategic innovation orientation: the relationship and consequences for innovativeness and performance. *J. Prod. Innovat. Manag.* 28 (6), 819–832.
- Tether, Bruce, S., 2002. Who Co-operates for innovation, and why: an empirical analysis. *Res. Pol.* 31 (6), 947–967.
- Thomke, Stefan H., von Hippel, Eric, 2002. Klienci Jako Innowatorzy: Nowy Sposób Tworzenia Wartości. *Harv. Bus. Rev.* 80 (4), 74–81.
- Valencia, Julia C.Naranjo, Valle, Raquel Sanz, Jiménez, Daniel Jiménez, 2010. Organizational culture as determinant of product innovation. *Eur. J. Innovat. Manag.* 13 (4), 466–480.
- van Doorn, Jenny, et al., 2010. Customer engagement behavior: theoretical foundations and research directions. *J. Serv. Res.* 13 (3), 253–266.
- Violino, Simona, et al., 2019. Are the innovative electronic labels for extra virgin olive oil sustainable, traceable, and accepted by consumers? *Foods* 8 (11), 529.
- Vlachos, Pavlos A., Tsamakos, Argiris, Vrechopoulos, Adam P., Avramidis, Panagiotis K., 2009. Corporate social responsibility: attributions, loyalty, and the mediating role of trust. *J. Acad. Market. Sci.* 37 (2), 170–180.
- von Hippel, Eric, 1988. *The Sources of Innovation*. Oxford University Press, Oxford.
- von Hippel, Eric, 2005. *Democratizing Innovation*. The MIT Press, Massachusetts Institute of Technology, Cambridge, Massachusetts.
- Wagner, Marcus, Wagner, Marcus, 2007. On the relationship between environmental management, environmental innovation and patenting: evidence from German manufacturing firms. *Res. Pol.* 36 (10), 1587–1602.
- WCED, World Commission on Environment and Development, 1987. *Our Common Future*. Oxford University Press, Oxford.
- Weerawardena, Jay, O'Cass, Aron, 2004. Exploring the characteristics of the market-driven firms and antecedents to sustained competitive advantage. *Ind. Market. Manag.* 33 (5), 419–428.
- Wiśniewska, Agnieszka, Liczmańska-Kopcewicz, Katarzyna, Pyplacz, Paula, 2022. Antecedents of young adults' willingness to support brands investing in renewable energy sources. *Renew. Energy* 190, 177–187.
- Yam, Richard C.M., et al., 2011. Analysis of sources of innovation, technological innovation capabilities, and performance: an empirical study of Hong Kong manufacturing industries. *Res. Pol.* 40 (3), 391–402.
- Yang, Yan, Wang, Qing, Zhu, Hengyuan, Wu, Guisheng, 2012. What are the effective strategic orientations for new product success under different environments? An empirical study of Chinese businesses. *J. Prod. Innovat. Manag.* 29 (2), 166–179.
- Yeung, Andy C.L., Lai, Kee Hung, Yee, Rachel W.Y., 2007. Organizational learning, innovativeness, and organizational performance: a qualitative investigation. *Int. J. Prod. Res.* 45 (11), 2459–2477.
- Yoo, Youngjin, 2010. Computing in everyday life: a call for research on experiential computing. *MIS Q.: Manag. Inf. Syst.* 34 (SPEC. ISSUE 2), 213–231.
- Zakrzewska-Bielawska, Agnieszka, 2018. *Strategie Rozwoju Przedsiębiorstw. Nowe Spojrzenie*.
- Zastempowski, Maciej, Cyfert, Szymon, 2021. Social responsibility of SMEs from the perspective of their innovativeness: evidence from Poland. *J. Clean. Prod.* 317, 128400. <https://linkinghub.elsevier.com/retrieve/pii/S0959652621026135>. (Accessed 26 July 2021).
- Zemigala, Marcin, 2019. Tendencies in research on sustainable development in management sciences. *J. Clean. Prod.* 218, 796–809.
- Zeschky, Marco B., WinterhalterProf, Stephan, Oliver, Gassmann, 2014. From cost to frugal and reverse innovation: mapping the field and implications for global competitiveness. *Res. Technol. Manag.* 57 (4), 20–27.
- Zhang, Caiping, Bai, Junfei, Wahl, Thomas I., 2012. Consumers' willingness to pay for traceable pork, milk, and cooking oil in Nanjing, China. *Food Control* 27 (1), 21–28.
- Zastempowski, Maciej, Cyfert, Szymon, 2022. The role of strategic innovation activities in creating agriculture companies' innovativeness – the case of Spain. *Agric. Econ.* <https://www.agriculturejournals.cz/web/agricecon.htm?type=article&id=66-2022-AGRICECON>. (Accessed 2 June 2022), 68(6), 230–238.
- Zhao, Guoging, Liu, Shaofeng, Lopez, Carmen, Lu, Haiyan, Elguete, Sebastiana, Chen, Huilan, Boshkoska, Biljana, 2019. Blockchain Technology in Agri-Food Value Chain Management: A Synthesis of Applications, Challenges and Future Research Directions. *Comput. Ind.* 109, 83–99.