

Innovative Models of Supply Chain Management

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Abstract

Purpose: The paper scientifically analyzes sustainable development in the context of economic entities and their integration in supply chains that reflect the various business models between parties involved in value creation.

Methodology: The authors seek the relationship between three aspects of sustainability and limitation of the functional weaknesses of the market through the integration of supply chains that reflect various business models. The paper bases on a survey conducted to identify interests of the companies in integrating innovations for greater sustainability.

Findings: The integration of supply chain is one of the reasons for using or limiting the functional weaknesses of the market related to the three sustainability aspects pictured by the concept of sustainability as environmental, social, and economic resources. Different forms of integration may contribute to the maintenance and enhancement of these resources.

Limitations: To clarify the influence of the supply chain integration on sustainable development, scholars need to conduct further research. The main point of the future research should be the development of a measure for the extent of influence of the supply chain integration on sustainable development.

Originality: The connecting of the integration of supply chain and sustainability is a new direction of scientific research that has previous studies. Thus, the research outcomes will impact the scientific field and community in both the area of supply chain management and sustainability studies.

Keywords: innovation, business model, sustainable supply chain, integration

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Introduction

The concept of sustainability refers to the maintenance and enhancement of *environmental*, *social*, and *economic* resources to meet the needs of current and future generations. Sustainable development covers a broad spectrum of consumption – and waste-related themes. Namely, food and agriculture use and production; natural resource consumption; population growth; quality of life; flora and fauna diversity; waste generation; air, land, and water pollution; recycling and reuse. Sustainable development meets the needs of the present population without compromising the ability of future generations to meet their own needs.

From another point of view, to sustain long-term growth and profitability in a competitive environment, economic entities must continuously improve their efficiency (Sudit, 1995). The search for potential improvement of efficiency quickened with the realization that not only individual enterprises compete against each other but also entire supply chains (Christopher, 1992). Hence, the authors believe that the search for potential improvement of efficiency is not a task only for single enterprises but also for entire supply chains, because one must always consider the interactions that occur between the different stages of the supply chain and the complex structure of activities within and between companies. Therefore, we should perceive the supply chain as one entity and any measurement system should span the entire supply chain. Considering the interactions that occur between the different stages of the supply chain, these management and structure are critical for the integration of the entire supply chain. The forms of integration of the supply chain combine elements of market and hierarchical organization. These forms may also contribute to the maintenance and enhancement of *environmental*, *social*, and *economic* resources; as assumes the concept of sustainability, in order to meet the needs of current and future generations.

According to Jabłoński (2013), it is very likely that the future starting point for the efforts to achieve a sustainable market advantage will be the right business model, its location on the market and hierarchical organization continuum. The increasing importance of business models results from the combination of information and communication technologies, markets deregulation, technological changes, globalization, the role of sustainable development, and the growth of corporate social responsibility. Following Obłój's rationale (Antonowicz, 2014; Obłój, 2002), a business model is a combination of a strategic concept and the technology of its implementation, which is a value chain that allows for the effective exploitation and renewal of resources and skills. For success, TSL³

³ Transport, Spedition, Logistics.

companies need a more consistent integrated approach to the major challenges of higher value creation than their competitors. This includes a design of an appropriate business model, adequate risk management under conditions of uncertainty in the markets, proper use of information, and results measurement or reporting.

The increasing importance of sustainable development stems from three areas of responsible business; namely, the economic, environmental, and social area. The purpose of such approach is the creation, protection, and long-term development of the economic, social, and environmental values for all stakeholders involved in the supply chain. The relations between the stakeholders formed within the chain include the following criteria (Rutkowski, 2008):

- Economic, like a fair contract, transparency in establishing the business network, prevention of corruption;
- Social, like fair employment practices, cooperation with local communities, respecting, principles of equality among employees;
- Environmental, like the impact on the environment throughout the product lifecycle, including transportation and operation of logistics contractors.

Moreover, in the face of increasing importance of the social element in business innovation, the social sphere of supply chain management requires increasingly more attention, mainly in the field of corporate social responsibility within the supply chain.

In this paper, the authors seek the relationship between these three sustainability aspects and the limitation of functional weaknesses of the market through the integration of supply chains that reflect various business models with the special focus on food supply chains.

Example of Supply Chains: Food Economy

The process of food production that happens in each national economy is known in the framework of its subsystem as food economy; it is the point of reference for agribusiness chains (Grabowski, 1998). According to A. Zalewski, food economy is among the most important and complex segments of the national economy. Furthermore, food economy covers the whole process of material production associated directly and indirectly with food production and distribution. Moreover, food economy consists of manufacturing the means of production for agriculture and food industry (Zalewski, 1989). According to A. Woś, the concept of the food economy precedes the theory of agribusiness

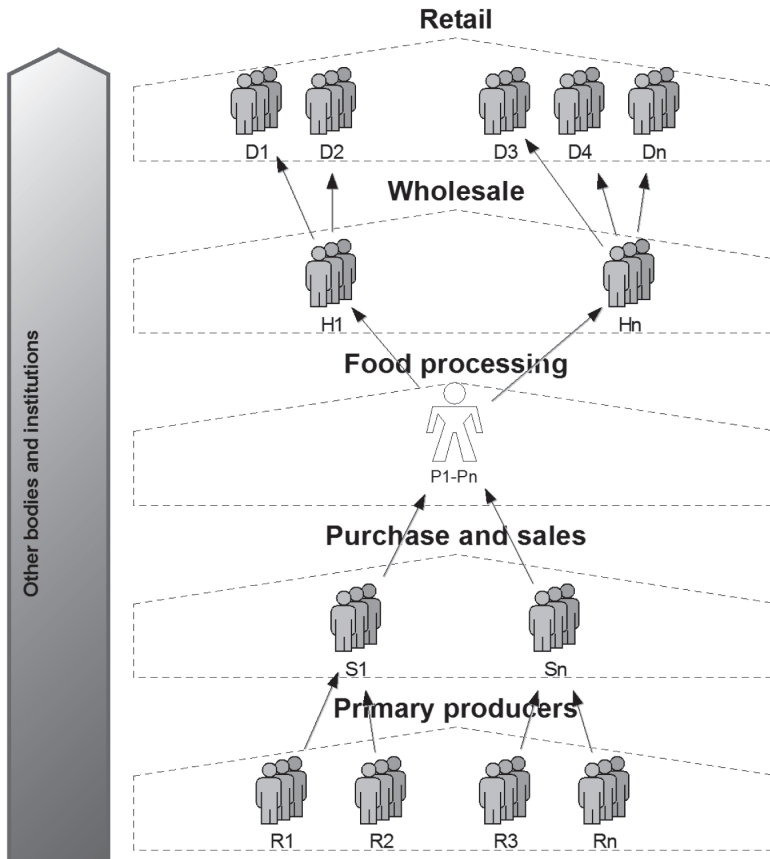
because it was used for the determination of related links in the national economy, directly and indirectly involved in food production and distribution (Woś, 1998).

Food production and distribution are one of the key conditions for the functioning of agribusiness. Agribusiness links that form the food chain determine the ways and principles of food movement from the farmer to consumer. F. Tomczak states that the food chain provides food supply from the farm gates to the consumer, transforming agricultural raw materials into products that may be easily purchased, prepared, and consumed. The chain includes the purchase, processing, and distribution companies, as well as food service companies and retail traders. As a result of the overall transformation and economic needs, the chain constantly changes and develops (Tomczak, 2004).

There are different types of entities that one may distinguish in the structure of the food chain (Lazzarini et al., 2001), namely agriculture, food industry, wholesale trade, and retail trade. In the literature, one finds various similar systematics. On the basis of literature review, the authors made the structure that characterizes food supply chains include agriculture, purchase and trade of agricultural products, food industry, wholesale and retail trade, but also other entities like government institutions, local government institutions, and service providers, including providers of means for agricultural production. They are all a network of organizations involved in a variety of processes and activities that create value in the form of products and services delivered to the final consumer, due to their relationships with suppliers and customers (Rutkowski, 2004). That is, the supply chain of food products is a "cooperation in different functional areas of agricultural producers, intermediary companies (trade), processing companies, manufacturing, services and their customers, between which flow streams of agri-food products, information, and funds" (Jarzębowski and Klepacki, 2013) (Figure 1).

We may analyze the supply chain by its individual stages that create added value. Within the framework of the food supply chain, one may notice that the share of agricultural products in consumers' budget shows a continuous downward trend in the long term. In this context, a good example is the Dutch market, which generates increasingly more value added at the stage of processing, trade, and services, while less at agricultural production. This trend intensified in the early 1990s. Reducing the share of farmers in the overall income of the supply chain needs not to directly relate to their performance, which is determined rather by return on investment and labor productivity (Ondersteijn et al., 2006).

Figure 1. Structure of food supply chains



Source: own work.

The observed phenomenon may result from significant changes in food consumption. Scholars notice a shift from consumption of fresh products in the direction of processed products and from consumption at homes to consumption outside. The production of processed foods requires greater involvement of value added than in the case of fresh products. This change in the way of production and consumption is reflected in food products, in the creation of which processing and trade have the largest share. The main problem of modern agriculture is that societies become wealthier, while their farmers become poorer. As stated by A. Czyżewski et al., added value in the market mechanism distributes in such way that most gains go to those who are the closest to the consumer. That is, market redistributes added value while depreciating agriculture (Czyżewski et al., 2006). Thus, the government should step in the intermodal flows to transfer downwards the value added created but not realized by farmers

(Kowalski and Rembisz, 2005). Moreover, a mechanism that counteracts the depreciation might be the capital integration of farmers and processing companies; it already happens in milk processing.

The other feature of the food supply chain is that products undergo specific safety requirements, designed to protect the final customer (the consumer). Throughout the food supply chain, producers should provide an adequate level of quality, hygiene, and wholesomeness for all intermediate and final products. The wholesomeness of products should appear at the beginning of the chain, so on farms, including their suppliers of inputs and services (Bezat and Jarzębowski, 2011); through trade and processing (primary and secondary) to the distribution system, including consumer products; as well as final consumers. Thus, a wide variety of standards and rules affects the activities of enterprises in the food chain. Regulations concerning the quality of agricultural products are the important aspect associated with the specificity of food processing. The growing requirements of consumers cause increasing interest in the high quality of these products. At the same time, the quality shows a direct relationship with the price of products and directly relates to the standards (Makarski, 1998).

Furthermore, one of the main elements of food safety is the assurance of identifying the origin of the product, as described in the EU Regulations No. 178/2002 and 1935/2004. The EU implemented the regulation 178/2002 to lay down the general principles and requirements of food law, establishing the European Food Safety Authority and providing procedures in the matters of food safety (Regulation 178/2002). The requirement obliges companies in the food chain to guarantee the traceability of its products and recall unsafe batches in products recall actions. The Regulation makes food processing companies implement a system that allows for the identification of the product from primary production to final consumers (tracking) and in the opposite direction (tracing). These companies should also, if necessary, share information about their suppliers and recipients of the relevant services (Regulation, 2002). In this way, the requirement enabled the tracking and tracing of food from the producers to industry and from logistic services to final costumers (Bezat and Jarzębowski, 2008). With the concept of traceability, it is now possible to indicate the origin of problems in the chain.

The central condition of the Regulation is the chain-wide coordination of data exchange, tracking, and tracing of the data which should inform about the food's quantity, type of raw materials, origin (country of import), supplier, transport, and warehousing. The basis for the development of traceability systems is the linking of defined product units with relevant accompanying parameters and access to suitable information (Bezat and Jarzębowski, 2008). This is particularly important in supply chains in which

cargo handling, transportation, and processing of large amounts of raw materials mix with each other frequently. The definition of units and sizes (Traceable Resource Unit) allows for the tracking of goods, clear differentiation of specific parts, and formation of new batches that arise in combination with other elements.

The implementation of solutions that support food security and cover the entire supply chain is voluntary and depends on the market situation and structure of companies' customers. However, the recipient may, depending on their market power, influence the quality policy of its suppliers which are then forced to provide information about the use of manufacturing technologies and their impact on the hygiene and quality of delivered products. Thus, the assurance of products' wholesomeness depends on the proper communication with customers and consumers; although the creation of quality tracking systems is a challenge for the entire supply chain.

Integration and Sustainable Development in Supply Chains

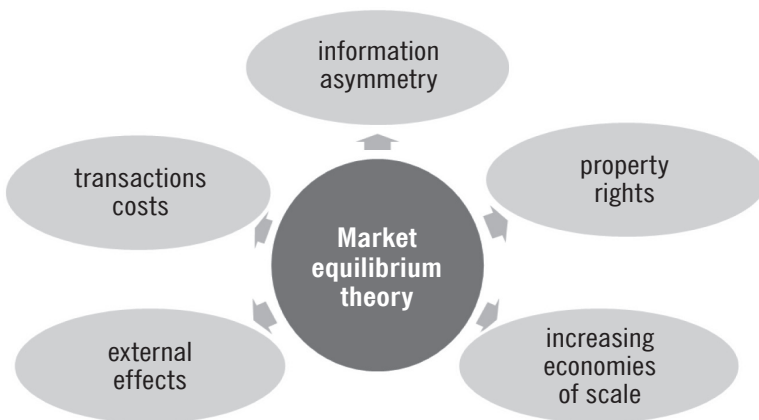
The concept of sustainability relates to the maintenance and enhancement of *environmental*, *social*, and *economic* resources, to meet the needs of current and future generations. The achievement of economic, social, and environmental success in a company is crucial to finding the way to a sustainable and profitable future in today's daunting era of environmental and social challenges. Current analyzes indicate that human activity exceeded the carrying capacity of earth's resources. Remediation efforts through technological advancement and conservation may extend the overall ability of earth's resources to sustain humanity. However, a "business as usual" approach to the problem will ensure that future generations are much worse off than us, their predecessors. Nevertheless, to keep the principles of sustainable development cannot contradict the efficiency of economic entities. There are several different concepts of efficiency, its measurement, and expressions. However, these concepts are not identical, and the actual concept of efficiency derives from the structure of the production function. Therefore, it is conditioned by the changes in the productivity of production factors and their remuneration and refers to the allocation of production factors in the most technically efficient way.

Many also foreground integration with the environment of the system; that is, with external organizations, when a company is understood as the system. Here, cooperation is the main element of organizational integration with the environment (Steffen and Born, 1987, p. 210). Scholars describe integration both in terms of traditional logistic functions (Gustin et al., 1995) and the removal of barriers between organizations

(Naylor et al., 1999). The need for integration between an enterprise and its environment increases with the degree of intensification of global competition. In this context, the concept of integration, considered as the key factor in achieving better results by an enterprise, is one of the most important themes in the scientific literature.

The interaction between market participants relates to the market equilibrium theory (Kreps, 1990). What coordinates this interaction is the price mechanism. Depending on the relative prices market, participants like households and enterprises take individual decisions on supply and demand, to maximize benefits and number of available goods. The theory omits the analysis of institutional circumstances. However, considering the existence of institutions and organizations, when the central assumptions of the equilibrium theory are not met, then one must deal with functional weaknesses of the market; that is, market outcomes are not Pareto-efficient. The elements that undermine the market equilibrium theory’s assumptions are the *information asymmetry*, the resulting *transaction costs* which include *property rights* and *external effects*, as well as the *increasing economies of scale*. These elements may incentivize market participants to seek a solution together in the form of institutions or organizations that would compensate the functional weaknesses of the market; or, eventually, use them. In this sense, we may interpret institutions and organizations as a kind of compensation mechanism.

Figure 2. Elements that undermine the market equilibrium theory’s assumptions



Source: own work.

One may call the economies of scale, transaction costs, information asymmetry, and uncertainty of transaction – market weaknesses that indicate the need for integration. To reduce the impact of market weaknesses or profit from them, people use various

forms of cooperation between market participants. As presented by Nash and game theory, such unselfish cooperative forms must happen for the optimal state of the economy to appear (Noga, 2009, p. 67). These activities are connections with external partners, integration forms or organizations, outsourcing, hierarchical strengthening within long-term contracts, symbiotic partnerships, cooperation with external partners. These forms bring a wide range of intermediate solutions between the market and vertical integration. At the same time, the forms combine elements of the market and hierarchical organization. These forms of integration might also contribute to the maintenance and enhancement of *environmental*, *social*, and *economic* resources – to meet the needs of current and future generations.

One of the elements of creating various forms of integration is the market failure reflected in *transaction costs*, *uncertainty*, *increasing revenues in terms of scale*, *opportunism and lack of confidence*, *external effects*, *specificity of capital*, *social inequality and information (knowledge) flow*. In this context, organizational solutions as integration present opportunities to use or limit market weaknesses.

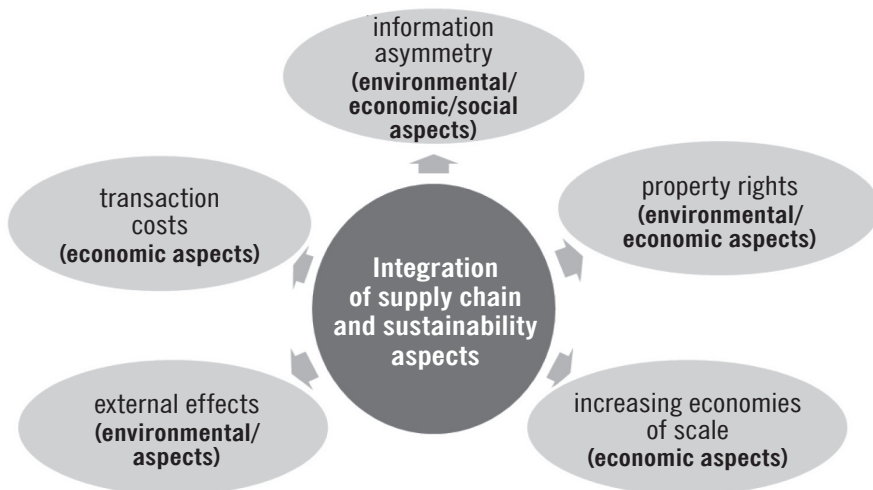
The limitation of functional weaknesses of the market through the integration of supply chain may relate to the three sustainability aspects. The relationships that occur in each group base on the previous work of the authors and indicate the following relations:

- Environmental aspects:
 - The reduction of *information asymmetry* regarding products and processes. In consequence of the reduction of information asymmetry, one may achieve more responsible exploration of natural resources like water, land, and air.
 - The reduction of *external effects* regarding products and processes. As a result, we may achieve a reduction of emissions to the environment; that is sewage to the water, fertilizers to the soil, gas emissions to the air. The impact on the environment can be achieved throughout the product life-cycle, including transportation and operation of logistics contractors.
- Economic aspects
 - The reduction of *transaction costs* between participants of supply chains through better coordination and shortening of value-creating Long Chains.
 - The reduction of *uncertainty*, *opportunism*, and *lack of confidence* between participants of supply chains. This may result from better coordination and communication between market participants and the reduction of resources involved in control and risk assessment.

- The reduction of *information asymmetry* regarding products and processes. In consequence of the reduction, one may achieve a fair contract, transparency in establishing business networks, and prevention of corruption.
- Social aspects
 - The reduction of *social inequality and information (knowledge) flow* between supply chain participants that create value and customers – the society. Thanks to a better exchange of information about products and processes, including resources involved in their creation, one may achieve the reduction of social inequality and information flow.
 - The reduction of *information asymmetry* regarding products and processes. In consequence of this one may introduce fair employment practices, cooperation with local communities, respecting, and principles of equality among employees.

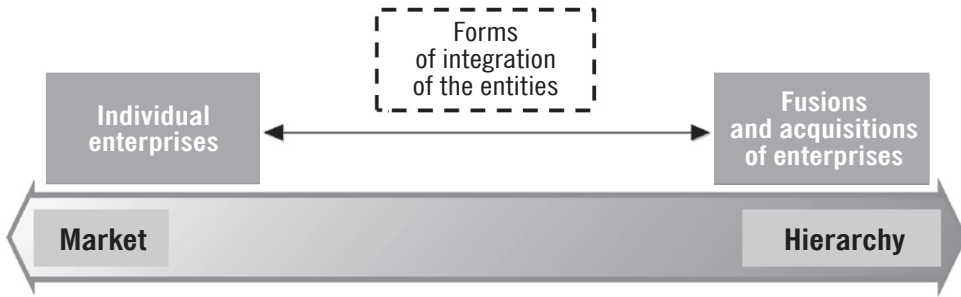
Figure 3 presents the relationship between the three sustainability aspects and the limitation of functional weaknesses of the market through the integration of supply chain.

Figure 3. Maintenance and enhancement of environmental, social, and economic resources through supply chain integration



Source: own work.

Scholars must continue research to clarify the influence of the food supply chain integration on sustainable development. In this context, we present the various forms of cooperation that represent a wide range of organizational solutions between the market and hierarchy in Figure 4.

Figure 4. Forms of entities integration in the market-hierarchy continuum

Source: own work.

We may choose from various legal forms, from individual enterprises, companies, cooperatives, franchises, cooperations of corporate groups, to clusters, joint ventures, consortia, networks of enterprises, fusions, and acquisitions of enterprises. The environmental aspects of the sustainability concept were underlined within the framework of the paper.⁴

Integration of the Innovations Study

The authors conducted this study for project I-CON (CE393), about the knowledge about the food sector in Poland. The goal was to learn more about the interests of the companies in integrating innovations related to sustainable development. 97 companies received questionnaires, and 24 returned them, which make the small sample of this study. Hence, our conclusions are cautious. Nevertheless, subsequent studies will expand the research sample and allow a deeper interpretation of the results.

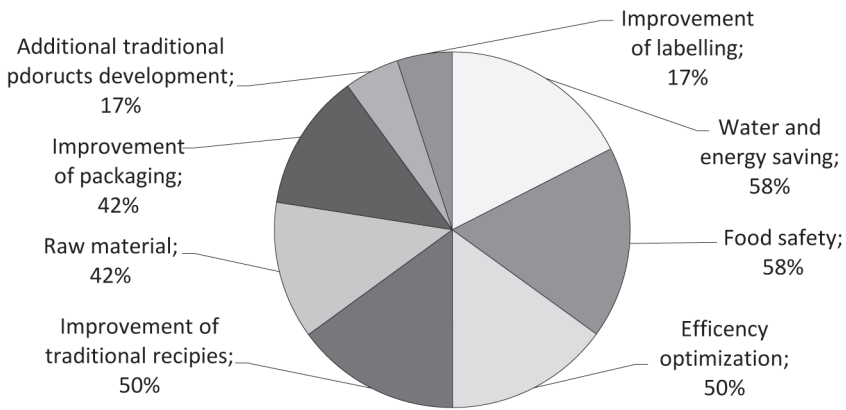
The majority of respondents (75%) does business in the global market, the rest of the respondents are active nationally. Only 8,3% of respondents generate less than EUR 2 million of revenues. On the other hand, 25% of the respondents generates more than EUR 50 million. Half of the respondents employs from 50 to 249 people, followed by only 8,3% of the respondents who employ more than 250 people. All respondents have documented at least one food safety management system. The most popular system is IFS (50%). 58,3% of the respondents has other systems than IFS, like BRC or SQMS system. None of them has SQMS. 46,6 % of the respondents plan a development or extension of existing systems. The size of their production sites varies significantly,

⁴ With regard to ecology, please see the following works: Symonides (2008) and Matachowski (2007).

from 600 m² to 15 000 m², with up to fifteen halls per respondent. Half of the respondents have a specific supplier.

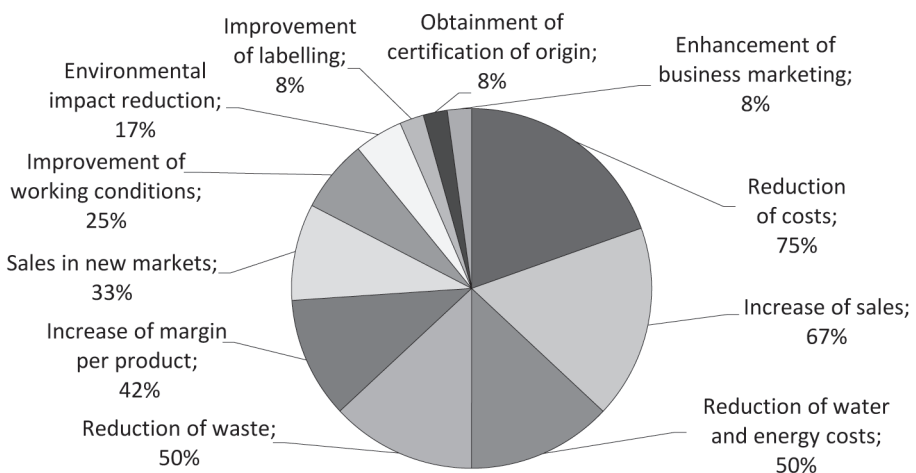
The questionnaire includes questions about the innovation in different types of production. All respondents are interested in integrating sustainability-oriented innovations in their companies. The dispersion of answers appears in Figure 5.

Figure 5. Interest in integrating innovations per field of industry



Source: own work.

Figure 6. Types of effects expected



Source: own work.

In Figure 6, we present what effects do respondents expect from the integration of sustainability innovations. They are most interested in water and energy savings, food safety, and efficiency optimization.

All respondents are interested in the introduction of innovations as they expect various types of benefits. Interestingly, almost all want to reduce the environmental impact of water and energy use. Other important expected types of effects come from the reduction of costs and waste and the increase of sales.

Conclusions

The concept of sustainability refers to the maintenance and enhancement of environmental, social, and economic resources to meet the needs of current and future generations. Thus, the clarification of the influence of food supply chain integration on sustainable development will positively impact the development of the society.

The connecting of the integration of supply chains and sustainability is a new direction of scientific interests, which was not yet researched. Thus, this study also confirms the interests of practitioners in the aspects of sustainability.

All respondents of the study conducted for this paper are interested in innovations introduction and, interestingly, while almost all consider the environmental impact of these innovations. Thus, the authors recommend integrating supply chains without contradicting the principles of sustainable development.

References

- Antonowicz, M. (2014). Wymiary innowacyjności łańcucha dostaw. In: M. Ilnicki and Z. Nowakowski (eds.), *Bezpieczeństwo, gospodarka, geopolityka. Wybrane problemy*. Warszawa: TNP S.A.
- Bezat, A. and Jarzębowski, S. (2008). The effective traceability on the example of Polish supply chain. In: T. Glauben, J. Hanf, M. Kopsidis, A. Pieniadz and K. Reinsberg (eds.), *Agri-food business: global challenges – innovative solutions*. Halle: IAMO.
- Bezat, A. and Jarzębowski, S. (2011). Traceability w łańcuchu dostaw przetwórstwa spożywczego. *Logistyka*, 2: 75–84.
- Christopher, M. (1992). *Logistics and Supply Chain Management – Strategies for Reducing Costs and Improving Services*. London: Pitman Publishing.
- Czyżewski, A., Poczta, A. and Wawrzyniak, Ł. (2006). Interesy europejskiego rolnictwa w świetle globalnych uwarunkowań polityki gospodarczej. *Ekonomista*, 3: 350–351.

- Jablonski, M. (2013). *Kształtowanie modeli biznesu w procesie kreacji wartości przedsiębiorstw*. Warszawa: Difin.
- Jarzębowski, S. (2013). *Integracja łańcucha dostaw jako element kształtowania efektywności sektora przetwórstwa rolno-spożywczego*. Warszawa: Wydawnictwo SGGW.
- Jarzębowski, S. and Klepacki, B. (2013). Łańcuchy dostaw w gospodarce żywnościowej. *Zeszyty Naukowe SGGW w Warszawie, Ekonomiki i Organizacja Gospodarki Żywnościowej*, 102: 107–117.
- Kowalski, A. and Rembisz, W. (2005). Rynek rolny i interwencjonizm a efektywność i sprawiedliwość społeczna. Warszawa: Wyd. IERiGŻ-PIB.
- Małachowski, K. (2007). *Gospodarka a środowisko i ekologia*. Warszawa: CeDeWu Wydawnictwa Fachowe.
- Lazzarini, S., Chaddad, F. and Cook, M. (2001). Integrating supply chain and network analysis: the study of net chains. *Journal on Chain and Network Science*, 1(1): 7–22, <https://doi.org/10.3920/JCNS2001.x002>
- Makarski, S., (1998). *Funkcjonowanie rynku rolno-żywnościowego*. Lublin: Wydawnictwo UMCS.
- Naylor, J.B., Naim, M.M. and Berry, D. (1999). Legality: Integrating the lean and agile manufacturing paradigms in the total supply chain. *International Journal of Production Economics*, 62(1–2): 107–118, [https://doi.org/10.1016/S0925-5273\(98\)00223-0](https://doi.org/10.1016/S0925-5273(98)00223-0)
- Obłój, K. (2002). *Tworzywo skutecznych strategii*. Warszawa: PWE.
- Ondersteijn, Ch., Wijnands, J., Hurine, R. and Kooten, O. (2006). *Quantifying the agri-food supply chain*. Dordrecht: Springer.
- Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety, 2002, available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:031:0001:0024:en:PDF>.
- Rutkowski, K. (2004). Zarządzanie łańcuchem dostaw – próba sprecyzowania terminu i określenia związków z logistyką. *GMI*, 12.
- Rutkowski, K. (2008). *Najlepsze praktyki w biznesie – między młotem wymagań ekonomicznych a kowadłem społecznej odpowiedzialności biznesu*. In: K. Rutkowski (ed.), *Najlepsze praktyki w zarządzaniu łańcuchem dostaw*. Warszawa: Oficyna Wydawnicza SGH.
- Steffen, G. and Born, D. (1995). *Prowadzenie gospodarstw i przedsiębiorstw w rolnictwie (Betriebs – und Unternehmensführung in der Landwirtschaft)*. Warszawa: Książka i Wiedza.
- Sudit, E.F. (1995). Productivity management in industrial operations. *European Journal of Operational Research*, 85(3): 435–543, [https://doi.org/10.1016/0377-2217\(94\)00312-Z](https://doi.org/10.1016/0377-2217(94)00312-Z)
- Symonides, E. (2008). *Ochrona przyrody*. Warszawa: Wydawnictwa Uniwersytetu Warszawskiego.
- Tomczak, F. (2004). *Od rolnictwa do Agrobiznesu. Transformacja gospodarki rolniczo-żywnościowej Stanów Zjednoczonych Ameryki Północnej*. Warszawa: Oficyna Wydawnicza SGH.
- Woś, A. (1998). *Gospodarka żywnościowa. Kompleks gospodarki żywnościowej*. In: Encyklopedia agrobiznesu. Warszawa: Fundacja Innowacja.
- Zalewski, A. (1989). *Problemy gospodarki żywnościowej w Polsce*. Warszawa: Wydawnictwo Naukowe PWN.