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The approach to supply chain cooperation in the implementation of sustainable development initiatives and company's economic performance

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Abstract

Research background: The idea of sustainable development, in the face of the challenges encountered by contemporary society, is gaining increasing popularity. Currently, it recognizes the substantial role that companies play in its successful implementation. Initiatives in the field of sustainable development may be undertaken by companies independently as part of their own activities, or together with entities forming the supply chain as an element of sustainable supply chain management.

Purpose of the article: Identification of groups of companies that are characterised by a different approach to cooperation in the field of sustainable development in the supply chain.

Methods: The quantitative research was conducted in September 2020 with the use of the CATI (Computer-Assisted Telephone Interview) technique and a standardised survey questionnaire. A total of 500 randomly selected companies located in Poland participated in this study. The respondents were representatives of top management of the companies. In order to

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identify various groups of companies, a cluster analysis was performed using the k-means method in SPSS.

Findings & value added: Based on the literature analysis, 3 areas of sustainable development have been identified, in which companies can become involved — green design, sustainable operations, and reverse logistics & waste management. For each of the 3 areas, 3 clusters of companies were identified: companies that are not involved in sustainable development at all (1), companies that carry out most of the sustainable development initiatives independently (2), companies that carry out most of the sustainable development initiatives jointly with supply chain partners (3). The article also shows that the companies in different cluster differ in terms of perceived economic benefits achieved thanks to the implementation of sustainable development initiatives. This may suggest the need to develop separate sustainability solutions for such groups of companies in the future.

Introduction

In recent years, the concept of sustainable development, and especially the involvement of companies in the implementation of its principles, is gaining increasing popularity (Gudic *et al.*, 2020; Pohlmann *et al.*, 2020). In this context, the importance of cooperation between companies within the supply chain is often emphasized (Jabbour *et al.*, 2020; Koeborg & Longoni, 2019), which led to the formulation of the idea of sustainable supply chain management (Bui *et al.*, 2021; Khan *et al.*, 2021b).

In practice, the fulfilment of sustainable development principles in companies is often considered through the prism of implementing sustainable development initiatives (Dubey *et al.*, 2017; Halati & He, 2018; Raut *et al.*, 2019). Some of such initiatives may be taken by companies only independently, as part of their internal activities (e.g., practices targeted at employees). Others can be implemented either independently or in cooperation with supply chain partners and are then referred to as sustainable supply chain initiatives (Agyabeng-Mensah *et al.*, 2020; Padin *et al.*, 2017).

Research conducted in other areas of company activity revealed that they may have different approaches to the issue of cooperation with other entities, i.e. be open or closed to cooperation (striving to carry out most of the activities independently, within the organizational structures of the company) (Fonfara, 2012; Fonfara *et al.*, 2018). These approaches can also have a significant impact on the extent to which links in the supply chain cooperate when implementing sustainable development initiatives.

Some of the previous studies were targeted at determination of the antecedents of inter-firm supply chain cooperation in the implementation of sustainability initiatives, revealing, for example, that the internal imple-

mentation of sustainable development initiatives, governance board characteristics (Sebastianelli & Tamimi, 2020), existence of various bonds in relationships (Tran *et al.*, 2021), or management and work organisation methods (Nath & Agrawal, 2020) impact their implementation at the supply chain level. However, to my best knowledge, no research has verified whether companies can have different approaches to cooperation in the supply chain when implementing sustainable development initiatives, i.e., whether they generally strive to cooperate in this area or usually try to implement them on their own. This creates a research gap.

The presence of companies with different approaches to cooperation in the implementation of sustainable development initiatives may indicate the need to develop different mechanisms or solutions, e.g. in the areas of sustainability metrics and reporting (see Butler *et al.*, 2011), social and environmental impact assessment (see Glasson & Therivel, 2013), environmental management systems (see Netherwood, 2016). Since some researchers indicate that without sustainable supply chains it is impossible to achieve sustainable development goals in business (de Camargo Fiorini & Jabbour, 2017; Villena & Gioia, 2020), this would also indicate the need to promote some sort of sustainable supply chain solutions also among companies closed to cooperation, perhaps in the form of appropriate regulations.

It is indicated that the implementation of the principles of sustainable development in companies should be consistent with the idea of the triple bottom line and take into account the environmental, social and economic dimensions (Birkel & Müller, 2021; Rashidi *et al.*, 2020). In practice, however, a number of proposed solutions focus on improving their environmental or social performance. The corresponding initiatives are sometimes referred to as environmental practices (Tate *et al.*, 2013) and social practices (Kiron *et al.*, 2012). Research is still being conducted on the relationship between the company's involvement in activities beneficial from the environmental and social perspective and its economic results. The results of these studies are ambiguous (Feng *et al.*, 2018; Golicic & Smith, 2013), but some of them indicate a positive relationship and e.g. the possibility of reducing costs, increasing profits or limiting risks (Barbosa-Póvoa *et al.*, 2018; Golicic & Smith, 2013; Muhmad & Muhamad, 2021). As a result of the indicated research gap, no study has so far compared the economic results achieved thanks to the implemented sustainability initiatives by cooperating and non-cooperating companies in this area.

The aim of the paper is identification of groups of companies that are characterised by a different approach to cooperation in the field of sustainable development in the supply chain. Additionally, the intention is to verify whether the groups of companies differ in terms of the perceived economic benefits of implementing sustainable development initiatives. The motive for the additional verification is to reveal if it is worth, from the economic perspective, cooperating in the supply chain in implementing the sustainable development initiatives.

The considerations presented in the article are based on quantitative data obtained from 500 companies located in Poland using the CATI (Computer-Assisted Telephone Interview) technique. Identification of groups of companies that are characterised by a different approach to cooperation in the field of sustainable development in the supply chain was made thanks to the k-means cluster analysis. The remaining analyses are based on the frequency of indications.

Literature review

As mentioned earlier, sustainable development was initially considered from a macroeconomic perspective. Nowadays, however, the important role that companies should play in implementing the principles of sustainable development is indicated (Gudic *et al.*, 2020; Pohlmann *et al.*, 2020; Seroka-Stolka, 2014). In this context supply chain sustainability is a particularly often addressed (Barbosa-Póvoa *et al.*, 2018; Khan *et al.*, 2021b; Koberg & Longoni, 2019). Supply chain sustainability includes best practices and technologies that take into account the environmental, social and economic aspects of supply chain components throughout the life cycle of products and services. The goal of a sustainable supply chain is to create, protect and increase long-term value (environmental, social and economic) for all its links (Dubey *et al.*, 2017; Seuring *et al.*, 2022). Addressing sustainability issues in the supply chain requires intensive cooperation between multiple companies (Seuring & Müller, 2008; Zhu & He, 2017).

The involvement of companies in sustainable development is often considered through the prism of the implementation of specific initiatives. Such initiatives are referred to as sustainable development initiatives (e.g. Halati & He, 2018), sustainable business practices (e.g. Ortiz-de-Mandojana & Bansal, 2016), sustainable supply chain practices (e.g. Gopal & Thakkar,

2016), sustainable supply chain management practices (e.g. Morali & Searcy, 2013) etc. Typically, the researchers intend to classify the initiatives (regardless the terminology used) into more general areas. Although there is no common agreement how the initiatives should be classified, three trends in this aspect are visible. The first one, which takes corporate social responsibility as a reference point, divides initiatives taking into account the criterion of stakeholders they affect, and usually involves employees, stakeholders, social, consumer, suppliers and environmental areas (Guerrero-Villegas *et al.*, 2018). The second is based on supply chain stages and includes areas of upstream supplier facing (e.g., supplier partnership, purchasing policies), design (e.g., eco-design, product innovation), production (e.g., pollution prevention, lean manufacturing), downstream customer facing (e.g., logistics process, customer cooperation) (Golicic & Smith, 2013; Wong *et al.*, 2018). The third trend in the classification of sustainable development initiatives takes the company's operations as its starting point (e.g. Yunus & Michalisin, 2016). In this case, it is assumed that specific initiatives in some areas can be only implemented by companies on their own, and in other areas on their own or in cooperation with partners from the supply chain. Some other classifications, as in case of specific initiatives, are highly influenced by the analysed industries (e.g. Gopal & Thakkar, 2016; Kumar *et al.*, 2020; Tura *et al.*, 2019).

The extant classifications could not be easily applied to the studies discussed in the paper. First of all, they intended to include relatively large spectrum of sustainability-related initiatives, implemented internally or in cooperation with other entities. The presented study intended to include only the initiatives subject to cooperation in the supply chain. Thus, the paper proposes a modified classification, which is inspired by presented studies and a green supply chain literature classification based on problem context in supply chain design proposed by Srivastava (2007). Srivastava's proposal, although relatively old, is still one of the most widely referred in contemporary studies (Barbosa-Póvoa *et al.*, 2018; Manavalan & Jayakrishna, 2019; Miklautsch & Woschank, 2022; Negri *et al.*, 2021). He classified extant literature, distinguishing three broad categories: importance of green supply chain management, green design, and green operations (divided into green manufacturing & remanufacturing, reverse logistics & network design, and waste management). He also gives examples of a number of specific initiatives in each category.

The classification proposed in the paper embraces three broad areas: green design of product (1), sustainable operations (2) and reverse logistics & waste management (3) (see Tables 2–4). Each of the areas include a number of specific, yet not industry-dependent initiatives.

Initiatives in the green design of product area include, among others, the reduction of raw materials and other resources necessary for production (including energy), reduction of the use of environmentally unfriendly or harmful raw materials, reduction of packaging (in transport and sales), product durability increase and the possibility of its repair or waste minimization (McDowall *et al.*, 2017; Moro *et al.*, 2021; Srivastava, 2007). A number of activities included in this area may be executed in cooperation with various independent entities. Working with suppliers can determine the types of raw materials and other resources used. Often, key suppliers are also involved in the product development process, especially if they provide finished components. The importance of purchasers (both intermediaries and end users) is especially visible in the area of accepting the proposed solutions and the possibility of reducing packaging or changing it to more environmentally friendly.

The area of sustainable operations, in particular, includes activities related to production and transportation. According to some authors, it may also include reverse logistics (Srivastava, 2007), however, its specificity and importance for sustainable development justify indicating it as a separate area. Many activities included in this area are described in literature. These may include the calculation of carbon emissions (Lu & Lai, 2020; Sourirajan *et al.*, 2009) and related changes in the area of warehousing and transport (Edeltraud & Vera, 2010), the localisation of important nodes, e.g. production centres or warehouse centres (Bosona *et al.*, 2013; Musavi & Bozorgi-Amiri, 2017) aimed at the implementation of the sustainable development principles, or the increase in work and transport safety (Carter & Rogers, 2008; Gössling, 2018). At the same time, it is indicated that cooperation within this area may concern a relatively large number of entities, including competitors (e.g. joint transport reducing the harmful environmental impact) (Thöni & Tjoa, 2017).

Reverse logistics involves the flow of information, raw materials, means of production and finished goods from the place of consumption to the place of their origin for the purpose of proper disposal or recovery of their value (Govindan & Soleimani, 2017; Prajapati *et al.*, 2019). Activities in this area are often described as 3R — reuse, recycle, return (Hassini *et al.*, 2012).

Companies may be characterised by one of two approaches to cooperation – openness or closeness (Fonfara, 2012; Fonfara *et al.*, 2018). These approaches can be the antecedents of competitive, cooperative or competitive behaviours (Hoffmann *et al.*, 2018). Openness to cooperation means accepting cooperation as an element of the business model and striving to develop close inter-organizational relations. Closeness to cooperation characterizes companies striving to independently implement the widest possible range of activities. Obviously, no company can be completely closed to cooperation with other entities (Håkansson & Snehota, 2017). Openness in the context of cooperation is rather understood as acceptance of the influence of other actors in the inter-organizational network on decisions, often of strategic importance, made by the company. Companies closed to cooperation allow only limited influence of external entities on decision-making processes and activities performed.

In recent years, a number of studies have been carried out that can serve as a reference point for the presented article. In particular, some of them were targeted at determination of the antecedents of inter-firm supply chain cooperation in the implementation of sustainability initiatives. Sebastianelli and Tamimi (2020) with the use of data on the S&P 500 Index retrieved from Bloomberg found that higher levels of diversity and independence of the focal firm's board of directors, as well as the focal firm's involvement in internal green policies and practices has a positive impact on the implementation of green and social supply chain initiatives. They also revealed that the researched companies are more likely to have implemented both types of supply chain practices – environmental and social, then just one of them. Tran *et al.* (2021) showed that the existence of financial, social and structural bonds in relationships of shipping companies in Vietnam has impact on their sustainable cooperation. Nath and Agrawal (2020), based on their research of Indian manufacturing sector, conclude that supply chain agility and lean management practices may act as antecedents of supply chain social sustainability. Some other studies also revealed an inverse relationship – firm's commitment to sustainability may facilitate the inter-firm collaboration (Burki & Dahlstrom, 2017; Luzzini *et al.*, 2015; Niesten *et al.*, 2017). To my best knowledge, no research has verified whether it is possible to distinguish groups of companies, characterized by a different approach to cooperation in the field of sustainable development in the supply chain, understood as openness or closeness to cooperation, what creates a research gap.

As mentioned earlier, initiatives in the field of sustainable development should include environmental, social and economic goals. However, because the economic dimension has always been the focus of companies, they are particularly encouraged to improve their environmental and social performance to meet sustainability goals. At the same time, as emphasized by Hoffman and Bazerman (2007), it should be recognized that initiatives beneficial from an environmental and / or social perspective are sometimes, and other times are not beneficial from an economic perspective. For this reason, research has been conducted for years to determine the impact that the implementation of environmental and social initiatives has on the economic results of companies. However, the results obtained are ambiguous – some studies indicate a positive impact of involvement in sustainable development practices on economic performance (Ali *et al.*, 2010; Fujii *et al.*, 2013; Jum'a *et al.*, 2021; Jung *et al.*, 2018; Margolis & Walsh, 2003; Phan *et al.*, 2020), some negative (Feng *et al.*, 2018; Salzmann *et al.*, 2005), in some studies the results obtained are statistically insignificant (Mahoney & Roberts, 2007; Zhu & Sarkis, 2004), and others show different results within a single study depending on the performance indicator or area of sustainability being analyzed (Agyabeng-Mensah *et al.*, 2020; Jawaad & Zafar, 2020; Khan *et al.*, 2021a). Because of that, the need for investigating the moderators of firms engagement in environmental and social initiatives, and their economic performance is raised in the literature (Kim *et al.*, 2011; Lee *et al.*, 2012; Seuring & Müller, 2008). Cooperation (or lack of it) in the supply chain can be such a moderator and therefore requires additional research.

Research method

The quantitative research was conducted in September 2020 with the use of the CATI (Computer-Assisted Telephone Interview) technique and a standardised survey questionnaire. The respondents were drawn from the PI total database covering 1,113,035 (As of September 2020) companies located in Poland.

The research intention was to get responses from 500 companies. To reach this target, 2011 companies had to be contacted, i.e., 500 out of 2011 companies answered the survey (24.9% response rate was achieved). Companies from 26 different industries participated in the study, including industries with relatively large environmental impact (e.g., mining, food),

and relatively small environmental impact (e.g., professional and consulting services). Companies from no industry dominated the research sample.

The pool included firms of various industries and sizes; however, the number of microenterprises in the pool was deliberately limited to 20% due to their lower expected involvement in sustainable development activities (in 2019, over 72% of micro-enterprises were self-employed, who most often provided work services for one company as typical employees and should not be regarded as a separate enterprises (Statistics Poland, 2020)). The size structure of companies participating in the study is presented in Table 1.

The respondents were representatives of the top management of the firms. First, the manager responsible for issues related to sustainable development or CSR was asked to participate in the survey. If such a position did not exist in the company, a member of the board of directors responsible for relations with key links in the supply chain was asked to answer the survey questions. The respondents received information about the anonymous processing of information received from them. It was expected that one respondent would answer a survey question.

The survey questionnaire included a number of questions about the involvement of companies in sustainable development initiatives, a strategic approach to sustainable development, motivators and barriers to implementation, and the perceived benefits of implementing the initiatives. It also included a number of questions about the characteristics of companies. The key element of the survey questionnaire were questions examining companies' involvement in specific initiatives in the field of sustainable development, in which companies can engage on their own or in cooperation with other entities forming the supply chain. As part of the literature research, a number of such initiatives were identified and divided into 3 areas: green design of product (1), sustainable operations (2), and reverse logistics & waste management (3). The preliminary list of sustainable development initiatives was tested in the course of a pilot study in order to adapt them to the specificity of the Polish market. The pilot study took form of IDI (individual direct interviews) with 4 prospective respondents representing companies from various sectors. The participants of the pilot studies were managers responsible for sustainable development issues, in each case employed in the Polish subsidiaries of MNCs. Ultimately, 28 initiatives were included in the research (see Tables 2–4).

Figure 1 presents the research framework. Respondents were asked to indicate whether specific, included in the questionnaire, initiatives had been implemented in their companies, and if so, whether independently or in cooperation with supply chain links (with possible "yes" or "no" answers). A similar approach was used in the selection and study of the achieved real economic benefits resulting from the implementation of sustainable development initiatives.

Data analysis consisted of two stages. In the first stage, an attempt was made to achieve the aim of the article, which is identification of groups of companies that are characterised by a different approach to cooperation in the field of sustainable development in the supply chain. In particular, it was assumed that there would be groups that:

- implement most of the sustainable initiatives independently, without cooperation with the links in the supply chain,
- implement most of the sustainable initiatives in cooperation with the links in the supply chain,
- implement some of the sustainable initiatives independently, without cooperation with the links of the supply chain, and some in cooperation with the links of the supply chain (mixed approach),
- in general, do not undertake sustainable development initiatives.

In order to determine whether it is possible to distinguish any of the indicated groups, the k-means method was used. The k-means method is a method belonging to the group of cluster analysis algorithms, i.e., the analysis consisting in searching for and isolating groups of similar objects (clusters). This algorithm involves moving objects from a cluster to a cluster as long as the variations inside the clusters and between the clusters are optimized. As a result, the similarity in a cluster should be as large as possible, and separate clusters should differ as much as possible from each other (Arthur *et al.*, 2011). In practice, this means that individual observations may deviate from the marked cluster centres (they are only best suited to a specific cluster).

One of the key (and challenging) element of k-means method is the determination of the number of clusters k , especially if there are no unambiguous grounds for its determination. As Jain (2010, p. 654) points out in such a situation "typically, K-means is run independently for different values of K and the partition that appears the most meaningful to the domain expert is selected". Although he also presents a number of automatic methods of determining the number of clusters, none of them are immune to criticism

(Jain, 2010, p. 656). In the presented research, analyses were performed for $k=2$ to $k=5$ clusters separately for initiatives assigned to 3 areas, i.e. 9 green design of product initiatives, 15 sustainable operations initiatives, and 4 reverse logistics & waste management initiatives.

In the second stage of the analysis, for selected groups of companies distinguished on the basis of the analysis performed using the k -means method, the frequency of indications for the achieved real economic benefits resulting from the implementation of sustainable development initiatives was determined. The intention was to determine whether cooperation in the supply chain has an (presumably positive) impact on the achievement of economic benefits thanks to the implemented initiatives. For obvious reason, companies, that as a rule do not implement sustainable initiatives were eliminated from the analysis, as the lack of implementation of initiatives cannot be associated with gaining benefits from them.

All analyses were performed using IBM SPSS.

Results

It should be noted that the involvement of companies in the field of sustainable development seems high — over 50% of the surveyed companies are involved in almost each of the identified initiatives. At the same time, a large percentage of companies indicate that they implement specific initiatives in cooperation with partners from the supply chain. Such high involvement allowed for verifying whether it is possible to distinguish any sensible groups of companies characterized by a different approach to cooperation in the supply chain in the implementation of sustainable development initiatives.

For analyses carried out separately for the 3 areas of sustainable development initiatives, it was possible to indicate 3 cluster centres in each case, allowing for the distinction of companies characterized by a different approach to cooperation in the supply chain in the implementation of sustainable development initiatives. Group of companies characterised by mixed approach to supply chain cooperation in the implementation of supply chain initiatives were not identified. Tables 2–4 provide a qualitative description for the obtained clusters.

The structure and number of clusters obtained for the area of green design of product is presented in Table 2. Convergence in the analysis was

achieved due to the lack of change in the cluster centres at 12 iterations. Qualitative analysis of the cluster structure allows for the identification of 3 types of companies characterized by a different approach to cooperation in the supply chain when implementing green design of product initiatives. Companies classified in cluster 1 (122 companies) usually introduce and implement sustainable development initiatives on their own. Only for the initiative related to the development of products that contain less harmful, hazardous and toxic substances compared to the prototype does the cluster centre indicate cooperation in the supply chain. Considering that this concerns only 1 out of 9 analysed initiatives, companies from this cluster can be described as independent in the implementation of sustainable development initiatives. In the case of companies included in cluster 2 (185 companies), the cluster centre indicates the implementation of all initiatives in cooperation with the supply chain entities. In turn, 193 companies from the most numerous cluster 3, in general do not implement sustainable development initiatives at all. Thus, the conducted analysis indicates the existence of 3 out of 4 groups, the possibility of the existence of which was assumed.

Table 3 presents the structure and number of clusters obtained for the area of sustainable operations. Convergence was achieved due to no change in cluster centres at 14 iterations. As in the case of the area of green design, the smallest cluster 1 (134 companies) indicates the implementation of most initiatives independently. However, in this case, the cluster centre points to the implementation of 4 out of 15 initiatives in cooperation with supply chain entities (see Table 3). However, it still seems that the companies included in this cluster can be described as implementing most of the sustainable development initiatives independently, without cooperation with the links in the supply chain. The conducted analysis shows that 167 companies included in cluster 2, in general carry out all initiatives in the area of sustainable operations in cooperation in the supply chain. The most numerous cluster 3 (199 companies) in general does not engage in activities in the field of sustainable operations at all. The only exception is recycling in the workplace – the cluster centre points to its implementation in cooperation in the supply chain. However, it is one of the least advanced sustainable development initiatives. The results obtained may suggest that even companies not interested in implementing the concept of sustainable development are encouraged to recycle in one way or another.

Table 4 presents the structure and number of clusters obtained for the analysis of initiatives in the area of reverse logistics & waste management. Convergence was achieved due to no change in cluster centres at 4 iterations. Cluster centres for all initiatives indicate that companies from cluster 1 usually implement all initiatives in this area independently, from cluster 2 – in cooperation in the supply chain, and companies from cluster 3 usually do not implement them at all. Contrary to the previously analysed areas, in this case cluster 1 is the most numerous and includes as many as 203 companies.

In addition, it was studied how many companies are in clusters characterized by the same approach to cooperation in the supply chain when implementing sustainable development initiatives in individual areas, i.e. how many companies usually implement sustainable development initiatives independently in all 3 areas, etc. The analysis carried out indicates that 63 companies were included in cluster 1 in all 3 areas, 40 companies – in cluster 2 in all 3 areas, and 114 companies in cluster 3 in all 3 areas. In other words, 63 of the 500 surveyed companies generally implement sustainable development initiatives from all areas, and they do so independently; 40 companies implement sustainable development initiatives from all areas, and they do so as part of cooperation in the supply chain, and 114 in general do not implement any sustainable development initiatives at all.

In the next stage of the analysis, an attempt was made to verify whether the companies included in clusters 1 and 2 in individual areas differ in terms of perceived real economic benefits resulting from the implementation of sustainable development initiatives. The intention was to determine whether cooperation in the supply chain has an (presumably positive) impact on the achievement of economic benefits thanks to the implemented initiatives. For this purpose, the frequencies of indications of individual benefits for clusters 1 and 2 were compared. For obvious reasons, companies included in cluster 3 were eliminated from the analysis, as the lack of implementation of initiatives cannot be associated with gaining benefits from them. Collective data is presented in Table 5. The columns present the number and percentage of companies from a given cluster that declare their achievement. Due to the limited repeatability of companies in clusters, differences in results may in fact result from undertaking cooperation in the supply chain or not doing so.

Most companies in all clusters declare that thanks to the implementation of sustainable development initiatives their company's image has improved. At the same time, it should be noted, however, that this benefit is one of the least tangible, and it seems to be one of the easiest to declare, especially that most companies do not examine their image in a formalized way. However, a clear tendency can be indicated – companies included in cluster 1 more often indicate the achievement of this benefit compared to cluster 2. There may be two reasons for this. Firstly, independent implementation of initiatives means that only one company implementing them can “boast” of them in the business environment. Thus, the “image” benefit does not “spread” to a larger number of entities forming the supply chain. Secondly, some companies implementing sustainable development initiatives as part of cooperation may be encouraged to do so by other entities in the supply chain, and implement them only to the extent expected by partners. Such companies may believe that only other entities gain “image” benefits from the implemented solutions (or, in fact, it may be so).

The second most frequently mentioned benefit in all clusters was reduction of costs. As in the case of the improvement of the company's image, the achievement of this benefit is declared by a greater percentage of companies included in cluster 1 compared to cluster 2. The reason for such results may be that undertaking intensive cooperation in business networks, including the supply chain, is associated with an increase in specific costs, especially at the initial stages of cooperation (Dwyer *et al.*, 1987; Gummesson, 2004). It can be assumed that some companies from cluster 2 still bear the costs of cooperation and thus cannot indicate a reduction of costs thanks to the implemented sustainable development initiatives. It is also worth noting that in the short term sustainable development initiatives themselves may involve additional costs of an economic nature (Payne & Raiborn, 2001; Walley & Whitehead, 1994), which may also affect the respondents' declarations.

For companies from most clusters, the third most frequently indicated benefit was increase in revenues. Contrary to the previously discussed benefits, in the areas of green design of product and sustainability operations, the achievement of this benefit is declared by a greater percentage of companies from cluster 2. The reasons for such results may be varied. The implementation of sustainable development initiatives may be a condition for cooperation with some purchasers, or a reason for the intensification of such cooperation, which then translates into an increase in revenues. It may

also involve the possibility of offering products at a higher price, which is the assumption of some sustainable development solutions (e.g. paying higher prices to small producers under fair trade cooperation).

In the area of reverse logistics & waste management, a greater percentage of companies implementing sustainable development initiatives independently declare an increase in revenues. Interpreting this result is difficult and may require additional qualitative research.

The fourth most frequently indicated benefit in all clusters was the improvement of the company's competitive position. Achieving this benefit was declared by a greater percentage of companies from cluster 2 in all analysed areas. The reasons for such results may be similar to the increase in revenues. Only the differences in declarations regarding the achievement of these two benefits in the area of reverse logistics & waste management are puzzling.

Another of the discussed benefits is improving resource efficiency. As in the case of the increase in revenues, in the areas of green design of product and sustainable operations, its achievement is declared by a larger percentage of companies from cluster 2, and in the area of reverse logistics & waste management from cluster 1. Declarations for the first two areas are consistent with assumptions that the effective implementation of sustainable development initiatives often requires the cooperation of companies in the supply chain. This assumption may be especially true for resource use initiatives. The interpretation of the respondents' declarations in the area of reverse logistics & waste management again seems to require additional qualitative research.

The author resigns from detailed analyses of the remaining benefits included in the research. On one hand, this is due to the lack of identifiable regularities (except for the increase in the company's innovativeness, which is declared by a larger percentage of companies from cluster 2). On the other hand, it is dictated by a relatively small number of indications suggesting the achievement of these benefits. In fact, a small percentage of companies pointing to the achievement of other benefits thanks to the implemented solutions seems to be a more important conclusion than their distribution in different clusters. It shows that a large group of companies do not achieve the economic benefits assumed in theoretical considerations related to the implementation of sustainable development initiatives.

Discussion

The main goal of the article, which was the identification of groups of companies that are characterised by a different approach to cooperation in the field of sustainable development in the supply chain, was achieved thanks to the use of the k-means method. In the case of the presented research, companies included in individual clusters may implement individual initiatives differently than indicated by cluster centres, e.g. a specific company included in cluster 2 may carry out some initiatives independently, and some not at all. Thus, the results make it possible to indicate general tendencies of companies included in particular clusters. However, such an indication seems to be sufficient for the implementation of the goal of the article. It reflects the company's approach to cooperation in the field of sustainable development in the supply chain, which does not necessarily coincide with the realities of operation.

As mentioned earlier, one of the key elements of this method is the determination of the number of clusters k , especially if there are no unambiguous grounds for its determination. In the presented research, analyses were performed for $k=2$ to $k=5$ clusters, taking the approach suggested by Jain (2010, p. 654), instead of automatically determining the number of clusters. As a result, 3 sensible clusters were obtained for each of the 3 identified areas of involvement. Although the previous studies analysed the implementation of sustainable development initiatives internally (e.g. Karlsson *et al.*, 2018; Seidel *et al.*, 2010) and in cooperation in the supply chain (Agyabeng-Mensah *et al.*, 2020; Padin *et al.*, 2017), to my best knowledge it is the first attempt to verify whether the identification of groups of companies that are characterized by a different approach (open or closed) to cooperation in this field is possible.

The article also attempts to verify whether companies characterised by a different approach to cooperation in the field of sustainable development in the supply chain achieve various benefits thanks to the implemented initiatives. However, first it should be pointed out that definitely fewer companies declare the achievement of economic benefits thanks to the implementation of initiatives than the implementation of sustainable development initiatives itself. To some extent, this is in contradiction with the very idea of sustainable development, according to which the economic result must be an integral element of the activities undertaken (Birkel & Müller, 2021; Rashidi *et al.*, 2020). There appear to be four reasons for such

indications concerning the achieved benefits. Firstly, some of the benefits may only be revealed the future. This is consistent with assumptions that some initiatives may generate mainly economic costs in the short term, and benefits only in the long term (Antonioli *et al.*, 2022; Carter & Rogers, 2008; Fujii *et al.*, 2013). Secondly, the involvement of some companies in sustainable development can only be superficial, what is sometimes referred as greenwashing (de Freitas Netto *et al.*, 2020; Hassini *et al.*, 2012, p. 69; Yang *et al.*, 2020). In such a situation, companies may not achieve possible economic benefits at all, or may not notice their achievement. Thirdly, companies can make mistakes in selecting specific initiatives, which can be considered a subject error. In this context, assumptions can be pointed out that actions beneficial from the environmental and / or social perspective are sometimes, and other times are not beneficial from the economic perspective (Baah *et al.*, 2020; Hoffman & Bazerman, 2007). Fourthly, companies can make mistakes in how initiatives are implemented (Amankwah-Amoah & Syllias, 2020; Walley & Whitehead, 1994), which is a process error. Regardless of the indicated possible reasons for a relatively small percentage of companies declaring achievement of economic benefits thanks to the implementation of sustainable development initiatives, this area requires additional research.

Previous studies on the relationship between the company's commitment to environmental and social practices and economic performance have yielded mixed results. Nevertheless, some of them indicated the possibility of improving economic results, in particular cost reduction, improved profitability and risk management (Barbosa-Póvoa *et al.*, 2018; Golicic & Smith, 2013; Muhmad & Muhamad, 2021). The conducted analysis indicates that there are differences in the economic results achieved thanks to the implemented sustainable development initiatives by companies cooperating and not cooperating in this area in the supply chain. These results can contribute to the discussion on the antecedents and conditions of economic performance improvement through a commitment to sustainable development.

The obtained results should be treated with some caution. Conclusions regarding the benefits achieved were drawn by comparing the declarations of companies included in clusters 1 and 2 in three areas of sustainable development. However, some companies were included in the same clusters in different areas — 63 companies were included in cluster 1 in all 3 areas, and 40 companies — in cluster 2. This repeatability may have a certain

(although limited due to the number of companies) impact on the identified regularities in the declarations concerning the achieved benefits. This is especially important under the assumption that aspects other than cooperation in the supply chain or the lack of it may have an impact on the achievement of specific benefits. They may include, for example, a strategic approach to sustainable development, organizational culture, the use of feedback on actions taken or an approach to risk management (Baah *et al.*, 2020; Carter & Easton, 2011).

At the same time, in the case of some benefits, the indication of the regularities in terms of their achievement by companies was only partial. In particular, declarations in the area of reverse logistics & waste management differed from the others. Interpretation of this difference seems to be difficult without additional empirical data of a qualitative nature.

In fact, the obtained data, despite allowing for the identification of differences in the achieved benefits, do not explain the reasons for these differences. The presented considerations about the causes are presumed and require confirmation in in-depth qualitative research.

Conclusions

As part of the literature research, 28 sustainable development initiatives were identified that can be implemented by companies independently or in cooperation in the supply chain. These initiatives were divided into 3 areas: green design of product, sustainable operations, and reverse logistics & waste management. The proposed division is an original contribution and is a result of deductive reasoning based on existing literature. In the research (and in the proposed areas), initiatives that are assumed to be implemented only independently by focal companies (e.g. initiatives concerning company employees) were omitted.

The research results indicate a high percentage of companies involved in sustainable development — in the case of almost all initiatives, over 50% of the respondents indicate their implementation. At the same time, a large percentage of companies declare the implementation of individual initiatives in cooperation with partners in the supply chain.

The analysis showed the existence of 3 clusters of companies characterized by a different approach to cooperation in the field of sustainable development in the supply chain in all 3 areas.

In the case of the first two clusters, the declarations concerning the economic benefits achieved thanks to the implemented initiatives were compared. The analysis shows that companies that independently implement sustainable development initiatives relatively more often declare improvement of the company's image and reduction of costs thanks to the implemented initiatives. In turn, companies that implement sustainable development initiatives in cooperation with the links in the supply chain relatively more often declare an increase in revenues, improvement of the company's competitive position and improving resource efficiency thanks to the implemented initiatives (with some exceptions in the area of reverse logistics & waste management). The article indicates possible reasons for such differences. These considerations, however, are presumed, and their verification requires additional qualitative research that should be undertaken in the future.

The conducted research has some limitations. The k-means cluster analysis made it possible to distinguish companies that usually cooperate in the supply chain when implementing sustainable development initiatives. However, this analysis does not allow to indicate whether these companies are active initiators of such practices at the level of the supply chain, or whether they only passively accept their implementation as a result of the initiative of other entities. Adopting an active or passive attitude in this regard can have a significant impact on the implemented practices and the economic results achieved thanks to them. This area therefore requires additional consideration.

The presented results indicate the need for further research. It should be aimed at identifying mechanisms for selecting initiatives in the area of sustainable development and the scope of necessary cooperation in their implementation for specific companies in such a way as to improve their business results. Previous studies focused on verifying the impact of the discussed initiatives on the results of the entire research samples, in some cases taking into account moderators of company size or industry. As noted, the results of such studies were mixed. It seems that the specific situation of specific companies (even of similar size, operating in the same sector) may require the selection of a unique set of sustainable development initiatives. It is worth pointing companies to the tools to facilitate the development of this kind of set of initiatives.

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Annex

Table 1. Size structure of respondent companies

Company size	All companies N=500	
	n	p
Micro enterprises	100	20,0%
Small enterprises	240	48,0%
Medium-sized enterprises	125	25,0%
Large enterprises	35	7,0%

Notes: N – number of companies in the sample; n – number of companies of a given size; p – proportion of companies of a given size

Table 2. The structure and number of clusters in the area of green design of product

Green design of product initiatives	Cluster 1 N=122	Cluster 2 N=185	Cluster 3 N=193
product development that enable their easy recycling	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
developing products that require less raw materials, production materials, energy, etc. to be produced compared to the prototype	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
use of environmentally friendly packaging	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
product development taking into account the reduction of packaging	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
development of products that are easy to repair, regenerate	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
developing products that contain less harmful, hazardous and toxic substances compared to the prototype	implementation as part of cooperation in the supply chain	implementation as part of cooperation in the supply chain	no implementation
development of products allowing for their longer use compared to the prototype	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
the development of products that allow the reuse of their components or materials used	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
developing products that enable their easy and relatively environmentally friendly withdrawal from use	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation

Table 3. The structure and number of clusters in the area of sustainable operations

Sustainable operations initiatives	Cluster 1 N=134	Cluster 2 N=167	Cluster 3 N=199
recycling in the workplace	self-implementation by the company	implementation as part of cooperation in the supply chain	implementation as part of cooperation in the supply chain
reduction of the use of raw materials, production materials, energy, etc. in production	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
measuring the environmental impact of production	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
use of renewable sources of supply (including energy, raw materials, recycled materials)	implementation as part of cooperation in the supply chain	implementation as part of cooperation in the supply chain	no implementation
reduction of resource losses during production	implementation as part of cooperation in the supply chain	implementation as part of cooperation in the supply chain	no implementation
location of production and warehouse centres based on environmental analyses	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
transport design based on environmental analyses	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
shortening of transport routes	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
reduction of the use of hazardous, harmful, toxic substances in production	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
provision of product repair, restoration services	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
organization of transport with other entities	implementation as part of cooperation in the supply chain	implementation as part of cooperation in the supply chain	no implementation
reduction of exhaust emissions in transport	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
reuse of components of end-of-life products	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
disassembly of end-of-use products	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
measuring the environmental impact of transport	implementation as part of cooperation in the supply chain	implementation as part of cooperation in the supply chain	no implementation

Table 4. The structure and number of clusters in the area of reverse logistics & waste management

Reverse logistics & waste management initiatives	Cluster 1 N=203	Cluster 2 N=131	Cluster 3 N=166
waste reduction	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
recycling of manufactured products or their components – collection and processing	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
reduction of pollutant emissions	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation
preventing the emission of pollutants	self-implementation by the company	implementation as part of cooperation in the supply chain	no implementation

Table 5. Frequency of indications of achieved benefits in individual clusters

Real business benefits	Green design of product				Sustainable operations			Reverse logistics & waste management	
	Cluster 1 - self-implementation N=122	Cluster 2 - implementation in supply chain N=185	Cluster 1 - self-implementation N=134	Cluster 2 - implementation in supply chain N=167	Cluster 1 - self-implementation N=203	Cluster 2 - implementation in supply chain N=131			
improvement of the company's image	92 75.4%	113 61.1%	96 71.6%	111 66.55	142 70.0%	87 66.4%			
reduction of costs thanks to the implemented initiatives	42 34.4%	52 28.1%	51 38.1%	45 26.9%	65 32.0%	29 22.1%			
increase in revenues thanks to the implemented initiatives	23 18.9%	51 27.6%	27 20.1%	41 24.6%	54 26.6%	22 16.8%			
improvement of the company's competitive position	20 16.4%	35 18.9%	20 14.9%	32 19.2%	33 16.3%	27 20.6%			
improving resource efficiency	10 8.2%	29 15.7%	11 8.2%	25 15.0%	30 14.8%	12 9.2%			
reduction of business risk	13 10.7%	16 8.6%	9 6.7%	20 12.0%	18 8.9%	16 12.2%			
increase in the company's innovativeness	7 5.7%	16 8.6%	7 5.2%	14 8.4%	12 5.9%	10 7.6%			
access to new markets	10 8.2%	9 4.9%	8 6.0%	11 6.6%	12 5.9%	8 6.1%			
increase in trust to the company	10 8.2%	5 2.7%	5 3.7%	13 7.8%	14 6.9%	6 4.6%			
increased purchaser satisfaction	2 1.6%	2 1.1%	1 0.7%	3 1.8%	3 1.5%	0 0%			

Figure 1. Research framework

