

RESULTS OBTAINED THROUGH IMPLEMENTATION OF GREEN ACTIVITIES IN THE SUPPLY CHAIN

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Abstract: As a result of the growing importance of "green" practices conducted by participants of supply chains, the interest of possibly obtained results on this account also increases. Therefore, the purpose of these considerations is to indicate what kind of effects are most often obtained by entities in the above dimension. Quantitative research was carried out among manufacturing enterprises registered in Poland, which are participants of domestic and international supply chains. A questionnaire was used as a research tool. On the basis of research, among other things, it has been proved that enterprises primarily produce results in the area of for the sake of materials management and for the natural environment, while clearly visible economic effects are not notably visible. This is characteristic of the initial stage of the development of green practices.

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1. INTRODUCTION

In the source literature concerning the green supply chain, issues related to: strategic approaches – e.g. strategy (Laari, Töyli & Ojala, 2017), supply chain types (Carvalho & Cruz-Machado, 2011), flow phases in the supply chain – for example, selection of green suppliers (Kannan, 2008), green design (Ameknassi, Aït-Kadi & Rezg, 2016), management and operational processes (e.g. adaptation of the logistics sector to the requirements of creating green supply chains (Lin & Ho, 2008), diffusion of knowledge (Maryniak & Stefańska, 2015).

Most often, however, model approaches are presented, constituted by such constructs as: activities, motivators, barriers and GSCM results. Examples of pro-environmental activities of horizontally integrated enterprises include: checking whether suppliers of further orders adhere to environmental requirements, the treatment of pro-environmental criteria as a priority in the process of selecting suppliers, using long-term programmes aimed at taking pro-environmental activities on the supplier-company line, if possible, selecting local suppliers to reduce CO₂ emissions, developing a policy of utilizing storage infrastructure that includes pro-environmental solutions, optimization of inventory management also in the context of its impact on the environment, using environmentally friendly means of transport, introduction of modern logistic technologies aimed at protecting the natural environment, taking into account environmental criteria when designing the logistics network, analysing the risk in the supply chain in the context of the natural environment, conducting research aimed at implementing pro-environmental solutions in the supply chain, research on the impact of a product and product packaging on the environment throughout its life cycle, striving to eliminate hazardous substances from products / packaging, analysis of customers' surveys on the possibility of introducing more pro-environmental products to the market, developing a goods return / packaging return policy, re-use or recycling.

Examples of GSCM incentives include: pressure from suppliers, intermediaries, final customers, pressure from entities from the logistics industry, entering markets that require GSCM, desire to gain a competitive advantage, green strategies of competitors, initiatives of industry organizations, legal regulations, public pressure, expectations of the environment in the field of reporting/communication on environmental activities, the prospect of reducing operating costs, high awareness of environmental issues among company employees, marketing/image activities.

In the area of GSCM barriers following examples can be listed: problems with adaptation of new pro-environmental solutions to the already developed management system, a sense of too much complexity in the field of green supply chains, too high costs of environmentally-friendly products that would cause difficulties in selling the goods, too high costs of monitoring suppliers in terms of compliance with pro-environmental requirements, too high costs of pro-environmental technologies and reimbursement of costs from these investments, difficulties in

estimating expenditures and results related to the implementation of GSCM, lack of GSCM designers, consultants and specialists in the implementation of GSCM in the enterprise, lack of IT system integration between the participants of the supply chain, lack of stability in the configuration of the supply chain, the inability to share knowledge in the field of GSCM, lack of initiator of GSCM activities in the supply chain, insufficient supply of warehouse infrastructure, in which numerous pro-environmental solutions were introduced, lack of possibilities to optimize inventories/turnover in the environmental context due to contractors' requirements, lack of a wide range of modern logistic technologies aimed at protecting the natural environment, lack of universality/custom of using environment-friendly solutions in logistics processes, no industry initiatives, no initiatives from non-governmental organizations, lack of widespread model practices regarding GSCM, no market requirements (contractors, clients, etc.)

In terms of results, items such as: standing out against the competition, image improvement, sales increase, increase in the market share, improvement of the overall level of profitability, a systematic approach to environmental protection, greater innovation of business processes, greater product innovation, reducing the number of environmental accidents, investment growth, higher level of performance, improvement of compliance with environmental standards, better use of potential/resources, improvement of relationships with suppliers/recipients/clients, improvement of relations with the local community, lowering the level of stocks, waste reduction, reducing the consumption of harmful materials, reduction of energy, water, CO₂ emissions, reduction of soil pollution. Above examples also highlight deliberately the aspects related to supply chain management and logistics, as in the previous studies these issues are often treated only marginally.

Due to the low level of implementation of GSCM, it is justified to present the benefits that can be gained on this account. Promoting knowledge on this subject is therefore important not only from the point of view of science, but also from the point of view of the needs of the business world. Therefore, in the further part of the study, the focus was on the resultant side of the implementation of GSCM, whereas the other dimensions of the research are equally important, cognitively interesting and complementary to each other.

The aim of the study was to identify the profile of GSCM results groups that are rated as the most frequently achieved and to identify the most popular results in their given classification group.

2. PRO-ENVIRONMENTAL RESULTS – RESEARCH STATUS

Research in the field of pro-environmental results is implemented in virtually every region of the world. In particular scientists from China, the United States, Taiwan, India, and the United Kingdom are engaged in the subject of GSCM.

Based on comprehensive review of the literature, inter alia Fang and Zhang (2018) stated that GSCM's internal and external practices are positively correlated with the company's performance. The authors concluded that their relationship with environmental performance is the largest in the operational and economic dimension. Mutingi (2013) concluded that GSCM leads to minimizing waste in the industrial system, minimising the use of harmful substances into the environment and to saving energy and resources. Vanalle and co-authors (2017) concluded that the adoption of GSCM practices is positively linked to economic and environmental performance, both Choi and Hwang (2015) came to similar conclusions. On the other hand Chu and co-authors (2017) paid attention to operational and environmental benefits. Nevertheless, Roehrich, Hoejmoose and Overland (2017) noticed that by increasing the GSCM's efficiency, the market share gains positive financial results and increases the competitive position in the process of selecting contractors. In turn Thun and Müller (2010) proved that green supply chain management leads to higher productivity according to many different criteria. Muduli and Barve (2013) showed that GSCM leads to a competitive advantage. Shekari and co-authors (2011) noted that thanks to GSCM initiatives, a competitive advantage can be found in the form of lower costs, more environmentally friendly products and better integration with suppliers. Mumtaz and co-authors (2018) indicated the implementation of GSCM practices causes a decrease in environmental pollution and operational costs, but this does not affect the increase of organizational flexibility. Morrissey and Khar (2013) emphasized that with the implementation of GSCM, particular benefits can be observed in the field of energy saving, reduction of waste volume, introduction of closed loop operation. On the basis of the research, it was also found that the activities in question bring, among others, the image effect and the effect related to improving relations with the environment, and that pro-environmental policy stimulates investments (Maryniak, 2017). To conclude, it can be stated that the source literature indicates the positive effects of implementing pro-environmental practices, but some studies show that there is no significant relationship between them (Giovanni & Vinzi, 2012; Huang, Wu & Rahman, 2012). However, these are rare. In general, it is thought that creating green chains should bring savings rather than incur additional costs (Craggs, 2012). In addition, it is stated that the implementation of green solutions reduces the impact of business operations on the environment, while improving their operational efficiency (Vanalle et al., 2017).

3. RESEARCH OPERATIONALIZATION

Proposals for the division of results (as in the case of motivators and barriers) are diverse. Among other things, attempts have been made (Epstein & Wisner, 2001) to present them using the thematic division included in the strategic score-

card, and therefore to present the results in the perspective of: learning and growth; business processes; customer and in the financial perspective. Most often, however, the results are included in such thematic categories as: economic, environmental, intangible, operational, market, social. In the current research, usually research is distinguished from two to four constructs which include detailed test items or exchange from two to four results without distinguishing narrower issues.

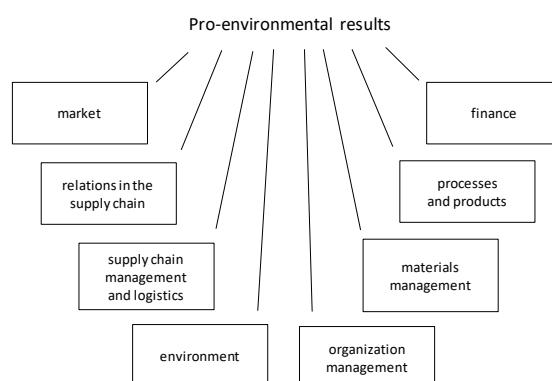


Fig. 1. Pro-environmental results

In this study, eight thematic groups were identified (Fig. 1) within which specific variables were distinguished. The individual entries defining the constructs consist of test items concerning:

- market conditions (e.g. increasing sales) – "market",
- improvement of relations in the supply chain (e.g. improvement of relations with target customers: enterprises, institutions, consumers) – "relations in the supply chain",
- supply chain management (e.g. greater competitiveness of the supply chain compared to other chains) – "supply chain management",
- environmental impact (e.g. reduction of energy consumption) – "environment",
- financial aspects (e.g. reduction of distribution costs) – "finance",
- improvement of processes and products (e.g. increasing their innovation) – "processes and products",
- materials management (e.g. reduction of waste) – "materials management",
- organization management (e.g. improvement of compliance with environmental standards) – "organization management".

Entry "GSCM results" is understood as benefits gained as a result of pro-environmental activities in the supply chain. "Logistics" (transport, warehousing, stocks) is treated as an element of supply chain management. In addition, it was assumed that "green supply chain management consists in: designing products and

managing their flow up and down the supply chain by entities including those involved, with particular emphasis on the need to protect the environment" (Maryniak, 2017).

During the empirical tasks the survey method was used. The questions were closed. Answers were given using the five-scale Likert scale, where 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strongly disagree.

The research was carried out under the "Sustainable supply chain" grant implemented in 2015–2018. The research subjects were production companies registered in Poland. In total, over seventy enterprises participating in domestic and foreign supply chains were surveyed. The questions concerned both the tested cell and the links cooperating at the entry and exit of the supply chain.

Based on the research, it was determined:

- which results obtained by implementing the GSCM are the most frequently obtained within the adopted thematic classification?
- what benefits have been most commonly found in individual groups?

Each construct that consists of individual results is positively correlated with pro-environmental activities regarding relations with suppliers and recipients, supply chain management, logistics and the moving product in the supply chain (Maryniak, 2017). To verify this, construct coherence was checked by Cronbach's Alpha coefficient, also Kolmogorov-Smirnov test was used to analyze the shape of the variable distribution (i.e., the distribution of variable differs from normal) and correlation coefficients r -Pearson and ρ -Spearman to check the relationship between variables and evaluation of their strength and direction.

All correlations proved to be statistically significant. Between the environmental activities and the results regarding the company's processes and products, business management, market, relationships – there is a strong positive relationship (respectively: $\rho = 0.564$, $r = 0.515$, $r = 0.513$, $\rho = 0.528$).

There is a moderate positive relationship between environmental activities and the results regarding the company's finances, materials management, supply chain management and the environment (respectively $\rho = 0.373$, $\rho = 0.472$, $r = 0.489$, $\rho = 0.418$). Values were obtained at $p < 0.001$. There is a moderate positive relationship between environmental activities and environmental and supply chain management results. The obtained results mean that high values of the "pro-environmental activity" variable are accompanied by high values of all detailed indicators.

4. RESEARCH RESULTS AND DISCUSSION

On the basis of the obtained data, it can be stated that the companies most rarely pointed to financial results, most often to environmental and material management results. This is characteristic of the initial stage of implementing green chains.

Investments in pro-environmental technologies and extensive programs with suppliers and recipients bring financial effects only over a longer period of time. Lack of knowledge of the topic in the field of GSCM, experience and lack of diffusion of knowledge in the field of GSCM among participants of supply chains causes that entities initially tend to implement simple activities consisting in saving water and energy. However, they are not spectacular enough to significantly affect the company's financial results. Reduction in the use of harmful materials, better management of already created materials, reduction of material consumption, reduction of waste – these are the results characteristic of entities that are just learning green activities.

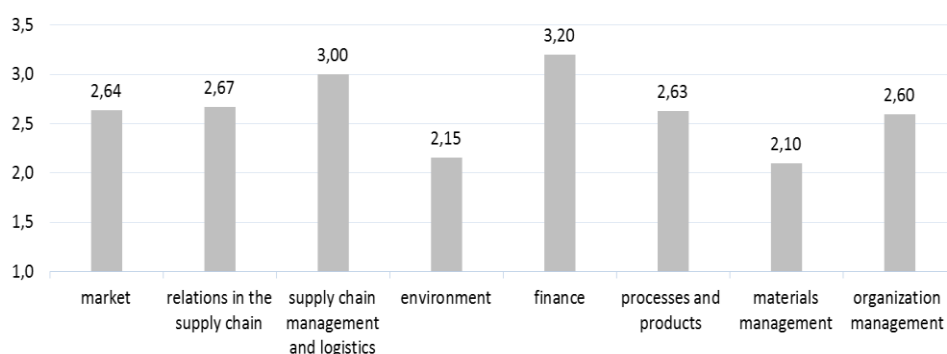


Fig. 2. Averages of responses regarding results within individual constructs

Tables 1 and 2 lists the effects that are obtained as a result of pro-environmental undertakings under individual thematic dimensions.

Table 1. Results, most often achieved within individual constructs – effects on supply chain management and the environment

External variables	Market	Image improvement	1.92
		Greater competitiveness	2.47
	Relations in the supply chain	Improvement of relation with target customers (enterprises, institutions, consumers)	2.40
		Improvement of relations with suppliers/recipients	2.62
	Logistics and supply chain management	Optimisation of the supply chain configuration	2.90
		Better KPIs terms of logistics processes	2.93
	Environment	Lower energy consumption	2.11
		Lower water consumption	2.14

Table 2. Results, most often achieved within individual constructs – effects concerning the company only

Internal variables	Finances	Profit increase	3.03
			Improving the overall level of profitability
Environmental processes		Implementation of environmental policy	2.32
		Systematic approach to environmental protection	2.52
Material management		Reducing the use of harmful materials	1.90
		Better management of produces waste	2.10
Organisation management		Increasing compliance with environmental standards	1.93
		Reducing the number of environmental accidents	2.55

5. CONCLUSION

Based on the analyses carried out, it can be concluded that the green supply chains are still at the initial stage of development, as the effects on supply chain management, logistics and financial effects are still hardly visible. Numerous studies carried out worldwide confirm positive effects in connection with the implementation of green activities. That is why it is so important to develop further research in this direction.

Due to the fact that this research is limited to the perspective of manufacturing enterprises, it is worthwhile to broaden the considerations regarding the perspective of other participants in supply chains in the future.

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BIOGRAPHICAL NOTES

Anna Maryniak is a Professor at the Poznań University of Economics. She works at the Department of Logistics and Transport. Her scientific interests concern sustainable supply chains (including in particular green chains), supply chain types and competitive conditions associated with it. Anna Maryniak is, among other things, a co-editor and co-author of the *Smart Supply Network* publication. She is also the author of publications presenting empirical research on hybrid chains, intellectual capital, methodological and warehouse management studies.