

## **ENVIRONMENTAL MANAGEMENT PRACTICES, INTERORGANIZATIONAL COOPERATION AND KNOWLEDGE SHARING IN THE STEEL AND METAL INDUSTRY IN POLAND**

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### **Abstract**

The utilization of the diverse measures to reduce environmental impact in the industries characterized by the high level of energy and pollution intensity is essential for achieving sustainable development. Therefore, the main purpose of this article was to investigate the engagement of steel and metal companies operating in Poland in the implementation of the voluntary environmental management practices, and to explore its relationships with the scope of interorganizational cooperation, the knowledge sharing intensity and the level of eco-innovation. The research has shown that the planning and organizational environmental management practices and the operational environmental management practices are significantly related to the companies' level of eco-innovation. There have been also statistically significant relationships between the engagement in environmental practices implementation and the scope of interorganizational cooperation and the knowledge sharing intensity within companies. However, the results of conducted study reveal that the interorganizational cooperation and the knowledge sharing are not significantly related to the companies' level of eco-innovation. Nevertheless, the study has proved that the more intensive the interorganizational cooperation and the knowledge sharing, the more developed voluntary environmental management practices are implemented. It means that the interorganizational cooperation and the knowledge sharing may indirectly support eco-innovation. This is because those activities directly foster environmental practices implementation which in turn significantly influences the level of eco-innovation.

**Keywords:** environmental management practices, interorganizational cooperation, knowledge sharing, eco-innovation, steel and metal industry.

### **1. INTRODUCTION**

In recent years, the environmental sustainability has considerably attracted attention in the steel and metal industry [1]. In order to reduce the environmental impact of business activity in an efficient way, the implementation of adequate environmental management practices is necessary. The development of such practices, especially in the turbulent business environment, should be supported by the interorganizational cooperation which has become very popular in the knowledge based economy. A notable role, in the absorption of the acquired external knowledge and in the dissemination of the knowledge accumulated in the company earlier, is played by the knowledge sharing among employees, business units or work teams. The voluntary environmental management practices, supported by the interorganizational cooperation and the knowledge sharing are expected to significantly facilitate implementation of eco-innovation. Since eco-innovation reduces environmental impact and improves business performance [2], studies on factors influencing the development of the voluntary environmental management practices and eco-innovations, as well as relationships occurring in this area, become more and more interesting in scientific and practical terms. There has not been any such analysis until now in respect of the steel and metal industry in Poland. Therefore, the results of the research presented in this article were, to a certain extent, to fill the existing gap.

The purposes of this study were in particular:

- to recognize the engagement of selected steel and metal companies operating in Poland in the implementation of the voluntary environmental management practices,

- to identify the specificity and the scope of interorganizational cooperation and knowledge sharing practices in the above mentioned companies,
- to investigate the relationships between the engagement in the implementation of voluntary environmental management practices, the scope of interorganizational cooperation, the knowledge sharing intensity and the level of eco-innovation.

## **2. THEORETICAL BACKGROUND**

There are various typologies of corporate approaches to environmental management. In general, researchers distinguish between two extreme postures: environmental reactivity and environmental proactivity. The latter strategy is typical for companies that voluntarily implement environmental management practices to reduce their impact on the natural environment [3].

The interorganizational cooperation results from the fact that no company possesses all the knowledge resources needed to achieve its objectives. Therefore, it is a way to complement the company's competencies [4]. Regarding cooperation on innovative activities it comprises different formal and informal modes and types of partners. They may have different functions in the R&D&I processes, including vertical and horizontal cooperation [5].

Knowledge sharing, as a basis of organizational learning, consists of knowledge donating and knowledge collecting. It involves the processes through which employees mutually exchange knowledge and accordingly create new knowledge [6] to help others and to collaborate with others to solve problems, develop new ideas, innovations etc.

The environmental proactivity manifested in the implementation of voluntary environmental management practices may be associated with the development of unique organizational capabilities as conceived by the resource-based view of the firm [7]. One of the most fundamental company's resources are knowledge resources, including external knowledge acquired from outside of the company. Sharing knowledge can not only facilitate the exchange and dissemination of the knowledge accumulated by the employees in the company, but it can also improve the efficiency of absorption of external knowledge acquired within the interorganizational cooperation. All these processes can be, therefore, significant for the success of eco-innovative activity.

## **3. MATERIALS AND METHODS**

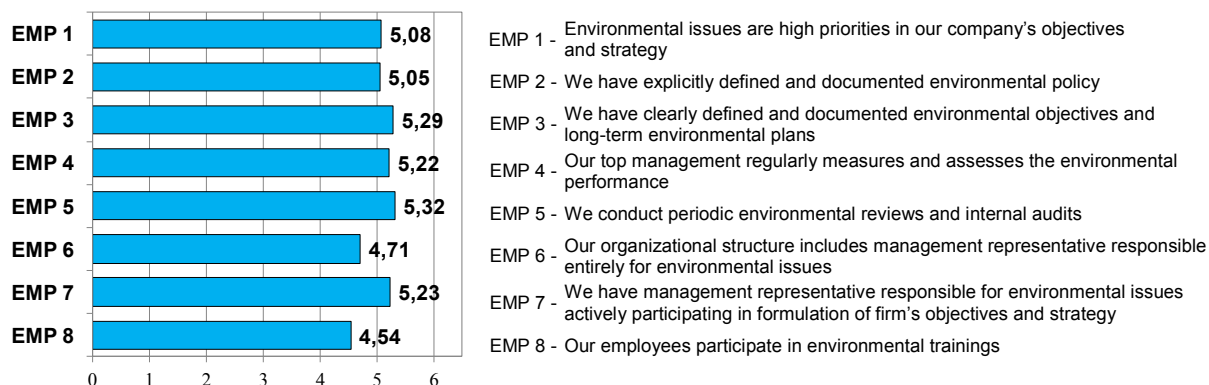
The presented empirical study is a part of the research conducted in November and December 2013 on a sample of 37 steel and metal companies (NACE code C24 – Manufacture of basic metals) operating in Poland. The surveyed group included 18 small, 12 medium and 7 large entities. The research method applied was an interview with a questionnaire conducted among representatives of the companies: the owners, management board members or other decision-makers in a given organization.

The thematic scope of the research concerned the issues related to proactive environmental management, interorganizational cooperation, knowledge sharing and eco-innovation. The representatives of the studied companies were asked to rate the degree of implementation of sixteen environmental management practices adapted from previous studies [3, 8]. There were also employed the adapted existing tools for measuring the scope of the interorganizational cooperation [9], the intensity of knowledge sharing [10] and the level of eco-innovation compared to key competitors [11] in the conducted research.

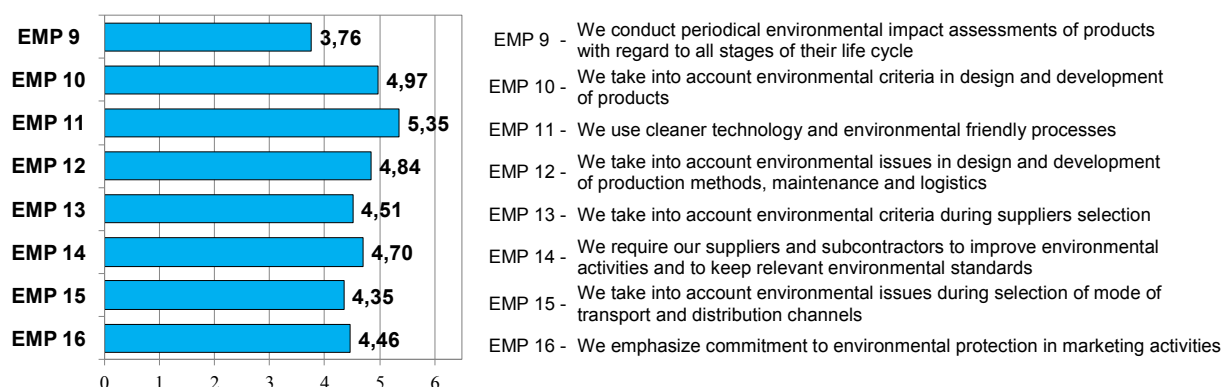
The seven-point Likert-type scales (1 - strongly disagree/much worse/not at all; 7 - strongly agree/much better/very high) were used in the questionnaire.

## 4. RESULTS AND DISCUSSION

The exploratory factor analysis revealed the two-factor construct for the environmental proactivity. The factors obtained were labeled as the planning and organizational environmental management practices (P&O-EMP) and the operational environmental management practices (O-EMP). The conducted study has shown that in general the planning and organizational environmental management practices were more developed than the operational practices in the surveyed steel and metal companies. The variables describing the development of analyzed environmental management practices are shown in figures 1 and 2.

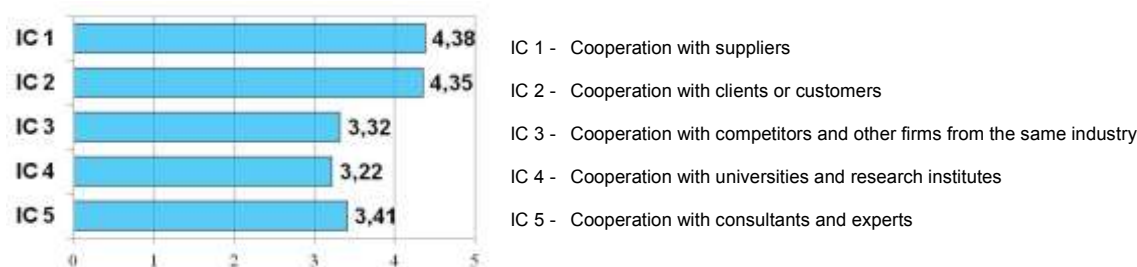


**Fig. 1** Development of planning and organizational environmental management practices in the surveyed companies [own analysis]



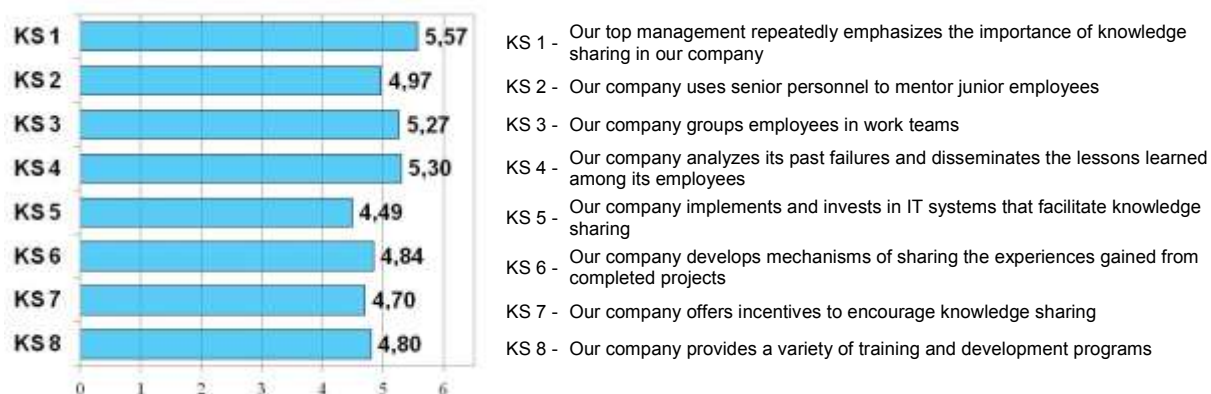
**Fig. 2** Development of operational environmental management practices in the surveyed companies [own analysis]

The variables characterizing the scope of interorganizational cooperation (IC) and the knowledge sharing (KS) intensity within the surveyed companies are shown in figures 3 and 4.



**Fig. 3** Scope of interorganizational cooperation in the surveyed companies [own analysis]

The results of the study have revealed that although knowledge sharing practices are relatively well developed in the surveyed companies, the scope of the interorganizational cooperation is rather poor. It concerned in particular cooperation with universities and research institutes.



**Fig. 4** Intensity of knowledge sharing in the surveyed companies [own analysis]

In the next stage of the analysis carried out within the study, an evaluation of the reliability of the scales of the examined constructs was performed and the relationships occurring between them were explored. The Cronbach's  $\alpha$  values exceeded the critical threshold of 0.7 for all analyzed constructs (they equaled between 0.83 and 0.89 respectively). This confirmed the reliability and internal consistency for each construct. In order to examine the significance and strength of the relevant relationships, Pearson's correlation coefficients were used. The results of this analysis are presented in table 1.

**Table 1** Relationships between proactive environmental management practices, interorganizational cooperation, knowledge sharing and eco-innovation - Pearson's correlation coefficients [own analysis]

Construct	P&O-EMP	O-EMP	IC	KS	EI
P&O-EMP	1				
O-EMP	0.753***	1			
IC	0.407*	0.383*	1		
KS	0.514**	0.566***	0.502**	1	
EI	0.526***	0.582***	0.251	0.312	1

Notes: \*  $p < 0,05$ , \*\*  $p < 0,01$ , \*\*\*  $p < 0,001$

The study results have shown that planning and organizational environmental management practices and operational environmental practices have been significantly related to the level of eco-innovation of the surveyed steel and metal companies operating in Poland. There have been also statistically significant relationships between the engagement in both types of environmental management practices and the scope of interorganizational cooperation and the knowledge sharing intensity. The scope of interorganizational cooperation and the intensity of knowledge sharing are not significantly related to the companies' level of eco-innovation. Nevertheless, the analysis has proved that the more developed interorganizational cooperation and the knowledge sharing, the more advanced proactive environmental management practices are implemented. This means that interorganizational cooperation and the knowledge sharing may indirectly support eco-innovation. The exploration of these indirect effects requires more detailed analysis to be carried out in the subsequent study on a larger surveyed group of companies (applying e.g. the structural equation modeling).

The obtained results proved that the engagement of the steel and metal companies in the implementation of environmental management practices is extremely important for supporting the eco-innovation. On the other hand, the intensity of knowledge sharing within these companies and the scope of their interorganizational cooperation have a considerable importance for the development of environmental practices. It confirms the fact that in order to implement the eco-innovation efficiently it is necessary to design and develop it using mainly the knowledge resources [12]. This process may facilitate the embodiment of eco-innovation in the business models of steel and metal companies [13] and the value creation [14] which can lead to gaining and maintaining the competitive advantage.

The promising area in terms of simultaneous improving competitiveness and reducing the impact on the natural environment is, for example, a new approach to EU research and innovation. The European Commission has proposed an European Innovation Partnership (EIP) on Raw Materials which promotes innovation (eco-innovation) at all stages of steel production, from raw material extraction and production to the efficient processing, recycling and the search for alternative raw materials [15]. Since the eco-innovation may reduce environmental impact and improve business performance it notably contributes to environmental and economic pillars of sustainable development.

## **CONCLUSION**

The considerations presented in this article point out the complexity of relationships between voluntary environmental management practices, the scope of interorganizational cooperation, the intensity of knowledge sharing and the level of eco-innovation in companies. The multifaceted nature of the issues discussed in the article should be the subject of interest of both managers of companies implementing eco-innovations and decision makers developing instruments to support various cooperation forms that facilitate eco-innovation activity.

The study performed proved the importance of the environmental proactivity. It comprises the implementation of the planning and organizational environmental management practices as well as the operational environmental management practices. This must be supported with systematic development of knowledge resources, including the external knowledge acquired from outside of the company. The role of knowledge sharing has been emphasized as not only does it facilitate the exchange and dissemination of knowledge accumulated earlier by the company's employees, but it may also improve absorption of external knowledge acquired within the interorganizational cooperation. Those processes directly foster voluntary environmental management practices implementation which in turn significantly influences the level of eco-innovation. For that reason, it is very important to develop and continuously improve such activities.

It should be pointed out that the study results presented herein have some limitations that must be taken into consideration. Due to the size of the surveyed sample, generalizing of the obtained results for the entire steel and metal industry should be rather cautious. Furthermore, the research focused on the analysis of relationships between selected constructs, which could be influenced by other context variables. For example, the application of the acquired external knowledge in the form of implemented eco-innovations depends on the absorption capacities of the specific entity, which in turn are contingent on the level and idiosyncrasies of the already accumulated knowledge, which was not the subject of the study presented in this article.

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