

QUALITATIVE-ENVIRONMENTAL ACTIONS EXPECTED BY SMEs FROM V4 COUNTRIES TO IMPROVE PRODUCTS

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Abstract: Sustainable development encourages companies to anticipate actions that will help reduce their negative impact on the environment, but will also be beneficial to customers in terms of meeting their expectations. Hence, the purpose was to define the actions that can be expected from SMEs from the V4 countries when improving products and minimizing the negative impact on the natural environment. The research tool was a survey, the presented results of which were obtained from March to September 2023. They included 379 SMEs from the Visegrad Group countries, i.e. Poland, Slovakia, the Czech Republic, and Hungary. The results were analyzed using statistical tests performed in STATISTICA 13.3. For this purpose, the ANOVA test (repeated measurement designs) and the Mann Whitney U test were used to analyze statistically significant differences between the test results. Analyses were performed at the significance level of $\alpha=0.05$. The analysis showed that entrepreneurs from the V4 countries expect relatively different actions from SMEs when improving products and minimizing the negative impact on the natural environment. The results from the analysis may be useful in planning sustainable activities in SMEs from the V4 countries, so that these activities contribute to improving the quality of products and at the same time minimizing the negative environmental impact.

Keywords: Visegrad Group, sustainable development, quality, environmental impact, production engineering

1. INTRODUCTION

Small and medium-sized enterprises (SMEs) are recognized as leading economic development around the world (Zhang, 2010). They constitute the vast majority of all European companies (98%) and collectively are the largest employer in the EU (67%) (Graafland and Smid, 2017). Therefore, SMEs create many jobs, support the creation of

innovations and are the most numerous among other types of organizations (Rahman and Zbrankova, 2019; Kuzior, 2022).

Their significant number means that these enterprises have a significant impact in the area of sustainable development covering the natural environment, society and economy (Pacana and Ulewicz, 2017; Sá et al. 2023). In addition, environmental management is the most widely practiced in SMEs. In some sectors this is a requirement in terms of business opportunities (Burke and Gaughran, 2006). It is important to mention that SMES generate a significant amount of pollution, e.g. in the manufacturing industry, where they have a very large impact on the environment (Agan et al., 2013). SMEs are responsible for approximately 60-70% of industrial pollution worldwide (Graafland and Smid, 2017; Hoogendoorn et al., 2015). Therefore, these companies are looking for effective solutions and innovations in the area of sustainable development in order to achieve competitiveness in the long term (Woo et al., 2014). However, the practices often refer to the activities of large organizations, where SMEs are wrongly interpreted as their miniaturized versions (Hoogendoorn et al., 2015).

At the same time, it is important to pay attention to activities in the area of improving product quality. In general terms, product quality means customer satisfaction, which concerns, for example, their satisfaction with the usability of the product or their knowledge about the product (Al et al., 2021; Krynke, 2022). Product quality refers to the introduction of a standardization process, low error tolerance (defects) and systematic operation (Czerwińska and Pacana, 2019; Pacana and Siwiec, 2021, 2022b; Siwiec and Pacana, 2022). In turn, in the area of innovation quality, it can also distinguish the level of the product or process and the company (Chaitanapat et al., 2022; Ulewicz et al., 2023). SMEs are moving from sequential to parallel product development, which involves shorter improvement cycles, but also reduces costs and achieves high product quality (Žužek et al., 2021). As part of sustainable development, SMEs are increasingly taking actions to improve products to simultaneously ensure the expected quality of products and take care of the natural environment, as, e.g., presented by the authors of studies (Albloushi et al., 2023; Nartey and van der Poll, 2021; Pacana and Siwiec, 2022a; Siwiec and Pacana, 2021a; Siwiec and Pacana, 2021b). These issues were examined in SMEs from the Visegrad Group (V4) countries, i.e. Poland, Slovakia, the Czech Republic and Hungary (Bednárová and Liberko, 2008; Ključnikov et al., 2022).

The aim of the article was to determine the activities that can be expected from SMEs from the V4 countries when improving products and minimizing the negative impact on the natural environment. The research method and results are presented in the following parts of the study.

2. METHOD OF RESEARCH

The research concerned the qualitative-environmental aspects of product improvement and was carried out as part of an international project „Qualitative-environmental aspects of products improvement” (IVF 22230264). To obtain data, a survey was used, which was conducted among entrepreneurs of small and medium-sized enterprises (SMEs) belonging to the electromechanical industry (machinery processing industry). These were SMEs from the Visegrad Group countries (Poland, Czech Republic, Slovakia and Hungary).

The analyzed survey results were obtained from March to September 2023. They included 379 SMEs from the Visegrad Group countries, i.e.: Czech Republic (10%), Poland (41%),

Hungary (25%), Slovakia (24%). Most of the surveyed SMEs from the V4 countries were city from 150 000 to 500 000 residents (30%), and city from 20 000 to 150 000 residents (26%). The vast majority of these were international companies (46%).

The survey was carried out according to a guided survey and using MS FORMS, as presented in the literature on the subject, i.e. (QuEn - Research Questionnaire For Enterprise, 2023). The survey questions were created after preliminary research, e.g.: (Hajduk-Stelmachowicz et al., 2022; Siwec et al., 2022; Siwec et al., 2023) and according to the literature on the subject, e.g. (Benito-Hernández et al., 2023; Bryła, 2020; Hudakova et al., 2021; Saqib et al., 2023; Wsocki, 2018).

The article analyzes the results obtained for one of the questions of the research survey. The question concerned the activities that can be expected from SMEs when improving products and minimizing the negative impact on the natural environment. Several issues were selected for analysis, i.e.:

1. The use of renewable energy sources in the production process.
2. The use of pro-environmental sources to generate energy, heating, cooling.
3. The use of energy-saving lighting.
4. Thermo modernization.
5. Implementation of the closed loop (closing the cycle in the production).
6. Implementation and functioning of a quality management system.
7. Implementation and functioning of an environmental management system.
8. Reducing the use of materials and raw materials.

Entrepreneurs responded on a Likert scale: 1 - this cannot be expected, 2 - this can be expected to a small extent, 3 - this can be expected, 4 - this can be expected to a significant extent, 5 - this can definitely be expected.

W ramach badań przyjęto następującą hipotezę:

H₁: Entrepreneurs from the V4 countries expect similar actions from SMEs when improving products and minimizing the negative impact on the natural environment.

The survey results were analyzed using statistical tests performed in the STATISTICA 13.3 program. For this purpose, the ANOVA test (repeated measurement designs) and the Mann Whitney U test were used to analyze statistically significant differences between the test results. Analyses were performed at the significance level of $\alpha=0.05$.

3. RESULTS AND DISCUSSION

The analysis of the research results began with the analysis of the average ratings given to quality and environmental activities. The average values of the responses of SMEs entrepreneurs from the V4 countries (Poland, Czech Republic, Hungary, Slovakia) were separately verified. The analysis was performed using the ANOVA test at a significance level of $\alpha=0.05$ (Ključnikov et al., 2022). The results are shown in Fig. 1.

In order to standardize the analysis, the average rating values were reduced to two numerical ranges. They were determined according to the maximum average grade value (4.26) and the minimum average grade value (2.81).

Then, the range of values (4.26, 3.54) meant that SMEs from a given country significantly expect these activities. However, the range of values (3.54, 2.81) meant that SMEs from a given country had little expectation of these activities. Due to the adopted assumptions, it was observed that the analyzed activities are most expected by SMEs from Poland, i.e. statements 2-7. Relatively most of the statements were also indicated by entrepreneurs from Hungary, i.e. 1-4, 8.

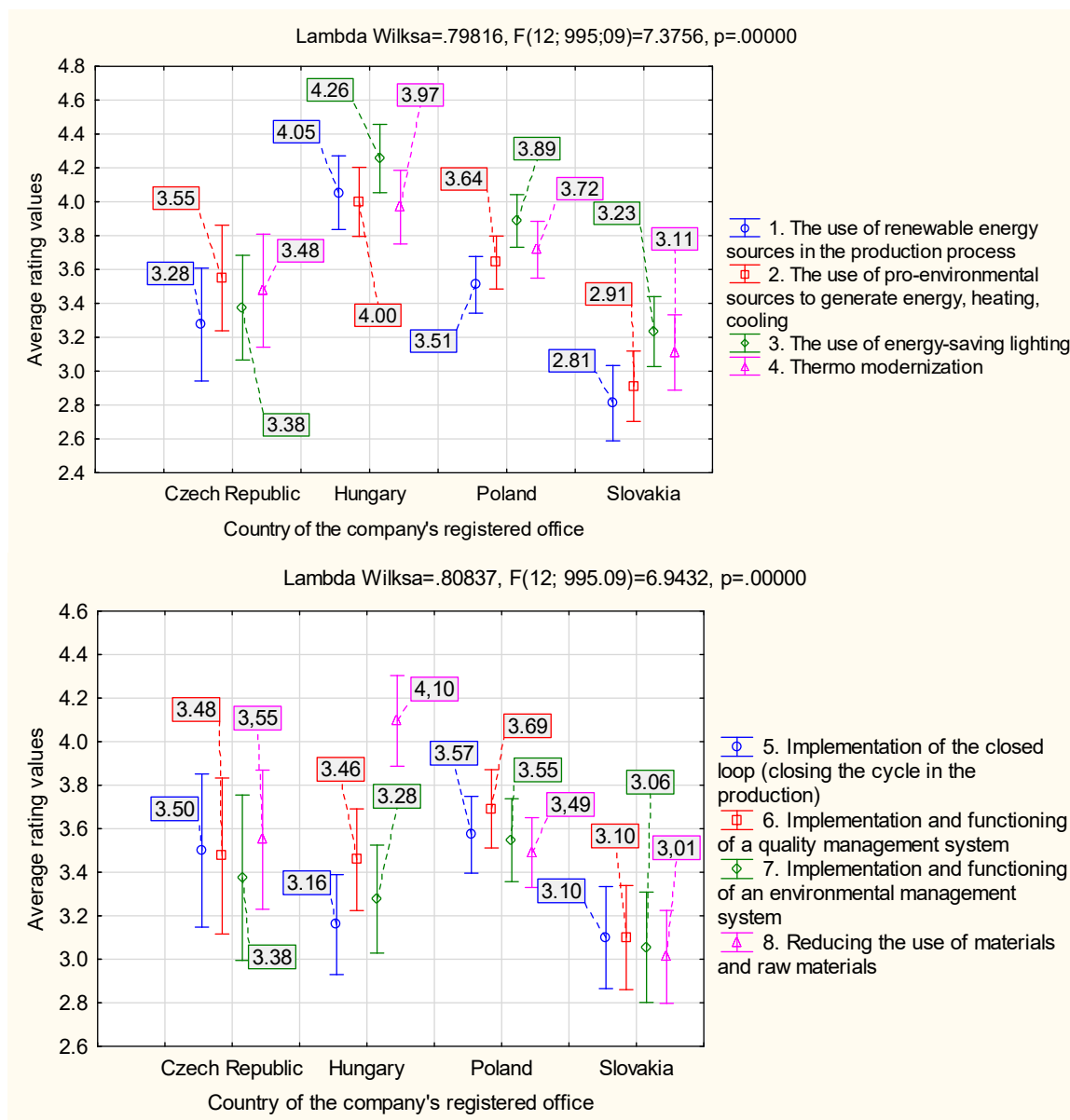


Fig. 1. Average values of assessments of SME entrepreneurs by V4 country for expected qualitative-environmental activities.

Source: own study

Entrepreneurs from the Czech Republic and Slovakia least expect changes in SMEs, while entrepreneurs from the Czech Republic only indicated that they expect actions marked as 2 and 8. In turn, entrepreneurs from Slovakia have little expectation that the discussed activities will take place.

Therefore, it was shown that the greatest number of changes in activities in the process of product improvement and minimization of the negative impact on the natural environment are predicted by SME entrepreneurs from Poland, slightly less from Hungary. However, SMEs entrepreneurs from the Czech Republic and Slovakia do not expect any changes in their activities. Hence, it was concluded that the approach of SMEs from Poland and Hungary is to a greater extent (than SMEs from the Czech Republic and Slovakia) focused on taking actions to improve the quality of products while minimizing the negative impact on the environment. Analyzing individual statements, it was shown that the majority of SMEs from the V4 countries assessed the following statements most

favorably: 3 - the use of energy-saving lighting, 6 – implementation and functioning of a quality management system, and 8 – reducing the use of materials and raw materials. However, the majority of SMEs from the V4 countries assessed the following statements the least favorably: 1- the use of renewable Energy sources in the production process, and 7 – implementation and functioning of an environmental management system.

Then, it was analyzed whether there are statistically significant differences in the responses of SME entrepreneurs from the V4 countries. The same issue was analyzed using the Mann Whitney U test to analyze statistically significant differences between study results. Analyzes were performed at the significance level of $\alpha=0.05$. Pairwise comparisons were made between the responses from the V4 countries, as shown in Table 1.

Table 1

Results of the Mann-Whitney U test for expected qualitative-environmental activities of SMEs from the V4 countries

Statements	PL-SK	PL - HU	PL - CZ	SK - HU	SK - CZ	HU - CZ
1. The use of renewable energy sources in the production process	0.000	0.001	0.217	0.000	0.021	0.000
2. The use of pro-environmental sources to generate energy, heating, cooling	0.000	0.011	0.478	0.000	0.004	0.010
3. The use of energy-saving lighting	0.000	0.004	0.002	0.000	0.595	0.000
4. Thermo modernization	0.000	0.210	0.151	0.000	0.091	0.011
5. Implementation of the closed loop (closing the cycle in the production)	0.001	0.033	0.434	0.505	0.054	0.363
6. Implementation and functioning of a quality management system	0.000	0.327	0.264	0.018	0.070	0.747
7. Implementation and functioning of an environmental management system	0.003	0.452	0.267	0.143	0.204	0.658
8. Reducing the use of materials and raw materials	0.001	0.000	0.857	0.000	0.011	0.003

where: PL – Poland, SK – Slovakia, HU – Hungary, CZ – Czech Republic.

One statistically significant difference ($p < \alpha$) was observed in the responses of SMEs from Poland and the Czech Republic. As part of activities to improve products and minimize the negative impact on the environment, entrepreneurs from these countries had a different opinion that use of energy-saving lighting. Disagreement in responses occurred in the case of SMEs from Poland and Slovakia. Statistically significant differences occurred in the responses from SMEs from Poland and Hungary, Slovakia and Hungary, and Hungary and the Czech Republic. They concerned statements, e.g.: 1, 2, 3, 8. In these countries, it was observed that statements, e.g.: 5, 6, 7, were assessed similarly. It was concluded that entrepreneurs from the V4 countries defined the expected actions from SMEs in relatively different ways when improving products and minimizing the negative impact on the natural environment. Hence, as part of the hypothesis, it was found that entrepreneurs from the V4 countries expect relatively different actions from SMEs when improving products and minimizing the negative impact on the natural environment.

4. CONCLUSION

Enterprises strive for continuous development. As part of sustainable development, they should take actions that improve the quality of products and reduce the negative impact on the environment. However, it is still problematic in developing countries, such as the Visegrad Group countries (Poland, Slovakia, Czech Republic, Hungary). Additionally, the negative environmental impact is particularly visible in the activities of small and medium-sized enterprises (SMEs), which constitute the largest number of all types of organizations.

Therefore, the aim was to define the actions that can be expected from SMEs from the V4 countries when improving products and minimizing the negative impact on the natural environment. The analysis of the results was based on 379 SMEs from the Visegrad Group (V4) countries. Data were obtained through a guided survey. The presented results were obtained from March to September 2023. The analyzes of the survey results were carried out using statistical tests in the STATISTICA 13.3 program.

The analysis of the average values of the ratings from the respondents' answers was carried out according to the ANOVA test (repeated measurement designs). Then, an analysis of statistically significant differences in the respondents' answers was performed. The Mann Whitney U test was used for this purpose. Statistical analyzes were performed at the significance level of $\alpha=0.05$.

The results of the analysis showed that entrepreneurs from the V4 countries expect relatively different actions from SMEs when improving products and minimizing the negative impact on the natural environment. Based on them, SMEs from individual V4 countries can select more appropriate actions to improve products in a consistent and competitive manner while protecting the environment.

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