

PRO-ENVIRONMENTAL IMPROVING PRODUCTS QUALITY IN SMES FROM THE VISEGRAD GROUP COUNTRIES (V4)

Andrzej PACANA^{1*}, Dominika SIWIEC², László MOLNÁR³

¹ Rzeszow University of Technology, Faculty of Mechanical Engineering and Aeronautics; app@prz.edu.pl,
ORCID: 0000-0003-1121-6352

² Rzeszow University of Technology, Faculty of Mechanical Engineering and Aeronautics; d.siwiec@prz.edu.pl,
ORCID: 0000-0002-6663-6621

³ University of Miskolc, Institute of Marketing and Tourism, Hungary; laszlo.molnar@uni-miskolc.hu,
ORCID: 0000-0003-1902-6553

* Correspondence author

Purpose: The aim of the article was to analyse the pro-environmental approach to products improvement by SMEs from the Visegrad Group (V4) countries.

Design/methodology/approach: The research was survey. The survey research was carried out in traditional (paper) and electronic form (MS FORMS). The survey was directed at electronic industries (machinery processing) belonging to small and medium enterprises (SMEs) from V4 countries. The results presented in the article refer to sample size of 379 SMEs, obtained between March and September 2023. Results were analysed in statistical way, i.e.: ANOVA test and Mann Whitney U test by significance level equal to $\alpha = 0.05$.

Findings: SMEs in V4 countries have a similar approach to pro-environmental improving of products. It was shown that pro-environmental activities of SMEs from the V4 countries, the lowest consistency of assessments occurs in the following countries: Poland and Slovakia, Poland and Hungary, Slovakia and Hungary.

Practical implications: The research results may contribute to more effective and coherent development activities of SMEs in the V4 countries as part of their sustainable development, and also to take appropriate actions that will be supporting qualitative and environmental products.

Social implications: The results can help SME entrepreneurs improve their products to protect the natural environment. In addition, they can be the basis for the development of SMEs from the V4 countries and their unidirectional development, which includes not only improving the quality of products, but also caring for the environment.

Originality/value: The originality of the research is the determination of the current pro-environmental approach to product improvement in SMEs in the V4 countries. The novelty is the provision of current data on the importance of improving pro-environmental products in SMEs from the V4 countries and their comparison between companies in the electrical machinery industry.

Keywords: Visegrad Group (V4), SMEs, environment, quality, product improvement, production engineering.

Category of the paper: Research paper.

1. Introduction

Small and medium-sized enterprises (SMEs) play an important role in most world economies, and their number is the largest, e.g. in the European Union, SMEs constitute up to 99% of all enterprises (Masocha, 2018). Therefore, SMEs determine many jobs and generate the economic level of business activity (Lu et al., 2022). At the same time, the importance of SMEs translates into their significant impact on the natural environment (Hoogendoorn et al., 2015). The environmental impact refers to the positive or negative impact of a company's (and other interested parties') activities on the natural environment (Civelek et al., 2021; Gajdzik et al., 2023; Ingaldi, Ulewicz, 2019; Pacana, Siwiec, 2022a).

As mentioned, the activities of companies have a very important impact on the state of the environment (Gajdzik, Wolniak, 2022; Pacana, Siwiec, 2022b, 2021). Inappropriate use of resources makes it necessary to increase the level of environmental responsibility (Golovko, Valentini, 2011; Ostasz et al., 2022; Siwiec, Pacana, 2021). This is a condition for SMEs (Hatmanu et al., 2019), which in particular must take care of competitiveness on the market (Pacheco Blanco et al., 2014). The mentioned environmental responsibility is caused by the increase in environmental problems that also affect society. This is also due to increased customer awareness and stricter environmental protection regulations. For this reason, enterprises are motivated to take into account the impact of their activities and products on the environment (Talbot, 2005) by searching for strategies and measures to reduce this negative impact. The increased concern and availability of natural resources becomes crucial for future generations. For this reason, decisions made in the industrial sector are focused on sustainable development and eco-efficiency. They concern, for example, waste reduction and increasingly greater economic benefits (Gajdzik et al., 2018; Siwiec et al., 2019; Siwiec, Pacana, 2022; Vásquez et al., 2018). In this area, a literature review was conducted.

As part of pro-environmental improvement in SMES, the authors of the article (Laforet, 2011) studied innovations in SMEs and developed a theoretical framework for them. For this purpose, they conducted interviews with entrepreneurs from various industries. However, the authors of the article (Lu et al., 2022) studied the quality management of SMEs and their impact on the management of supply chain financing. The analyses were based on determining the relationship between quality management and the supply chain, but also determining the role of environmental dynamics. However, the authors (Vásquez et al., 2018), presented a conceptual framework to assess the efficiency of SMEs from an environmental perspective (the so-called ecoefficiency). They concerned sustainable development strategies as part of reducing the negative impact and increasing the profitability of SMEs. Another example is the article (Hatmanu et al., 2019), in which the importance of factors influencing environmental responsibility in SMEs was estimated, where the analyses were carried out for enterprises at different levels of socioeconomic development. In turn, in the article (Hasan,

Rahman, 2023), the authors examined the key factors that support eco-innovation initiatives in SMEs. They analysed the criteria of sustainable development, i.e., economic, environmental, and social. However, the authors of the study (Afum et al., 2021) conducted research in SMEs using a questionnaire. The results of the analysis were concerned with the interactions between lean production, internal ecological practices, innovations, and sustainable production indicators. Another example is an article by (Mittal et al., 2023), which determines the impact of green business on the perception of SMEs' wealth. The results of these analyses showed that elements such as process, measurement, communication, and capacity building have an impact on the assessment of the wealth of SMEs and their ecological approach. The authors of the study (Agusdin et al., 2023) carried out a similar type of research, in which the impact of improving ecological products on the marketing results of SMEs was verified.

It has been shown that pro-environmental activities undertaken by SMEs have been studied. They concerned not only the public awareness, but also products. However, no research has been found that analyses pro-quality product improvement in all Visegrad Group (V4) countries, and additional in small and medium enterprises (SMEs) belonging to the electromechanical industry. This was considered a research gap. Hence, the purpose of the article was to analyse the environmental approach to products improvement by SMEs from the countries of the Visegrad Group. The research carried out during the project co-financed by the Governments of the Czech Republic, Hungary, Poland and Slovakia through Visegrad Grants from the International Visegrad Fund. The fund's mission is to promote ideas for sustainable regional cooperation in Central Europe.

2. Method of research

The research involved qualitative-environmental approaches to the improvement of products and was carried out as part of an international project „Qualitative-environmental aspects of products improvement” (IVF 22230264). The research was carried out in small and medium enterprises (SMEs). These enterprises belonging to the electromechanical industry from Visegrad Group countries (V4), that is, Czech Republic, Hungary, Slovakia and Poland. The research consisted of survey research. In this article has shown only selected results of research, which included period from March to November 2023. In this period, we obtained surveys from 379 SMEs (Figure 1).

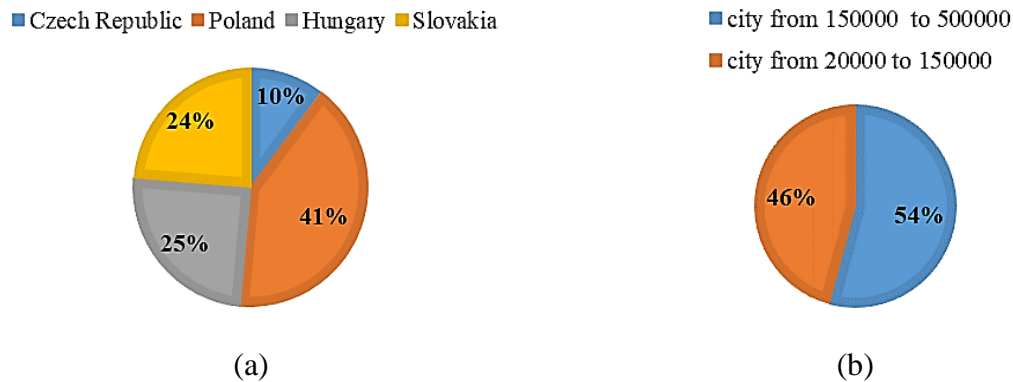


Figure 1. Survey details: (a) sample size of SMEs, (b) number of residents.

Source: Own study.

In addition, many SMEs were international companies (46%). The research survey was conducted in paper and electronic form using MS FORMS. The survey was created based on preliminary research which is presented for example in (Hajduk-Stelmachowicz et al., 2022; Siwiec et al., 2022; Siwiec et al., 2023). Also, the questions included in survey resulted from literature review, i.e.: (Benito-Hernández et al., 2023; Bryła, 2020; Hudakova et al., 2021; Saqib et al., 2023; Wysocki, 2018).

In this article was concentrated on results of research refers to pro-environmental approaches of SMES from V4 countries in products improvement. Therefore, following hypothesis was assumed:

H₁: *Do SME entrepreneurs from the V4 countries have a similar approach to pro-environmental product improvement?*

Research results for these topics were obtained through the following question:

Question: What is your opinion about every statement refers to pro-environmental improving of products? Mark one answer for each statement in scale: 1 – I totally don't agree, 2 – less than once every three years, 3 – once every two to three years, 4 – I mostly agree, 5 – I totally agree.

Statements:

1. Customers attach great importance to the pro-environmental actions of analyzed enterprise.
2. Customers will pay more if the product is pro-ecological.
3. A pro-ecological product is the product that meets the current requirements of customers.
4. Currently, pro-ecological products have also a high level of quality.
5. Wealthy customers usually choose pro-ecological products.
6. Choosing a pro-ecological product can improve a customer's self-esteem.
7. Customers pay attention to the pro-ecological packaging of product.
8. Pro-ecological products are sufficiently promoted.
9. We as a company strives to produce pro-ecological products.

10. The higher price of pro-ecological products significantly discourages customers from buying them.
11. Customers are more likely to buy a pro-ecological product if it has been previously recommended/tested.
12. Customers have a lot of knowledge about the attributes of products that affect their pro-ecological features.
13. Pro-ecological products have higher prices.
14. Customers will pay more for products from enterprises that take real pro-ecological actions.

The results were analyzed by using STATISTICA 13.3. program. It were ANOVA test (repeated measure designs) and Mann Whitney U test. These analysis were at the significance level of $\alpha = 0.05$. The results has shown in the next part of the article.

3. Results

The environmental activities undertaken in SMEs of the V4 countries were analysed. Similarly as before, the ANOVA test (repeated measurement designs) was used. The analyses were performed at the significance level of $\alpha = 0.05$ (Figure 2).

To standardise the analysis, the mean values obtained from the responses were grouped into two groups, that is, statements with high scores for mean values $\langle 2.72; 3.50 \rangle$ and statements with low scores for mean values $\langle 3.50; 4.29 \rangle$. According to the assumptions adopted, it was concluded that SME entrepreneurs from all V4 countries unanimously rated one statement highly: (13) pro-ecological products have higher prices. However, the vast majority of the statements were rated low, that is, 1, 2, 3, 7, 12, 14, according to method of research. The vast majority of positively evaluated statements were made by Hungary's small businesses, that is, 4, 5, 6, 8, 10, 11, 13, according to the research method.

Then it was verified whether there are statistically significant differences in responses on pro-environmental activities among SME entrepreneurs from V4 countries.

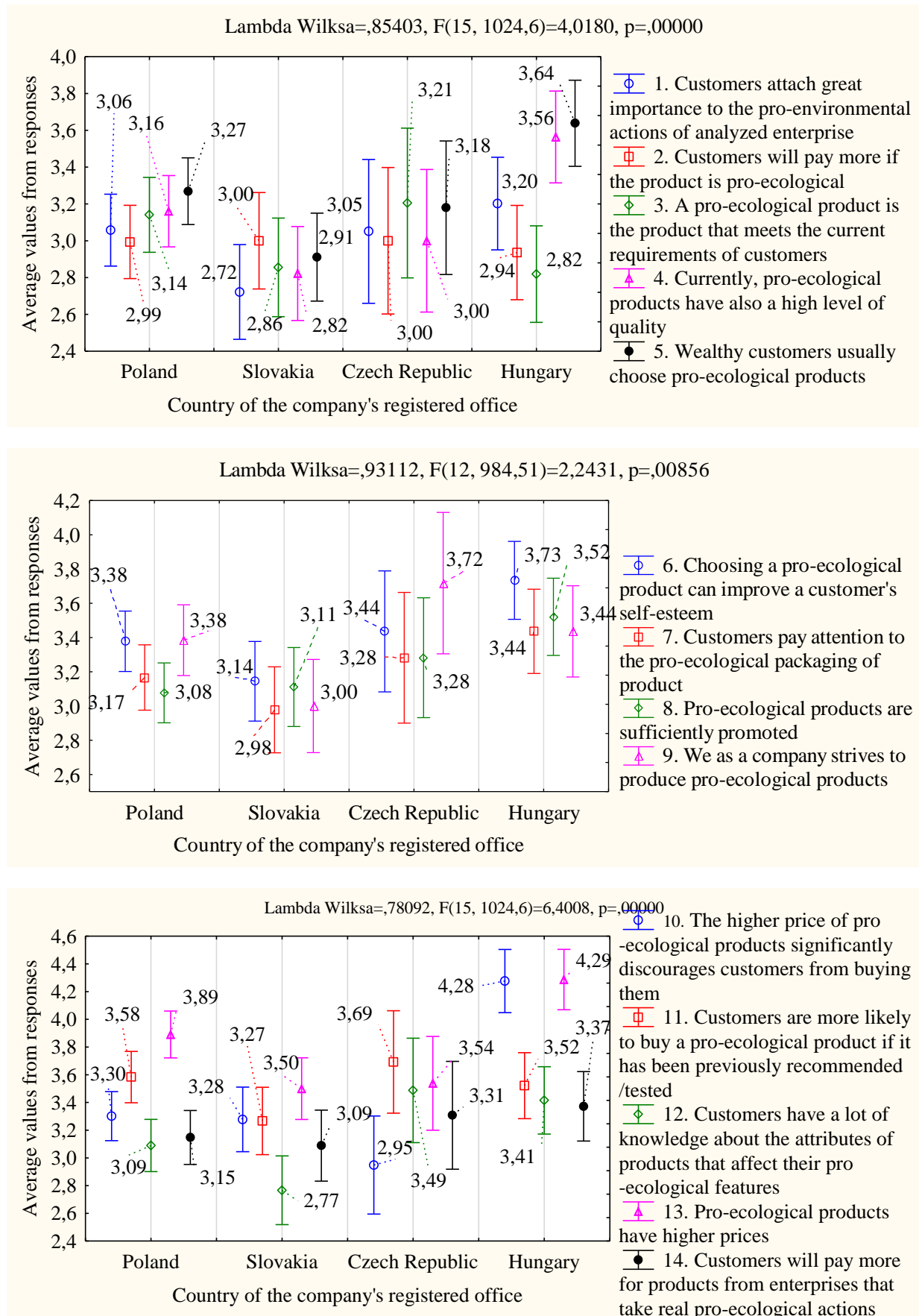


Figure 2. Average values of assessments of SME entrepreneurs by V4 country for pro-environmental activities.

The Mann Whitney U test was carried out to verify whether there are statistically significant differences in responses on pro-environmental activities among SME entrepreneurs from V4 countries. Analyses were performed at the significance level of $\alpha = 0.05$. The result is shown in Table 1.

Table 1

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

Number of actions	Poland-Slovakia	Poland - Hungary	Poland - Czech Republic	Slovakia - Hungary	Slovakia - Czech Republic	Hungary - Czech Republic
1	0.042	0.376	0.935	0.019	0.106	0.554
2	0.998	0.760	0.935	0.756	0.873	0.877
3	0.095	0.083	0.757	0.916	0.128	0.247
4	0.039	0.013	0.469	0.000	0.327	0.007
5	0.025	0.020	0.572	0.000	0.241	0.026
6	0.196	0.038	0.972	0.003	0.311	0.100
7	0.260	0.117	0.621	0.012	0.175	0.585
8	0.840	0.005	0.304	0.016	0.370	0.449
9	0.018	0.542	0.188	0.018	0.002	0.625
10	0.915	0.000	0.088	0.000	0.122	0.000
11	0.044	0.545	0.838	0.163	0.081	0.513
12	0.042	0.030	0.070	0.000	0.001	0.896
13	0.013	0.005	0.056	0.000	0.962	0.000
14	0.781	0.163	0.590	0.145	0.474	0.575

where: 1-14 statements as in method research for pro-environmental actions.

The research shows that the relatively largest statistically significant differences in the answers given occur in the case of Slovakia and Hungary. SME entrepreneurs from these countries have different views on the issues, i.e.: (1) customers attach great importance to the pro-environmental actions of the analysed enterprise ($p < \alpha$, $p = 0.019$), (4) currently, pro-ecological products also have a high level of quality ($p < \alpha$, $p = 0.000$), (5) wealthy customers usually choose pro-ecological products can improve the self-esteem of a customer's self-esteem ($p < \alpha$, $p = 0.000$), and 6, 7, 8, 9, 10, 12, 13, according to method of research.

Slightly less statistically significant differences occurred in the responses of SME entrepreneurs from Poland and Slovakia, as well as Poland and Hungary. In the case of Poland and Slovakia, they were: 1, 4, 5, 9, 11, 12, 13, according to the research method. For Poland and Hungary, statistically significant differences occurred for the following statements: 4, 5, 6, 8, 10, 12, 13, according to method of research. The least statistically significant differences were observed in SMEs from Hungary and the Czech Republic, respectively, that is, 4, 5, 10, 13 and Slovakia and the Czech Republic, that is, 9, 12, according to the research method. An important observation is the lack of statistically significant differences in the claims evaluations of the analysed claims of SME entrepreneurs from Poland and the Czech Republic. Hypothesis (H_1) concluded that SME entrepreneurs in the V4 countries have a similar approach to improving products in an environmentally friendly way.

4. Discussion and conclusion

Enterprises strive to consistently implement activities that will support their effective development. These activities should correspond to the concept of sustainable development. However, this remains a challenge for SMEs from the V4 countries. Therefore, research was carried out in the area of the environmental approach of SMEs from countries in the Visegrad Group to product improvement (Civelek et al., 2021; Domaracká et al., 2018; Siwiec et al., 2023a).

According to the results of the analysis of pro-environmental activities of SMEs from the V4 countries, it was shown that:

- the complete consistency of the assessments of SME entrepreneurs occurs in Poland and Slovakia,
- the greatest consistency in the assessments of SME entrepreneurs occurs in the countries of Slovakia and the Czech Republic, as well as Hungary and the Czech Republic,
- the lowest consistency of assessments of SME entrepreneurs occurs in the countries: Poland and Slovakia, Poland and Hungary, Slovakia and Hungary,
- SME entrepreneurs from Poland, Slovakia, and Hungary jointly agree most with the statements that choosing a pro-ecological product can improve a customer's self-esteem, and pro-ecological products have higher prices,
- SME entrepreneurs from the Czech Republic most agree with statements such as: a pro-ecological product is the product that meets the current requirements of customers; or we as a company strive to produce pro-ecological products,
- SME entrepreneurs from the V4 countries indicated in different ways the statements with which they agreed the least.

The pro-environmental approach to improving products in SMEs in the V4 countries is similar in most aspects. It has been shown that the lowest consistency of assessments occurs in the following countries. Poland and Slovakia, Poland and Hungary, Slovakia and Hungary.

The originality of the research is the determination of the current pro-environmental approach to product improvement in SMEs in the V4 countries. The novelty is the provision of current data on the importance of improving pro-environmental products in SMEs from the V4 countries and their comparison between companies in the electrical machinery industry.

Future research will focus on comparing pro-quality and pro-environmental approaches to product improvement in SMEs from the Visegrad Group countries with enterprises in western Europe or other regions of the world.

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