

PRO-ECOLOGICAL PRACTICES IN SMES FROM THE ELECTROMECHANICAL INDUSTRY OF VISEGRAD GROUP COUNTRIES

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Abstract: Sustainable development causes companies to try to meet the requirements placed on them in order to maintain their competitive position on the market. This applies not only to improving product quality, but also to ensuring environmentally friendly products. The key players in the development of the economy are small and medium-sized enterprises (SMEs), which are also the driving force of development in the Visegrad Group countries (Poland, Slovakia, Hungary and the Czech Republic). However, there is a lack of research in the area of pro-environmental activities undertaken in SMEs in these countries. Therefore, the aim of the article was to analyze the possibility of implementing pro-ecological practices in enterprises belonging to SMEs in the electrical machinery industry from the V4 countries. The research method was a survey in which 383 SME entrepreneurs were surveyed (in the period from February to October 2023). The research was conducted among SME entrepreneurs from the electromechanical industry from the Visegrad Group countries. The survey results were analyzed using the Kruskal-Wallis ANOVA statistical test with a significance level of $\alpha = 0.05$. The results showed, e.g., that SMEs from the V4 countries: are interested in environmental problems and have awareness and up-to-date knowledge of the company's impact on the environment. They undertake pro-ecological practices mainly due to applicable laws (penalties), the need to care for the well-being of future generations and awareness of pollution and the state of the environment. The research results determine the current state of possibilities

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of implementing good pro-ecological practices in SMEs from the V4 countries. can be Therefore, they can be useful as part of the sustainable development of their activities.

Keywords: sustainable development, Visegrad Group, V4, SMEs, pro-ecological practices, electromechanical industry

PROEKOLOGICZNE PRAKTYKI W MŚP Z BRANŻY ELEKTROMASZYNOWEJ KRAJÓW GRUPY WYSZEHRADZKIEJ

Streszczenie: Zrównoważony rozwój powoduje, że przedsiębiorstwa starają się sprostać stawianym im wymaganiom, tak aby utrzymać swą konkurencyjną pozycję na rynku. Dotyczy to nie tylko doskonalenia jakości produktów, ale także zapewnienia produktów przyjaznych środowisku. Kluczowymi w rozwoju gospodarki są małe i średnie przedsiębiorstwa (MŚP), które jednocześnie stanowią siłę napędową rozwoju w krajach Grupy Wyszehradzkiej (Polski, Słowacji, Węgier i Czech). Jednak, brakuje badań w obszarze działań prośrodowiskowych podejmowanych w tych krajach w MŚP. Dlatego, celem artykułu było przeanalizowanie możliwości wdrażania praktyk proekologicznych w przedsiębiorstwach należących do MŚP z branży elektromaszynowej z krajów Grupy Wyszehradzkiej (V4). Metodę badań stanowiła ankieta za pośrednictwem której przebadano 383 przedsiębiorców MŚP (w okresie od lutego do października 2023). Badania przeprowadzono wśród przedsiębiorców z MŚP z branży elektromaszynowej (przemysł przetwórstwa maszynowego) z krajów Grupy Wyszehradzkiej. Wyniki ankietowe poddano analizie wykorzystując test statystyczny ANOVA Kruskala-Wallisa z poziomem istotności $\alpha = 0.05$. Wyniki wykazały między innymi, że MŚP z krajów V4: interesują się problemami środowiskowymi oraz mają świadomość i aktualną wiedzę na temat wpływu firmy na środowisko. Podejmują one praktyki pro-ekologicznych głównie ze względu na obowiązujące prawa (kary), potrzeba dbania o dobro przyszłych pokoleń oraz świadomość zanieczyszczeń i stanu środowiska. Wyniki z badań określają aktualny stan możliwości wdrażania dobrych praktyk proekologicznych w MŚP z krajów V4. mogą być Dlatego, mogą być przydatne w ramach zrównoważonego rozwoju ich działalności.

Słowa kluczowe: zrównoważony rozwój, Grupa Wyszehradzka, V4, MŚP, praktyki proekologiczne, przemysł elektromaszynowy

1. Introduction

Small and medium-sized enterprises (SMEs) play an important role in the national economies of the European Union (EU) Member States (Bednárová and Liberko, 2008; Ključnikov et al., 2023; Pacana and Siwiec, 2022; Siwiec and Pacana, 2022). The traditional statement that large enterprises are key economic participants has been questioned for a long

time, mainly because the role of SMEs in the current business environment is increasingly better researched and understood (Masocha, 2018). Additionally, SMEs in EU countries generate many jobs (about two-thirds of all jobs) and are responsible for more than half of the gross domestic product (Amaeshi et al., 2016). Due to the fact that SMEs constitute 99% of all enterprises from EU countries, their activities have a significant impact on the environment (Hoogendoorn et al., 2015).

However, as the authors of the studies mentioned (Masocha, 2018; Musa and Chinniah, 2016; Stubblefield Loucks et al., 2010), SMEs do not pay particular attention to the problem of excessive environmental impact of their activities. This is due, for example, to the lack of appropriate financial resources and qualified personnel to carry out such analyses. According to study (Masocha and Fatoki, 2018), SME entrepreneurs often believe that the negative environmental impact of their enterprises is much smaller compared to large enterprises. This proves, among other things, the low awareness of these enterprises, not only individually, but often also collectively. Nevertheless, the challenges of sustainable development, including regulatory pressures from stakeholders, other organizations and other interested parties, are causing SMEs to pay greater attention to the environmental impact of their activities. This is manifested by SMEs striving to practice the so-called green production, as well as improving the company's reputation in terms of environmental activities (Szennay et al., 2021).

Therefore, a review of the literature on the pro-ecological practices undertaken by SMEs was conducted. For example, in the article (Majid et al., 2023) the activities of SMEs in the field of resource efficiency and their impact on costs, investments and product expansion were examined. It was shown that there is a lack of information on the impact of pro-ecological activities on the company's results. Authors of the article (Müller and Voigt, 2018), analyzed three dimensions of sustainable development (ecological, economic and social). The analyzes concerned SMEs, which showed that these indicators may differ depending on the country. In turn, the authors of the study (Gunawan et al., 2022) analyzed institutional barriers and factors improving the implementation of sustainable development-oriented practices. It has been shown that ecological, technological, socio-cultural and political factors can significantly facilitate the achievement of sustainable development goals. Another example is an article (Kraus et al., 2017), in which the authors looked for causal patterns explaining the success of sustainable entrepreneurs, where the measure of analysis was social performance. However, the authors of the article (Tounés et al., 2019) analyzed the factors preceding environmentally friendly intentions among SME managers. The results of the analysis showed that the reasoned action approach has a beneficial effect in predicting the environmentally friendly intentions of managers of these enterprises. A similar example is the article (Lynch and Ferasso, 2023), in which the analyzes concerned the impact of the founder of an enterprise from the SMEs group

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on the company's values in terms of sustainable development, i.e. social, environmental and economic. In turn, the authors of the study (Pechancová et al., 2019) analyzed the practices and behaviors of SMEs in the area of environmental management in the industrial sector. It has been shown that an important feature of pro-ecological business activities is the ownership structure, where foreign ownership has a positive impact on the implementation of the environmental management system.

Based on the literature review, it was shown that SMEs undertake pro-environmental activities. Mainly, they try to meet the challenges of sustainable development. However, no research has been found on pro-ecological practices in SMEs from the Visegrad Group countries (Poland, Slovakia, Hungary and the Czech Republic). The Visegrad Group (V4) is a form of cooperation between the countries of the so-called New Europe. These countries have a similar development direction, including location and history. Their common elements are similar economic development, geopolitical ideas, and efforts to ensure energy security. The Visegrad Group countries play a very important role in the European economic system (Ivanová and Masárová, 2018; Oláh et al., 2019; Sulich and Sołducho-Pelc, 2021).

Therefore, the aim of the article was to analyze the possibility of implementing pro-ecological practices in enterprises belonging to SMEs in the electrical machinery industry from the Visegrad Group (V4) countries.

This study presents some of the results of the project “Qualitative-environmental aspects of products improvement”. The research summarizes the current approach of companies and their customers to environmental product quality management, based on the responses of the companies surveyed in the electromechanical industry in V4 countries. The main research question of the presented questionnaire survey: how to promote the current potential for the use of good environmental practices by SMEs in the electromechanical industry in the V4 countries.

2. Method of research

The aim of the Qualitative-environmental aspects of products improvement project is to compare the current approach of companies in the electromechanical industry in the V4 countries (Poland, Slovakia, Czech Republic, Hungary) with the approach of their customers and potential customers in the field of environmental product quality management. The target group and stakeholders of the project are SMEs in the electromechanical industry (industrial manufacturing) of the consortium members (Poland, Slovakia, Czech Republic, Hungary), where the surveys are carried out. Respondents to the surveys in these companies are mainly

concerned with the quality of products design and improvement of the products, also from an environmental point of view. This study presents the results of the question of potential for the use of good environmental practices by SMEs in the electromechanical industry of V4 manufacturing companies. The results of the research will help determine the current level of activities in SMEs from the electromechanical industry in the V4 countries in the field of pro-ecological product quality management and meeting customer expectations.

The research was conducted in the form of surveys. The survey was conducted directly (paper survey) and electronically (MS FORMS). Paper surveys were entered into the electronic database independently. The research was conducted among enterprises belonging to the electromechanical industry (machine processing industry) from the Visegrad Group countries (Poland, Czech Republic, Slovakia and Hungary). The survey was distributed via e-mail and in direct contact with the respondent. Following the distribution of the questionnaires, the main challenge was to find and motivate respondents who were able to answer the questions on the survey areas in the company on their own, which in some cases also meant visiting the contacts/representatives in person to encourage them to fill in the questionnaire at the company's premises. The selection of respondents was based on the following categories: SMEs, industrial processing, electrical machinery industry, geographical location V4 (Poland, Slovakia, Hungary, Czech Republic). The respondents were entrepreneurs from SMEs. The respondents were selected after reviewing enterprises located in the Visegrad Group countries and using the publicly available "Colist" database. It was assumed that when a company does not produce new products, it significantly undertakes activities to improve existing products. According to the verification carried out, it was concluded that the return rate of the surveys was 10%. Additionally, there were no missing data reported in the surveys. The original target for the questionnaire on companies was a minimum of 85 responses per country, which was exceeded by nearly 13%, with a total of 383 questionnaires completed. The credibility of the survey responses was ensured by directing them to representatives of the top management staff. The research sample was estimated according to the method presented in the literature on the subject (Siwiec and Pacana, 2021). According to the results of the method, it was shown that the sample is sufficient for testing and formulating preliminary conclusions.

The article presents the results of analyzes carried out on the basis of selected survey questions that were developed according to preliminary research, e.g. (Hajduk-Stelmachowicz et al., 2022; Siwiec et al., 2022; Siwiec et al., 2023) and based on a review of the literature on the subject, e.g. (Benito-Hernández et al., 2023; Bryła, 2020; Hudakova et al., 2021; Saqib et al., 2023; Wysocki, 2018). Survey questions were also created as part of the above-mentioned preliminary (pilot) research, i.e. (Hajduk-Stelmachowicz et al., 2022; Siwiec et al., 2022; Siwiec et al., 2023). The method of answering the survey questions was for the vast majority

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of questions on a five-point Likert scale. This scale was used due to its simple form and popularity in research involving customer respondents (Sullivan and Artino, 2013). The developed study is presented in the literature on the subject, i.e. ("QuEn - Research Questionnaire For Enterprise," 2023). The presented and analyzed research results related to the following research question:

To what extent do you agree with the statements regarding the enterprise's activities?

- We are not interested in environmental problems;
- We are aware and have up-to-date knowledge of the impact of the enterprise on the environment (including the impact of the industry in which we operate);
- We take actions referring to the impact of our activities on the environment:
 - due to applicable law (penalties);
 - due to market pressure (expectations of customers, investors, etc.);
 - in case of realization of the development and/or pro-ecological strategy;
 - we have awareness of pollution and exploitation of the environmental;
 - we care about well-being of the future generations;
 - we do not take actions;
- Pro-environmental activities in our industry are important for:
 - Customers;
 - Suppliers;
 - banks/credit unions;
 - insurance companies;
 - government fiscal institutions (e.g. tax offices);
 - local government units (public/local administration).

Answers to the given issues were given on a Likert scale, i.e.: 1 – I don't agree at all, 2 – I partly agree, 3 – I agree, 4 – I mostly agree, 5 – I totally agree. The research verified the following hypotheses:

- Are SMEs from the V4 countries similarly interested in environmental problems?
- Are SMEs from the V4 countries aware of and have up-to-date knowledge of the company's impact on the environment (including the impact of the industry in which we operate).
- Do SMEs from the V4 countries take similar actions related to the impact of their activities on the environment?
- Are the pro-ecological activities of SMEs from the V4 countries important for a similar group of recipients/stakeholders?

The test results were analyzed using the Kruskal Wallis ANOVA statistical test. The choice of this test resulted from its use to compare at least three groups with respect to a quantitative variable. In this case, the studied groups were the V4 countries (Poland, Slovakia, the Czech Republic and Hungary), which, as mentioned earlier, were analyzed in terms of a quantitative variable. Hence, the assumption about the size of verified groups and the type of variable was met. In addition, the ANOVA test can be used when the groups being compared are independent of each other (Kim, 2022). The results of the analysis concern the value of the median rating. The Kruskal Wallis ANOVA test was performed in the STATISTICA 13.3 computer program.

3. Results

The results refers of the possibility of implementing pro-ecological practices in enterprises belonging to SMEs in the electrical machinery industry from the Visegrad Group (V4) countries. The composition and main characteristics of the respondent sample are presented in Table 1.

Table 1.
Characteristics of the surveyed group of respondents

Country	N	%	Enterprise type	N	%
Czech Republic	40	11%	micro	49	13%
Hungary	94	24%	small	110	29%
Poland	159	42%	medium	129	33%
Slovakia	90	23%	large	95	25%
Company headquarters	N	%	Range of activity	N	%
rural area	51	13%	local	70	18%
city to 20 000 residents	82	22%	regional	60	16%
city from 20 000 to 150 000	100	26%	national	75	20%
city from 150 000 to 500 000	118	31%	international	178	46%
city above of 500 000 residents	32	8%			
Implemented ISO 9001:2015 system	N	%	Implemented ISO 14001:2015 system or EMAS system	N	%
yes	199	52%	yes	139	36%
no	80	21%	no	134	35%
during implementation	34	9%	during implementation	32	9%
I don't know	70	18%	I don't know	78	20%

Source: own calculation

Of the companies surveyed, 42% were Polish, 23-24% Slovak and Hungarian and 11% Czech. Medium-sized companies are the most represented (33%), closely followed by small

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and large companies (29% and 25% respectively). International companies are the most significant in the sample.

Firstly, it was analyzed that SMEs from the V4 countries similarly interested in environmental problems. In this aim, the entrepreneurs assessed the statement "We are not interested in environmental problems". The research shows that the majority of surveyed entrepreneurs strongly disagree with the statement that 'We are not interested in environmental problems.' (37%), while every third partially disagrees with it. Only 5% believe that they do not contribute to environmental problems. The results are presented in Figure 1.

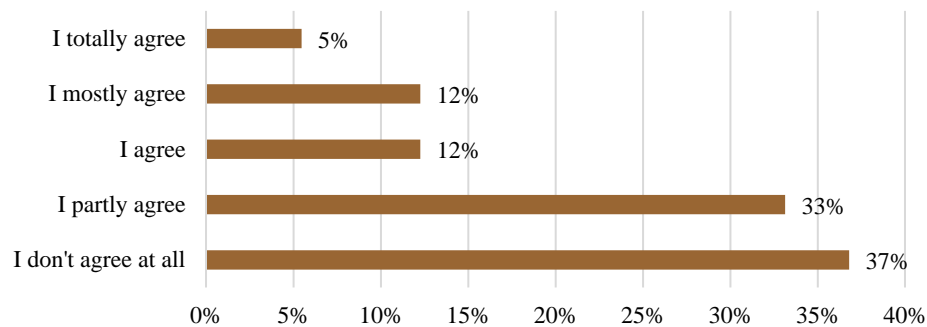


Figure 1. Statement – 'We are not interested in environmental problems'.

Source: own study.

Then, it was checked whether there is a statistically significant difference in this statement between respondents from individual V4 countries. From the Kruskal Wallis ANOVA test, it can be concluded that $p < \alpha$ ($p = 0.0035$), and therefore the differences in the assessment of interest in environmental problems by the respondents' country of origin are statistically significant. The differences are shown in Figure 2.

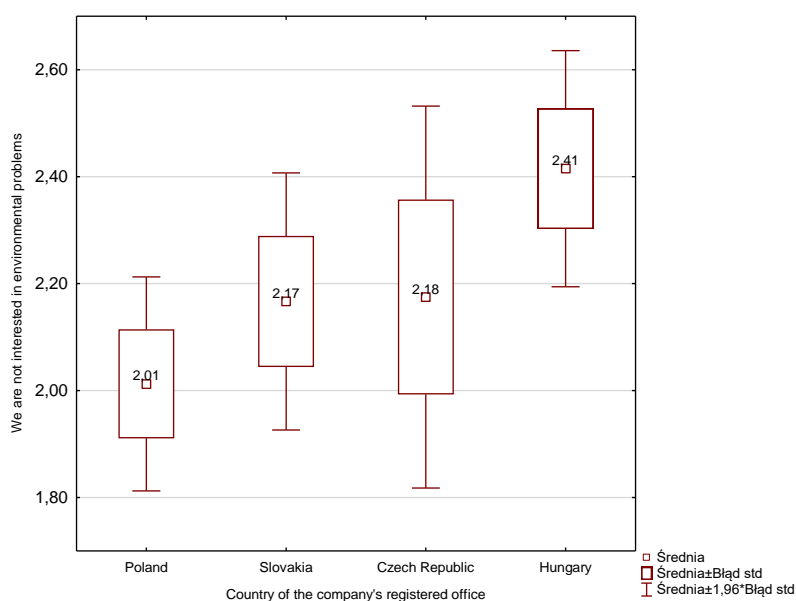
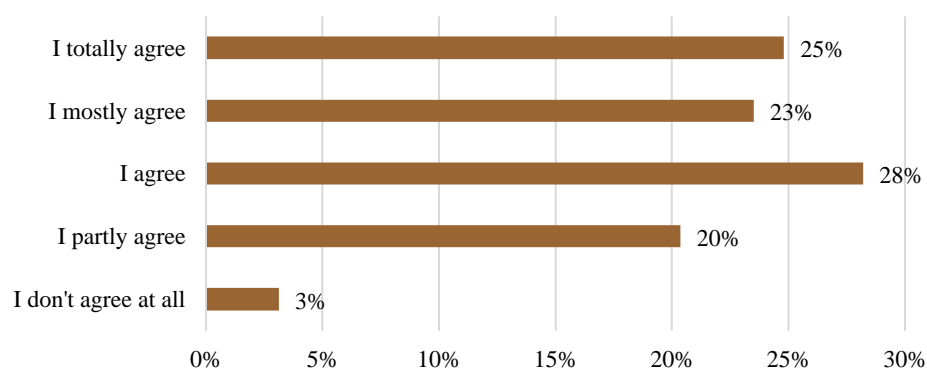


Figure 2. Average agreement rating with the statement ‘We are not interested in environmental problems’.

Source: own study.

It is worth noting that the average rating in all groups is below 3, which means that, on average, the majority in the surveyed groups do not agree with this statement. People living in Poland are most opposed (2.01). Least of all coming from Hungary (average rating 2.41).

Next, it was analyzed hypothesis “Are SMEs from the V4 countries aware of and have up-to-date knowledge of the company's impact on the environment (including the impact of the industry in which they operate)?”. Research shows that most respondents agree that they are aware and have up-to-date knowledge of the company's impact on the environment. Every fourth respondent completely agreed with this statement, 23% mostly agreed with it and 28% simply agreed with this statement. Only 3% believe that SMEs from V4 countries are not aware and have no knowledge on this topic. The results are presented in Figure 3.



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Figure 3. Statement – ‘We are aware and have up-to-date knowledge of the impact of the enterprise on the environment (including the impact of the industry in which we operate)’.

Source: own study.

It was checked whether there is a statistically significant difference in the assessment of compliance of the examined statement between the V4 countries. The tests carried out using the Kruskal-Wallis ANOVA test showed that $p < \alpha$ ($p = 0.0092$). Therefore, the differences in the assessment are statistically significant, as shown in Figure 4.

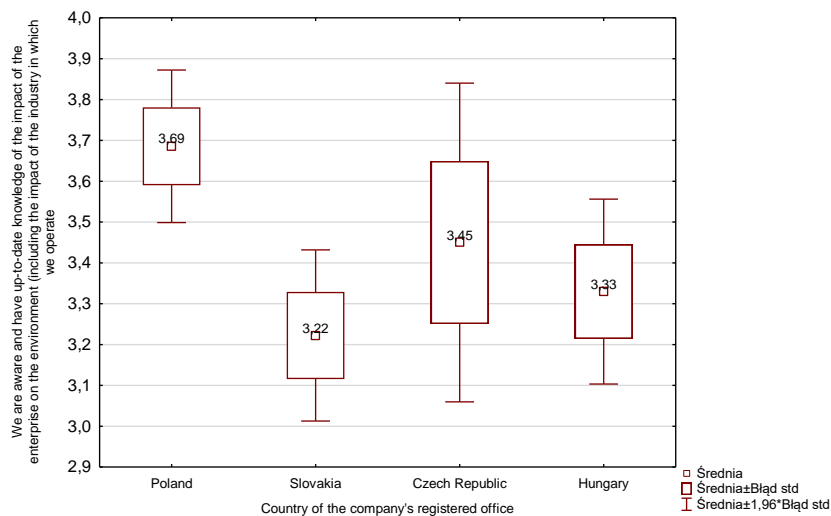


Figure 4. Average ratings for the statement ‘We are aware and have up-to-date knowledge of the impact of the enterprise on the environment (including the impact of the industry in which we operate)’ by respondents' country of origin.

Source: own study.

In this case, it is also worth noting that all averages are above 3 points, which means that, on average, all countries agree that SMEs from the V4 countries are aware and have up-to-date knowledge of the company's impact on the environment (including the impact of the industry in which they operate). However, the test showed differences in grades. Respondents from Poland agree most with this statement (3.69) and those from Slovakia least agree (3.22).

Then, it was analyzed question: “Do SMEs from the V4 countries take similar actions related to the impact of their activities on the environment?”. Figure 5 presents a ranking of activities related to the impact of their activities on the environment that are most often undertaken by survey respondents. The research shows that the most common is ‘due to applicable law (penalties)’ (average 3.67) and we care about well-being of the future generations (average 3.48). In third place was the awareness of pollution and explanation of the environment (3.44).

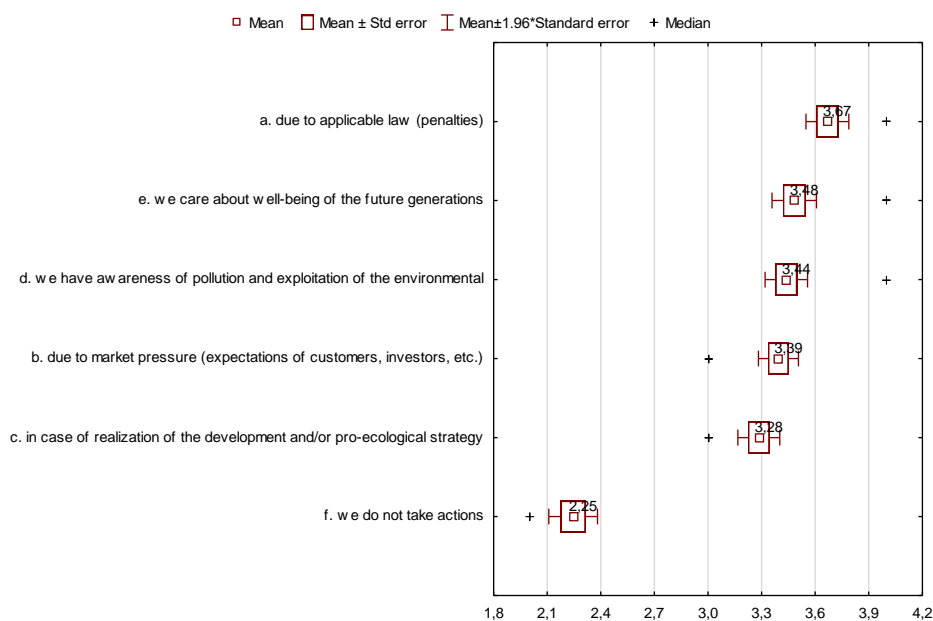


Figure 5. Average assessments of activities undertaken by SMEs from V4 countries related to the impact of their activities on the environment.

Source: own study.

It was checked whether there are differences in the assessment of the actions taken depending on the respondents' country of origin. The results of the analysis are presented in Table 2. It includes the average assessment of compliance with a given action, the median, and the test probability p-value. The research shows that differences occurred in the case of: we do not take actions $p < \alpha$ ($p=0.0000$), in case of implementation of the development and/or pro-ecological strategy $p < \alpha$ ($p=0.0316$), we have awareness of pollution and exploitation of the environmental $p < \alpha$ ($p=0.0007$) and due to applicable law (penalties) $p < \alpha$ ($p=0.0000$).

Table 2.

Kruskal-Wallis ANOVA test results. Assessment of individual activities divided by the respondent's country of origin

Answer	Mean	Median	p-value
we do not take actions	2.25	2	0.0000***
in case of realization of the development and/or pro-ecological strategy	3.28	3	0.0316*
due to market pressure (expectations of customers, investors, etc.)	3.39	3	0.0506
we have awareness of pollution and exploitation of the environmental	3.44	4	0.0007***
we care about well-being of the future generations	3.48	4	0.1596
due to applicable law (penalties)	3.67	4	0.0000***

Source: own study.

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The analyzes (Figure 6) show that respondents from Hungary agree most with due to applicable law (penalties) (4.31) and respondents from Slovakia least agree (3.04). Respondents from Poland have the most concerns about pollution and use of the environment (3.70), and the least concerns about environmental pollution and use in Hungary (3.17). Respondents from Poland are most likely to agree with the implementation of the development and/or pro-ecological strategy (3.47), while respondents from Hungary are least convinced about it (3.03). In all V4 countries, respondents definitely disagree with the fact that they do not undertake any tasks, all ratings are below 3 points, but there are also significant differences in the assessment: respondents from Poland are most opposed to this statement (1.84) and respondents from Hungary are the least opposed (2.89).

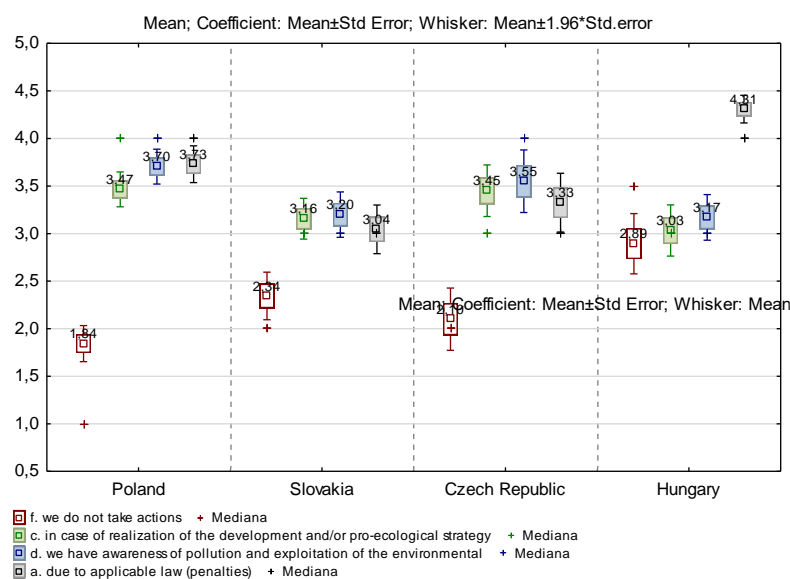


Figure 6. Average compliance ratings with the specified activities, divided by the respondent's country of residence.

Source: own study.

The next analysis concerned the hypothesis, i.e. “Are the pro-ecological activities of SMEs from the V4 countries important for a similar group of recipients/stakeholders?”. Respondents believe (Figure 7) that pro-ecological activities of SMEs from V4 countries are most important for customers (average 3.44), for local government units (public or local administration, 3.20) and least important for banks/credit unions (2.79).

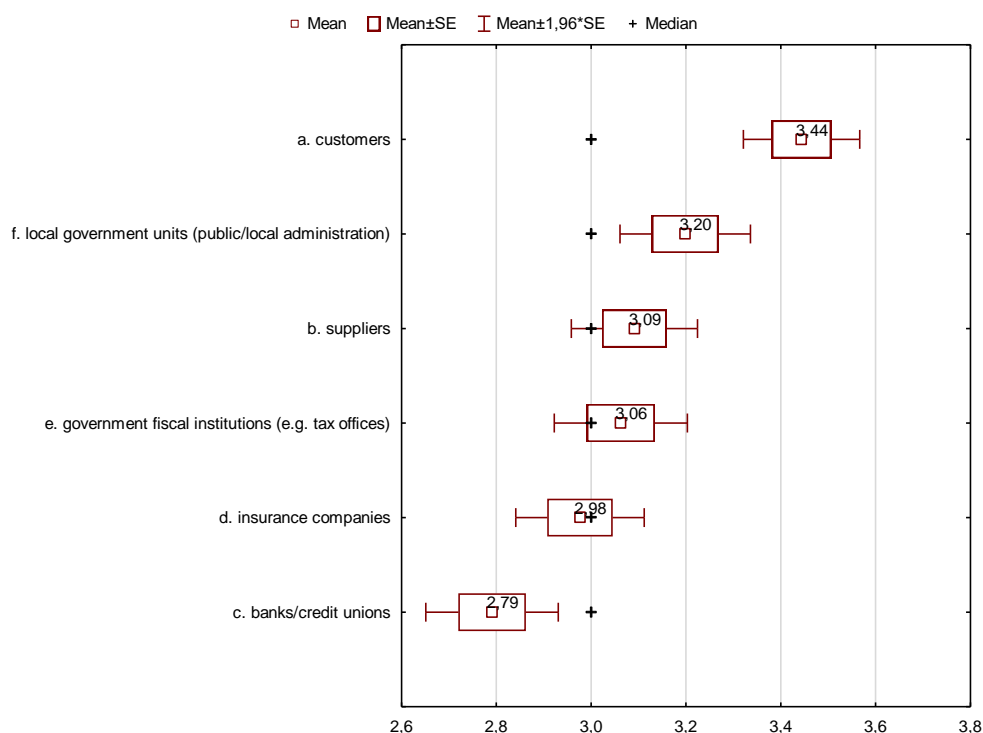


Figure 7. The importance of pro-ecological activities of SMEs from the V4 countries.

Source: own study.

It was checked whether there were differences in the assessment depending on the respondent's country of origin (as shown in Table 3).

Table 3.

Kruskal-Wallis ANOVA test results. Assessment of individual activities divided by the respondent's country.

Pro-environmental activities in our industry are important for:	Mean	Median	p-value
banks/credit unions	2.79	3	0.4105
insurance companies	2.98	3	0.7293
government fiscal institutions (e.g. tax offices)	3.06	3	0.7485
suppliers	3.09	3	0.0769
local government units (public/local administration)	3.20	3	0.1670
customers	3.44	3	0.2053

Source: own study.

In each case, $p > \alpha$. Hence, the analyzes conducted show that there are no differences in the assessment.

4. Discussion and Conclusion

This study presents the results of a survey of V4 countries' manufacturing companies belonging to SMEs in the electromechanical industry. It analyses that a part of the questionnaire, which covers several different statements. The statements focus on pro-environmental activities. In the light of the results, it can be concluded that the majority of surveyed entrepreneurs strongly disagree with the statement that 'We are not interested in environmental problems.' The most respondents agree that they are aware and have up-to-date knowledge of the company's impact on the environment. It was tried to rank of activities related to the impact of companies' activities on the environment that are most often undertaken by survey respondents. The research shows that the most common is 'due to applicable law (penalties)' and 'we care about well-being of the future generations'. In third place was the awareness of pollution and explanation of the environment. The responses of the surveyed companies show that the pro-environmental activities of SMEs in the V4 countries are the most important for customers, for local authorities (state or local government) and the least important for banks/credit unions. Although the companies surveyed in the V4 countries have similar views on certain issues, there are also significant differences in the assessment.

For the project as a whole, it can be concluded that it is able to draw new conclusions from the presentation of the opinions of V4 companies belonging to SMEs in the electromechanical industry on product quality and environmental awareness. In addition, the project will provide new findings related to product design in line with sustainable development rules, while taking into account the current approach of V4 companies and customers to environmentally friendly product quality management. In the light of the results, it is possible to develop a set of good practices that will be very useful for SMEs in the electromechanical sector in the V4 countries. In conclusion, the results of the survey and the overall project will provide desirable results for companies in the V4 countries and worldwide to establish an innovative and sustainable approach to the design and manufacture of environmentally friendly products.

The research results determine the current state of possibilities of implementing good pro-ecological practices in SMEs from the V4 countries. can be Therefore, they can be useful as part of the sustainable development of their activities.

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