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

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Purpose: The aim of the article was to analyse the qualitative approach to product improvement by Small and Medium Enterprises (SMEs) from the Visegrad Group (V4) countries (Poland, Slovakia, Czech Republic, and Hungary).
Design/methodology/approach: The analysed results included a research sample of 379 companies in the electromechanical industry (machinery processing industry). The sample was obtained between March and September 2023 by means of a guided survey. Analyses of the results of quantitative research were carried out to verify the approaches of SMEs from V4 countries to pro-quality product, including comparative analyzes of the results obtained. Analyses were performed using the ANOVA test (repeated measure designs). The Mann Whitney U test was used to identify statistically significant differences in entrepreneurs' responses. The significance level adopted was $\alpha = 0.05$.
Findings: It has been shown that SMEs from V4 countries have different approaches to improving product quality. Additionally, it was shown that both in the case of pro-quality 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: Research results may contribute to more effective and coherent development activities of SMEs in the V4 countries as part of their sustainable development.
Social implications: Based on the research conducted, it is possible to provide SMEs in V4 countries with a more adequate approach to undertake consistent and effective quality activities as part of the improvement of the product.
Originality/value: Determining the current pro-quality approach to product improvement in SMEs in the V4 countries. The novelty is also the identification of the importance (level of importance) of these approaches in each V4 country, as well as the determination of the similarities and differences between these approaches in SMEs from countries in the Visegrad Group.

Keywords: Visegrad Group (V4), SMEs, quality product improvement, production engineering.
Category of the paper: Research paper.

1. Introduction

Small and medium-sized enterprises (SMEs) are treated as the most important in the development of the economy, e.g., they create jobs, stimulate competition, and the creation of innovations and ventures (Ključnikov et al., 2023; Song et al., 2023). SMEs are important in both developed and developing countries (Nguyen, Ho, 2021; Siwiec, Pacana, 2021c) such as the countries of the Visegrad Group (V4) (Domarackcá et al., 2018; Gavurova et al., 2022; Hudakova et al., 2021). One of the key factors generating their market position is the quality of the products (Pacana, Siwiec, 2022a; Siwiec, Pacana, 2022), that is, customer satisfaction with their use (Kiran, 2017; Siwiec, Pacana, 2021a). Therefore, to meet customer expectations and global competition, SMEs focus on, for example, the efficiency of their processes, optimising resource use, or achieving efficiency in cost consumption (Bednárová, Liberko, 2008; Pacana, Siwiec, 2021; Xu et al., 2023).

Improving product quality in SMEs involves the use of various instruments, as well as examining practices, approaches, and other aspects of SMEs' activities (Pacana, Siwiec, 2022b; Siwiec, Pacana, 2021d). The basic activity is to acquire customer expectations and then take actions to meet customer satisfaction (Ostasz et al., 2022; Siwiec, Pacana, 2021c, 2021a). Other activities include, for example, the modernisation of enterprises within the framework of Industry 4.0, as proposed by, for example, the authors of the studies (Gajdzik et al., 2023; Ingaldi, Ulewicz, 2019; Ivascu, 2020; Shqair, Altarazi, 2022). However, in the study (Biea et al., 2023), it was proposed to analyse recruitment procedures in the changing business environment after the COVID-19 pandemic. The analyses were carried out in SMEs among managers of these enterprises, where they analysed, for example, digital technologies, human resources, and other technological improvements. In turn, the authors of the article (Gomathi Prabha, Yuvaraja, 2023) implemented Lean Six Sigma and the Internet of Things (IoT) to streamline SMEs processes, thus improving the quality of products and shorten the implementation time of these processes. Another example is the study (Chaithanapat et al., 2022), which examined the connections between customer knowledge, leadership, quality, and innovation in SMEs. The results indicated, for example, that the mediating roles of customer knowledge management and knowledge-orientated leadership in these relationships are important (Nagy, Veresné Somosi, 2022).

Based on a review of the literature on the subject, it was shown that small businesses undertake pro-quality activities as part of the improvement of the product. However, no research has been found that would analyse quality-based approaches when improving

products in small businesses in the countries of the Visegrad Group (V4). This was considered a research gap, which was attempted to fill in the ongoing research. The purpose of the article was to analyse the qualitative approach to product improvement by SMEs from countries of the Visegrad Group.

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).

2. Method of research

The research was carried out as part of a survey among entrepreneurs of small and medium-sized enterprises (SMEs) belonging to the electromechanical industry (machinery processing industry). These were SMEs from the countries of the Visegrad Group (Poland, Czech Republic, Slovakia and Hungary). The article analyses the results of surveys collected in the period from March to November 2023.

The survey results included 379 SMEs from the countries of the Visegrad Group, i.e. Czech Republic (39), Poland (156), Hungary (94), Slovakia (90). Most of the surveyed SMEs from the V4 countries were located in city from 150000 to 500000 residents (117), and city from 20000 to 150000 residents (99). Most of them were international companies (175).

The survey was conducted in paper and electronic form using MS FORMS. The developed survey is presented in the literature on the subject, i.e. (QuEn - Research Questionnaire For Enterprise, 2023). The survey questions were developed according to preliminary research, e.g.: (Hajduk-Stelmachowicz et al., 2022; Siwiec et al., 2022, 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).

Pro-quality approach of SMEs in the V4 countries to improving product quality were analysed. As part of the research, the following hypotheses were verified:

H_1: Do SME entrepreneurs from the V4 countries have a similar approach to pro-quality product improvement?

Question: What is your opinion about every statement refers to pro-quality 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. All customers in the supply chain attach great importance to the quality of products.
2. Customers will pay more if they get high quality product.
3. A high-quality product is the product that meets the current requirements of customers.

4. Currently, high-quality products have also a high level of environmental friendliness.
5. Wealthy customers usually choose high-quality products.
6. Choosing a high-quality product can improve a customer's self-esteem.
7. Customers pay attention to the high-quality of packaging of product.
8. High-quality products are sufficiently promoted.
9. We as a company strive to continuously improve products' quality.
10. The higher price of high-quality products significantly discourages customers from buying them.
11. Customers are more likely to buy a high-quality product if it has been previously recommended/tested.
12. Customers have a lot of knowledge about the attributes of products that affect their high quality.
13. Higher quality products have a higher price.
14. Customers will pay more for products from enterprises that are active in improving the quality of products.

Analyses were performed using the ANOVA test (repeated measure designs). The appearance of statistically significant differences in responses regarding product improvement approaches in SMEs from the V4 countries was also analysed. The Mann Whitney U test was used for this purpose. All analyses were performed at the significance level of $\alpha = 0.05$. Using STATISTICA 13.3.

3. Results

As part of the ongoing research, statements regarding pro-quality activities were initially analysed. An ANOVA test (repeated measurement designs) was used for this purpose. Analyses were performed at the significance level of $\alpha = 0.05$. This is shown in Figure 1.

To standardise the analysis, the mean values obtained from the responses were grouped into two groups, i.e. statements with high scores for mean values <2.84;3.51), and statements with low scores for mean values <3.51;4.19>. In line with this assumption, in all V4 countries, SME entrepreneurs highly rated the statement, that is, (9) we as a company strive to continuously improve the quality of the products. However, SME entrepreneurs from Poland, Slovakia, and the Czech Republic jointly rated it highly (11) customers are more likely to buy a high-quality product if it has been previously recommended/tested. It was observed that SME entrepreneurs from Poland and Hungary rated most of the statements highly, e.g.: 1, 3, 6, 7, 12, 13, 14, according to the method of research. However, most statements were given low ratings by SME entrepreneurs from Slovakia and the Czech Republic, i.e.: 1, 2, 4, 5, 6, 7, 8, 10, 12, 13, 14, according to method of research.

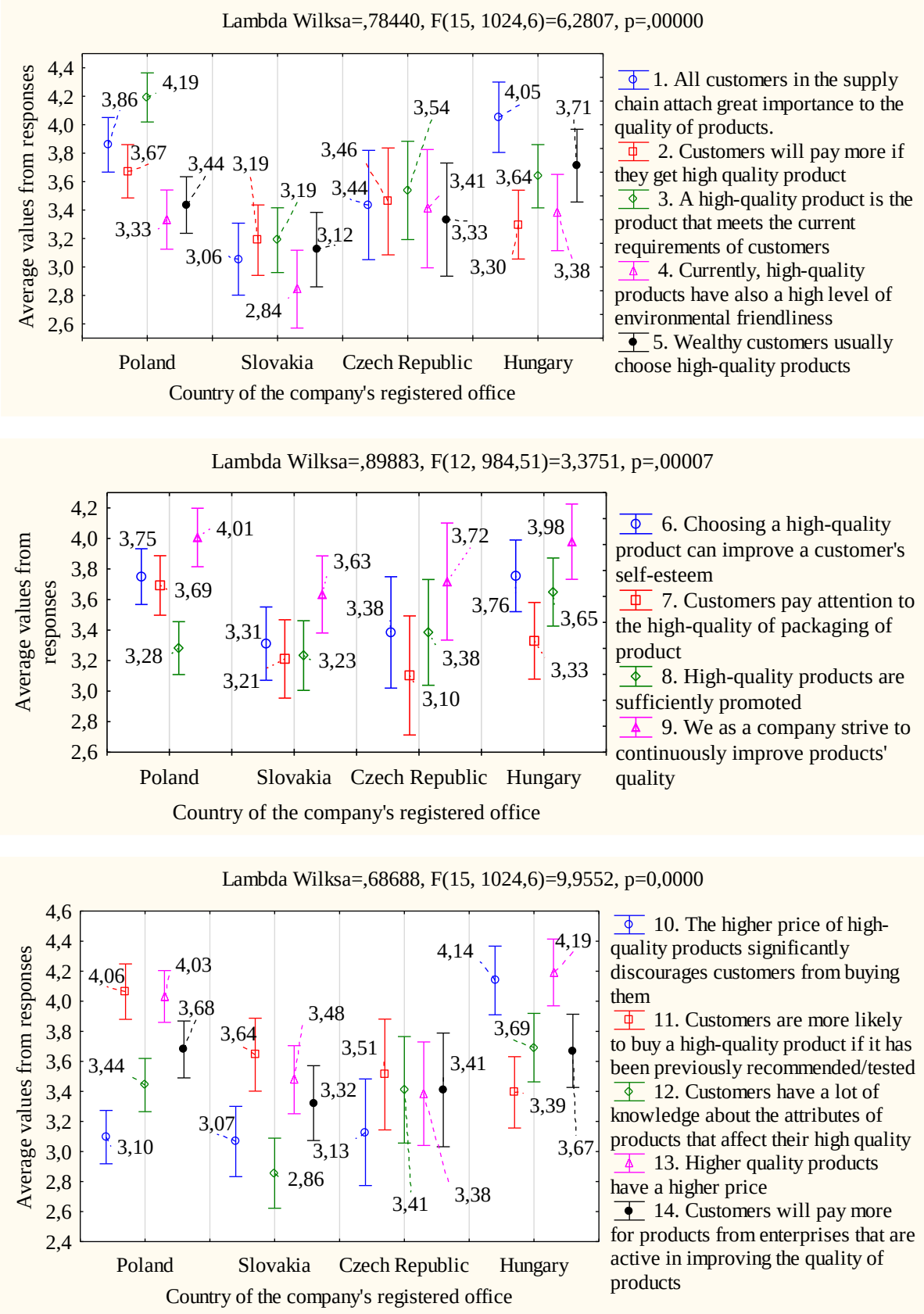

Figure 1. Average values of assessments of SME entrepreneurs by V4 country for pro-quality activities.

Then, it was checked whether there were statistically significant differences in the responses of SME entrepreneurs from individual V4 countries. Responses to statements regarding pro-quality activities were analysed. On their basis, the Mann Whitney U test was carried out. The analyses were carried out at the significance level of $\alpha = 0.05$. The results of the analysis are presented in Table 1.

Table 1
Results of the Mann-Whitney U test for pro-qualtiy 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	0.000	0.275	0.079	0.000	0.155	0.016
2	0.006	0.003	0.112	0.620	0.320	0.399
3	0.000	0.000	0.002	0.017	0.139	0.842
4	0.005	0.593	0.789	0.005	0.031	0.972
5	0.104	0.152	0.569	0.009	0.519	0.098
6	0.008	0.500	0.085	0.035	0.786	0.189
7	0.011	0.005	0.012	0.573	0.636	0.429
8	0.960	0.020	0.571	0.107	0.665	0.384
9	0.031	0.826	0.181	0.083	0.748	0.308
10	0.797	0.000	0.923	0.000	0.765	0.000
11	0.011	0.000	0.004	0.104	0.487	0.419
12	0.000	0.110	0.764	0.000	0.008	0.126
13	0.001	0.450	0.001	0.000	0.555	0.000
14	0.038	0.561	0.100	0.045	0.833	0.052

where: 1-14 statements as in method research for pro-quality activities.

The research shows that the relatively largest statistically significant differences in the answers given regarding pro-quality activities occur in Poland and Slovakia, but also in Slovakia and Hungary. SME entrepreneurs from Poland and Slovakia have different views on the following issues: (1) all customers in the supply chain attach great importance to the quality of products ($p < \alpha$, $p = 0.000$), (2) customers will pay more if they get high quality product ($p < \alpha$, $p = 0.006$), (3) a high-quality product is the product that meets the current requirements of customers ($p < \alpha$, $p = 0.000$), and 4, 6, 7, 9, 11, 12, 13, 14, according to method of research. However, entrepreneurs from Slovakia and Hungary evaluated the claims significantly differently, that is, 1, 3, 4, 5, 6, 10, 12, 13, 14, according to method of research. Less statistically significant differences were observed in the responses of SME entrepreneurs from Poland and Hungary. These differences concerned the following statements: 2, 3, 7, 8, 10, 11, according to the research method. The least statistically significant differences were observed in SMEs from Poland and the Czech Republic, respectively, that is, 3, 7, 11, 13, Hungary and the Czech Republic, that is, 1, 10, 13, and Slovakia and the Czech Republic, that is, 4, 12, according to method of research. Therefore, after verifying hypothesis (H_1), it was shown that V4 SME entrepreneurs have a relatively similar approach to improving quality products.

4. Discussion and conclusions

Companies are trying to meet the challenges of climate change and strive to achieve the expected quality of their products. Intensified efforts in this area are undertaken mainly by SMEs. They strive to consistently implement activities that will support their effective development. However, this remains a challenge for SMEs in the V4 countries. This results, for example, from the dynamics of changes and the turbulent environment (e.g., as a result of the COVID-19 pandemic), still make it difficult to make accurate development decisions.

Therefore, research was carried out in the area of the qualitative approach of SMEs from countries in the Visegrad Group to product improvement (Civelek et al., 2021; Domarackcá et al., 2018; Siwiec, Gawlik et al., 2023). For this purpose, a survey was used; the results presented included a sample of 379 enterprises from the electromechanical industry (machine processing industry). The sample was obtained in the period from March to September 2023. The analyses of the research results were carried out by examining the approach of SMEs from V4 countries to the improvement of quality and environmental products, including comparative analyses of the results obtained. An ANOVA test (repeated measurement designs) was used for this purpose. However, to identify statistically significant differences in the responses of entrepreneurs, the Mann Whitney U test was used. Analyses were performed at the significance level of $\alpha = 0.05$.

Based on the qualitative approach of SMEs from the V4 countries, it was shown that:

- the greatest consistency in the assessments of SME entrepreneurs occurs in the countries of Slovakia and the Czech Republic, Hungary and the Czech Republic, and Poland 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,
- SMEs analysed SMEs from the V4 countries strongly agree with the statement that we as a company strive to continuously improve product quality,
- Poland, Slovakia and the Czech Republic collectively agree most with the statements, e.g.: customers are more likely to buy a high-quality product if it has been previously recommended/tested, or a high-quality product is the product that meets the current requirements of customers,
- Slovakia, the Czech Republic and Hungary collectively least agree with the statement that customers pay attention to the high-quality of packaging of product,
- Poland least agrees with the statement that the higher price of high-quality products significantly discourages customers from buying them.

It is concluded that the approach to improving product quality in SMEs in the V4 countries is different in most aspects.

The originality of the research is the determination of the current pro-quality approach to product improvement in SMEs in the V4 countries. What is also new is the identification of the importance of these approaches in improving products in SMEs from countries of the Visegrad Group.

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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