SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2026
ORGANIZATION AND MANAGEMENT SERIES NO. 242

MANAGERIAL COMPETENCIES IN THE MEDICAL DEVICE INDUSTRY — GENDER AND NATIONALITY PERSPECTIVE

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Purpose: The aim of the present study is to identify and assess managerial competencies in the medical device industry, taking into account differences between women and men. The analysis addresses the issue of women in management positions in a sector traditionally identified as typically male.
Design/methodology/approach: The research was conducted between 2018 and 2020 using a diagnostic survey among 130 managers representing 130 companies. The sample was selected purposively, and collaborating companies from four European countries were invited to participate: Poland, Germany, France, and the United Kingdom.
Findings: Analysis of the research results showed differences in the self-assessment of women and men. Women significantly more often pointed to their strengths in interpersonal skills, communication, and diversity management, while men rated their technical and strategic skills higher. The international analysis also showed differences in self-assessment – managers from Poland rated their skills higher than respondents from other countries.
Research limitations/implications: Limitations include the relatively small sample of 130 respondents from four European countries and the fact that the study is based on self-assessment of respondents, which limits the generalizability of the results.
Practical implications: Based on the research findings, future initiatives could include designing tailored development programs for women and men in the medical device sector.
Originality/value: The study adds new value to the literature by combining a gender perspective with international analysis in a male-dominated industry.
Keywords: managerial competencies, medical device industry, women and men in management, international context.
Category of the paper: Research paper.

1. Introduction

Managerial competencies are the foundation of effective leadership and efficient management in any industry, but in the medical device sector, they take on special importance. Due to the high dynamics of technological development, strict regulations and the interdisciplinary nature of the business – combining elements of engineering, medicine and business – managers in this sector must demonstrate not only strategic and operational capabilities, but also the ability to adapt, manage innovation and make decisions in an environment of high accountability (Mylyanyk, 2022; Olafenwa et al., 2021). Digital, trans-professional, and leadership competencies are particularly important to effectively respond to changing market conditions and implement modern technological solutions (Denend et al., 2020). In the context of women's managerial competencies, it also becomes crucial to recognize the structural, cultural, and perceptual barriers that affect how these competencies are developed, perceived, and used in management practice (Denend et al., 2020; Perez, 2022; Elkhwesky et al., 2023; Crimmins et al., 2023).

Within the framework of this study, a four-element competency model was adopted, which takes into account both subject matter knowledge and personal and social aspects crucial for effective management in complex structures. The competency groups analyzed include: (1) knowledge – understood as a body of information on management, industry regulation, innovation and finance (15 competencies assessed); (2) personal skills – such as work organization, mental toughness, self-reliance and reflexivity (9 competencies assessed); (3) interpersonal skills, including communication, collaboration, situational leadership, conflict resolution and relationship building (25 competencies assessed); and (4) competencies and attitudes related to diversity management – including sensitivity to gender equality, cultural inclusion, anti-discrimination and fostering an inclusive organizational culture (12 competencies assessed). This cross-cutting model captures both hard and soft aspects of competencies, which research shows can be developed and used differently for women and in different settings and structures than for men (Denend et al., 2020; Perez, 2022).

The article is based on a quantitative research approach and forms part of a broader project on managerial competencies and diversity management in the medical device sector. The aim of the study is to identify and assess the declared level of competencies among managers employed in this industry, with particular attention to gender and national differences. The article adds new value by comparing the self-assessment of managerial competencies of women and men in the medical device sector in four European countries, which has not been widely analyzed in the literature to date.

The article consists of several interrelated parts. The first part presents a theoretical framework for managerial competencies in the context of gender and their significance in management. Then, the empirical research methodology is presented, followed by the results

of studies conducted in four European countries. The article concludes with a discussion of the research results from the literature on the subject and a summary containing practical implications for management practice and recommendations for further study.

2. Literature Review

The subject matter of this article concerns the competencies of managers in the medical device industry. This sector was chosen for research due to its innovative and interdisciplinary nature. The functioning of the medical device industry at the intersection of biotechnology, engineering, information technology, and regulatory sciences, combined with a high level of social responsibility, means that managerial competencies are of particular importance here (Shet, Pereira, 2021). Managers operate in an environment characterized by rapid technological progress and digitization processes, growing legal requirements, and intense international competition (Bondarenko et al., 2021). Europe is currently the global center of the medical device industry (MedTech Europe's Facts & Figures 2023, 2023), with the most significant employment in Germany and strong positions in France, the UK, and Poland. Germany is Europe's largest and most mature market, accounting for over 25% of EU exports in this sector (The Medical Technology Industry in Germany, n.d.). France is intensively developing innovation thanks to strong state support, including through the "France 2030" strategy, which aims to double the value of the MedTech market within a decade (Market, 2024). The United Kingdom stands out for its dynamic development of digital and remote technologies in healthcare, which are significantly changing the profile of desired managerial competencies (Newsdesk, 2024). Although smaller in terms of market value, Poland is one of the fastest-growing MedTech markets in Europe, with projected growth to USD 6.9 billion in 2031 and the growing importance of exports (6Wresearch, 2024; ReportLinker, 2024).

Various classifications are used in research on managerial competencies. Bakanauskienė and Martinkienė (2015) distinguished three basic groups: professional competencies (specialized knowledge and skills), social competencies (adaptability and interpersonal skills), and personal competencies (individual characteristics and self-awareness). This model has been verified in studies of manufacturing companies and can also be successfully applied in the context of the medical device industry.

The literature emphasizes that effective management in high-tech sectors requires an adaptive approach and transprofessional competencies, combining traditional management skills (planning, control, delegation) with digital competencies, innovation, and the ability to manage change (Mylyanyk, 2022). Particular importance is also attached to lifelong learning and leadership capital development, which translates into a competitive advantage for the organization (Olafenwa et al., 2021).

At the same time, it is essential to emphasize the importance of digital and innovative competencies, which, in the light of the Industry 4.0 concept, include, among others, decision-making efficiency, systems thinking, readiness to implement innovations, and the ability to manage geographically and technologically dispersed teams (Shet, Pereira, 2021). These competencies complement traditional managerial skills and are key to effective functioning in digital transformation.

Another important approach is the GLOBE model, which indicates that managerial competencies are strongly culturally conditioned. Depending on the country, different competencies, e.g., interpersonal, strategic, or diversity management, may be considered key (House et al., 2004; Bücker, Poutsma, 2010). An effective global manager should develop universal competencies and adapt to specific cultural and institutional expectations.

In the context of this study, it is impossible to ignore the concept of relational demography, which is how similarities and differences in relation to other group members shape an individual's experiences in an organization. In environments where a particular characteristic (such as gender, age, or ethnicity) makes an individual "different" from the majority, their actions become more visible and evaluations often more critical (Rakowska, 2021). In the male-dominated medical device industry, female managers often function as a minority, which affects how their competencies are perceived, their career development, and their access to key strategic roles (Fitzsimmons et al., 2014; Perez, 2022).

This approach justifies the analysis of gender differences in managerial competencies. Studies on self-assessment of competencies presented in the literature indicate that women tend to underestimate their competencies, while men tend to overestimate or assess them more accurately. Such patterns have also been observed in technical and high-tech fields. According to researchers, this may significantly impact employees' promotion and professional development (Elkhwesky et al., 2023; Bodard et al., 2024; Syzmanowicz, Furnham, 2011). Studies indicate that women often develop and declare higher interpersonal and diversity management competencies, while men usually emphasize technical and strategic competencies (Zhang et al., 2022; Thelma, Ngulube, 2024).

In the context of this study, it is also worth noting that the high-tech ecosystem (including MedTech) draws its workforce from STEM/ICT, where women are still underrepresented (e.g., in 2024, women accounted for approximately 19.5% of ICT professionals in the EU; in R&I, they were a minority among researchers/engineers). This is still a significant factor limiting the influx of female talent into management roles (European Commission: Directorate-General for Research and Innovation, 2025; Eurostat, 2025).

Analyzing these differences from the perspective of relational demography theory provides a better understanding of why women, despite their high competence, still encounter barriers in accessing top management positions in the MedTech sector (Denend et al., 2020; Entradas, 2023; Chandra, 2020; Berlin et al., 2019). It also provides a starting point for consideration of the research presented in this article.

3. Methods

The presented article is based on a quantitative approach to identify and assess the competencies of managers representing the analyzed companies. The presented study is part of a broader research project on the competencies of managers in the medical device industry and diversity management in the companies they represent. The study aimed to identify and assess managerial competencies in the medical device industry.

The specific objectives of the presented research are the answers to the formulated research questions:

RQ1: What is the respondents' declared level of competence concerning gender?

RQ2: What are the differences in the declared level of competence between men and women?

RQ3: What specific differences in self-assessed competencies can be observed between Polish managers and those from Germany, France, and the UK?

The empirical study was conducted in 2018-2020 using a diagnostic survey method with a questionnaire technique. The research questionnaire was constructed on the basis of an analysis of the literature on the subject, followed by qualitative research in the form of in-depth individual interviews. During these interviews, we asked participants to identify key competencies relevant to their industry, assess their importance in the context of the role of a medical device manager, and provide feedback on the content of the survey. The selection of the sample was purposeful. We targeted experienced managers to ensure their relevant expertise. We systematically coded and analyzed the qualitative data collected to identify patterns and insights that influenced the final structure and content of the survey tool used in the second stage of the research.

The questionnaire covered four competency areas: (1) knowledge – understood as a body of information on management, industry regulation, innovation and finance (15 competencies assessed); (2) personal skills – such as work organization, mental toughness, self-reliance and reflexivity (9 competencies assessed); (3) interpersonal skills, including communication, collaboration, situational leadership, conflict resolution and relationship building (25 competencies assessed); and (4) competencies and attitudes related to diversity management – including sensitivity to gender equality, cultural inclusion, anti-discrimination and fostering an inclusive organizational culture (12 competencies assessed). Respondents rated the degree to which they possessed the analyzed competencies on a scale of 1 to 7, where 1 represented the lowest and 7 the highest rating. The quantitative survey was conducted in English, face-to-face. Only the survey of managers of Polish nationality was presented in their native language. The questionnaire was translated from Polish to English and vice versa to Polish to ensure conceptual equivalence and clarity.

The survey covered managers of medical device companies. They were mainly senior and middle managers, mainly of small and medium-sized enterprises, due to the structure of the industry, in which about 95% of employees work. These are small and medium-sized enterprises. It is assumed that the structure of the survey sample in terms of gender, age, and nationality reflected the structure of the sector.

The survey was conducted in selected European countries, namely Germany, France, the UK, and Poland, using a purposive sample of cooperating companies from the medical devices sector. In addition to Poland, countries with high activity in the medical device industry were selected for the study. Germany, France, and the United Kingdom are among the six countries with the largest number of registered medical device businesses, as well as the highest percentage of people employed in the industry in Europe. Poland, Germany, France, and the UK were selected for this study due to their strong positions in the European MedTech sector and contrasting market profiles. Germany leads in scale (€43 billion; GTAI, 2023), France is rapidly expanding (Market Research Future, 2024), the UK excels in digital innovation (IoT World Magazine, 2024), while Poland represents a fast-growing emerging market (6Wresearch, 2023). This diversity enables a multidimensional analysis of managerial competencies across varying levels of maturity, innovation, and regulatory complexity.

There are an estimated twenty-six thousand companies operating in Europe. The survey included 130 managers, which is about 0.5% of the population. The survey was conducted among 130 managers from 130 different organizations. Of the respondents, 21% work in micro companies, 46% in small companies, 25% in medium-sized companies, and 8% in large companies. At the same time, 71% of these companies operate globally, 18% in European theaters, and 11% in national stadiums. The structure of the origin of the surveyed organizations is as follows: 29% are registered in Germany, 16% in the UK, 25% in France, 19% in Poland, and 11% in other countries. 38 women (29%) and 91 men participated in the study, while one person refused to provide information about their gender. Of the surveyed managers, 11% work at a low management level, 67% at a medium or high management level, 18% on a management contract, and 5% did not answer. The survey provided empirical material, which was analyzed statistically. The data obtained were entered into a database created in an Excel spreadsheet. Relationships between qualitative variables were assessed using the Chi-square test of independence.

4. Results

Differences in the self-assessment of competencies of women and men

The problems of the presented article concern the competence of women in managerial positions in the medical device industry. Respondents were asked to assess the competencies they possess, divided into four areas. Given the problematic nature of the article, the self-assessment of women's and men's competencies was analyzed.

As for the area of knowledge, it turned out that the level of these competencies in the self-assessment of women and men was similar. This is particularly evident in the case of the so-called hard competencies, i.e., English language skills, strategic management, marketing, and industry knowledge, as well as knowledge of legislation. Among the 15 competencies assessed in this group, only one had a statistically significant difference. Male respondents report having higher knowledge of corporate financial management than female respondents (difference of 0.95).

The next area analyzed was the respondents' personal skills. As in the case of knowledge, only one competence (out of the 9 assessed) showed statistically significant gender differences in self-assessment. These concern the ability to process large data sets and translate them into abstract concepts ($p = 0.01$; $p < 0.05$). The average level achieved by female managers was 4.41, while that achieved by men was 5.12.

The next area analyzed was the interpersonal competence of the respondents. In this group, the largest number of items was assessed – 25 competencies. Statistically significant differences were observed in the case of three evaluated areas. It is interesting to note that this time the situation is reversed, with women declaring a higher level of competence than men. Statistically significant differences were observed for the following competencies: teamwork (women: 6.26; men: 5.67; difference: 0.59; $p = 0.01$), ethical behavior (women: 6.46; men: 5.88; difference: 0.58; $p = 0.01$), and the ability to identify sources of conflict (women: 5.51; men: 4.96; difference: 0.56; $p = 0.01$).

The last area assessed was competencies and attitudes related to diversity management (12 items). Analysis of the results of the surveys conducted in this area shows that women generally declare a higher level of these competencies than men. It can be assumed that it is women who are more sensitive to areas related to the presence of differences that can lead to inequality, since, as analysis of the literature shows, they are more likely to be victims of discrimination. However, there are statistically significant differences for two of them. Women report significantly higher sensitivity and empathy for diversity (mean score: 6.21) than men (mean score: 5.36, difference: 0.85; $p = 0.00$) and for fair and impartial treatment of diversity (women: 6.13; men: 5.54; difference: 0.59; $p = 0.02$).

In summary, for 11% of competencies, statistically significant differences were diagnosed in the degree to which men and women possess them. At the same time, men declare a higher level for two competencies (knowledge of corporate financial management and the ability to process large data sets and translate them into abstract concepts), while women declare a higher level for five (teamwork, ethical behavior, ability to identify sources of conflict, sensitivity and empathy to diversity, and fair and impartial treatment of diversity). These differences are presented graphically in Figure 1.

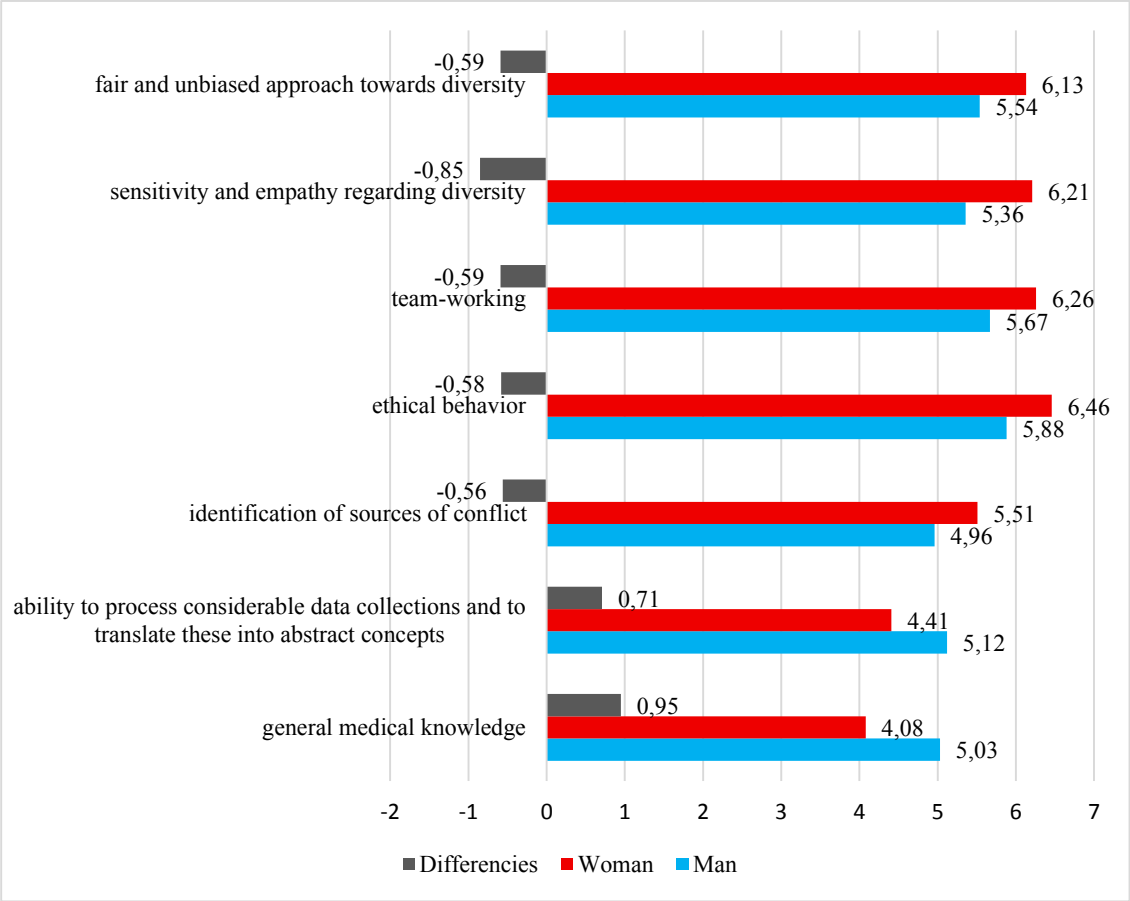

Figure 1. Self-assessment of competencies by gender (n = 129, statistically significant differences only, $p < 0.05$).

Source: own study results.

Competencies vs. the nationality of respondents

It was of interest to the authors of this article to find out the differences in competencies declared by managers from different countries. To this end, we conducted a statistical analysis of the collected empirical material. We compared the competencies declared by managers from Poland and managers from other countries. Due to the smaller proportion of women in the group of managers surveyed, this time the analysis was not carried out by gender.

Interestingly, for all competencies assessed, Polish managers declared that they had a higher level of a given competence than their foreign counterparts. Table 1-3 presents the results of the comparative analysis of managers from Poland, Germany, France, and the UK. They include

information only on statistically significant differences. The most statistically significant differences were identified when comparing the results of managers from Poland and Germany. These differences concerned 11 assessed competencies.

Table 1 shows a comparison of self-assessed competencies between Poles and Germans. There were statistically significant differences for 11 of the assessed areas, with Poles rating their competencies higher than Germans.

Table 1.
Competencies of Poles vs. Germans (statistically significant differences only, $p < 0.05$)

Competencies	Poles N = 24	Germans N = 38	Difference in the declared competence level	p
K: other foreign languages knowledge	4.00	3.08	0.92	0.04
K: human resources management knowledge	5.33	4.35	0.98	0.01
PS: development and application of new forms of communication and the ability to critically process such content	5.13	4.27	0.85	0.04
IS: ability to create a vision and pass it on	5.58	4.81	0.77	0.04
IS: identification of sources of conflict	5.54	4.89	0.65	0.05
IS: prioritizing objectives	5.85	5.05	0.78	0.02
IS: change management	5.48	4.22	1.26	0.00
IS: effective virtual team-working	5.48	4.43	1.05	0.01
IS: efficient decision-making skills	5.96	4.92	1.04	0.00
DM: ability to apply differences emerging from diversity	5.87	5.06	0.81	0.04
DM: learning when at work	6.30	5.53	0.78	0.02

Source: own study results.

The most significant differences occurred in the areas of interpersonal skills (IS): change management (a difference of 1.26), effective virtual team-working (1.05), and efficient decision-making skills (1.04). Other notable differences included human resources management knowledge, critical information processing skills, and learning when at work. Overall, the results indicate that Poles tend to have a higher self-assessment of their competencies compared to Germans, especially in soft and management skills.

Table 2 presents the results of statistically significant differences identified by comparing the self-assessment of competencies between Polish and French managers surveyed. Ten statistically significant areas were identified, and in all of them, Poles rated their competencies significantly higher than the French.

The largest differences were observed in the areas of: sector-related IT software knowledge (a difference of 1.08), assertiveness (0.95), influencing others' skills (0.86), and human resource management knowledge (0.85). Differences were also found in decision-making skills, motivating employees, managing change, and creating and communicating a vision. No statistically significant differences were identified in the self-assessment of Poles and French in the area of competencies related to diversity management.

Table 2.
Competencies of Poles vs. French (statistically significant differences only, p < 0.05)

Competencies	Poles N = 24	French N = 32	Difference in the declared competence level	p
K: sector-related IT software knowledge	4.63	3.55	1.08	0.04
K: human resources management knowledge	5.33	4.48	0.85	0.01
PS: proficiency in thinking and developing solutions other than those already existing	5.83	5.13	0.71	0.03
IS: ability to create a vision and pass it on	5.58	4.78	0.80	0.01
IS: identification of sources of conflict	5.54	4.91	0.64	0.04
IS: impacting others' skills	5.45	4.55	0.86	0.03
IS: change management	5.48	4.90	0.58	0.04
IS: motivating employees- selection of tools	5.63	4.78	0.84	0.04
IS: efficient decision-making skills	5.96	5.25	0.71	0.01
IS: assertiveness	5.50	4.55	0.95	0.02

Source: own study results.

Table 3 shows a comparison of the self-assessment of competencies between Poles and Brits, where statistically significant differences occurred in only three competencies. It is worth noting that in two of the three areas analyzed, Poles rated their competencies significantly higher than the British, while in one case, they rated their competencies lower ($p < 0.04$), which did not occur in the comparison of self-assessment of Polish managers against any of the other nationalities. The biggest difference in favor of Poles was in industry-related knowledge (a difference of 1.17), as well as in learning when at work (0.99). Only in resourcefulness did the British rate themselves higher than the Poles (a difference of -0.64).

In summary, Poles rated their technical and adaptive competencies higher, while Brits rated their own resourcefulness better. Again, no statistically significant differences were noted in the area of diversity management in this comparison.

Table 3.
Competencies of Poles vs. British (statistically significant differences only, p < 0.05)

Competencies	Poles N = 24	British N = 21	Difference in the declared competence level	p
K: sector-related knowledge	3.17	2.00	1.17	0.03
PS: resourcefulness	5.58	6.22	-0.64	0.04
IS: learning when at work	6.30	5.31	0.99	0.01

Source: own study results.

5. Discussion

The research showed that differences in the self-assessment of competencies between women and men in the medical device industry are concentrated in selected areas. Women often indicated higher interpersonal, ethical, and diversity management competencies, while men

rated their analytical and financial skills higher. The results are consistent with the findings of Eagly and Carla (2009) and Fischer et al. (2018), who emphasize that women more often demonstrate competencies related to empathy and cooperation, while men focus on technical and strategic competencies. This also confirms the thesis of gender competency complementarity, which, as Fitzsimmons et al. (2014), can be a source of organizational strength.

Interpreting the results from the perspective of relational demography theory (Rakowska, 2021) allows for a better understanding of the dynamics of these differences. Women, being a minority in the MedTech sector, operate in conditions of greater "visibility" and often stronger evaluation, which may explain their greater focus on interpersonal and ethical competencies. Conversely, men, as the dominant group, are more likely to declare confidence in areas of strategic and technical knowledge. Similar correlations are indicated by the research of Szymanowicz and Furnham (2011), which shows that women are more likely to underestimate their competencies, while men tend to overestimate them.

The results of international studies further confirm the importance of cultural factors. Managers from Poland rated their competencies significantly higher than respondents from Germany, France, and the United Kingdom. This can be interpreted in the light of the GLOBE model (House et al., 2004), which indicates that achievement-oriented cultures (such as Poland) place greater emphasis on competencies related to decision-making and effectiveness (Komor, Schumann, 2015). At the same time, as noted by Gunkel, Schlaegel, and Taras (2016), there is a tendency in Central and Eastern Europe to overestimate managerial competencies, which is also reflected in this study.

The results can also be compared with the literature on women's presence in management positions in high-tech industries. Although women constitute the majority of employees in the healthcare sector, their share on the boards of MedTech companies is only 25-30% (Perez, 2022; Fitzsimmons et al., 2014). As Denend et al. (2020) and Entradas (2023) point out, this results from women's limited access to strategic roles and informal networks that shape managerial careers. The results of this study confirm this context – women declare key competencies for collaboration and diversity management. However, men are more likely to occupy positions that require financial and analytical competencies.

6. Summary

This article aimed to identify and evaluate managerial competencies in the medical device industry, considering gender differences and the international context. In response to the research questions, it can be concluded that:

(RQ1) The managers surveyed generally rated their level of competence highly, but gender differences emerged. Women more often declared higher interpersonal and diversity management competencies, while men pointed to their strengths in financial knowledge and analytical skills. These results confirm observations from the literature, indicating different emphases in the development and self-assessment of competencies between the two genders (Eagly, Carli, 2009; Fitzsimmons et al., 2014).

(RQ2) Analysis of the differences in the self-assessment of competencies between women and men showed that they are selective but significant from a management practice perspective. Interestingly, in many studies, women rate their competencies lower than men (Szymanowicz, Furnham, 2011; Bodard et al., 2024), while in this study, women reported higher skills related to relationship building, cooperation, and ethics. Other authors also obtained similar results, indicating the advantage of women in the area of interpersonal skills and diversity management (Eagly, Johannesen-Schmidt, van Engen, 2003). Conversely, men rated their strategic and technical competencies higher, which emphasizes the complementary nature of the competencies of both genders in management teams.

(RQ3) The results of international comparisons show that managers from Poland consistently declared a higher level of most competencies than their counterparts from Germany, France, and the United Kingdom. The most significant differences concerned change management skills, effective decision-making, and working in virtual teams. This can be interpreted in the light of the GLOBE model (House et al., 2004) and the literature pointing to a culturally conditioned tendency towards higher self-esteem in Central and Eastern European countries (Gunkel, Schlaegel, Taras, 2016).

In summary, the study confirms that differences in the self-assessment of managerial competencies between women and men in the medical device industry are selective but significant. In light of relational demography theory, they can be seen as the result of structural imbalances and different gender experiences in a sector traditionally dominated by men. At the same time, the results point to the potentially complementary nature of these competencies, which may foster the development of diverse, innovative teams in the MedTech industry.

Analysis of the research results enabled the formulation of practical recommendations for mixed-gender leadership training programs. In this context, it is worth noting:

- encouraging participation in training courses that complement areas in which a given gender is usually rated lower (e.g., finance, analytics, empathetic communication, teamwork),
- creating mixed-gender pairs and teams to learn from each other in practice,
- include women in strategic and financial projects, and men in initiatives requiring strong interpersonal skills,
- use mentoring and mutual feedback to identify and strengthen different leadership styles,
- ensure equal access to career paths and “visible” projects, regardless of gender.

At the same time, the limitations of the study should be emphasized. The analysis covered only four European countries, which limits the possibility of generalizing the results. In addition, the sample included a relatively small number of women (38 people), which requires caution in concluding. Finally, using self-assessment as the only data collection tool may involve the risk of overestimating or underestimating one's own competencies (Kruger, Dunning, 1999). The study's results can contribute to discussing managerial competencies in the innovative medical device industry and serve as a starting point for further in-depth research in this area. It would be worthwhile to use triangulation of methods (e.g., 360-degree feedback, supervisor assessments, case studies) and extend the analysis to other countries to capture cultural and institutional diversity better.

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