ASSESSMENT OF THE IMPORTANCE OF ORGANIZATIONAL LEADERSHIP IN THE CONDITIONS OF INDUSTRY 4.0 BASED ON RESPONDENTS' ANSWERS BY GENDER

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Purpose: The article discusses the assessment of perceptions of organizational leadership under Industry 4.0 conditions among the surveyed group based on 17 questions. The statements in the survey were formulated to allow respondents to express their opinions on the impact of leadership on various aspects of organizational performance, including financial performance, employee productivity, customer satisfaction, innovation, organizational culture, employee engagement and turnover. The article also outlines differences and similarities in perceptions of the importance of organizational leadership between women and men.

Design/Methodology: A survey was conducted on a targeted group. When analyzing the results obtained, the authors focused on descriptive statistics, in particular, the interpretation of the results of the percentage frequency of responses obtained, a comparison of responses among selected groups of respondents was carried out.

Findings: Based on the survey, a description was drawn up of the similarities detected and the differences between the responses of men and women in their perception of the importance of organizational leadership in Industry 4.0.

Research limitations/implications: In this article, the authors compile the results of their own research on leadership in Industry 4.0, being fully aware that research conducted on a purposive sample of 73 respondents does not allow generalizing conclusions to entire populations, although it does allow identifying the regularities present in a given community to guide further research. The research was conducted as part of a preliminary draft of Industry 4.0 issues and is a starting point for conducting in-depth research in this area. Due to the limitations of the small sample and its purposive selection, it is worthwhile in future research to expand the research group and use random sampling for the study.

Originality value: The results of the study provide important conclusions regarding perceptions of leadership, particularly between the responses of men and women on this issue. The research presented in this article is addressed to researchers dealing with the issue of organizational leadership in the context of Industry 4.0, as well as to practitioners interested in improving leadership effectiveness in the modern business world.

1. Introduction

Today's world, in the midst of the fourth industrial revolution known as Industry 4.0, is experiencing extraordinary technological changes that are having a profound impact on various aspects of business (Cresnar et al., 2023). From production methods to project management, human resources, these transformations are shaping the current business and organizational landscape (Spałek, 2017; Czupryna-Nowak, 2020; Kuzior 2020; Miśkiewicz et al., 2020; Spałek, 2020; Bijańska et al., 2020).

In the face of dynamic technological change, leadership is becoming an increasingly important and complex issue that plays a key role in the field of management and organization (Dzwigoł et al., 2020; Gębczyńska et al., 2020; Mrówka, 2021). Despite the intensive research on this issue, organizational leadership in the conditions of Industry 4.0 still remains a research area that needs further exploration (Soliński, 2023; Dębicka, 2023).

Research believes that leadership in organizations is seen as a key factor for adaptation and innovation (Ganiyu, 2022). In a dynamic environment, the ability of leaders to quickly adapt to changing conditions and effectively manage teams becomes critical (Kucharska, 2023).

The purpose of this article is to conduct an assessment of perceptions of organizational leadership in the era of Industry 4.0 among the study group, and to identify differences and similarities in perceptions of the importance of organizational leadership between genders. The article seeks a sound understanding of the role of leadership in today's organizations, taking into account today's technological and social challenges.

2. Importance of Leadership in Industry 4.0.

In an era of rapid technological advances and increasingly complex consumer needs, industry has undergone a series of transformations that can be put in the context of four major industrial revolutions (Thangaraj et al., 2018; Jeevitha et al., 2018; Lau et al., 2020; Raschke, 2022). The first industrial revolution, which had its origins in James Watt's invention of the steam engine, opened an era dominated by mass production (Wisniak, 2007; Vinitha et al., 2020; Zamorska, 2020). The second industrial revolution, characterized by the growing use of electricity and the introduction of innovative machinery, has revitalized the processes of production, processing and distribution of goods (Hunter, 1985; Olszewski, 2016; Schega,

2022). The third industrial revolution is described in the literature as the integration of advanced technologies such as the Internet of Things, Big Data, robotics, 3D printing and mobile technologies. These elements of a complex technological mosaic have had a significant impact on the optimization and automation of manufacturing processes (Zakoldaev et al., 2020; Ratajczak et al., 2020).

In the face of a rapidly changing business environment, accelerating technological advances and increasing global competition, organizations are obliged to constantly explore innovative strategies and models of operation. These goals are aimed at gaining and maintaining competitive advantage, which is only possible by effectively adapting to changing circumstances and taking advantage of emergent opportunities (Rogozińska-Pawełczyk, 2022). This concept is deeply rooted in the phenomenon of the fourth industrial revolution, which represents the culmination of advances in the fields of information technology and automation. The latest phase of the industrial revolution is defined by the synergistic action of elements such as digitization, the Internet of Things (IoT) and advanced production management systems. These cutting-edge approaches are not only complementary, but also mutually reinforcing, offering entirely new ways of manufacturing and managing production (Davies, 2015; Bendkowski, 2017; Gracel et al., 2017; Götz, 2018; Furmanek, 2018; Wieczorek, 2018; Cellary, 2019; Skórnóg, 2023].

Faced with the changing context of the business environment, extracted from a framework of complex dynamics resulting from technological advances and globalized competition, organizations are obliged to continue strategic innovation. They aspire to achieve and maintain competitive advantage by effectively adapting to change and exploiting newly emerging opportunities (Rogozińska-Pawełczyk, 2022). This is an understandable phenomenon in the context of the fourth industrial revolution, which is dominated by advanced information technology, automation and robotics (Gracel et al., 2017; Götz, 2018; Furmanek, 2018; Wieczorek, 2018). This revolutionary paradigm is influencing the configuration of the industry through the synergetic interaction between elements such as digitization, the Internet of Things and advanced manufacturing systems, thus catalyzing the re-engineering of manufacturing and management processes (Davies, 2015; Bendkowski, 2017; Cellary, 2019; Skórnóg, 2023).

Organizational sustainability is closely linked to the growing need for competent employees who can adequately navigate organizational activities in pursuit of strategic goals (Gajdzik, 2021; Rogozińska-Pawełczyk, 2022). This demand for skills has resulted in the formation of the concept of Leadership 4.0, which is becoming increasingly fundamental in the context of Industry 4.0 (Kasapoglu, 2018). In this modern industrial landscape, leadership is defined as the ability to dynamically adapt and mobilize integrated, networked teams to achieve designated imperatives (Rogozińska-Pawełczyk, 2022). Such leaders must possess a rich set of competencies that includes not only digital knowledge and skills, but also vision, the ability to manage risk, and the ability to collaborate effectively (Bawany, 2019).

In the era of Industry 4.0, the importance of organizational leadership is evolving, emphasizing the need for innovation and adaptation in management (Berdecia-Cruz et al., 2022). Differences in leadership styles expected by men and women can affect effectiveness and dynamics in the workplace (Sayang, 2021). Understanding generational differences in leadership perceptions is key in the context of rapidly changing technology and innovation (Naicker et al., 2018). Promoting diversity and equality in leadership, especially in traditionally male-dominated industries, is important for creating sustainable and innovative work environments (Banihammad, 2023). Additionally, there is a need to prepare future leaders to lead organizations in an equitable, diverse and inclusive manner, which underscores the importance of leadership education and strategy (Gray, 2023). Research on the impact of gender on leadership style and job satisfaction can provide insight into how different leadership approaches affect employee satisfaction (Naicker et al., 2018). Research in other authors shows that female gender can be important in building enterprise value, especially in the area of innovation (Zastempowski, Cyfert 2021).

3. Methods

The study was carried out by means of a survey questionnaire developed by the authors of the article and was aimed at people supporting decision-making processes in trade, production and service establishments in Poland. The survey questionnaires were distributed to 4673 purposefully selected entities. This decision allows the deliberate selection of respondents who have certain characteristics of interest to the researchers. Seventy-three correctly completed return questionnaires were obtained, which met the established sampling criteria for the study:

- respondent's length of service is at least three months,
- type of activity of the organization in which respondents work: trade, production or services,
- respondent is an adult (over 18 years of age).

The research was conducted between November 2022 and July 2023. The authors are aware that this type of research does not allow the generalization of conclusions to the entire population, although it does allow the emergence of regularities occurring in a given community, in order to guide further research directions.

The questions in the survey questionnaire made it possible to assess the phenomena under study and the relationships between them. The questionnaire consists of the following parts:

- Metrics (12 questions, 12 features).
- Specific questions (2 questions, 67 features).

The survey questionnaire contained a total of 14 questions examining 79 characteristics.

When analyzing the results obtained, the authors focused on descriptive statistics, in particular, the interpretation of the results of the percentage frequency of responses obtained, a comparison of responses among selected groups of respondents was conducted.

The objectives of this research are:

C1. Assessing perceptions of organizational leadership in the era of Industry 4.0 among the surveyed group.

C2. Identify differences and similarities in perceptions of the importance of organizational leadership among men and women.

The following research questions were posed in relation to the research objectives:

P1. How is the importance of organizational leadership in the era of Industry 4.0 perceived among the group surveyed?

P2. What are the differences and similarities in perceptions of the importance of organizational leadership among men and women in the professional group studied?

4. Results

73 respondents took part in the survey. Analysis of the responses of respondents to the survey included: gender, age, education, length of service, form of employment, position, form of work performed. Respondents were also asked about the province in which the organization in which they work is registered, the age of the organization, the number of employees it employs, the type of business it conducts and its scope. Table 1 shows the summary characteristics of the group of respondents and the organization in which they work.

Table 1.
Summary characteristics of the group of respondents and the organization in which they work

Variable	Variant	Volume (n = 73)	Share %
Sex	Male	46	63,01%
	Female	27	36,99%
Age	26 – 35	35	47,95%
	36 – 45	17	23,29%
	over 45	16	21,92%
	18 -25	5	6,85%
Education	Higher	56	76,71%
	Secondary	14	19,18%
	Basic vocational or primary education	3	4,11%
Seniority	3 months to 1 year	6	8,22%
	1 do 3 years	31	42,47%
	4 to 10 years	8	10,96%
	7 to 10 years	8	10,96%
	Over 10 years	20	27,40%

Cont. table 1.

Form of employment	Permanent employee, under contract	60	82,19%
	Temporary worker, contractual agreement	13	17,81%
Position	Administrative worker	33	45,21%
	Manager	20	27,40%
	Board member	13	17,81%
	Manual worker	7	9,59%
Form of work performed	Stationary work at the company's headquarters	42	57,53%
	Hybrid work	27	36,99%
	Remote work	4	5,48%
Province	Śląskie Province	52	71,23%
	Mazowieckie Province	8	10,96%
	Other: Podkarpackie Province (3), Pomorskie Province (2), Świętokrzyskie Province (2), Wielkopolskie Province (2), Lubelskie Province (1), Małopolskie Province (1), Opolskie Province (1), Warmińsko-Mazurskie Province (1)	13	17,81%
Age of the organization	Over 10	64	87,67%
	3-5	4	5,48%
	5-10	3	4,11%
	Under 3 years	2	2,74%
Size of the organization	51-250 people	27	36,99%
	More than 250 people	25	34,25%
	11-50 people	16	21,92%
	Up to 10 people	5	6,85%
Type of activity of the organization	Manifacturing	44	60,27%
	Services	19	26,03%
	Trade	10	13,70%
Organization's reach	International	48	65,75%
	National	14	19,18%
	Local/regional	11	15,07%

Source: own elaboration.

Analysis of the data showed that 63.01% of men and 36.99% of women participated in the survey. Most respondents have a university degree (76.71%), followed by high school (19.18%), and the remaining respondents have basic vocational or primary education (4.11%). Respondents represent different age groups, and therefore different generations. The 26 to 35 age bracket, which accounts for 47.95% of the sample, includes representatives of the so-called Generation Y (millennials) (Bakalova et al., 2023). Those between the ages of 36 and 45, representing 23.29% of respondents, belong to Generation X. Respondents over 45 (21.92%) represent the Baby Boomers generation (Hwang, 2022). The smallest group of respondents, i.e. 18-25 years old, is Generation Z (6.85%). Analyzing the data by generation provides a deeper understanding of the phenomenon under study, taking into account potential differences in the perception of leadership in Industry 4.0 among people in different age categories.

The seniority variable in the surveyed group of respondents also varies and is as follows: Employees with seniority of 1 to 3 years (42.47%) make up the largest group of respondents. This was followed by those with seniority of more than 10 years (27.40%), 4 to 10 years (10.96%) and 7 to 10 years (10.96%). The responses of respondents with varying length of service provide an important perspective on the surveyed phenomenon in the context of work experience.

The majority of respondents are permanent employees working on a contract of employment (82.19%), while the rest are temporary employees working on a contract (17.81%). Respondents represent the following groups of employees: administrative (45.21%), managers (27.40%), board members (17.81%) and manual workers (9.59%).

Respondents mostly work in desktop form (57.53%)., followed by hybrid (36.99%). The fewest work only in remote form (5.48%).

Respondents mostly work in organizations operating in the Śląsk Province (71.23%) and Mazowieckie Province (10.96%) provinces. Other provinces, such as Podkarpackie Province, Pomorskie Province, Świętokrzyskie Province, Wielkopolskie Province, Lubelskie Province, Małopolskie Province, Opolskie Province, Warmińsko-Mazurskie Province, together account for 17.81% of the sample. The dominant sector in which respondents work is manufacturing (60.27%), followed by the service sector (26.03%) and trade (13.70%). Respondents mostly work in organizations that have been in the market for more than 10 years (87.67%), which operate in the international market (65.75%), followed by domestic (19.18%) and local/regional (15.07%). The survey included those who work in organizations that employ 51 to 250 people (36.99%), more than 250 people (34.25%), 11 to 50 people (21.92%) and up to 10 people (6.85%).

A detailed analysis of these data provides a more complete picture of the structure of the respondent group, which provides important context for further conclusions and discussions.

In order to answer the research questions posed, respondents were asked to rate the importance of organizational leadership in the era of Industry 4.0 based on a five-point Likert scale, where 1 - definitely no; 2 - no; 3 - don't know; 4 - yes; 5 - definitely yes. Table 2. presents a list of 17 questions addressed to respondents. The statements in the survey were formulated to allow respondents to express their opinions on the impact of leadership on various aspects of organizational performance, including financial performance, employee productivity, customer satisfaction, innovation, organizational culture, employee engagement and turnover. In addition, the survey touches on the importance of a leader's soft and hard competencies, providing a deeper understanding of which skills are considered key in the new business paradigm.

Table 2.
List of survey questions with results of average ratings of perceptions of organizational leadership among respondents (n = 73)

Lp.	Statement	Purpose of the question	Average raiting (n = 73)
1	Organizational leadership today is far more important than ever before.	This statement explores the notion that the role of organizational leadership is now more important than ever, which may reflect the increasing complexity and speed of change in the business environment.	3,77
2	Industry 4.0 has introduced new requirements for leadership skills.	This question focuses on whether respondents believe the fourth industrial revolution has introduced new requirements for leadership skills, which may indicate the need for new competencies or adaptation of existing ones.	3,77
3	Organizations need a pro-quality model to provide effective leadership in an Industry 4.0 environment.	Here, opinion is explored on the need for a leadership model that is tailored to promote quality and efficiency in an Industry 4.0 environment.	3,79
4	Leadership is critical to an organization's success.	This statement is intended to assess the belief that leadership is a key determinant of an organization's success.	4,18
5	Industry 4.0 has influenced a shift in traditional organizational leadership models.	The question explores whether Industry 4.0 has influenced a change in traditional leadership models, which may suggest an evolution in approaches to managing and leading teams.	3,56
6	A leader is essential in an organization.	This statement assesses the belief in the indispensability of the leadership role in the organizational structure.	4,41
7	Organizational leaders should have the ability to quickly adapt to the changing conditions of Industry 4.0.	Here, respondents assess the importance of leaders' ability to adapt quickly to the changing conditions of Industry 4.0.	4,30
8	An organizational leader should have the ability to make decisions based on the values of the organization.	This question focuses on the importance of leadership skills in making decisions that are consistent with the organization's values.	4,14
9	Leadership has an impact on an organization's financial performance.	This statement explores the notion that leadership has a direct impact on an organization's financial performance.	3,96
10	Leadership has an impact on employee productivity.	Here, the belief that leadership influences employee productivity levels is assessed.	4,29
11	Leadership has an impact on customer satisfaction.	This question examines whether there is a relationship between leadership quality and customer satisfaction.	3,79
12	Leadership has an impact on an organization's innovation.	This statement assesses whether leadership is considered a factor in an organization's ability to innovate.	4,07
13	Leadership has an impact on organizational culture.	Here, respondents express their opinions on the impact of leadership in shaping organizational culture.	4,11
14	Leadership has an impact on employee engagement.	The question explores the belief that leadership affects the level of employees' commitment to their work and the organization.	4,30
15	Leadership has an impact on employee turnover.	This finding assesses whether leadership can influence the frequency of employee change within an organization.	4,07
16	A leader's soft skills are important.	The question explores the importance of a leader's soft skills, such as communication, empathy and the ability to motivate.	4,07
17	The hard competencies of a leader are important.	Here, respondents rate the importance of a leader's hard competencies, such as technical knowledge and analytical skills.	3,88

Source: own elaboration based on (Budgol, 2006; Budgol, 2010; Austen, 2010; Walczak, 2011; Hartliński, 2012; Mockałło, 2013; Jucha, 2013; Mróz, 2014; Kopertyńska, 2015; Gadomska, 2015; Kazak, 2017; Dyduch, 2017; Głomb, 2020; Gundowska et al., 2020; Gostowska et al., 2021; Mrówka, 2021; Majczyk, 2022; Schwabe, 2023).

Table 3 presents the results of surveys based on calculating the average responses of respondents, taking into account their gender. Through this analysis, it is possible to better understand how different aspects of the issues under study are evaluated by respondents according to gender.

Table 3.
Average scores of leadership importance for selected groups of respondents

Lp.	Variable	Average scores for selected groups of respondents		
		The entire study group (n = 73)	Men (n = 46)	Women (n = 27)
1	A leader is essential in an organization.	4,41	4,46	4,33
2	Organizational leaders should have the ability to quickly adapt to the changing conditions of Industry 4.0.	4,30	4,26	4,37
3	Leadership has an impact on employee engagement.	4,30	4,33	4,26
4	Leadership has an impact on employee productivity.	4,29	4,30	4,26
5	Leadership is critical to an organization's success.	4,18	4,11	4,30
6	An organizational leader should have the ability to make decisions based on the values of the organization.	4,14	4,02	4,33
7	Leadership has an impact on organizational culture.	4,11	4,09	4,15
8	Leadership has an impact on an organization's innovation.	4,07	4,13	3,96
9	Leadership has an impact on employee turnover.	4,07	3,98	4,22
10	A leader's soft skills are important.	4,07	4,07	4,07
11	Leadership has an impact on an organization's financial performance.	3,96	3,96	3,96
12	The hard competencies of a leader are important.	3,88	3,87	3,89
13	Organizations need a pro-quality model to provide effective leadership in an Industry 4.0 environment.	3,79	3,74	3,89
14	Leadership has an impact on customer satisfaction.	3,79	3,85	3,70
15	Organizational leadership today is far more important than ever before.	3,77	3,61	4,04
16	Industry 4.0 has introduced new requirements for leadership skills.	3,77	3,74	3,81
17	Industry 4.0 has influenced a shift in traditional organizational leadership models.	3,56	3,46	3,74

Source: own elaboration.

For the entire group of respondents, the following variables are the most important in assessing leadership 4.0:

- A leader is essential in an organization (4,41).
- Leadership has an impact on employee engagement (4,30).
- Organizational leaders should have the ability to quickly adapt to the changing conditions of Industry 4.0 (4,30).

For men, the results are as follows:

- A leader is essential in an organization (4,46).
- Organizational leaders should have the ability to quickly adapt to the changing conditions of Industry 4.0 (4,33).

- − Leadership has an impact on employee productivity (4,30).

For women, the following are of greatest importance:

- − Leadership has an impact on employee engagement (4,37).
- − A leader is essential in an organization (4,33).
- − An organizational leader should have the ability to make decisions based on the values of the organization (4,33).
- − Leadership is critical to an organization's success (4,30).

Figure 1 shows in the form of a radar chart the average assessment of the importance of leadership among a group of male and female respondents.
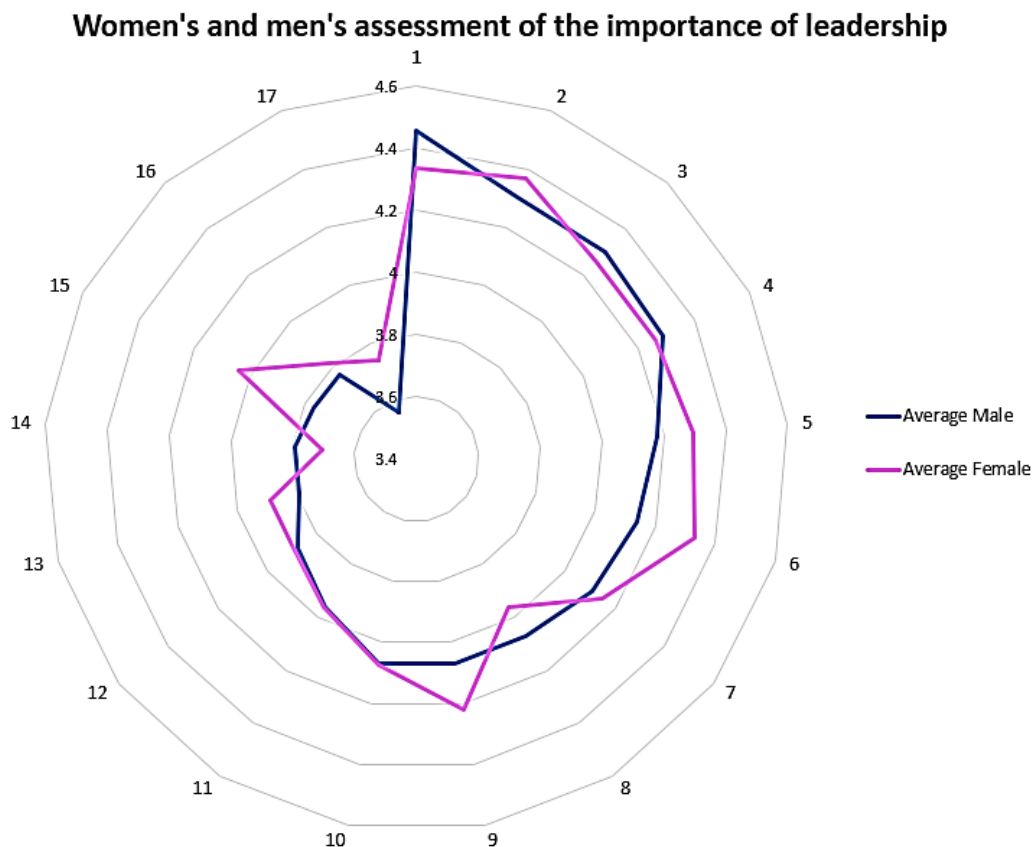

Figure 1. Average rating of the importance of leadership among a group of male and female respondents.

Source: own study.

Women and men agree that a leader is essential in an organization (Schwabe, 2023). For women, however, the most important thing is that leadership has an impact on employee engagement (Walczak, 2011). Women also point out that a leader should have the ability to make decisions based on the organization's values, and note that leadership is crucial to an organization's success (Bugdol, 2006; Austen, 2010). Women also note that leadership has an impact on organizational innovation and that organizational leadership today is much more important than ever before (Hartliński, 2012; Mrówka, 2021).

For men, on the other hand, the most important thing is that organizational leaders should have the ability to adapt quickly to the changing conditions of Industry 4.0, and pay attention to the impact of leadership on employee productivity (Gostkowska et al., 2021). Men also rate higher than women on the statement that: leadership has an impact on employee turnover (Majczak, 2022).

Men also rate higher than women on the statement that: leadership has an impact on employee turnover. Differences in perceptions of leadership among men and women may be due to different experiences and expectations regarding the issue under study (Cha et al., 2023). Research in the field of leadership often points to gender differences in leadership styles and preferences, which may influence how respondents of different genders evaluate the importance and effectiveness of leadership in different contexts (Sondakh et al., 2021).

Analysis of the survey results indicates that women and men have broadly similar perceptions of the role of leadership in an organization. Women and men agree that a leader is essential in an organization, with women emphasizing the impact of leadership on employee engagement and the key role of leadership for organizational success. With respect to men, they highlight the ability of leaders to adapt quickly to the changing conditions of Industry 4.0 and the impact of leadership on employee productivity. Both genders are positive about the impact of organizational leadership on various aspects of company performance, such as organizational culture, innovation, financial performance and customer satisfaction. Respondents also agree that a leader's soft and hard competencies are important in the context of Leadership 4.0, with soft competencies rated higher on average (4.07) than hard competencies (3.88). Respondents rated lowest the statements that organizations need a pro-equality model to provide effective leadership under Industry 4.0 conditions (3.79), Industry 4.0 has introduced new requirements for leadership skills (3.77) and that Industry 4.0 has influenced a change in traditional organizational leadership models (3.54).

These results may suggest that organizational leadership is seen as an important factor in organizational success, especially in the context of the challenges and changes associated with Industry 4.0.

5. Conclusion

The survey presented in this article aims to assess perceptions of organizational leadership in the context of Industry 4.0 and to identify differences and similarities in perceptions among men and women. In response to the research questions posed, the survey results point to several key findings.

First, both women and men agree that a leader is essential in an organization, highlighting the universal importance of leadership in the modern business world. The average score for this variable was 4.41 for the entire group of respondents, indicating a high degree of agreement among respondents.

Second, among women, the impact of leadership on employee engagement is of greatest importance, suggesting that women value leaders who can motivate and inspire their teams. Women also highlight the ability to make decisions based on the organization's values, and the key role of leadership for the success of the organization.

Men, on the other hand, place more emphasis on the ability of leaders to adapt quickly to the changing conditions of Industry 4.0 and on the impact of leadership on employee productivity. This indicates that men value leaders who are flexible and focused on results.

Differences in perceptions of leadership between men and women may be due to different experiences and expectations. Studies in the field of leadership often indicate differences in leadership styles and preferences between the sexes, which may affect how respondents of different genders evaluate the importance and effectiveness of leadership.

In summary, the results of the study indicate that women and men generally have similar perceptions of the role of leadership in the organization, with some differences in the emphasis of particular aspects of leadership.

Both genders express positive evaluations of the impact of organizational leadership on various aspects of company performance, such as organizational culture, innovation, financial performance and customer satisfaction. A review of these results suggests that organizational leadership is an important determinant of organizational success, especially in the context of the dynamic challenges and transformations associated with the Industry 4.0 era.

The research presented in this article may be useful for researchers working on the issue of organizational leadership in the context of Industry 4.0, as well as for practitioners interested in improving leadership effectiveness in the modern business world. The results of the survey provide important insights into perceptions of leadership, especially gender differences on this issue.

The survey can provide a basis for further research on gender differences in leadership perceptions and for developing team management strategies that take these differences into account. For business practitioners, the analysis of the results can inspire the adaptation of leadership practices to the expectations of different groups of employees, which will contribute to more effective organizational management in the era of Industry 4.0.

The findings are part of a collection of articles on perceptions of organizational leadership under Industry 4.0 conditions by different groups of respondents. In the following articles, the authors will focus on the differences in perceptions of leadership in generations BB, X, Y, Z, by position, scope of the organization, type of activity, form of work performed and number of employees in the organization.

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