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THE ROLE OF GREEN COMPETENCIES FOR THE SUSTAINABILITY MANUFACTURING GROW: PRELIMINARY RESEARCH

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Purpose: The EU's guidelines exert an important influence on companies aiming to accelerate the implementation of green measures and minimise their negative environmental impacts. The objective of this paper is to define the key categories of green organisations and green competences whose development can accelerate the implementation of green processes in companies.
Design/methodology/approach: Based on the literature review, a semi-structured qualitative research questionnaire was developed and a pilot study was conducted on four large manufacturing companies.
Findings: A list of categories of activities linked to green organisations was developed and key components of green competences were defined. It was shown that performance-related managerial competences are the most important components of green competences for the companies. It was also pointed out that the categories that are the components of green organisations are important and that the degree to which they are met has been increasing over time in recent years.
Research limitations/implications: The pilot study was conducted with middle and senior-level representatives of four manufacturing companies. Its conclusions will be used to continue the research with a larger sample.
Practical implications: The results of the study will allow companies to better adapt to the challenges of sustainability and green organisations. Key green competences and an emphasis on their development in the companies will allow more green organisation areas to be achieved more quickly.
Social implications: The development of green organisations has a direct influence on minimising the negative environmental impacts and thereby improving the quality of life for everyone in society.
Originality/value: Based on the analysis of the literature, it can be stated that there is no clear definition of green organisations while the variety of measures and their nomenclature in the area of sustainability is extensive. Research in that area contributes to the development of the science of management and quality and represents an important new field of research. This paper is meant for researchers and practitioners as well as HR representatives who work with the issue of green competences and green organisations.

Keywords: green organisation, green competences, competence management, sustainability, sustainable manufacturing.

Category of the paper: Research paper.

1. Introduction

For nearly 30 years, the European Union (the European Economic Community until 1993) has been taking intensified action to minimise negative impacts on the environment. With more and more guidelines relating to ecology being defined in legislation, companies are being urged to implement "green measures"in various spheres of their operations. Green measures refer not only to the concept of sustainability but also to other relevant concepts that have been defined in the literature and legislation such as the circular economy (Machado et al., 2020), green supply chain (Jamwal et al., 2021), sustainable manufacturing (Lin et al., 2017), green human resource management (Paulet et al., 2021), environmental management (Bak, 2021), green marketing (Saleem et al., 2021), green product design or zero-waste buildings (Jamwal, 2021).

From the point of view of the current environmental challenges and regulatory requirements facing companies (especially those in the manufacturing industry), it is essential that people, their responsibility, knowledge, skills and attitudes are oriented towards taking up the challenges of building "green organisations" (GO) (Singh et al., 2018). Such an approach ensures that measures are implemented that lead to the minimisation of negative environmental impacts.

An important research gap in the field of human resource management (HRM) is formed by the lack of clearly defined and systematised pro-environmental competences that can accelerate the development of GOs. The aim of this paper is to provide a preliminary verification of the level of green organisations in manufacturing companies and to analyse the knowledge of their HR representatives regarding green competences and the need for them in the surveyed enterprises. The research results were achieved in several steps. A literature review of green manufacturing enterprises and green competences (GCs) was conducted. Subsequently, based on the literature review, a semi-structured individual interview questionnaire was developed and then divided into two main parts of questions concerning GOs and GCs, respectively. The methods, techniques, research tool and data are characterised in chapter four. Based on the pilot study, i.e. four individual interviews, GO levels in the manufacturing companies and the knowledge of their HR representatives regarding GCs and the need for them in the surveyed companies were preliminarily verified, as presented in part four of the paper. The final chapter summarises and identifies further research directions.

2. Green organisation

GOs are thought to be those in which production, organisational and marketing processes are carried out in line with the principles of sustainable development, using environmentally friendly technologies, waste reduction, energy efficiency and sustainable resource management based on social, natural and economic pillars. The importance of implementing green processes in companies, especially manufacturing ones, is key to reducing negative environmental impacts.

In the literature, a growing number of authors have been conducting research focused on sustainability-related concepts. Those relating specifically to manufacturing companies include the following:

1. *Sustainable manufacturing* characterised by the integration of processes and systems that can produce high-quality products and services using fewer and more sustainable resources (energy and materials) that are safer for the employees, customers and surrounding communities and can mitigate environmental and social impacts throughout the life cycle (Mohanty, Jagtap, 2020).
2. *Green Human Resource Management* (GHRM) means the policies, practices and systems that make the organisation's employees plan and implement green processes for the benefit of the individual, society, the environment and the business. These include three categories: green skills, including green recruitment and selection, green motivation, including green performance management, and green possibilities, including opportunities consisting of green employee engagement and a green culture (Cabal, Dhar, 2020).
3. *Improving employees' knowledge and awareness* of ecology and sustainability as part of training, green skills education and green GHRM motivation.
4. *Environmental management* is based on the organisational implementation of an environmental management system, i.e. the identification of the environmental aspects of activities and the development, implementation and maintenance of the company's environmental policy (Bąk, 2021, p. 10).
5. *Minimising the use of resources*, *including energy,* understood as improving the industrial sector's capacity to manufacture in a sustainable and resource-efficient way. The concept is linked to sustainable manufacturing (Machado et al., 2020).
6. *Green (sustainable) marketing* which assumes that all activities to prepare, produce, promote and sell a good and maintain contact with the customer should combine the aspect of profitability and competitiveness of the company with social and ecological usefulness to improve the quality of life (Brzustewicz, 2014).

7. *Green construction of products*, i.e. the correct choice of raw materials and intermediate products and a way of combining different materials in a disjointed manner to enable the reuse of as many product components as possible (Geda, 2020).
8. *Green supply chains* broadly defined as e.g. environmental management in the supply chain, green purchasing and procurement, green logistics, reverse logistics and environmental logistics and sustainable supply network management (Tseng et al., 2019).
9. *Circular economy* (*closed-loop waste management)* defined as the realization of a closed-loop material cycle throughout the economic system as well as the optimization of resource consumption (Alhawari et al., 2021) and the ecological design of the resource management system.
10. *Zero waste buildings* are buildings with very high energy performance where the primary energy consumption rate expressed in kWh/m2 is important. They are characterised by almost zero or very low amounts of required energy which should largely come from renewable energy sources, including sources of renewable energy generated on site or nearby (Jura, 2014).

In each of these categories, important are competences that will help develop green organisations faster, thus reducing negative environmental impacts.

The concept of green competences can be understood as the knowledge, skills and attitudes that make it possible to accomplish the mission of minimising negative impacts on the environment and initiating and implementing actions in line with the principles of sustainable development. Literature uses various keywords in that area, including green competences (Cabral and Dhar 2020), green skills (Vona et al., 2015) or "sustainability competencies" (Remington-Doucette, and Musgrove, 2015), understood as competences in the area of sustainable development (Wiek et al., 2015).

In addition to the literature review with respect to green competences (Cabral, Dahr, 2020), report results (Willard et al., 2010) provided the basis for the development of a questionnaire for individual interviews with managers and heads of human resources departments of selected large Poland-based manufacturing companies.

3. Methods, techniques, research tool and data

The semi-structured individual interview questionnaire was divided into 3 parts, i.e. background information about the company, green organisations and green competences. Based on the literature review (briefly characterised in part 2 hereof) and ten green organisation categories, respondents were asked about their knowledge of them. The study used a three-step scale, with each step having the following meaning: 1 – I have never heard about it;

2 – I have heard about it but do not know exactly what it is; 3 – I have heard about it and I know what it is; Where the respondents have heard of the concepts (step 2 or 3), they assessed the extent to which the category was met in the company now, i.e. in 2022, and in 2017. The study adopted a scale of 0 to 5 where 0 means that it is not important at all while 5 means that it is important to a very high degree.

Based on the literature devoted to GC, the third part was divided into four categories: knowledge, skills, attitudes and performance-related managerial skills. A total of 138 concepts were defined and assigned to separate categories. They were rated by respondents in the same way as in the second group of questions in the questionnaire devoted to GOs.

The pilot study in the form of individual interviews was conducted between 31 March and 8 April 2022 with managerial level representatives of mainly human resources departments of four large manufacturing companies with an average of more than 250 employees in 2021. The positions held by the respondents included HR Manager, HR Country Manager or Project Director.

4. Preliminary results of research on green competences in manufacturing companies

4.1. Green organisations

Ten assessed categories characterising GOs were known to all or almost all respondents (Table 1). Among the ones they never heard of, only three are mentioned: GHRM, green marketing and eco-friendly product design. The results indicate that the companies are familiar with current trends in implementing sustainability principles in different areas of the company. The highest-rated categories include environmental management (4.3), minimising the consumption of resources, including energy (4.3) and shaping employee knowledge and awareness of ecology and sustainability (3.8). Sustainable manufacturing (3.5) is another important category. That may indicate that the companies are now moving from the level of shaping employee knowledge to the level of practically implementing and improving production processes in line with the principle of sustainability. It is confirmed by the result differences in the evaluation of the implementation of each category in 2017 versus 2022. The biggest difference (2.0) was reported in the sustainable manufacturing category as well as employee knowledge and awareness (2.0). Detailed results are presented in Table 1.

Table 1.
Categories associated with green organisations and the extent to which they were met in the surveyed companies in 2022 and in 2017

	Number of respondents who have heard of or know the category well	Number of respondents who have not heard of the category	The extent to which the category was met in the company in 2022	The extent to which the category was met in the company in 2017	2022 vs 2017 result difference
Sustainable manufacturing	4	0	3.5	1.5	2.0
Knowledge and awareness of ecology and sustainability	4	0	3.8	1.8	2.0
Environmental management	4	0	4.3	2.5	1.8
Minimising the use of resources, including energy	4	0	4.3	2.5	1.8
Green supply chains	4	0	2.5	0.8	1.8
Green Human Resources Management	3	1	2.3	1.0	1.3
Circular economy	4	0	3.3	2.0	1.3
Green marketing	3	1	2.3	1.3	1.0
Zero waste buildings	3	1	2.3	1.3	1.0
Environmentally friendly product design	3	1	2.7	1.7	1.0

4.2. Green competences

GCs were divided into four component groups: knowledge (34 components), skills (37 components), attitudes (34 components) and performance-related managerial skills (33 components). Due to the limited possibility of presenting all the results, the most important ones have been selected.

Table 2.
Selected knowledge areas associated with green competences and the extent to which they are met in the surveyed companies in 2022 and in 2017

	Number of respondents who have heard of or know the category well	Number of respondents who have not heard of the category	Relevance of knowledge in the company in 2022	Relevance of knowledge in the company in 2017	2022 vs 2017 result difference
Natural resources and biodiversity	3	1	4.3	2.0	2.3
Searching for niches	3	1	3.5	1.5	2.0
Business model	4	0	4.0	2.0	2.0
Environmental justice	2	2	5.0	3.3	1.8
Gross National Product	4	0	4.3	2.5	1.8
Low-Impact Development (LID)	2	2	4.0	2.3	1.8

Cont. table 2.

Knowledge that integrates natural and social science disciplines to focus on aspects that reduce energy consumption, reduce environmental waste and protect ecosystems	**4**	**0**	**4.5**	**2.8**	**1.8**
Knowledge relating to environmental practices, in particular compliance with laws, rules of order and safety regulations	4	0	4.5	2.8	1.8
Knowledge on how to reduce energy and resource consumption, the greenhouse effect, waste and pollution and how to conserve and protect nature	4	0	4.8	3.0	1.8
Environment	4	0	3.5	2.0	1.5
Social justice	4	0	4.3	2.8	1.5

Among the 37 surveyed areas of **knowledge**, the areas least familiar to respondents were highlighted. They included the triple bottom line, knowledge of the tragedy of the commons, natural systems, social justice and low-impact development. Table 2 shows the knowledge areas whose relevance has changed the most between 2017 and 2022 in the surveyed companies.

The largest differences in the relevance of the different categories of knowledge were diagnosed in the following areas: natural resources and biodiversity, environmental justice and Gross National Product.

The area of **skills** was more familiar to the respondents. Among those least familiar were groups that were unknown to half of the respondents: pollution allowance trading and the Natural Step. Table 3 shows the skills whose relevance has changed the most between 2017 and 2022 in the surveyed companies.

The area of **attitudes** was clear to all respondents. None of the 34 attitudes was indicated by the respondents as unknown. The arithmetic average of respondents' assessments and their requirements in 2017 and 2022 are shown in Table 4.

Table 3.
Selected skill areas associated with green competences and the extent to which they were met in the surveyed companies in 2022 and in 2017

	Number of respondents who have heard of or know the category well	Number of respondents who have not heard of the category	Relevance of skills in the company in 2022	Relevance of skills in the company in 2017	2022 vs 2017 result difference
Citizen involvement	4	0	4.0	2.0	2.0
Sustainability planning	4	0	3.8	1.8	2.0
Specialist skills in eco-friendly product development	4	0	3.3	1.5	1.8
Resource-based community development	3	1	4.3	2.7	1.7
Project planning	4	0	4.3	2.8	1.5
SWOT analysis	4	0	4.0	2.5	1.5
Skills needed for green jobs, including reducing energy and raw material consumption, mitigating greenhouse gas emissions, reducing pollution and protecting the ecosystem	4	0	3.8	2.3	1.5
Leadership	4	0	4.5	3.0	1.5
Natural Step	2	2	3.0	1.5	1.5

Table 4.
Selected attitude areas associated with green competences and the extent to which they were met in the surveyed companies in 2022 and in 2017

	Number of respondents who have heard of or know the category well	Number of respondents who have not heard of the category	Relevance of attitudes in the company today	Relevance of attitudes in the company in 2017	2022 vs 2017 result difference
Preventive actions taken to protect and preserve the environment	4	0	4.0	1.8	2.3
Behaviour towards the production of green products, labelling of products as environmentally safe, recycling and recovery of packaging and development of products that cause the least environmental damage	4	0	4.5	2.5	2.0
Local and global responsibility	4	0	4.3	2.5	1.8
Green awareness as personal awareness, curiosity and environmental skills	4	0	3.8	2.0	1.8

Cont. table 3.

Awareness of sustainable development, especially in environmental, social and economic terms	**4**	**0**	**3.8**	**2.0**	**1.8**
Change agent	4	0	3.8	2.3	1.5
Flexibility	4	0	4.8	3.3	1.5
Perceiving, feeling and being aware of the environment and its problems	4	0	3.8	2.3	1.5
Attitudes oriented towards the world-view and concern for the environment and a commitment to solving environmental problems	4	0	3.5	2.0	1.5
Attitude supported by a sense of responsibility for environmental issues, respect for nature and society and evaluation of socio-environmental conflicts	4	0	3.5	2.0	1.5

The areas of **performance-relevant managerial skills** that were least familiar to the respondents included the design and management of the Sustainability Operating System (SOS) (2 respondents). Table 5 shows selected performance-related managerial skill areas associated with green competences and the extent to which they were met in the surveyed companies in 2022 and in 2017.

Table 5.
Selected performance-related managerial skill areas associated with green competences and the extent to which they were met in the surveyed companies in 2022 and in 2017

	Number of respondents who have heard of or know the category well	**Number of respondents who have not heard of the category**	**Relevance of skills in the company today**	**Relevance of skills in the company in 2017**	**2022 vs 2017 result difference**
Design and management of the Sustainability Operating System (SOS)	2	2	3.0	0.5	2.5
Conducting sustainability audits	4	0	3.8	1.3	2.5
Recognising cultural, economic and political forces that influence environmental attitudes and decision-making based on an understanding of science and technology	3	1	4.0	1.7	2.3
Possibility of supporting the Marshal's activities	3	1	3.7	1.3	2.3

Cont. table 4.

Experience in developing and presenting sustainable business concepts, training and new technologies	**4**	**0**	**3.5**	**1.3**	**2.3**
Knowledge of new sustainable business strategies	4	0	3.5	1.3	2.3
Creating an environment of acceptance, fairness and mutual respect	4	0	4.3	2.3	2.0
Understanding the meaning, process of defining and usefulness of sustainability indicators	4	0	3.8	1.8	2.0
Waste elimination	4	0	4.8	2.8	2.0
Environmental policy and planning	4	0	4.8	2.8	2.0
Environmentally sound purchasing and supply chain management	4	0	3.8	1.8	2.0
Development and presentation of annual sustainability reports	4	0	2.8	1.0	1.8
Understanding the basic principles that govern natural systems	3	1	3.7	2.0	1.7
Resource inventorying	3	1	4.3	2.7	1.7
Effective communication	4	0	4.0	2.5	1.5
Transport planning	4	0	5.0	3.5	1.5
Climate change research and analysis	4	0	2.8	1.3	1.5
Resource protection	4	0	3.8	2.3	1.5
Identifying sources of funding for social and sustainable development projects	4	0	3.5	2.0	1.5
Development of new initiatives that promote sustainability	4	0	3.8	2.3	1.5
Social marketing for changing consumer behaviours	4	0	3.0	1.5	1.5
Understanding the basic principles that govern natural systems	4	0	3.3	1.8	1.5

A big group of managerial skills linked to business performance and GCs was identified as more relevant in 2022 than in 2017. It can be suggested that it is these competences that have a key impact on the implementation of GO activities.

5. Summary and conclusions

The paper studies the GOs specified in the literature on the example of selected large manufacturing companies. The pilot study resulted in the identification of knowledge in the area of GOs as well as GCs. The greatest acceleration in the implementation of measures in the surveyed manufacturing companies was reported in the area of sustainable manufacturing and the shaping of employee knowledge and awareness of ecology and sustainability.

In the case of knowledge, the greatest growth has been observed in the areas of natural resources and biodiversity, searching for niches and business models. Skills that have become more relevant in recent years are those related to citizen involvement and sustainability planning skills. Preventive actions taken to protect and preserve the environment and behaviour towards the production of eco-friendly products and recycling were diagnosed among the key attitudes for the development of companies in the area of sustainability. Managerial skills relevant to the performance of manufacturing companies appear to be key. In that group, as many as one-third changed significantly by a minimum of 2 points. These include designing operational systems, conducting audits or recognising the environmental forces that influence environmental attitudes and decision-making.

The results of the pilot study are among the first in this area and need to be followed up with both qualitative and quantitative research.

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