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Analysis of the Scope of Scientific Research of Academics at the Faculty of Engineering Management: A Case Study

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Abstract:

Purpose: *To understand how they acquired the high and medium level of the competencies the research on the academic teachers was conducted. The goal of the research was to find out whether the scope and field of research of the FEM academics is correspondent with competencies of the future and fully and synergistically supports development of competencies of students.*
Design/Methodology/Approach: *The methodology of the research included surveys and analysis of the results with VOSviewer software.*
Findings: *The scientific profile of the FEM covers the aspects of human factor, safety, logistics and entrepreneurship which is consistent with the structure of the Faculty and courses provided for students. The research topics are overlapping and integrating between the Institutes which proves that the cooperation and internal integration at the Faculty is at the high level and has strong potential, equipping students with full and coherent knowledge. The research topics respond to the needs of business environment, which is also proven by strong cooperation between the Faculty and companies in Wielkopolska (both large companies, representing automotive industry, SMEs and start-ups). They are also correspondent to contemporary trends in scientific methods (i.e., simulation, grey methods), approaches (i.e., sustainability, responsibility, maturity), and solutions (i.e., agile organization, Industry 4.0).*
Practical Implications: *The research results show that the competencies of the students are shaped by the academic teachers representing wide range of scientific knowledge and contemporary topics of research, thus supporting acquiring competences of the future.*
Originality/Value: *The research conducted is valuable from internal perspective, helping the society of the Faculty understand better what is the scope and profile of research conducted, what are the opportunities of fruitful and innovative scientific cooperation, and what are the areas still not covered. It supported development of the FEM strategy and definition of future research fields, even more responding to the social, economic, and technical challenges of contemporary world. Considering the external perspective, the research helped to define and communicate the profile of the Faculty, showing its specificity and strengths, together with potential offer for companies and other universities to support cooperation with both academia and business.*

Keywords: *Competencies of the future, scientific research.*

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1. Introduction

Each society consists of several generations that coexist with each other, connected by common historical events and social life experiences, as well as by the requirements of economic and industrial development. They led each generation to share similar values and perceive the world in a similar way. Each generation develops its collective personality, which translates into a specific way of life of its members, and thus - an approach to patterns of activity, ways of creating an organization or expectations towards work. Currently, four generations can be distinguished in society, the labor market and the broadly understood educational market (Lyons and Kuron, 2014, Cilliers, 2017).

According to the literature, these are Baby boomers (born in 1946-1964), generation X (born after 1965), generation Y (also called Millennials, born after 1980) and generation Z (born after 1995) entering just on the job market. The time frame of a given generation was determined as a result of specific features assigned to and occurring in a given group. It can be seen that in many areas the differences between the generations are particularly apparent. The differences can be noticed primarily in the aspects of the approach to privacy, approach to professional life and attitude to developing technologies. The paper presents the results of the two-research conducted in 2021, one conducted among students, and one conducted among academics. The first research conducted among students was to identify whether the students at the FEM are equipped with competencies of the future, while the second conducted among academics was to check whether the scope of scientific research conducted at the FEM supports the development and introduction of the competencies of the future among students.

2. Competencies of the Future

The future of a stable, global economy depends largely on the youngest generation Z, who currently stand on the verge of completing individual education and entering the market. It is the competences of this generation that will allow for the dynamic development of the new economy of the future, the basis of which is digitization, automation, and integration of human work with artificial intelligence. The challenges posed by global social and economic megatrends, such as the growing role of technology, climate change, demographic changes, urbanization, and globalization of value chains, are changing the nature of work, as well as creating a demand for new competences. Competences are a key and most important component of human capital.

They refer to efficiency, effectiveness and high quality of performing specific tasks, as well as improving the functioning of employees in the personal and organizational dimension. They cover all permanent human properties, creating a cause-effect relationship with the high and / or above-average work effects achieved by, which have a measurable dimension (Włodarkiewicz-Klimek, 2018).

According to the guidelines of the World Bank, to be successful in the 21st century labor market, the young generation must be equipped with a comprehensive set of competences, which includes:

1. Cognitive skills, which encompass the ability to understand complex ideas, adapt effectively to the environment, learn from experience, and reason. Foundational literacy and numeracy as well as creativity, critical thinking, and problem-solving are cognitive skills.
2. Socio-emotional skills, which describe the ability to navigate interpersonal and social situations effectively, and include leadership, teamwork, self-control, and grit.
3. Technical skills, which refer to the acquired knowledge, expertise, and interactions needed to perform a specific task, including the mastery of required materials, tools, or technologies.
4. Digital skills, which are cross-cutting and draw on all of the above skills, and describe the ability to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately.

Competences are also an important part of determining the degree of preparation of the next generation to enter the labor market in the economy of the future. Research conducted at the Faculty of Management Engineering in 2021 on the assessment of the possession of competences by the generation inspires optimism[4]. The study involved 740 representatives of the young generation; the aim of the study was to assess the level of competences of the future. The following specific competences have been distinguished within the four groups of competences indicated by the World Bank:

- group 1 Cognitive skills - creativity; fast learning,
- group 2 Socio-emotional skills - emotional intelligence (persistence in achieving goals despite failures, conflict resolution, motivating, assertiveness); communicativeness; teamwork; time management and planning; intercultural competences (the ability to operate in various cultural environments),
- groups 3 and 4 Technical and digital skills - ability to use new media (computer, communication platforms), digital and technical competences (communication, digital work, online safety).

The results of the research show that the young generation has mastered the above competences to a high or medium level. The competences mastered to a high degree include communicativeness, teamwork, fast learning, critical thinking, the ability to use new media as well as digital and technical competences. Competences acquired at an intermediate level are emotional intelligence, creativity, time management and planning, intercultural competences.

The dynamic development of the digital economy, accelerated by the conditions of the pandemic, forced both enterprises and educational systems to decide on the shape of the future organization of work and learning. Enterprises wishing to keep up with the trends

[4]*Research as part of the seminar "Functioning of an organization in remote mode - changes in the process of Human Resource Management" under the supervision of Dr. Hanna Włodarkiewicz-Klimek, Prof. PP and Dr. Agnieszka Krugiełka, Faculty of Management Engineering, 2021.*

of global markets, as well as the expectations of new generations of employees, must undertake evolutionary changes in the forms of work (Włodarkiewicz-Klimek, 2021). On the other hand, educational institutions are faced with the challenge of transferring substantive knowledge to present and future generations, and above all, to develop competences required in the economy of the future.

3. Research Methodology

The competencies of Z generation are shaped in the education system. The group that was referred to in the previous section were the students of the Faculty of Engineering Management, educated by the academic teachers employed at the Faculty. To understand how they acquired the high and medium level of the competencies the research on the academic teachers was conducted. The research questions were the following:

What is the scientific profile of the academics at the FEM?
What is the cooperation and collaboration potential between the academics at the FEM?
Are scientific interests of the academics at the FEM consistent with contemporary trends in science and expectations of business environment?

The goal of the research was to find out whether the scope and field of research of the FEM academics is correspondent with competencies of the future and fully and synergistically supports development of competencies of students. To identify scientific interest and competencies of the academics of the Faculty of Engineering Management the three steps approach was implemented:

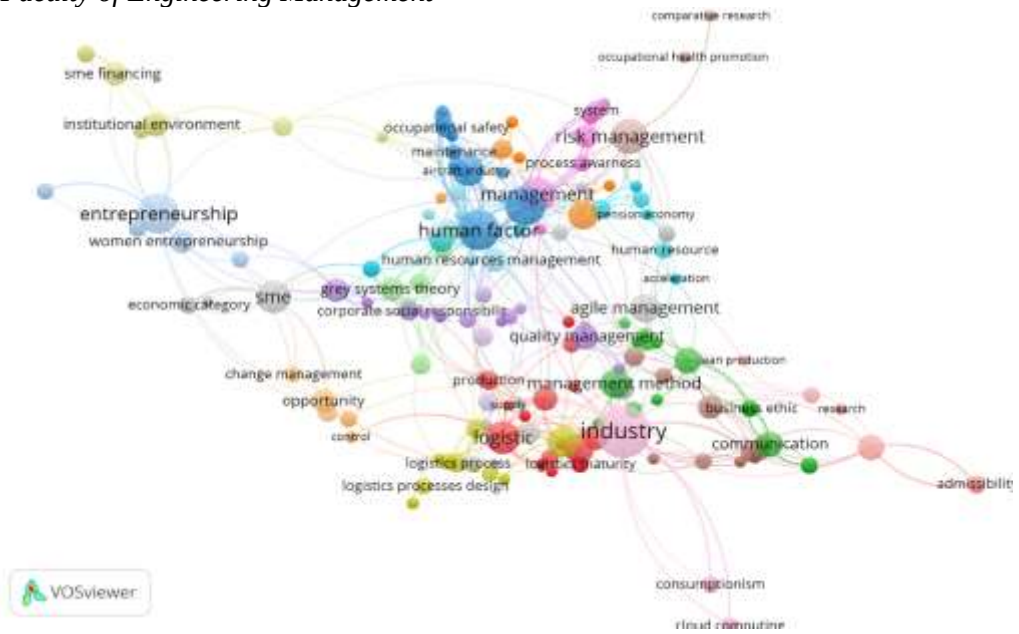
1) The interviews were conducted to identify the scope and directions of research. The interviews were conducted in October 2021 and all the academics were asked to specify five keywords that describe their field best. The research was complete, all 107 respondents gave their answers. There was no list, the keywords were given without any limitations, and could also take form of expressions.
2) The keywords were subjected to analysis with Vosviewer, which is a tool commonly implemented for visualizing bibliometric networks and mapping the content of scientific databases. As the results maps of links between individual scientists and their interests was produced, with nodes that link the academics.
3) The maps were developed for the entire Faculty, to present its profile and most common research topics, as well as the original and specific fields of research. Afterwards, the map was decomposed into layers representing Institutes: Safety and Quality Engineering, Logistics and Management and Information Systems.

The maps were presented as networks (showing the links between topics) and density (showing importance of topics) visualization.

4. Research Results

The results of the research are presented as networks (for the Faculty and three Institutes) and as a density map (for the Faculty). Overall analysis shows wide range of topics and subject that the Faculty of Engineering Management is dealing with (Figure 1), with focus on 1) human factor and risk management area, 2) entrepreneurship, 3) logistics and industry. There are numerous links between the topics concentrated around the focus points which proves that the interests of academics have many common aspects and cooperation between FEM employees on scientific projects and research is well settled in organizational culture.

Figure 1. *Networked research topics and interests of academics representing the Faculty of Engineering Management*

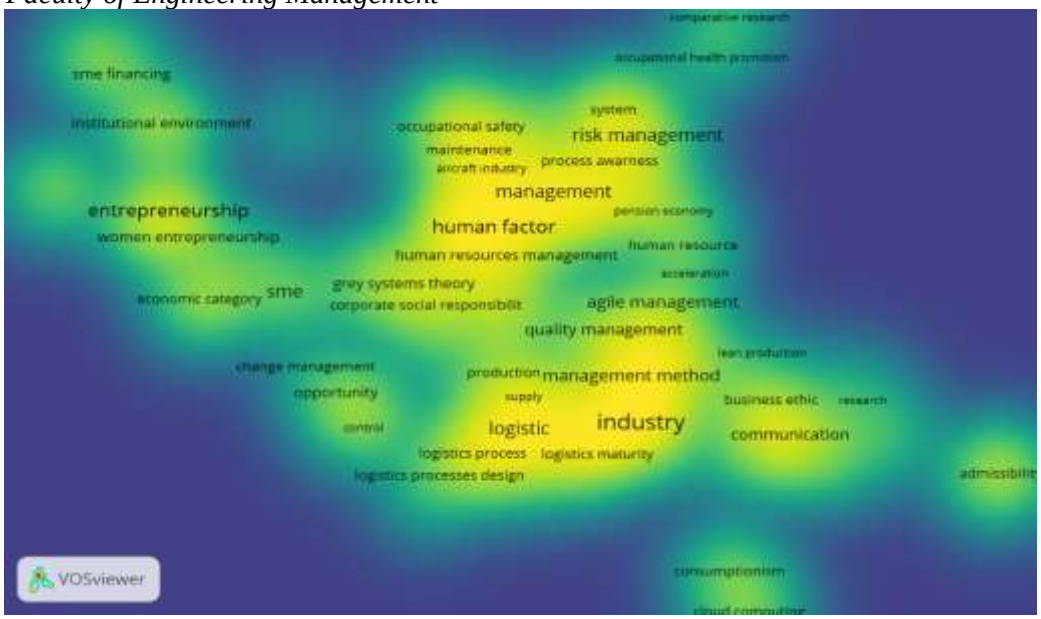


Source: *Own study.*

The next important aspect was what are the most often mentioned keywords/research topics to profile the Faculty and show its specifics in the scientific environment (Figure 2). The density map was used to highlight these topics.

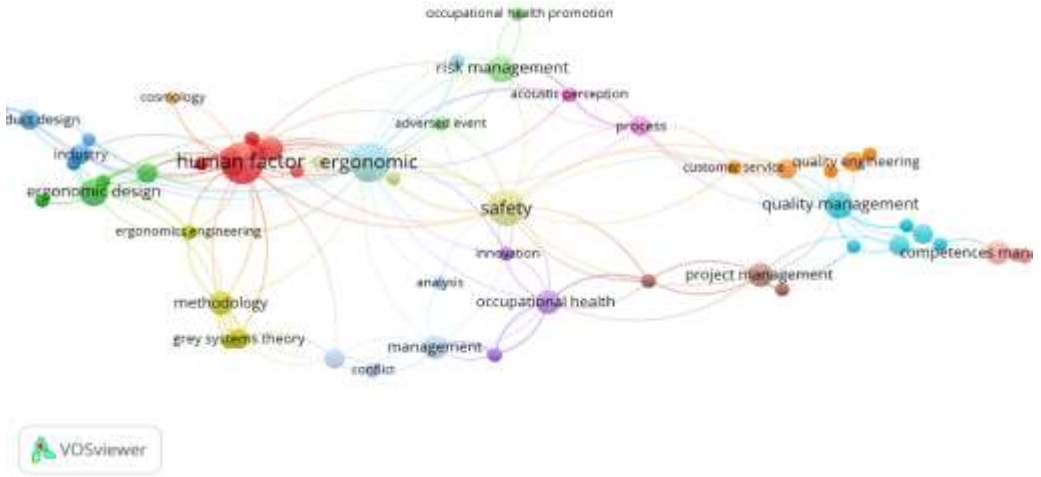
The map shows that important aspect was what are the most often mentioned keywords/research topics to profile the Faculty and show its specifics in the scientific environment. The keywords used refer to areas specific to business environment of Wielkopolska region, namely logistics and industry (there are numerous companies operating in the field) and correspond with the trends recognized in contemporary management. The maps were decomposed to show specificity of the Institutes at FEM and their individual profiles. The safety, risk and human factor aspects are the core of Institute of Safety and Quality Management (Figure 3).

Figure 2. *Density map of research topics and interests of academics representing the Faculty of Engineering Management*



Source: *Own study.*

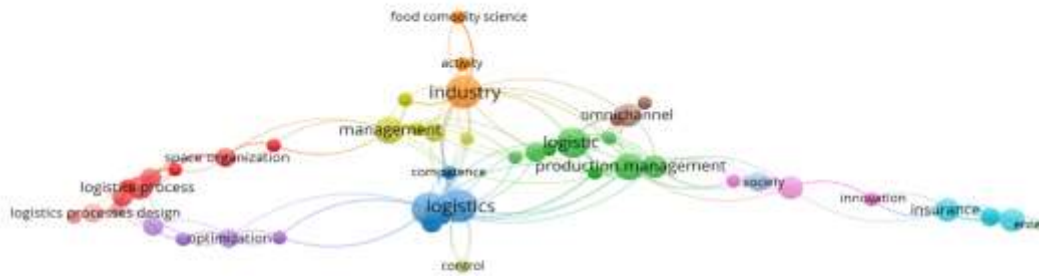
Figure 3. *Network of research topics and interests of Institute of Safety and Quality Management*



Source: *Own study.*

The logistics and industry are the core of Institute of Logistics (Figure 4).

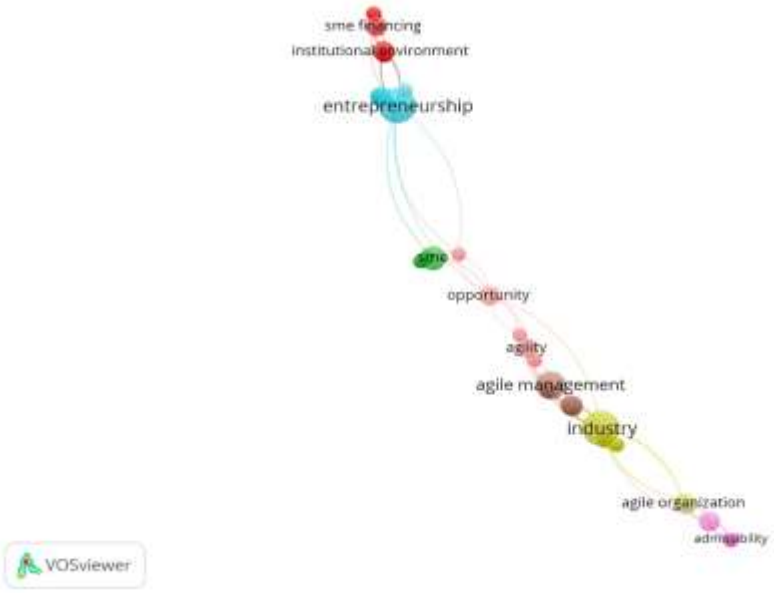
Figure 4. *Network of research topics and interests of Institute of Logistics*



Source: *Own study.*

The entrepreneurship and agile management are the core of Institute of Management and Information Systems (Figure 5).

Figure 5. *Network of research topics and interests of Institute of Management and Information Systems*



Source: *Own study.*

The scientific scope of the ISQM is the broadest, as safety and risk issues are multi-faceted, while the scope of the IMIS are the most focused.

3. Discussion and Conclusion

The research results enable answering the research questions:

1) The scientific profile of the FEM covers the aspects of human factor, safety, logistics and entrepreneurship which is consistent with the structure of the Faculty and courses provided for students.
2) The research topics are overlapping and integrating between the Institutes which proves that the cooperation and internal integration at the Faculty is at the high level and has strong potential, equipping students with full and coherent knowledge.
3) The research topics respond to the needs of business environment, which is also proven by strong cooperation between the Faculty and companies in Wielkopolska (both large companies, representing automotive industry, SMEs and startups). They are also correspondent to contemporary trends in scientific methods (i.e., simulation, grey methods), approaches (i.e., sustainability, responsibility, maturity), and solutions (i.e., agile organization, Industry 4.0).

The research results show that the competencies of the students are shaped by the academic teachers representing wide range of scientific knowledge and contemporary topics of research, thus supporting acquiring competences of the future.

The research conducted is valuable from internal perspective, helping the society of the Faculty understand better what is the scope and profile of research conducted, what are the opportunities of fruitful and innovative scientific cooperation, and what are the areas still not covered. It supported development of the FEM strategy and definition of future research fields, even more responding to the social, economic and technical challenges of contemporary world.

Considering the external perspective, the research helped to define and communicate the profile of the Faculty, showing its specificity and strengths, together with potential offer for companies and other universities to support cooperation with both academia and business.

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