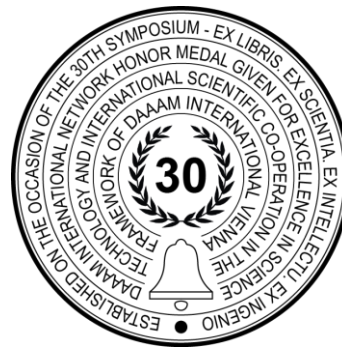


TECHNICAL AND TECHNOLOGICAL CULTURE – ENGINEERS POINT OF VIEW

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Abstract

Technical and technological culture remained in the shadow of innovation culture. If we want to respond to the demands of future technological development, it is important to reinvest in the concept of Technical and Technological Culture and engineers, as its bearers, have to ask themselves about the impact of technique and technology on society and the world we live in. This paper will present the results of the examination of attitudes and beliefs about the development of Technical and Technological Culture and its connection with socio-demographic factors. Respondents in this research are engineers of technical sciences: professors, students and employees in the economy/IT industry/NGO. For this research, was created an instrument, upgraded to the already existing instrument for examining Technical and Technological Culture. The results of this examination will indicate the attitudes and beliefs of engineers about the development of technical and technological culture and the connection of socio-demographic factors with its development.

Keywords: Technical and technological culture; engineers; attitudes; socio-demographic factors.

1. Introduction

There was not much research in the past indicating the importance of Technical and Technological Culture. It remained in the shadow of innovation culture. The introduction of technological innovations into everyday life, the readiness to recognize new solutions, and the acquisition of abilities to exploit technological products are related to personal, organizational and local culture, and should be analyzed as a separate category – Technical and Technological Culture [1]. Technological changes and the introduction of new technological concepts lead to the emergence of entirely new needs in terms of behavior and competencies of those involved in production processes [2]. The subject of this pilot research is the attitudes and beliefs of engineers in technical sciences regarding the development of Technical and Technological Culture and to determine socio-demographic factors that may influence its development.

2. Review of literature

According to Pochanek's definition, [3] Technical (Technological) Culture is the entirety of social achievements in the field of technical sciences and their application, as well as all the knowledge and skills needed to understand achievements, use them correctly, transfer them to the younger generation, and create new values in this field.

Wyrwicka [1] has analysed a literature review, and delivered an insight into the research's views of technological culture. According to Wyrwicka [1] Technical and Technological Culture is a system of permanent attitudes and competencies of people that enable the proper use of existing technology products to change the pattern of quality of life. It is expressed in relatively enduring and positive attitudes toward technology phenomena (design and production), in possessing knowledge, and above all, in ethical behavior and attitudes of people in various technological situations [1]. Technical and Technological Culture is manifested in relatively long-term activities and good ethical attitudes that enable the correct application of existing technologies and the development of new ethical solutions to improve the efficiency of life cooperation processes [4].

Chalas states [5] that Technical and Technological Culture must recognize the fundamental value of life, as modern humans can achieve much in the field of biological engineering and the study of life, thereby improving and enhancing the quality of human life, while on the other hand, they can use technology to destroy human lives. Technical and Technological Culture is a logical, artistic and positive attitude toward the use of technology to improve the quality of economic, social and spiritual daily life by the level of technical and technological progress [6].

Modern technologies today are not only the product of men but also represent a precondition for their existence. They continuously change humans and their relationship with the environment [7]. Knowledge and awareness are important human characteristics that define and distinguish them from the world around them [8]. The development of Technical (Technological) Culture accompanied the development of education enriched with new disciplines, leading to the establishment of universities in the 12th and 13th centuries [8]. Thanks to universities, Europe began to take a leading role in the world of science and technology [8].

Innovations drive many societies, but they are often thought of only in terms of solutions, rarely in terms of the relationship that humans maintain with technical objects and/or the object's relationship with the society of which it is a part [7]. Technical and Technological Culture has remained in the shadow of innovation culture, although it is a key factor for innovation with awareness [7] and could be a prerequisite for the reliability of work processes and support for maintaining the standard of quality [1].

If we want to respond to the demands of future technological development, it is important to reinvest in the concept of Technical and Technological Culture and for engineers, as bearers of Technical and Technological Culture, to ask themselves what impact techniques and technologies have on society and the world in which we live.

3. Research and results

3.1. Instrument development

In the framework of this pilot research, we constructed a questionnaire to examine attitudes and beliefs about the development of Technical and Technological Culture, which was created based on a list of questions related to the perception of the development of Technical and Technological Culture (list of survey questions by Wyrwicka [1]), which applied in her research [1], and for which we obtained the author's consent. This created questionnaire contain statements about Technical and Technological Culture, and it is located in the second and third part of our instrument. In these parts we used a 5-point Likert scale. The first part of the questionnaire consists of the socio-demographic characteristics of the participants: their gender, age, education, professional status, years of experience, size and ownership of institution, and material status.

3.2. Research results and discussion

Socio-demographic characteristics of the sample: The participants in this study were engineers from technical faculties, including professors (39,13%), students (10,87%), and employees in industry/ IT sector/ non-governmental organizations (50%). Gender of the total number of participants: 58,7% were male, and 41,3% were female. Age of the participants: under 20 years (0%); between 20 and 24 years (4,35%); between 25 and 29 years (6,52%); between 30 and 34 years (17,39%); between 35 and 39 years (15,22%); between 40 and 49 years (45,65%); between 50 and 59 years (6,52%); 60 and more years (4,35%). Level of education: Undergraduate Academic Studies – Bachelor (UAS) =17,39%; Master Academic Studies (MAS) =**36,96%**; Doctoral Academic Studies (DAS) =**39,13%**; others 6,52%. Years of work experience: 1 year (4,35%); from 1 to 5 years (19,56%), from 6 to 10 years (13,04%), from 11 to 15 years (**23,91%**), from 16 to 20 years (21,74%), from 21 to 25 years (8,7%), from 26 to 30 years (2,17%), from 31 to 35 years (4,35%), 35 years and more (2,17%). The size of the institution: micro:1-10 employees (2,17%), small: 11-50 employees (17,39%), medium: 51-250 employees (17,39%), large: 250 and more employees (**63,04%**). Ownership structure of the institution: domestic-public=**58,69%**; domestic-private= 21,74%; foreign ownership=15,22%. Material status: very satisfied are 17,39% of participants, satisfied are 50% of participants, neither satisfied nor dissatisfied are 28,26% of participants, and dissatisfied are 4,35% of participants.

The participants expressed the following attitudes and beliefs about Technical and Technological Culture: 65,22% of participants understand the meaning of the term Technical and Technological Culture, 6,52% don't understand the meaning, and 28,26% are uncertain about the understanding of the meaning of the term of Technical and Technological Culture.

Pearson's correlation coefficient indicates a positive and relatively weak association between understanding of the term of Technical and Technological Culture and: age ($r=0,433$); years of work experience ($r=0,365$); ownership structure of the institution ($r=0,272$); and professional status ($r=0,181$). The correlation between the understanding of the term Technical and Technological Culture and the level of education is positive and insignificant ($r=0,016$). The correlation between the understanding of the term Technical and Technological Culture and the size of the institution is negative and insignificant ($r= -0,043$).

In the second part of the questionnaire, respondents stated their attitudes and beliefs regarding Technical and Technological Culture (understanding, education, promotion, legal regulation etc.). The results indicated the following:

- Participants understand the meaning of the term Technical and Technological Culture (65,22%).
- They emphasize the importance of educating young engineers about Technical and Technological Culture (84,78%).
- They believe that it is important to promote Technical and Technological Culture to the general public (78,26%) and especially among scientists and engineers (82,61%).
- They also believe that this topic is insufficiently represented in the media (32,61%) or they are uncertain about that (54,35%).
- Regarding the legal regulation of Technical and Technological Culture participants believe that it does not exist in their country (36,96) or they are uncertain about that (52,17%).
- That Technical and Technological Culture should be regulated by legal regulations believes 54,35% of participants.

The third part of the questionnaire referred to views on the meaning of Technical and Technological Culture. In addition to the statements made by Wyrwicka in her list of survey questions, we created the new statements, that our participants stated as more significant. They point out the most important:

- The awareness of sustainable development (93,47%);
- The impact on environmental protection (89,13%);
- Technical and technological literacy of young people (86,96%);
- Using renewable energy sources (84,78%);
- The development of positive attitudes of young people towards Technical and Technological Culture (84,78%);
- Developing a responsible attitude towards work, tools and own environment (82,62%);
- The social impact of modern technologies (69,56%) (Figure 1.) .

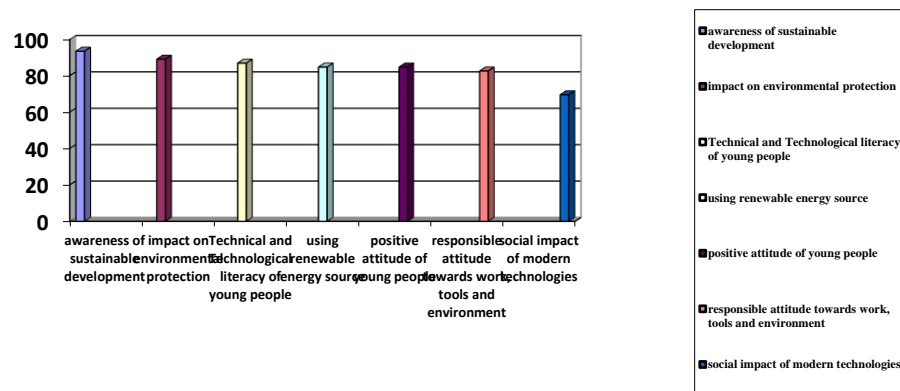


Fig. 1. Expressed point of view on the meaning of Technical and Technological Culture

The statements we used (from the list of survey questions by Wyrwicka) also indicated:

- Obeying norms – 76,09%;
- Establishing procedures – 73,91%;
- Standardization – 76,09%;
- Unified approaches to technical problems -67,39%;
- Prevention (anticipation of future requirements) -69,56%;
- Thriftiness – 63,04%;
- Efficiency – 73,91%;
- Professional solidarity and cooperation – 73,91%;
- Reliability – 73,91%;
- Discipline – 69,56%;
- Involvement in work – 73,91%.

Research conducted by Wyrwicka [1] identified statements that participants perceived as part of Technical-Technological Culture:

- Obeying norms – 72,4% of responses
- Establishing procedures – 62,6% of responses
- Standardization – 50,2% of responses
- Unified approaches to technical problems -37,5% of responses
- Prevention (anticipation of future requirements) -23% of responses
- Thriftiness – 30% of responses
- Efficiency – 50,6% of responses
- Professional solidarity and cooperation – 35,4% of responses
- Reliability – 45,5% of responses
- Discipline – 35,2% of responses
- Involvement in work – 39,4% of responses.

Based on the analysis of the obtained data, the author of this research [1] suggests that Technical and Technological Culture will be more important in future business environments and should be nurtured in every organization through organizational learning and continuous improvement. If we compare the results obtained in this research and the results obtained by Wirwicka [1], we can conclude that for both group of participants (more than 50%) the priority is: Obeying norms, Standardization, Establishing procedures, and Efficiency (Table 1.).

Statements	% of participants	
	In our research	From research by Wyrwicka
Obeying norms	76,09%	72,4%
Standardization	76,09%	50,2%
Establishing procedures	73,91%	62,6%
Efficiency	73,91%	50,6%
Reliability	73,91%	45,5%
Involvement in work	73,91%	39,4%
Professional solidarity and cooperation	73,91%	35,4%
Prevention (anticipation of future requirements)	69,56%	23%
Discipline	69,56%	35,2%
Unified approaches to technical problems	67,39%	37,5%
Thriftiness	63,04%	30%

Table 1. Expressed comparing results from a list of survey questions by Wyrwicka

The results of the research [9] indicate that introducing content to form Technical and Technological Culture among students, as future engineers, allows for an increase in the level of development of indicators of Technical and Technological Culture. It also provides integration of special, professional and technological training that contributes to the formation of a specific technological view of the world and mastery of Technical and Technological Culture [9]. The results of the research we conducted support these claims and indicate the importance of educating young engineers about Technical and Technological Culture, which implies the introduction of Technical and Technological Culture in the content of the education in Technical faculties. They also indicate the importance of promoting and affirming Technical and Technological Culture in the media and between the general public and among experts and engineers, and the importance of introducing legal regulations for Technical and Technological Culture.

The results of the conducted research indicated the importance of Technical and Technological Culture [10] and determined that Technical and Technological Culture significantly moderates the relationship between technological acquisition and innovative investment and moderates the relationship between technological acquisition and attitudes toward digital innovations. We believe that Technical and Technological Culture has been unfairly overshadowed by innovation and that our research will encourage further research into its impacts.

4. Conclusion

From the Middle Ages to the present day, there has been an awareness that liberal and mechanical arts should not be separated but should complement each other, that they are interdependent, that knowledge enlightens man and work dignifies him, and that only their balanced development can improve humanity and mankind [8]. This points to the need for engineers and experts to develop a more comprehensive and humane approach to their knowledge and work, which we consider here under the concept of Technical and Technological culture. The results of this research have provided insights into the attitudes and beliefs of engineers in technical faculties regarding the development of a Technical and Technological culture. The research shows that engineers largely understand the concept of Technical and Technological culture, that they most often identify it with sustainable development and environmental protection, and that it is still related to the person's experience, company ownership structure, and professional status.

The results show the importance of educating young engineers about Technical and Technological Culture. In addition, the results point out weaknesses that can be improved in institutions, but also strengths that can be considered in the development of Technical and Technological Culture, such as the importance of introducing legal regulations for Technical and Technological Culture. Furthermore, one of the implications of this research could be an incentive for a proactive policy of transforming national culture through changes in education, such as introducing the subject of Technical and Technological Culture into the engineering education program, developing responsible engineering and promoting Technical and Technological Culture in the professional and wider public.

The instrument validated through this research will serve for further research on influential factors in the development of Technical and Technological Culture. Future research could include not only technical, but also technological faculties, secondary and primary schools and representatives of companies and institutions that want to contribute to the promotion and improvement of the development of Technical and Technological Culture.

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