

Development of a System for Assessment of Digital Professional Suitability in the Company Environment

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Abstract. The relevance of the chosen topic is in response to the increasingly clear understanding by the member states of the European Union that digital professional suitability has an important role in increasing the possibilities of adaptation of human capital to the changing requirements of workplaces and the labor market in the conditions of Industry 4.0. The developed system includes tools, selection of criteria and indicators for the assessment of digital skills and competences, necessary for better professional realization and exercise of key professions/positions in modern Bulgarian enterprises, in line with the level of digitization of company processes.

Keywords: assessment, company environment, digitalization, professional suitability.

I. INTRODUCTION

The relevance of the chosen topic is in response to the increasing use of technology in daily activities, which inevitably has an effect on a number of aspects of company activity. Digital transformation requires significant investments, technological innovations and targeted measures to stimulate the digital competence and digital culture of the workforce. [1,2]

Timely diagnosis of the current digital skills of the employed and taking measures to overcome the imbalances in skills is important. a prerequisite for the successful implementation of the change and for increasing the competitiveness of Bulgarian companies. Digital skills and competences have an important role in increasing the possibilities of adaptation of human capital to the changing requirements of jobs and the labor market in the conditions of Industry 4.0.

The author aims to propose a set of tools and parameters covering the process of assessing digital skills and competencies, necessary for better professional

realization and exercising key professions/duties in modern Bulgarian enterprises. This necessitates the development of a system for assessing the professional and practical suitability of workers working in a digital environment. For this purpose, two tools will be developed and tested for assessment of digital competencies – one for self-assessment against the profile of digital skills required for the job/profession and one for self-assessment of specific digital competencies.

II. MATERIALS AND METHODS

A. Literature review

The topic was developed in response to the increasingly clear understanding by the member states of the European Union that employers and managers need additional and specific digital skills to integrate innovation in all company activities.

To improve their competitiveness it is necessary for Bulgarian industrial enterprises to focus their efforts on increasing the quality of the workforce by improving its practical skills for working in a digital environment.

The developed system defines the specific competencies for individual positions, necessary to perform their daily tasks in the course of the production process and which require the application of digital technologies. Three separate strands are being introduced in terms of digital competences:

- basic digital competences that apply to the entire target group;
- competencies aimed at the use of digital technologies by company specialists;
- digital competences for the management of the production process, aimed at managers and administrative staff.

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Alignment with national, regional and university priorities

The topic was developed in accordance with the vision and directions for the digital transformation of Europe 2020 - 2030 "Digital Compass" adopted by the European Commission.

European documents of key importance for the present development refer to:

- European Qualifications Framework for Lifelong Learning;
- New European Adult Learning Program 2021-2030;
- EU Plan "Road to the Digital Decade" to achieve a digital Europe by 2030.
- Europe 2030: A strategy for smart, sustainable and inclusive growth.

National applicable documents

- Program for research, innovation and digitization for smart transformation for the period 2020-2027.
- National strategy for individual small and medium enterprises 2021-2027;
- Program for competitiveness and innovation in enterprises for the period 2021-2027;
- Human resources development program 2021-2027;
- Operational program "Competitiveness and innovation in the enterprise" 2021-2027;
- Ministry of Labor and Social Policy Project BG05M9OP001-1.127-0001 "Development of digital skills".

Content aligns with **priorities** in:

- Thematic area "Mechatronics and clean technologies - Design in mechanical engineering - Engineering, reengineering and continuation of the life cycle of industrial machines, devices and systems, laid down in the Innovation Strategy for Intelligent Specialization of the Republic of Bulgaria 2021-2027;
- Internationalization strategy of Technical University - Gabrovo for the period 2020-2030;
- Strategy for intelligent specialization of the municipality of Gabrovo 2021-2030.

The "Mechanical Engineering" sector has a decisive role for the European economy. The sector is a strategic industry with high added value, knowledge-intensive, providing other economic sectors with machinery, production systems, components and related services, including technology and knowledge. [6]

Purpose and tasks of research

Based on a research analysis of the current state of engineering companies, a system for evaluating digital professional suitability in a real company environment, corresponding to the modern requirements of Industry 4.0, has been developed and adapted.

In this report, the digital professional suitability of the incumbent is defined as a set of knowledge, skills and behavior (attitudes) for the performance of work duties,

functions and tasks involving the use of information and communication technologies.

Main activities for their implementation

1. Identifying the leading literary sources, articles and keywords in the problem area and defining the basic terms and concepts necessary for its processing.

2. Identification of key professions/positions in specific companies of the "Mechanical Engineering" sector, which is of great importance for the Bulgarian economy in terms of increasing the added value, improving the foreign trade balance and employment. The process of globalization and the integration of Bulgaria into the international business community place high demands on competitiveness and technological development for those employed in the sector.

3. Diagnosing the state and needs for the development of digital skills/competences for the identified key professions/positions in the surveyed enterprises.

4. Development of tools, selection of criteria and indicators for the assessment of digital competences, consistent with the level of digitization of company processes.

5. Establishing the needs of individual categories of personnel for specific training to improve their digital skills depending on the specifics of the activity being performed.

6. Development and adaptation of a system for evaluating the digital professional suitability of employees in a real company environment.

7. Pilot testing of the proposed system and making corrections with a view to increasing its adaptability and effective practical applicability in the sector.

B. Methodology of the research

- office research for collecting and processing information from literary and online sources about the researched problem;
- analysis and assessment of European and national applicable documents on the subject;
- survey in companies and enterprises with employers to establish the state and needs of digital skills in key professions/positions;
- conducting a "brainstorming" method to identify the key employees and workers in the investigated company activities;
- in-depth interviews and discussions with representatives of branch organizations, employers and interested parties to discuss the applicability of various models for increasing the digital professional suitability of workers in the "Mechanical Engineering" sector.

III. RESULTS AND DISCUSSION

A. Scientific results

a. Expanding the term "professional suitability" to include digital competencies for the exercise of key professions in modern companies.

b. Renewing strategic approaches to digital education and digital skills and competences.

c. Development of training programs for training and development of specific digital skills based on research and establishing the needs of workers.

d. Methodology for managing and evaluating the professional suitability of human resources for the sustainable development of engineering companies in a digital environment.

e. Supplementing the content and scope of the job descriptions such as functions and tasks, typical of the professions of the NCPD in the country.

f. Promotion of obtained results in scientific publications at the announced annual international conferences.

B. Applicability of the results in practice and the learning process

a. Scientific and methodical support of machine-building companies in connection with the identification of key professions and positions in the industry as a structural determinant for the industry.

b. Practical application of the developed tools for assessing the digital skills and competences of workers.

c. Building models of social partnership and collective bargaining related to the digitization of company processes.

d. Establishing the needs for improvement and additional training for the development of specific digital skills, according to the requirements of a specific position.

e. Testing and adaptation of the system for assessing the digital professional suitability of key categories of personnel in a selected real company from the "Mechanical Engineering" sector.

f. The obtained experimental results from the adaptation of the digital professional suitability evaluation system will be reflected in the curricula of the students of the "General Engineering" and "Materials and Materials Science" professional fields.

The development of the competence profiles is preceded by analyzes of the needs of digital skills in companies from the "Mechanical Engineering" sector, included in the conducted study.

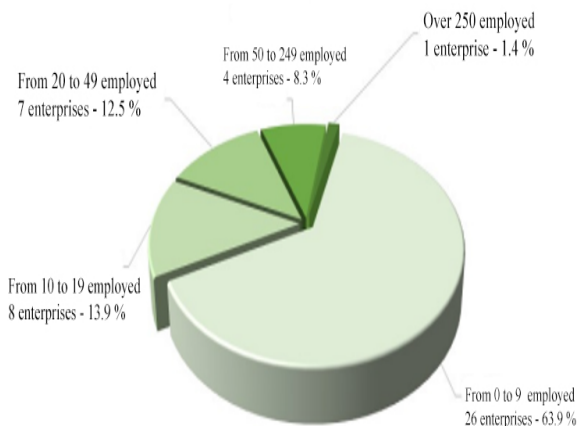


Fig.1. Number and type of enterprises in the study

A questionnaire was used to establish the availability of the necessary digital skills/competences among employed persons occupying key professions/positions. It contains 5 main directions with formulated scales for diagnosing the mastery levels of each competence related to:

- information and data;
- communication and cooperation;
- creation of digital content;
- safety and security;
- solving cases.

TABLE 1. DIGCOMP COMPETENCE FRAMEWORK (Stephanie, Riina, & Yves, 2017) [5]

Areas of competence	Competencies
1. Information and data	1.1 Browsing, searching and filtering data, information and digital content
	1.2 Evaluation of data, information and digital content
	1.3 Data management, information and digital content
2. Communication and collaboration	2.1 Interaction through digital technologies
	2.2 Sharing through digital technologies
	2.3 Civic participation through digital technologies
	2.4 Collaboration through digital technologies
	2.5 Netiquette
	2.6 Digital Identity Management
3. Content creation	3.1. Digital content development
	3.2 Integration and processing of digital content
	3.3 Copyrights and Licenses
	3.4 Programming
4. Safety	4.1 Protection of electronic devices
	4.2 Protection of personal data and privacy
	4.3 Protection of health and welfare
	4.4 Environmental protection
5. Problem solving	5.1 Solving technical problems
	5.2 Identifying needs and technology responses
	5.3 Creative use of digital technologies
	5.4 Identifying gaps in digital competence

The starting point for the development of the questionnaire in terms of content is the European Digital Competence Framework DigComp, implemented as an assessment tool for the respondents. [4] The obtained

average results are normalized in 5 levels (table 1): no skills; basic, low, medium and high. Digital skills are assessed through self-assessment questions on knowledge and skills for working in a digital environment. Tests and practical tasks are used to assess real digital competences.

The analysis shows that only 16% of employees meet the required level of digital competence for their key position.

Among the overall digital competencies, information and data literacy had the highest share (27.6%), followed by communication and collaboration competencies (23.3%), safety (21.9%), problem solving (19.5%) and digital content creation (7.7%).

The most specific competencies relate to information and data literacy (44.8%), followed by digital content creation (21.6%), problem solving (19.5%), communication and collaboration (10.3%) and safety (3.8%).

The survey found that 56% of employers are looking for a workforce with an advanced level of basic digital competencies, and 14% require a highly specialized level. 28% would accept workers with an intermediate level of basic digital competencies, and only 2% - with a basic level. In terms of specific digital competencies, 54% of employers require an advanced level, 19% - a highly specialized level, 23% an intermediate level, and 4% a basic level.

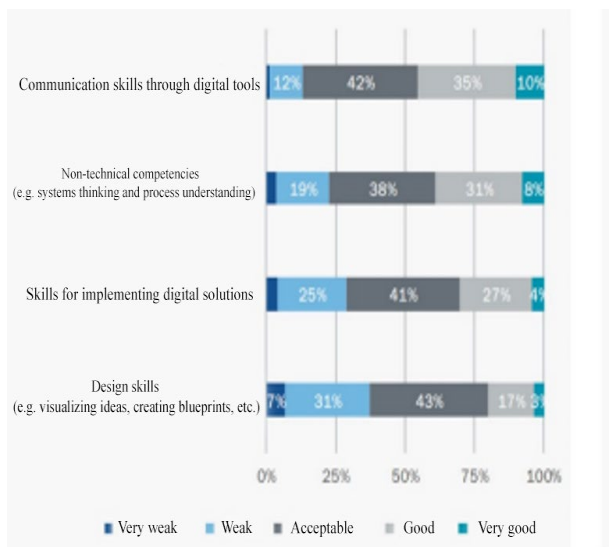


Fig. 2. Assessment of respondents' current skills

More than 46% of the surveyed persons have to one degree or another problems with digital skills, which inevitably reflects on the quality of their work, on their suitability for employment and their ability to successfully transition to the labor market. About 13% of the surveyed persons have deepening problems with digital skills, which brings them closer to dropping out of the labor market, digital isolation, social and digital inequality.

The change in skills is clearly visible. Overall, engineering jobs in the future will be primarily about cognitive digital and complex transversal digital skills that require some basic technical and digital knowledge. For those working in the sector, social competences must also

be improved when it comes to developing skills in an increasingly digitized work environment.

There are significant differences (digital inequality) in the level of digital competence between different categories of personnel, as well as between individual enterprises within the sector. The levels of digital competence are directly dependent, both on the differences in the degree of maturity of the technologies used, and on the company's policies for the management and development of human resources.

From the conducted in-depth interviews with line and functional managers, we find that there is not yet a sufficiently developed practice in enterprises to assess the level of the current digital skills of the staff. More attention is paid to technology, but not to people.

Against the background of the changing nature of work, the changing specifics of the tasks performed at the workplace and the dynamically growing requirements for digital skills in the conditions of the transition to digitalized workplaces, 34% of the employees in the studied engineering companies possess only basic digital competence - minimal digital skills related to the use of more widely applicable unified software products and digital technologies such as Windows, Word, Excel, PowerPoint, working with Outlook, working on the Internet, working with digital platforms for communication, etc. This is an indicator of the quality and results of basic training - education and vocational training.

In companies that have implemented new equipment and technologies in recent years, the need for qualified personnel with new competencies in the field of: welding; laser cutting; heat treatment, etc. The basic training of specialists in theory takes place in the system of higher and professional education and training (university, vocational high schools, vocational high schools, vocational schools, licensed by NAPOO), but for their transformation into highly qualified specialists and workers, the training continues in the companies themselves, including . on the specific jobs.

In a number of companies that have supplied modern equipment and technologies, there is an urgent need for training the people who will work with them. The training is specialized and is for the specific workplace.

To the question: "How would you rate the importance of training programs related to increasing digital competences?", we received the following responses, presented in the figure:

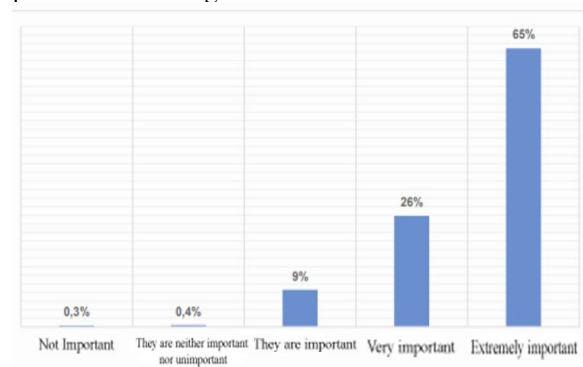


Fig.3. Respondents' assessment of the importance of training programs in the field of digital competence

The research conducted shows that both managers and employees are aware of their responsibility to invest time and/or financial means to improve their skills in the field of digital technologies. Around 50% of managers surveyed strongly agree that businesses should invest in training programs to keep their employees' digital skills up to date, and 58% of employees agree that they should invest in digital training themselves. In this context, the social partners play a crucial role in raising the awareness of employees at all levels about the need to actively participate in training measures. Participating respondents recognize the important role of the cooperation of the social partners in this process. Over three-quarters of employees and two-thirds of managers surveyed agree that social partners should negotiate new and/or review existing training schemes.

Interviewed managers emphasize that, in addition to collective and legally binding agreements, other options should be used to address and shape the digital transformation of the workplace and the challenges arising from it.

The general and specific digital skills required have been determined based on reports and studies on the state of the Mechanical Engineering sector; state educational standards for acquiring qualifications in professions; job descriptions for the identified positions; analysis from brainstorming sessions with industry experts, HR managers and vocational training specialists; National classification of occupations and positions.

The self-assessment system enables employees in key occupations to identify their digital skills/competence levels. The value of each scale is an arithmetic mean, ranging from 0 to 3 points. The results are divided into the following levels: «no skills»; low, medium and high.

The tool allows the measurement of digital competence through the three elements – knowledge, skills and attitudes, providing respondents with an opportunity for self-analysis of their digital competence through clear and easy-to-fill questions regarding practical activities and common situations in the professional environment.

TABLE 2. SYSTEM FOR SELF-ASSESSMENT THE LEVEL OF DIGITAL COMPETENCE BY THE TARGE GROUP

Knowledge	Skills	Attitude
0 p. – I have no idea of that;	1 p. – I don't know how to do it;	1 p. – missing;
1 p. – I have limited knowledge and need further explanations;	1 p. – I can do it with someone else's help;	1 p. – weak;
2 p. – I have good knowledge in the professional field;	2 p. – I can handle it on my own;	2 p. – average;
3 p. – very good	3 p. – I am an expert and can guide others.	3 p. – high.

From the conducted «brainstorming» conversations, mainly with the managements of the investigated enterprises to identify the key employees and workers in the investigated company activities, concrete proposals

were also formed for the development of competency models for individual professions/positions and their testing with them such as: «design engineer», «engineer-technologist», «engineer-supervisor», «machinist «operator of metalworking machines», «operator of metal-cutting machines with CNC», «locker-installer».

IV. RECOMMENDATIONS

The pilot testing of the proposed system aims to assess its quality and reliability by providing an opportunity for employers and employees to optimize the content of the skills and knowledge they use. On the other hand, corrections can be made in order to increase its adaptability and effective practical applicability in the sector. The approaches we propose for system validation are:

- sending the collected and analyzed information from the conducted survey to the heads of companies for feedback in the form of corrections, additions, clarifications and notes;
- conducting focus groups for its discussion with representatives and experts in the "Mechanical Engineering" sector, who can share an opinion on the applicability of the developed system for evaluating the digital professional suitability of performers of key professions in their organizations;
- sending feedback surveys to the incumbents of elected positions with formulated questions and an evaluation scale.

The questionnaire contains:

- the proposed general and specific digital competences, including the specific knowledge, skills and behaviors that form them, as well as a 4-level scale for applicability assessment by the relevant respondent;
- two questions related to determining the recommended level of mastery of general and specific digital skills/competencies according to the opinion of the respondents (two persons each from one company for a specific profession/position – employer or manager and the incumbent) for validating a unified profile of various enterprises in the sector.

V. CONCLUSION

In the current study, a wide range of sources were considered, which allow a broad and comprehensive view of the topic under consideration. The research covered a number of international, European, national and sectoral developments, both related to digital transformation in general, and considering the development of the engineering sector in particular, incl. against the backdrop of the digital revolution. The "Brainstorming" method conducted among representatives of different categories of company

personnel was aimed at presenting the point of view of those working in the sector. Through tools such as surveys and interviews, Bulgarian enterprises were given the opportunity to provide reliable information about the real situation in the sector, about their level of digital readiness, about the problems they face, about their vision in the future, about the sought-after and possessed skills of employees for their views on the causes leading to shortages in the workforce and other aspects of their activities.

The scope of the research and the analysis made shows the degree of readiness of the sector for the implementation of digital technologies; identification of the key positions influencing the achievement of the strategic goals of the enterprises related to the digital transformation in the sector, as well as establishing the deficits of digital skills of the holders of the identified key positions by comparing the general and specific competencies sought and possessed in the selected key positions.

The presented system for evaluating the digital professional suitability offers a set of tools and criteria that can be applied in other branches at the company level.

An aging population and the adoption of digital technologies will lead to a huge skills imbalance globally, with the Mechanical Engineering sector fully following this trend. To counter this, employers in Europe need to be more flexible, adaptable and creative.

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