

An Innovative Model of Management Education at Technical Universities: A Future-Oriented Approach

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Abstract: The sustainability of education depends on a well-defined strategic vision within the university environment that reflects society's evolving needs. At technical universities, this vision is oriented toward knowledge development, digitization, online education, innovative teaching methods, comprehensive management and business education platforms.

The main objective of this research was to develop an innovative educational model for technical universities. This model is based on the synergistic effect of economic subjects, digitization, various forms of management, and innovative didactic methods, with a focus on future-oriented education. As part of the research, the “Student Company” project was implemented, incorporating digital tools, e-learning approaches, and the integration of different management functions in a simulated business environment. The results of the project demonstrated improvements in students’ key competencies, including soft skills, social competencies, and financial and economic literacy. Furthermore, a positive impact on the evaluation of study subjects was observed. The main outcome of the research is the proposal of an innovative model of engineering education within university management study programs. This model has the potential to serve as a tool for transforming education at technical universities worldwide.

Key words: education, skills, competence, innovative methods, e-learning.

1. Introduction

The fundamental pillars for improving the quality of higher education at technical universities are digitalization, innovation, and a competence-oriented approach to students that reflects labor market requirements and the demands of Industry 4.0. The sustainability of education depends on a strategic vision within the university environment that reflects society's evolving forms. At technical universities, this vision is oriented towards knowledge development, digitalization, online learning, innovative teaching methods, and the integration of management and business education platforms. The main goal of this research was to design a teaching model for a

management study program at the Technical University that integrates economic subjects, digitalization, various forms of management, and innovative didactic approaches, with a focus on future-oriented education. As part of the research, the project “Students’ company” was implemented, utilizing digitalization, e-learning approaches, and the integration of management practices from a real business environment. The strategic vision of education at technical universities must be based on the requirements of documents such as the Green Paper on Entrepreneurship in Europe, the Entrepreneurship 2025 -2027 Action Plan, the Maastricht Declaration on Global Education 5, the Operational Program Education in Slovakia, and other documents of the European Commission, which were presented as part of improving education in Europe. The EU sets a framework within which EU Member States can exchange best practices and learn from each other, to ensure the implementation of lifelong learning and mobility, improve the quality and effectiveness of education and training, promote equality, social cohesion, and active citizenship, creativity, innovation, and entrepreneurship

2. Literature review

Innovations in the pedagogical process at universities are a current topic today, and various approaches are used, such as e-learning, web learning, blended learning, project management, practical training, excursions, robotics, virtual reality, simulation, etc. [1]. Innovative approach in education in higher education institutions is also captured and presented in the Action Plan 2025 - 2027, which identifies the use of innovative elements in education as a priority pillar within the European Union, with a focus on building a knowledge-based, information-driven, social, and economic society and lifelong learning [6].

Garanin, M. (2022) presented innovations in higher education institutions such as digitalization, virtual reality, AI artificial Intelligence and their implementation in the education process [2]. Interactive inquiry-based learning creates space for a strategic vision in education at technical universities, oriented toward the circular economy and its importance for economic growth and development, environmental sustainability, ecosystems, and their management [3,8,14]. The essence of this direction lies in integrating different forms of management into education, where management must be supported by innovative technologies or information management systems such as ERP and SAP [15]. Education and educational systems must be aligned with the requirements of Industry 4.0 [13].

The 21st century requires the implementation of changes in educational processes with a focus on digitalization. It is necessary to transform the educational model towards entrepreneurship and digital transformation [12]. The foundation of digitalization lies in the use of the internet and its advantages for education [11]. Overall, digitalization initiatives must be managed and implemented by competent organizations and approaches in compliance with GDPR [10]. Artificial intelligence and the use of GPT-

based tools are emerging as new instruments in education, while it is necessary to regulate and coordinate the learning process of university students due to concerns about potential loss of creativity [9]. The strategic vision of educational change in higher education should move towards entrepreneurial education, within which it is necessary to address areas such as financial literacy, enhancement of students' information competencies, improvement of soft skills, development of key competencies for labor market readiness, rapid adaptation to jobs and reskilling, as well as strengthening communication and presentation skills.

The formation of a knowledge society is considered a priority, because such a society is a prerequisite for democratic development, scientific and technological progress, economic growth, and social security, employment [7]. Changes in education represent an adaptation to the conditions of education in the era of Industry 4.0, which is focused on digitalization, optimization, innovation, sustainability, and entrepreneurship [5]. An important role is also played by society, which requires prepared potential employees for the needs of the labor market and adaptation to rapidly changing conditions and criteria in the workplace [4]. All those approaches are oriented on a strategic vision of education by integration of items of economic, social, information, and knowledge society (Figure 1).

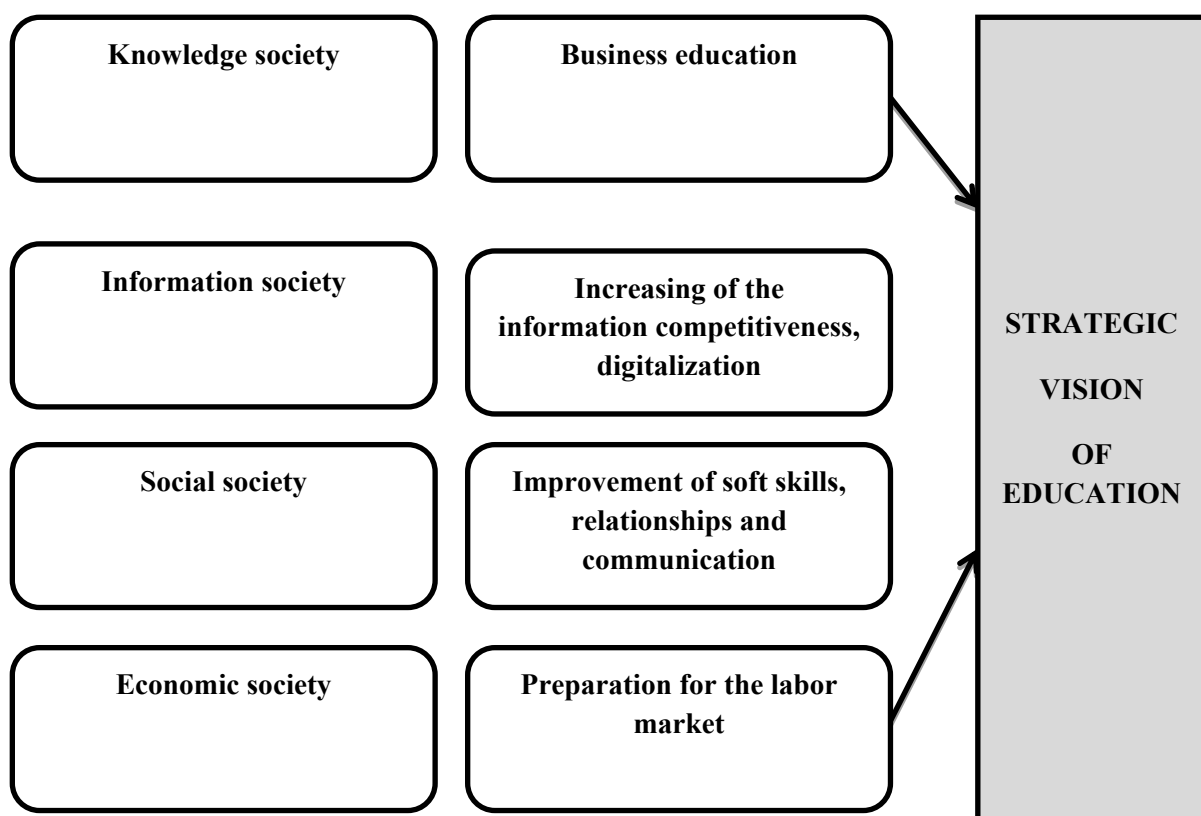


Figure 1 Strategic vision of education at technical universities. *Source: own source*

Global education focuses on the development of basic competencies such as information literacy, critical thinking, communication, and problem-solving skills. Global education develops economic, socio-cultural, and environmental competencies. The goals of global education should also be implemented in the structure of higher education at technical universities. This approach is oriented towards knowledge, social, information, and economic society. The strategic vision of education must accept all the requirements of these societies and thus achieve success in higher education, which will be oriented towards digitalization, competencies, soft skills, entrepreneurship, and creativity.

3. Methods of research

The sustainability of higher education depends on a strategic vision oriented towards a knowledge and economic society, with the acceptance of the information and social fields. The main objective of the contribution is to create an innovative model of education in the field of Management at technical universities based on the synergistic effect of economic subjects, digitalization, innovative didactic methods, soft skills of students, competencies with preparation and application in the labor market. The new education model will enable students to acquire quality knowledge in terms of business skills, financial literacy, and soft skills, and at the same time, the labor market requirements for university graduates and their successful application in the labor market will be met. As part of the solution of the educational project and the creation of an innovative model of education in the field of Management at technical universities, we applied innovative educational tools and their connection within the criteria of knowledge, information, social, and economic society (Figure 2).

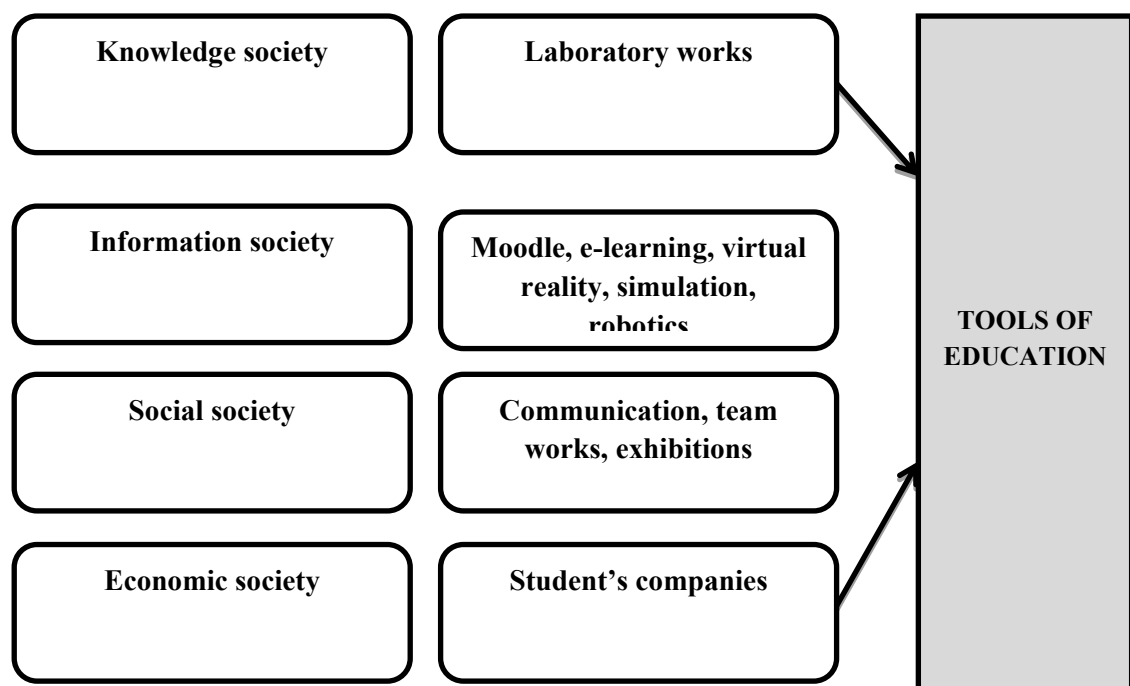


Figure 2 Didactic tools and methods of education. *Source: own source*

The applied educational tools - methods, techniques, software, procedures, forms, robots, simulators, virtual reality, AI - artificial intelligence, e-learning, web learning, Webex, Teams, Moodle, conferences, discussion forums and others are very important tools for improvement and increasing quality education. As part of the implementation of the "Student Companies" project, we also used scientific methods oriented towards analytical methods, quantitative methods, qualitative methods, questionnaires, mathematical methods, programming methods, economic and financial methods, etc.

4. Results

As part of the implementation of the educational project, we applied innovative educational tools in the educational process. In the first step, it was necessary to change the method of teaching individual subjects within lectures, which related to explanations in practical conditions in research laboratories (Figure 3). In addition to this approach, various forms of innovative didactic methods were also implemented within the lectures - explanations of a new topic, such as Cinquain, Acrostic, Motivational Challenge, Case Study, Project Solution, Moderation, Mind Map, Brainstorming, Problem Explanation, Synectic, Clustering, Question storming, Concept Mapping, Kahoot, etc. All these innovative additional tools in lectures and exercises represent motivation for students and a different approach to acquiring knowledge, skills, and experience.



Figure 3 Lecture in the faculty laboratory. *Source: own source*

The entire project used an e-learning approach (Figure 4) in the form of the Moodle platform, which is part of the educational process at the Technical University. This platform provides students and teachers with unrestricted access to information and educational materials for individual subjects.

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Ekonomická fakulta

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Figure 4 E-learning platform Moodle at technical university. *Source: own source*

One of its key advantages is that students have continuous access to study materials throughout the semester. They are kept informed about any changes in the course and have access to materials for exercises and lectures, including problem statements, presentations with audio commentary, various diagrams, and case studies. A significant benefit is the built-in assessment system, which includes review tests that students can complete after each lecture. This allows them to continuously evaluate their acquired knowledge and, if necessary, revisit and further study specific topics. Another advantage is the system for submitting assignments and projects, which are uploaded directly within the course interface rather than being sent via email to the instructor. This e-learning approach is not time- or location-dependent; it is accessible from anywhere and at any time when students need course materials.

The possibilities that a teacher can use within the e-learning portal are an effective means of communication with students. This portal allows students to regularly follow the events in each subject; they have the necessary information available throughout the semester, and, most importantly, they can work online. This portal is a convenient teaching tool for both the teacher and the student. It represents time savings for both the teacher and the student, quick access to information on a given subject, student feedback with the teacher, as well as the opportunity to present their opinions on a given subject and the subject's issues. It is important for university teachers to

constantly improve within their subject, and therefore e-learning can be one of the forms that will ensure that they increase the level of teaching.

As part of improving the use of information and communication technologies, it is possible to present challenging topics in the educational process through virtual reality (such as the introduction of the Kanban system in companies), simulators for using machinery in mining companies (drilling rig for extracting raw materials), or the use of robots for moving materials in the logistics chain (moving materials on a production line) (Figure 5). All these approaches and new forms of education allow students to better understand the principles of business processes, they could try out process control through simulators, and they could see how automated production lines work without human intervention with the help of operators. These opportunities open space for students for creative work and critical thinking.



Figure 5 Virtual reality, simulation, robotics methods of education. *Source: own source*

Part of the use of innovative tools is important communication and communication skills, which students acquire through teamwork and problem-solving within individual teams. They could try out the method of teamwork in a management game, which was also implemented for an open society, for students at other universities and schools (Figure 6). Communication had to take place between competing teams, in relation to the public, but within individual teams.



Figure 6 Teamwork – competition in Management. *Source: own source*

The goals of the economic company were implemented within the student company project called “**JA Firma**”, which was implemented in secondary schools through the initiative of the Ministry of Education of the Slovak Republic within the Education Call. This project focused on establishing a student company, and it is necessary to complete all the steps of entrepreneurship from establishment, planning activities, through marketing, market research, own activities to liquidation of the company and distribution of profits upon termination of the company. Based on this practical experience - student company (Figure 8), students gain the opportunity to apply theoretically acquired knowledge about the functioning of a business entity immediately in practice, in specific practical conditions.

They learn not only knowledge from the subject Economics, but also to be responsible, know how to make decisions, and run a company. After establishing a company, students choose management and obtain share capital by issuing shares. Based on marketing research, they subsequently prepare a business plan and implement the production and sale of products supported by marketing activities and financial records. At the end of the year, they will close their financial records, prepare an annual report, pay dividends to their shareholders, and liquidate the company according to applicable regulations. The program is not just on a fictitious basis, but students work with real money and offer real products and services.



Figure 8 Student's Companies. *Source: own source*

5. Discussion

The integration of entrepreneurship education, soft skills, financial literacy, and information technology creates space for a new innovative model of education at technical universities (Figure 9). The implementation of all forms and approaches to education requires changes that will accept the intentions of global development education, which means an educational approach that leads to a deeper understanding of diversity and inequality in the world, the causes of their existence and the possibilities of solving the problems associated with them.

The new model of education encourages all interested parties, regardless of age, to explore issues such as poverty and their connection with everyday life, economic growth, migration, and digitalization. By disrupting stereotypes and supporting independent thinking, global development education seeks to help develop practical skills and contribute to positive changes on a local and global scale.

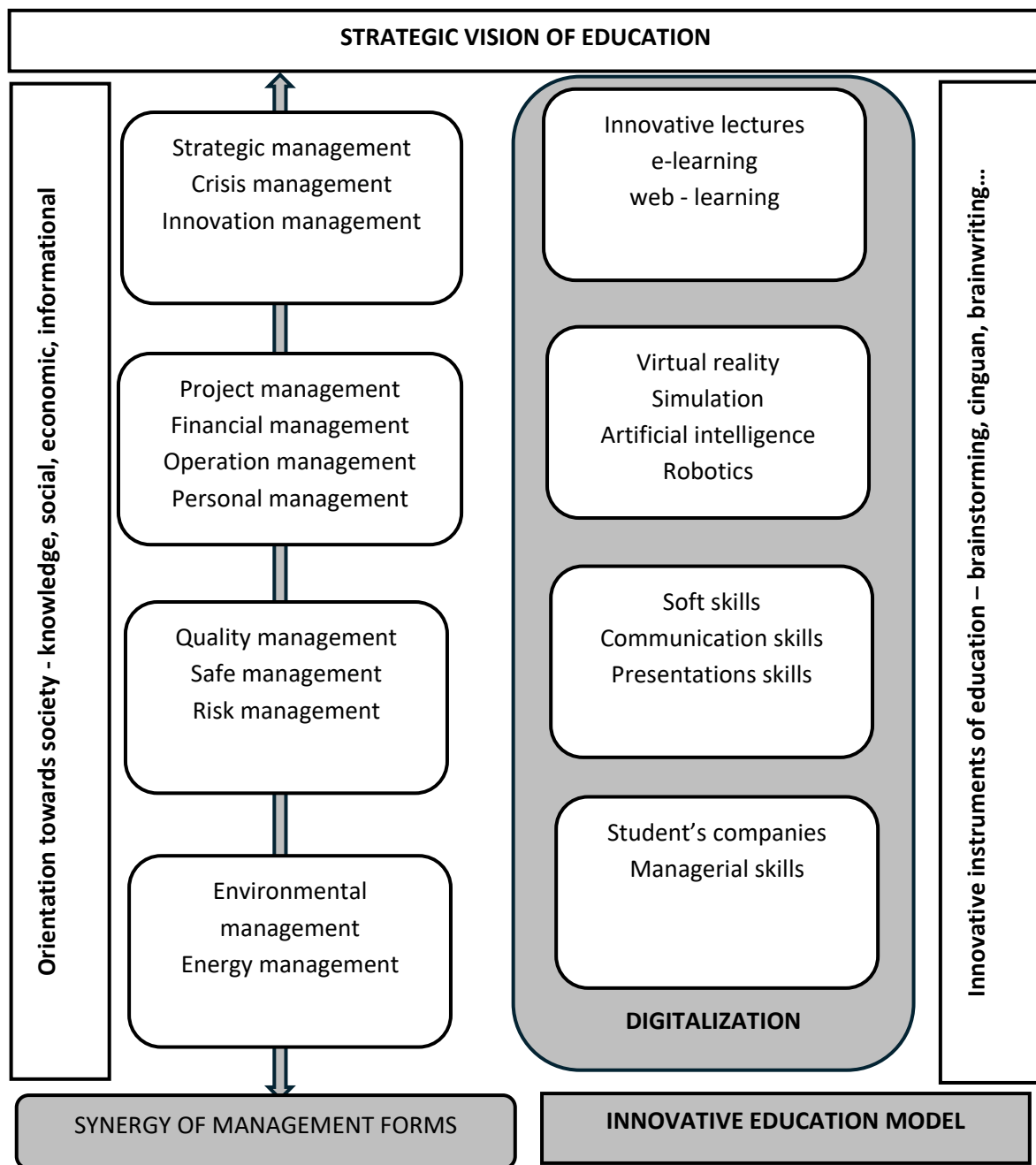


Figure 9 Innovative model of education. *Source: own source.*

The benefits of educational programs are the acquisition of knowledge by students, acquisition of entrepreneurial skills, attitudes as well as creative thinking and problem solving, communication and presentation skills, self-confidence, teamwork, and the ability to lead a team, negotiation and decision-making, goal setting and time management, and risk management. The success or failure of a project is assessed by the degree to which the objectives are met, which are intended to ensure the benefit of change in business.

6. Conclusion

The new model of engineering education is based on innovations in education at universities (new methods, forms of education, approaches, didactic tools). It is a prerequisite for students to find employment in the labor market and a basis for the entrepreneurial and business environment. Knowledge of hard and soft skills is essential today. Inclusion of new forms of education in individual technical subjects is a prerequisite for the satisfaction of potential employers. New innovative forms of education also improve the knowledge and skills of students. They are also good motivational tools for continuous improvement and continuous education. Business education in today's globalized world, and especially in the European Union, is the basis of entrepreneurship. The proposal of a new model of engineering education can mean a new direction in education for universities and define a new educational strategy with the aim of introducing economic, social, personal, informational, economic competencies of students and thus also in the labor market. The success of students in finding employment depends on their approach to education and the quality of the educational process.

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