



MetaTech Exchange
BRIDGING INDUSTRY 4.0 IN WESTERN BALKANS

SUMMARIVE REPORT



Co-funded by
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1. Project goal

The project "MetaTech Exchange: Bridging Industry 4.0 in Western Balkans (METATECH4.0)" is an activity that responds to the challenges of the modern world in several key areas. These activities include: broadly understood digital challenges, implementation of artificial intelligence solutions, introduction of modern production technologies and provision of services based on technologies such as 3D printing, 3D scanning, Artificial Intelligence, Industry 4.0 tools. The project involves both organizations dealing with vocational education and representatives of industry and entrepreneurs. Such a combination means that during discussion panels, jointly developed training materials, e-learning platform, and methodologies for implementing modern industry 4.0 tools, it is possible to properly match the content that satisfies all represented parties.

As part of the project implementation, several activities are planned, which are preceded by broadly understood consultations, which is presented in the further part of the report in relation to the developed national reports.

2. Project cooperations

At the current stage of work, cooperation between representatives from all project countries took place through a Kick-of-Meeting and online working meetings and the exchange of email correspondence. Coordinating this work made it possible to develop a preliminary methodology for further proceedings and to develop certain guidelines for further work consisting, among others, of developing digital materials.

Training materials - the development of this material in consultation with all representatives from the project countries took place during the period of consultations, modifications, and adjustments to both the content and the form of testing knowledge. Depending on the specifics of the economy of a given country, conditions and requirements, the 50-pages training materials were supplemented with content assumed in the project but focused on selected tools, such as industry 4.0, digitization, virtual reality, etc.

E-learning materials - work on materials supporting the education process in such a way as to adapt it to the needs of the economies of the project countries began with consultations, which were based

on the guidelines included in the "Training materials" materials, but also expanded with additional modules that could be implemented. The development of materials is ongoing and is also monitored in a way that ensures the implementation of the project's planned points. The current challenge is to work on developing such a form of e-learning materials that will be attractive to students and graduates as well as current employees and that their content will be both high quality and have practical possibilities of use.

3. Implementation of project in the countries

As part of the implementation of the current stage of the project, three country reports have been developed from Kosovo, Bosnia and Herzegovina and Montenegro. The reports contain information on the implementation of individual project tasks with a focus on two areas: work already completed and planned for implementation.

3.1. Kosovo

Based on the country project prepared by: University "Haxhi Zeka" it can be stated that the level of advancement of the project implementation by the Kosovo partner is at the level assumed in the project. As part of the implementation of their tasks, study visits were carried out in four companies. In addition, visits to several other companies were planned, all of which were mentioned in the country report. The companies and educational institutions that were visited as part of the visits or are planned to be visited in the future are selected in an appropriate way, i.e. in a way that fits into the framework of the metal and manufacturing sector project. The report emphasizes the emphasis on focusing on cooperation with partners involved in vocational education, manufacturing companies and employee representatives. During regular meetings or exchange of information via e-mail, the project participants from Kosovo showed progress in diagnosing the needs that the project should focus on. Targeting the needs, as indicated in the country report, was carried out through meetings with representatives of the parties in a given country, companies and vocational VET education. As emphasized in the conclusions of the national report, national participants from Kosovo see a great involvement of companies and schools in the project activities and look forward to the implementation of its further stages.

Based on the Kosovo country report, it can be concluded that Kosovo has recently embarked on a very dynamic industrial development in the private sector, which in the initial phase of transformation generates numerous problems related to the technology sector and employee competencies. Analysis of the *Kosovo Agency of Statistics* report indicates that a significant area influencing the country's economic development is the development of the manufacturing sector, with an emphasis on the development of modern manufacturing technologies. This approach presented in the country report fits well with the ongoing Industry 4.0 transformation. The country report indicated an increase in the use of CAD/CAM software, modern CNC machines, digital communication tools, and production and management support, but also identified gaps in the application of IoT technologies, automation, smart manufacturing, data-driven production management, and AI-supported production optimization. This information helps in developing training materials and program content for the project. The country report also includes information on the lack of coherence regarding the development strategy in these areas, which may result from financial issues, access to dedicated programs, and staff shortages (i.e., a shortage of highly qualified employees). However, companies are showing significant interest in development and programs that could impact their growth.

Regarding vocational education and training (VET), the optimistic fact is that the national report identifies five important sectors, including metal, that VET is targeting in Kosovo. At the same time, the national report highlights gaps in the areas mentioned above: CNC, CAD/CAM, automation, digitalization, and production planning software. In the VET aspect, attention was drawn to companies' expectations regarding practical learning areas such as laboratories and internships using modern technologies. This aspect was also highlighted in the Interviews section. The practical aspect of laboratories and internships will undoubtedly strengthen VET-company relations and contribute to the popularization of VET education. It seems that the Kosovo Metatech 4.0 project partners have successfully selected a target group that is very diverse but also well-suited to the project's profile. The Bibliography included in the national report is relevant.

3.2. Montenegro

Based on the country project prepared by: Montenegrin Employers Federation, it can be stated that the level of advancement of the project on the side of the partner from this country is also at the level expected in the project calendar. Representatives of this country participated in both the Kick of Meeting and in correspondence related to the process of adapting the content of the project to the current needs of the national and local employment market and industry. The country report for Montenegro contains information on the current situation in the country related to the activities targeted by the project. The problem related to the lack of qualified staff was broadly described, emphasizing the high expectations regarding the project in this area, the problem related to low investment in modern technologies was presented, and consequently in the unadapted process of vocational education (VET). At the same time, concerns were expressed about the development of the industrial sector and its need to be protected.

As part of conducting research in the area of enterprises and adapting the content of the project and its materials to national needs, key industries were diagnosed, described in the country report, and specific examples from these industries regarding employee needs.

The broadly described report also touched upon the issues of vocational education and changes in this, which indicates the great involvement of the partners in the implementation of the project. As part of the search for the best training program and identifying key gaps that should be filled by the project in the area of VET and the metal sector, the problem of digitization and modern tools of industry 4.0 such as 3D modeling (also known as CAD), production optimization was broadly discussed, which can have a large positive impact on ecological issues in the era of development of artificial intelligence and the possibilities it creates in the area of both prototyping and manufacturing optimized projects with reduced mass and, consequently, reduced amount of energy needed to produce such products. The national report described the barriers identified by the partners from Montenegro in the area of digitization, financing and many other areas, which will certainly be helpful at the stage of carrying out subsequent activities in the project.

The national report also presents information based on national reports such as the *Government of Montenegro's "Industrial Policy of Montenegro 2024–2028"* and the *Ministry of Economic Development of Montenegro's "Public Call for Participation in the Programme for Improving the*

Competitiveness of the Economy 2025," which provide a strong bibliographic foundation for the national report. Furthermore, research by the *Employment Agency of Montenegro* confirms that occupations in **mechanical** and **electrical engineering** are among the most deficient at the national level. The report also highlighted the need for strong integration between the VET sector and the industrial environment.

In terms of implementing modern technologies, the Montenegro national report highlights the challenges of **climate change** and, consequently, the challenges of modern industrial technologies in production in this area. The topic of the so-called **Circular Economy** certainly fits into this area, and will also be extensively discussed during training sessions and meetings with project participants..

To sum up, the activities of the representatives from Montenegro, among others, described in the project, aim at the correct implementation of the project and are aimed at increasing national and international cooperation in this area as well as at developing a solid development National strategy in this area, including both legal conditions, financial issues and technology transfer in the field of industry and vocational education VET (development of e-platforms, etc.) A strong strategy in the area of shaping the VET sector in **cooperation with the industry** is currently being strongly developed in many European Union countries, which will certainly be a strong point of many discussions in the presented project as the aspect of knowledge transfer in practical application.

3.3. Bosnia and Herzegovina

The national report prepared by Digital Innovation Hub ONEX indicates the proper implementation of the current stage of the project by partners from Bosnia and Herzegovina.

Similarly to the previously described activities, partners from Bosnia and Herzegovina actively participated in consultations between project partners both in the form of Kick-off Meetings and via email correspondence. In the report, they indicated key problems of the metal industry in Bosnia and Herzegovina and known forms of support. In the area of the metal industry itself, they indicated development opportunities and some barriers. The area of the analysis of the current metal and manufacturing market for Bosnia and Herzegovina carried out by partners from this country also included the vocational education sector, where the current state of VET and the challenges currently posed to this industry in connection with the ongoing industrial transformation 4.0 were described. In addition, recommendations were presented regarding the possibilities of adapting the VET

industry to the current needs of the developing economy and the issue of the so-called Target Groups for all parties involved in the project in Bosnia and Herzegovina was raised. Such a comprehensive presentation of the problem certainly indicates the great commitment of the project partners and their high level of substantive and theoretical preparation. The report contains an extremely large amount of useful information.

In terms of identifying the gap between current production and modern standards, the following can be included: Digital Transformation Support, Green Recovery, and VET Reform. At the same time, the increasing share of precision manufacturing processes requires the use of modern machines and technologies such as CNC, 3D printing, AI, digitization, automation, and robotics. Prototyping is highlighted here, which is understandable given that it is crucial for the development of many industries and their competitiveness in international markets. The report recommends developing a clear strategy for vocational education (VET), particularly for small and medium-sized enterprises. The national report highlights that very large enterprises have a self-developed employee training path, which is precisely what is lacking in smaller enterprises. It highlights the significant differences resulting from this and the need to target support specifically at smaller enterprises.

The national report highlights the need to standardize national regulations and development strategies with those in the European Union. The national report on vocational education (VET) recommends increasing efforts to establish Regional Excellence Centers, Dual Education Legislation, Teacher-in-Industry and Targeted Digitalization Grants, and Leverage Critical Minerals. In the area of vocational education, schools and institutions lack not only machinery, equipment, and modern technologies, but also training for teaching staff should be considered. In conclusion, the report's authors recommend: "Triple Helix approach—a formal collaboration between the government, academia (VET, and universities)."

4. Conclusions

In summary, it can be stated that at this stage all project partners have completed their tasks at a satisfactory level and the forecast for further cooperation is promising. In addition, the active participation of partners in the first stages of developing materials and currently at the stage of creating an e-learning platform allows us to positively assess the tasks planned for implementation. The large contribution of individual project partners in adapting the VET vocational education process to the needs of the current, changing and developing industry is also at a very good level. The project drew attention in the currently developed materials to the issues of an appropriate technological process focused on and greater efficiency and optimization, which also has an impact on the ecological aspect, also related to smart manufacturing and smart design.

The country reports are enriched with an extensive professional bibliography, which allows for the identification of the data presented therein and a broader analysis of the issues for the project partner countries.

For all participating countries, the project is primarily dedicated to industries related to the production process of both metals and plastics, design, prototyping, and material processing. Therefore, the companies/recipients are primarily entities such as:

- Small and medium-sized enterprises (SMEs) in the metal sector
- Vocational education institutions
- VET teachers and trainers
- Technical staff and machine operators
- Students in technical and vocational education
- University representatives and academic staff

In all cases, regarding the profile of companies that may be recipients of the project, the country reports clearly indicate that small and medium-sized enterprises (SMEs) are the main targets. In Bosnia and Herzegovina, in the private sector, major firms such as Mahle, Kolektor, and ELAS have established their own internal training centers to bridge the skill gaps left by the formal education system.

Industries suitable for implementing digital tools, as indicated by all national reports, include:

- broadly defined machining, with an emphasis on CNC machining,
- quality control - Metrology, with an emphasis on the use of fast tools such as 3D scanning and dimensional inspection software,
- areas related to prototyping and the use of tools such as 3D printing and artificial intelligence in the 3D design process,
- production process management, i.e., issues responsible for communication during the implementation of broadly defined projects and between departments,
- vocational education in the implementation of training projects.



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