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## EDUCATION SERVICES ON INDUSTRY 4.0 IN THE AGE OF 4TH INDUSTRIAL REVOLUTION

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**Abstract:** *Business is becoming more and more networked and multinational. The amount of data available in decisions and data management is dramatically increasing. There is need of architecture for based business management. Industry 4.0 is available to be used in multinational co-operation in business networks. Organizations have to understand ontologies, nomenclatures and concepts on common way as businesses are harmonized across organizational interfaces. It is important to understand Industry 4.0 as architecture and terminologies and concept same way. Industry 4.0 and it's business structures have to be trained for all the partners to succeed in networked business. The role of education and training of modules of industry 4.0 is changing in multinational co-operation. Digitalization and use of new technologies has created also new opportunities to increase understanding and competence on co-operative way. This article introduces results of European Co-operation project iCoins, which has created in multinational co-operation a new content, education modules and way of collaborative training on Industry 4.0 in networked environment.*

**Key words:** *Digitalization, Multinational business networking, Industry 4.0, Harmonization, Competence and skills, Education.*

### 1. INTRODUCTION

Digital transformation and Industry 4.0 principles realization is to significant influence on the both aspects the supply chain and production in manufacturing industry and SME's continuous professional staff development (CPSD) as well. In this connection CPSD is the signifying ongoing process of developing, maintaining and documenting all professional competences and skills.

The industrial sector contributes essentially to the economy of different countries around whole world which is a critical driver of growth and employment.

Digital transformation in Industry 4.0 also provides new business models that challenge the traditional businesses. If company or enterprise want to become more competitive in the modern reality it needs to fully take advantage of the opportunities Industry 4.0 offers and supply chain and production in manufacturing industry and continuously to take the attention to staff development. Digital transformation in

companies can create ten times better performance, however, many enterprises do not use those principles still due to insufficient development of personnel in the use of digital technologies in their workplaces.

Digital transformation is based on the use of new tech to modify key business processes and already existing services and a variety of technologies companies are currently using in coming up with digital strategies. A variety of companies are ready to use such technologies such as artificial intelligence, cloud computing, the Internet of Things.

Because of increasing digitalization enterprises must find new ways to innovate for business advantage. Digital transformation forces enterprises to use new technologies like cloud, big data, and social networks with increasing intelligence and automation. By that way enterprises can capitalize new opportunities and optimize existing operations to achieve significant business improvement. The increase of available data have to be used in the use

decision making and in managing business by data.

Business leadership needs democratic innovation culture and co- innovation and co- evolution processes.

The Fourth Industrial Revolution will bring unprecedented change to societies, education organizations and business environments. The goal of this article is to identify how education, education content, the way education is proceeded and overall whole the education business is changing. Most important is how we should respond to this inevitable co- evolution.

This article introduces results of an EU- project, iCOINS which has developed common EU competences for raising awareness of SMEs on Industry 4.0 through an innovative Training Course. During the execution of the development work it has been analyzed also the content to educate, the way to educate and train and need for collaborative learning environments. Multidisciplinary and multinational aspects are considered more closely as well in business networks and organizations adapting data- based business architecture, Industry 4.0.

## 2. THEORETICAL BACKGROUND

Statistics around the world show the growing adoption of digital and cloud solutions, which shows that digital technologies are constantly improving the business activities of SMEs. According vital digital transformation Statistics in 2021 [1], spending, adoption, analysis and data, 46% of small businesses use business intelligence tools.

According Deloitte analysis [2] high digital maturity digitally achieved already 58% of companies with implementation of digital technologies (Fig. 1).



Fig. 1. Companies' maturities levels with digital technologies implementation [2].

Nevertheless, for instance, Europe has not tapped into its digital potential, as if 47% of EU citizens shop online, only 14% of SMEs use the Internet to sell goods and services, and less than 2% of European businesses make full use of digital technologies such as mobile communications, social media, big data analytics and the Internet of Things.

The European Trade Union Confederation underlines the importance of developing new tools to support and manage transformational change. The benefits of Industry 4.0 and the transformation of traditional enterprises through new digital advances are realized in different ways across the EU. Moreover, across Europe, there are different levels and standards of skills and competencies in the workforce of the new digital era [3].

Therefore, digital CPSD could speed up innovation and supports faster design processes and increase profitability for a variety of SME.

On the other hand, for the point of view of the industry the availability of skillful labor force and innovation environment are crucial factors. In this context, qualified staff has been seen to be able to utilize the opportunities of digitalization and response the needs of future skills. World Manufacturing Forum has stated on year 2019- report, that in next five years 40% of workers have to change their core competences.

Through digital transformation, the use of new technologies like cloud, mobile, big data, 5G- infrastructure, platform- technology, data- analysis, and social networks with increasing intelligence and automation enterprises can capitalize on new opportunities and optimize existing operations to achieve significant business improvement.

Digitalization is going to be an important part of everyday life of citizens, and present in the working day of the average citizen and employee in the future. For that reason, also education system and education programs on all levels of education from diaper age to doctorate have been directed to fulfill this ecosystem strategy.

World Economic Forum [4] raised up the need for national accelerators of the Fourth Industrial Revolution on dimensions such as artificial intelligence and machine learning, data

policy, the internet of things, blockchain, autonomous vehicles and drones.

In 2019 WMF Report [5] it focuses on training and education to develop the skills and competencies in the manufacturing workforce. Different mechanisms have been identified such as educational design, use of technology to improve learning outcomes such as digital learning platforms, mobile learning, virtual and augmented reality and learning factories.

Fulfilling of the data-based business architecture, Industry 4.0, is not only augmenting the nature of existing manufacturing roles but also leading to the creation of completely new roles such as big data scientists. That is the reason why educators and training providers should ensure that there is adequate training to prepare workers for these emerging roles increasingly required by the job market [5]. Companies equally should place emphasis on transition opportunities for existing workers to take on new or augmented roles within the organization, providing the workforce education and training programs needed to support such transition.

Every expert as a human being has his own metacognitive mental mindset and he can build his own schema out of discussed topic or problem to be solved. Individual expert members of co-operative team can change ideas of their individual schemas based on knowledge exchange [6]. The other expert member can learn, make his own mental picture out of that combining it with his own knowledge and create a new schema and make dialogue with the other expert. When having a common understanding of the new tuned schema after dialogue it can be applied in problem solving or task executing.

Every opportunity must be taken to assist in the development of activities.

### **3. RESEARCH QUESTIONS AND METHODOLOGY**

Business is becoming more and more networked and multinational. Organizations have to understand ontologies, nomenclatures and concepts on common way as businesses are harmonized across organizational interfaces.

The role of education of modules of industry 4.0 is changing in multinational co-operation.

The main research questions are:

- a) Is there need for multinational co- operation on Industry 4.0?
- b) Can the training be organized in a different way from traditional in international cooperation?
- c) What is the added value in multinational co- operation?

This article introduces results of European Co-operation project iCOINS, which has created in multinational co-operation a new content, education modules and way of collaborative training on Industry 4.0 in networked environment.

The purpose of the study is to verify how the learning process is boosted by new digital content, new learning software and tools and customer- oriented learning environments. The change of education programs and individual education modules can be supported by applied research projects. You can use them in making proof- of- concept of new technology, new way to teach and train and through the experiences gathered change education content, way to educate and finally education business as whole.

### **4. OPEN DIGITAL ECOSYSTEM FOR EDUCATION AND TRAINING**

During EU- project iCOINS it has been studied the main directions of continuous adult education development in the European Union and the structure and dynamics of adult students in the European Union countries and how digitalization of education environment influences on education.

One of the most important component or attributes of the digitalization process is functioning and continuously developed and supported the digital educational ecosystem. We are speaking about the adult educational system for the knowledge level improvement to develop and support carrier during whole professional life.

Digital educational ecosystem (our point of view) can be defined as network of stakeholders consisted of:

- Customers;

- Distributers;
- Educational organizations, communities and societies;
- Educational service providers;
- Private experts;
- Administrative structures and legal societies;
- Business organizations and communities.

All these stakeholders can both to co-operate with and compete with each other in frame of digital educational ecosystem.

In the frame of such ecosystem continuously on-line should be solved next tasks:

- Identification, definition and including of the global leading technologies and the global target industries;
- Identification of leading technologies' innovation sources providing research findings (universities, research institutions, technology and innovative transfer centers, other) around the World;
- Work of agents in sourcing innovation findings, innovation needs, initiating commercialization of creation and support of training courses etc. Researchers and experts, educational experts and business angels;
- Research and educational incubators, industrial parks, industries and workforce in the target areas for defining capacity and capabilities for creation of the leading technologies and training courses;
- Exploration and elaboration of principles regarding intellectual property rights policy and division of financial benefits (between research institutions and communities, researchers and educational experts etc.);
- Elaboration of mechanism (motivation, financing) for involvement of researchers and educational experts to creation and support of the
- Knowledge bases training courses);
- Recruitment and training of specialists for each target educational in sourcing financial capital; identification of seed, start-up and venture capital financing sources;
- Exploration of inter-country ownership sharing legislation and principles;

- Attracting, training of technological experts capable of properly representing the target leading technologies industries; Creation of expert societies of those experts;
- Exploration, analysis and description of all legal, technical, financial issues
- Establishing mechanism and structure for maintenance: legal body, personnel, financing;
- Creation and support of the digital knowledge management system

## **5. EDUCATION SERVICES FOR COLLABORATIVE LEARNING ON THE CONTEXT OF INDUSTRY 4.0**

Industry 4.0 is expected to significantly advance the supply chain and production in manufacturing industry. It can speed up innovation and support faster design processes and also increase profitability. The industrial sector contributes essentially to the EU economy which is a critical driver of growth and employment.

Digitalization and data- based business development according Industry 4.0- framework also provides new business models that challenge the traditional businesses. Europe needs to fully take advantage of the opportunities Industry 4.0 offers, to become more competitive. Europe has not used its digital potential, as though 47% of EU citizens shop online, only 14% of SMEs use internet to sell products and services, and less than 2% of European enterprises are taking full advantage of the digital technologies like mobile communications, social media, big data analytics, cloud computing, platforms and IoT. European Trade Union Confederation emphasizes that development of new tools to support and manage transformational change is essential. Industry 4.0 benefits and creates transformation for traditional businesses through new digital advancements. It is realized differently by various EU countries. Moreover, there are different levels and standards of skills and competencies of the work force new digital era in different countries of Europe.

The objective of iCOINS project has been to develop common EU competences for raising

awareness of SMEs on Industry 4.0 through an innovative Training Course. The primary target staff, higher education staff and students, vocational institutions, vocational higher education institutions/teachers, public administration staff.

The specific objective of iCOINS project has been to analyze common future needs of SMEs in the context of Industry 4.0. Common sets of learning outcomes were defined based on ECVET and ECTS principles. The project has addressed the main skill shortages for which the competences for capacity building in SMEs in industry 4.0 context are described. Through innovative blended learning contents on industry 4.0 themes, iCOINS targets a mind change of SME entrepreneurs and employees which will enable creation of a community of practice in the learning and training process.

iCOINS has developed a common competence map and training modules on raising awareness on Industry 4.0 in SMEs. An OER platform with training modules and a training course plan for trainers has been created. A training methodology handbook is available to enable trainers to transfer knowledge to trainees by using iCOINS outputs. The outputs will be tested through pilot trainings and multiplier events.

iCOINS has developed a methodical approach to meet the SMEs' needs for awareness raising on Industry 4.0 principles, enhancing VET trainers' skills in using innovative methods and tools to transfer the knowledge. The OERs will allow trainers to implement innovative methodologies in training by using ICT and online resources. Open Badges has also been released as a recognition of achievements reached within the trainings.

The iCOINS methodology, is promoting continuous professional development of VET teachers, trainers and mentors in work-based settings, with a focus on developing effective open and innovative education through the use of OER in work-based context.

iCOINS has created an innovative roadmap for the description of competences and built capacity on industry 4.0 in SMEs. The roadmap defines the frame and targets for the content and methodology for the Training Modules. The

groups are VET teachers, trainers and mentors. Additionally, iCOINS serves the needs of SMEs Training Modules has been tested with VET-trainers and with SMEs' staff.

iCOINS has designed and implemented OER- platform with convenient operational functionalities: modules, exercises, learning outcomes and procedures for the Open Badges release.

iCOINS has engaged participants, participating organizations, target groups and stakeholders into the co-creation process by activating open communication, sharing information, reflecting outcomes and challenging into discussion and co-operation. iCOINS – conference and National iCOINS meetings has been scheduled for this purpose.

The development of training path for building capacity and training modules for raising awareness on Industry 4.0 in SMEs will serve for harmonization and unification of Industry 4.0 skills of VET teachers, trainers and SME staff in Europe which is one of the primary objectives of this project. Moreover, a standardized system for recognition of competences acquired by the trainees based on knowledge, skills and competences gained by the iCOINS OER Platform will be provided through the release of Open Badges. iCOINS project will create a training methodology handbook and training course plan for trainers to further promote and develop the results of the project.

## **6. FUTURE OF EDUCATION BUSINESS 4.0**

ICOINS-project has shown that education business is becoming more and more networked and multinational. That will mean that structure of education organization will change, and they will profile themselves more strongly as well in different education business the use of new technology will be different.

Because of fast change in business environment there is increasing need to continuously complement the skills of employees. World Economic Forum estimated (August 2020) that 40% of workers will need to renew their core competencies by 2025.

New technology is rapidly entering the market globally. This requires creation rapidly



application of new technology in order to create new business models and rapidly introduce new services. In order to manage a complex situation, a new way of organizing development work is also required. In general, the business of training organizations is undergoing significant change and is facing various challenges. With national funding alone, the education provider will no longer be able to compete.

Educational institutions must use their skills globally and find their own role in the joint development of educational networks. This means focusing on one's own strengths and internationalization but also the ability to be able to function in ever-changing ecosystems.

There will also be new goals for the training. The most important of which are increasing the willingness to change, the ability to respond to new challenges, improving the flow of key information to employees, but also facilitating communication with the partners.

It should be noted that as technology evolves, not only will communication technology change but it will also change communication channels and the way we communicate. The iCOINS-project has considered the challenges posed by the changing environment. has created in multinational co-operation a new content, education modules and way of collaborative training on Industry 4.0 in networked environment. It has verified verify how the learning process is boosted by new digital

content, new learning software and tools and customer- oriented learning environments.

We no longer merely transfer information across the network but share understanding between different actors and ensure that understanding is transferred.

The online business needs to change in a rapidly changing environment so that every member in business network understands the change.

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### SERVICII EDUCAȚIONALE DESPRE INDUSTRIA 4.0 ÎN ERA CELEI DE-A 4 REVOLUȚII INDUSTRIALE

**Rezumat:** Afacerile devin din ce în ce mai interconectate și multinaționale. Cantitatea de date disponibile pentru luarea deciziilor și managementul datelor crește dramatic. Este nevoie de organizare în managementul bazat pe afacere. Industria 4.0 este disponibilă pentru a fi utilizată în cooperarea multinațională a rețelelor de afaceri. Organizațiile trebuie să înțeleagă ontologiile, nomenclaturile și conceptele comune utilizate, deoarece afacerile sunt armonizate între interfețele organizaționale. Este important să înțelegem industria 4.0 ca arhitectură, terminologii și concept. Conceptul de industrie 4.0 trebuie să fie înțeles de toți partenerii pentru ca aceștia să aibă succes în afaceri interconectate. Rolul educației și al formării în module ale Industry 4.0 se schimbă în cooperarea multinațională. Digitalizarea și utilizarea noilor tehnologii au creat, de asemenea, noi oportunități de a crește înțelegerea și competența în mod cooperativ.

Acest articol prezintă rezultatele proiectului de cooperare europeană iCoins, care a creat în cadrul unei cooperări multinaționale un nou conținut, module educaționale și o modalitate de formare colaborativă în industria 4.0 într-un mediu de tip rețea.

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