

# IMSCI'20

## The 14th International Multi-Conference on Society, Cybernetics and Informatics

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# PROCEEDINGS

Edited by:

Nagib Callaos

Bill Muirhead

Lorayne Robertson

Belkis Sánchez

Michael Savoie



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# **Professional-oriented Training of Specialists under Implementation of Cloud Computing Information Systems in Cooperation Between Universities and IT companies**

**Olena KOPISHYNSKA**

Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian Academy  
Poltava, 36001, Ukraine

**Yurii UTKIN**

Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian Academy  
Poltava, 36001, Ukraine

**Ihor SLIUSAR**

Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian Academy  
Poltava, 36001, Ukraine

**Vadym SLYUSAR**

Central Research Institute of Armaments and Military Equipment of Armed Forces of Ukraine,  
Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian Academy  
Kyiv - Poltava, Ukraine

**Nadiia PROTAS**

Educational Research Institute of Economics, Management, Law and Information Technologies, Poltava State Agrarian Academy  
Poltava, 36001, Ukraine

**Olha BARABOLIA**

Faculty of Agrotechnology and Ecology, Poltava State Agrarian Academy  
Poltava, 36001, Ukraine

## **ABSTRACT**

The article reveals an original approach to the organization of professional-oriented training and retraining of specialists in agrarian universities, which is based on the example of creating syllabuses and curriculum design in cooperation with business companies that are developers of information systems (IS). Cloud computing based IS, which were designed to automate the accounting of production and management processes in agrarian enterprises, allow students to attend training and perform a wide range of production tasks. The authors describe the main stages and results of the implementation of different ERP and CRM cloud computing systems in the training programs for bachelor and master courses in management, marketing, agronomy, as well as methods for organizing various forms of training for practicing professionals from agrarian enterprises.

**Keywords:** professional-oriented training, information systems, cloud computing, universities and IT companies' cooperation, augmented reality.

## **1. INTRODUCTION**

In modern conditions world of work is changing in connection with digitalization, deepening globalization and population ageing; information and development of infocommunications on the basis of network technologies became one of the main productive resources [1]. The extent, to which individuals, firms and economies can harness the benefits of these changes, critically depends on the readiness of higher education and adult

learning systems to help people in developing of relevant skills for this changing world of work. Enterprises and employers will need to make new investments to expand their involvement in educating, training and reskilling of workers to support economic growth. And workers will need to proactively upgrade their skills or acquire new ones through training, education and lifelong learning to remain employable [1]. Education and training systems will also need to take advantage of new educational technologies and give greater attention to digital skills.

One of the main directions of modernization of higher education in Ukraine as well as throughout the world is the introduction of a competence-based approach to the educational paradigm aimed at providing the student not only with theoretical knowledge but also to create the experience of carrying out a certain activity in order to solve practical problems. New state standards of higher education are aimed at the formation and development of professional and general cultural competences, which enable a future specialist to be not only a skilled performer of professional functions, but also to act effectively in different life situations [2]. The concept of "competence" of specialists, students was introduced by experts of the International Labor Organization in the end of the last century in accordance with the requirements of the labor market [1]. Distinctive characteristics of a competent approach are:

- orientation towards the formation of the specialist's, professional's personality;
- interdisciplinary model of education;
- professionally-oriented direction;
- description of the result of training with competencies.

According to the list of general and professional competencies for the majority of specialties in today's educational standards,

there are so called information and communication competencies, which reflect the trends in the development of the information society and information technologies. Information and communication competence provides the ability of a person to be guided in the information space, operate the data on the basis of the use of modern ICTs in accordance with the needs of the labor market [3].

## **2. ANALYSIS OF RECENT STUDIES AND PUBLICATIONS, WHICH DISCUSS THE PROBLEM**

A lot of papers [4-6] have been devoted to studying of the directions to achieve greater balance of education and labor market needs, in which knowledge management is defined as one of the successful factors of development of project-oriented companies, as well as obstacles that affect their success. According to data of IBM Institute for Business Value, industry and academic leaders revealed that highly-demanded skills needed for workforce success are the same skills graduated students lack: analysis and problem solving, collaboration and teamwork, business-context communication, and flexibility, agility, and adaptability [7].

Professionally-oriented learning is considered as a special innovative technology in a large number of publications, but mostly in the context of teaching of foreign languages or in the preparation of modern pedagogical workers [8]. Among the methods of professionally oriented technologies the authors identify problematic, reflective, rating, case-methods, information and communication technologies, etc.

However, coverage of the problem of combining professional-oriented training for specialists in agrarian industries, taking into account the need for possession of information technologies used in the transfer of farms to precision farming agriculture, is insufficient. It is one of the reasons of Ukraine's lagging from European countries in planning and implementing of a wide range of technologies related to the use of GPS monitoring systems, robotics, cloud computing systems, augmented reality (AR), artificial intelligence (AI), etc.

Such transformations in agrarian production and business predetermine the need of the search for effective forms, teaching methods and the widespread introduction of information and communication technologies (ICTs) in the educational process either as a subject of study or as means and methods of training. The purpose of this work was to present original professional-oriented approaches to the training of specialists in agronomy, agrarian management and marketing in universities through the introduction of information systems (IS) designed to automate accounting of production, management processes and commercial activities in agrarian enterprises. Educational programs were created in cooperation with business companies that are developers of domestic information systems, introduced in the educational process as well as proven training courses for the training of information technology practitioners of the agrarian sector.

## **3. MAIN RESULTS OF THE IMPLEMENTATION OF CLOUD COMPUTING BASED INFORMATION SYSTEMS IN THE EDUCATIONAL PROCESS**

In the presented work the authors are basing on their own experience and testing the innovative projects offer not only as general overview of possible forms of partnership with all interested institutions, but also describe the algorithm (in a case

form) for organizing such mutually beneficial cooperation and the forms of its implementation on specific examples from the beginning to intermediate results and perspective development.

A number of successful innovative approaches for rising of the level of quality and competitiveness of training specialists for one of the important sectors of the economy and the labor market was put into practice in one of the well-known Ukrainian universities – Poltava State Agrarian Academy (further – PSAA). In the conditions of tough competition, the strategic directions of the institution's work are updating the list of modern specialties, raising the scientific and professional level of each teacher as well as establishing mutually beneficial links with leading industrial and business companies that are ready to cooperate with universities.

The impetus for the beginning of multilateral cooperation was the search of modern IS which would have become the subject of studying in the teaching of individual academic disciplines in leading different specialties for agriculture: agronomists, managers, economists. At the same time, it was necessary to provide broad and free access to licensed professional software for students during the learning process. Therefore, from 2013 a gradual transition to the usage of the most advanced cloud-based CRM and ERP systems were started. "Traditional IT spending is in decline compared to enterprise investment in public and private cloud services," says research group IDC. Cloud system software (CSS) is the foundation for private clouds. Most of the commercial market is for enterprise on-premise deployments and telco NFV, and while much desired featurewise, it is still very complex to deploy and operate. CSS continues to be adopted primarily by highly skilled and technologically advanced firms [9]. This trend was primarily caused by the fact that during the transition to "cloud" infrastructure there is no need for high financial costs to support and develop its own IT infrastructure of the company with an additional increase in the special staff of servicing specialists. Today, thousands of companies work using of IS on platforms which provide cloud technologies, also in Ukraine: representatives of small and medium-sized businesses, enterprises, financial institutions [10].

The process of forming a new concept of interaction between education and business in the study and implementation of cloud computing IS took place in stages over several years. The signing of cooperation agreements between IT companies and the university, the introduction of CSS into the educational process and the training of specialists with modern competencies have become key elements of this concept, as well as regular events to promote partner companies.

The first IS that was used in the learning process was Bitrix24: international CRM system of personnel and customer relationship management, which based on cloud technologies and appeared on the Ukrainian market in 2013 [11]. The originality of the project is based on the combination of cloud computing technologies with the interface of social Intranet and provides teamwork in a company with high efficiency of various types of communications. The combination of these components allows the user companies to start quickly working with the IS excluding long-term implementation and the involvement of additional IT professionals.

During the monitoring of the IS market this project, unlike others, drew attention not only to the complex set of tools, but also the opportunity to start free of charge for a company with a number of business users for up to 12 people (the "Free" package) without limitation of its use, with a space of up to 5 GB in the "cloud" [11]. These conditions are sufficient for organization of effective personnel management and electronic document management of a small company, as well as an affordable tool for future

managers training on the example of a real information system. Students have the opportunity to register their own virtual company and perform a cross-cutting situational task, which reflects the real actions of the manager in terms of professional activity: control the real-time tasks realization by staff, divide duties, organize electronic meetings, work in a remote office, organize work with clients, draw up reports and organize electronic document management.

As an institution of higher education PSAA signed a partnership agreement with "IC: Bitrix" in 2014 and received permission for free use of the "Professional" package with unlimited amount of data storage and unlimited number of users. Training programs, laboratory workshops were developed for the study of information systems in the training of management and marketing specialists and finally a tutorial was written. The training is held using the case-method; students solve real-life problems in cloud services.

Approaches of professionally oriented learning and the technology for creation of successful collaboration between developers of domestic software and universities have shown more positive aspects when the IS Soft.Farm was introduced into the educational process for preparation of future agronomists. After analyzing a sufficient number of specialized IS, which are widely represented in the market of software products for automation of the agrarian sector of Ukraine, Soft.Farm was selected for implementation in the educational process of the domestic IS – free software for the organization and management of agricultural activities, developed by Quart-Soft company [12]. The main advantage of this system – basement on cloud technologies and most of its modules are available for users for free. The system is developed for the needs of agricultural producers (the database of reference books on the main components of agriculture, such as soils, pesticides, etc., the generation of electronic documents), and thus is one of the best to demonstrate the prospects of implementation in real enterprises and the ability to keep records of all work types in both crop production and animal husbandry. It is enough for a new user to register as a manager, register a company employees and start working on entering real data about his own enterprise

(for students - a model of a virtual enterprise) for the further usage and automate processing of results.

The first course on the introduction of an information system in agronomy, the training tasks of which were developed in close cooperation with representatives of the developer company, showed great interest by the students in practical training as well as the prospects of multilateral long-term interaction between universities and representatives of agrarian enterprises. On the one hand, they are waiting for a modern young specialist who is aware about modern farming practices, and on the other hand, they need to implement modern information management and accounting systems for production processes.

At the same time, among the employees of older generation in agro enterprises there is a lack of awareness of the necessity and inevitability of changes, which calls for special training and retraining to start working with information systems. The place of such retraining is most likely to be a higher educational institution. Such a multilateral model of interaction was implemented at the Poltava State Agrarian Academy after the signing of the cooperation agreement with the company Quart-Soft in April 2016.

In order to consolidate the basic principles and directions of the common activity of the University and Quart-Soft company, a "Center for the training of users of the IS Soft.Farm was created on a voluntary basis. With the consent of the partners, for successful course students of the IS Soft.Farm during the discipline studying as well as for students of special scientific and practical seminars, the certification system was introduced. The list of all certified users is located on the special section of the official website [www.soft.farm](http://www.soft.farm).

The designation of such certificates is an attribute of professional qualities recognition of the specialists in agronomy in the field of information technology and a marketing system element for companies-developers. This is one example of implementing of common interests.

Summarizing the areas of intersection of the interests of each potential participant in the cooperation, the directions of project participant's interaction can be presented in the form of a scheme on Fig. 1.

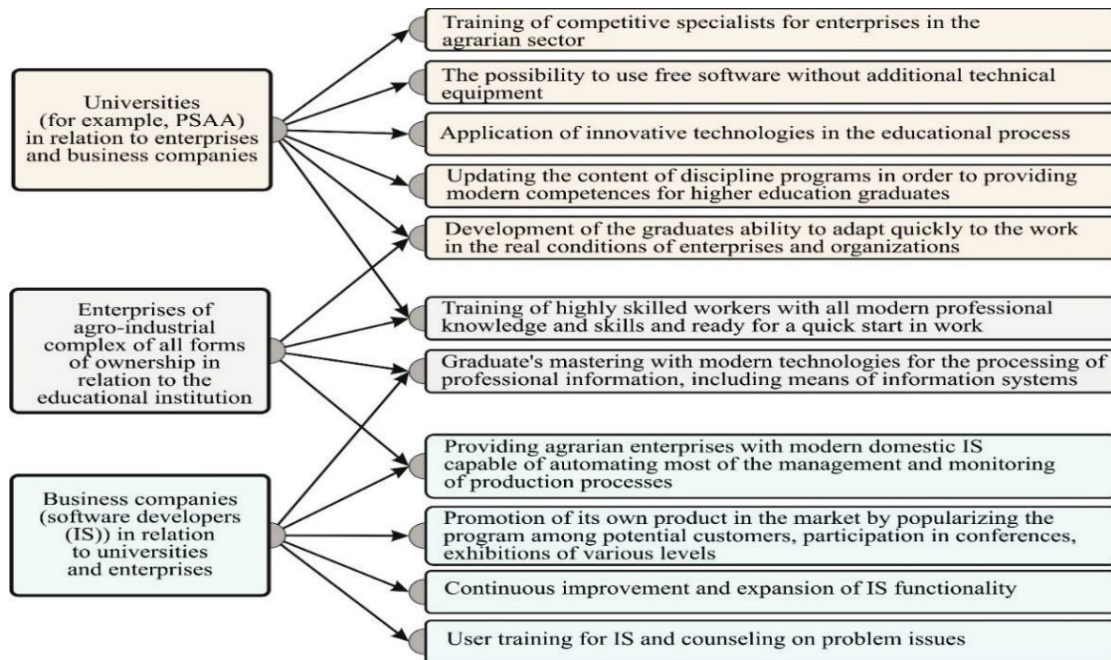


Fig. 1. The main directions of interaction between project participants based on shared interests [designed by authors]



The given model of cooperation between representatives of quite different spheres of the economy and the labor market was formed not artificially and not simultaneously, but rather by a natural association based on awareness of each side of its own goals and objective needs. This model shows that the university is an integrative link between many representatives of agricultural enterprises and business companies that provides educational and consulting services that each participant needs [13]. The workshop participants are the main specialists of agrarian enterprises, which are engaged in basic skills training, expanding the understanding of the possibilities of modern software and technologies, break down the barriers that appear to the older generation while working with PC programs. At the same time, their readiness to implement this system increases multiply, which contributes to the commercial success of the company-developer.

The stability of such a system of cooperation is evidenced by the fact that not only new educational establishments have joined it, but also the number of interested enterprises is also increasing. So, in December 2017 an agreement on cooperation between the PSAA and AGROXY Ukraine Company, which is the developer of the system of electronic bidding of crop production on the modern platform, was signed. The agreement signing was preceded with the search for potential partners by each of the partners in order to solve a number of professional tasks and ways of their best implementation. The AGROXY project has a number of advantages over other numerous trading platforms that are designed to support producers and buyers in the way of selling / purchasing agricultural products. The main innovations of the electronic trading system were the use of reduction and technologies of block chain (distributed databases) to ensure the reliability of stored information and the speed of concluded transactions. On-line auctioning will allow the participants of agro-market to have the following benefits [14]:

- make business with verified companies. The system provides an automatic and independent checking of Ukrainian and foreign counterparties, the buyer's ability to pay for goods, use of helpful and cheap financial instruments of our partner banks and insurance companies;
- have documented characteristics of the purchased goods. The system carries out an automatic check of documents for agricultural products sold in the form of warehouse receipts, warehouse documents;
- quickly fix the price of the transaction in online trades (legally significant sale / purchase through on-line reduction);
- to have a package of documents for the conclusion of a direct sale agreement, formed automatically according to the results of the on-line reduction: instantly and without a commission to receive in electronic form a record of reduction, an invoice, a contract of sale (supply), a storage contract (with an elevator).

The AGROXY system aims to optimize the processes of managing the supply chains and processing of documents, saving time and reducing risks for trading participants to increase their profits, reduce costs and expand the geography of supply and demand. Such characteristics have become decisive when introducing professional modern future marketers and economists for the agro-industrial complex into the process of professional training.

The most general results and achievements obtained through the implementation of professional-oriented approaches for the training of future specialists in the agrarian sphere, when introducing information systems of different directions into the educational process, are described in the following sections.

### **Results of implementation in the educational process of IS Soft.Farm**

The signing of the cooperation agreement between the company Quart-Soft and the PSAA on April 24, 2016 was the beginning of the partnership. The following is a brief description of the contents and the main stages of cooperation.

Starting from 2016-2017 academic years within the framework of the course "Information Technologies in Agronomy" for students of Master level there was developed and successfully tested laboratory workshop with a detailed description and practical exercises on the use of IS Soft.Farm in the activities of the agronomist. Training of masters on the example of a real production information system promotes the consolidation of special competencies in agronomy and the creation of general information and communication competencies during the registration of the enterprise using e-mail and work in cloud service throughout the entire training cycle.

October 12, 2016, the first scientific-practical event in the format of the round table was held, where there were invited the leaders of the company Quart-Soft, the administration and teachers of PSAA, representatives of state organizations for managing agro-industrial development as well as representatives of agrarian enterprises for the purpose to familiarize them with the benefits of implementing information systems on the example of IS Soft.Farm. The event caused a considerable resonance. The coverage was highlighted by the mass media of the city, the region, on the educational institution's websites and in the news section of the official website [www.soft.farm](http://www.soft.farm).

The experience of introducing IS Soft.Farm into the educational process in the preparation of specialists in agronomy was fixed and described through the publication of a tutorial, written in co-authorship with the leading teachers of PSAA and the project mentor from Quart-Soft and presented at several All-Ukrainian agrarian exhibitions during 2017-2018.

In October 2017 on the basis of the PSAA a large-scale workshop on the exchange of experience was held with participants of up to 30 representatives of the agronomic faculties. Now several agricultural universities in Ukraine work on a similar system: Sumy, Kherson, L'viv, and others.

In general, during last 4 years for specialists from different parts of the agrarian enterprises there was conducted 8 scientific and practical seminars, including a theoretical part and practical training on work with IP (1-2 times a half year, 6 hours a day) with distribution of handouts and special methodical support for participants.

During the period of cooperation, the number of enterprise-users of this IC has grown by 21 % according to IT-developers' data and has exceeded 8,500 registered users. From the side of the PSAA scientists a new scientifically-proven crop yield prediction model was suggested for implementation for the Soft.Farm system developers, which is much more precise than the standard method of the average NDVI indicators as a separate module.

In the near future a number of actions are planned to integrate this system into the general scheme of the implementation of precise farming systems in advanced farms in Ukraine.

### **Results of implementation of the electronic trading system AGROXY into the educational process**

The decision to introduce into the training process the AGROXY system was adopted due to its legitimacy and openness in the commercial market of agro-products and the application of advanced software development technologies. At the same time, PSAA teachers took a mission to reveal all the technical features

and commercial tools of online trading both during training sessions and scientific seminars, conferences.

The company AGROXY UKRAINE provided separate promotional codes and instructions on the use of the commercial information system AGROXY in the educational process and ensured the promotion of the project among the young professionals, who constitute the future fund of the agricultural and business workers. Subsequently, a special module for testing auctions for conducting training simulations during e-commerce sessions with students was specially developed. Students had the opportunity to develop professional competencies in marketing, entrepreneurship and also to acquire the skills of using e-commerce systems in conditions that are as close as possible to real business processes.

In February 2018 the first comprehensive announcement of the AGROXY project opportunity was made during the regional scientific and practical workshop. Among the audience there were representatives of the University, industrial agrarian enterprises, and representatives of other IT companies. Especially for this event, methodological recommendations for the full application of the electronic trading system were developed and published in the form of step-by-step instructions, which were distributed to representatives of consumer services companies.

A significant achievement in 2018 was the holding of practice for students of the specialty "Information Systems and Technologies" based on the computer laboratory trainings of the Department of Information Systems and Technologies of PSAA with the involvement of students-practitioners for remote implementation of the practical tasks set by AGROXY UKRAINE Company. The practical tasks were aimed at improving of the Internet platform content in the part of its website as well as on the formation of a clear understanding of the volume, complexity, importance of work in the field of information provision of all production units in the field of plant growing. The positive side this kind of activity was that the implementation of the simplest task, for instance, to make a precise concise description of each of more than a thousand elevators of Ukraine, required from students to apply competencies from many disciplines. During the internship students were introduced to the system descriptions and specifications of more than 1100 elevators of Ukraine. Today the information on elevators of Ukraine, presented in the section "Elevators Map" of Agroxy.com site, is one of the most comprehensive in terms of content and form of presentation in comparison with few other similar resources (Fig. 2).

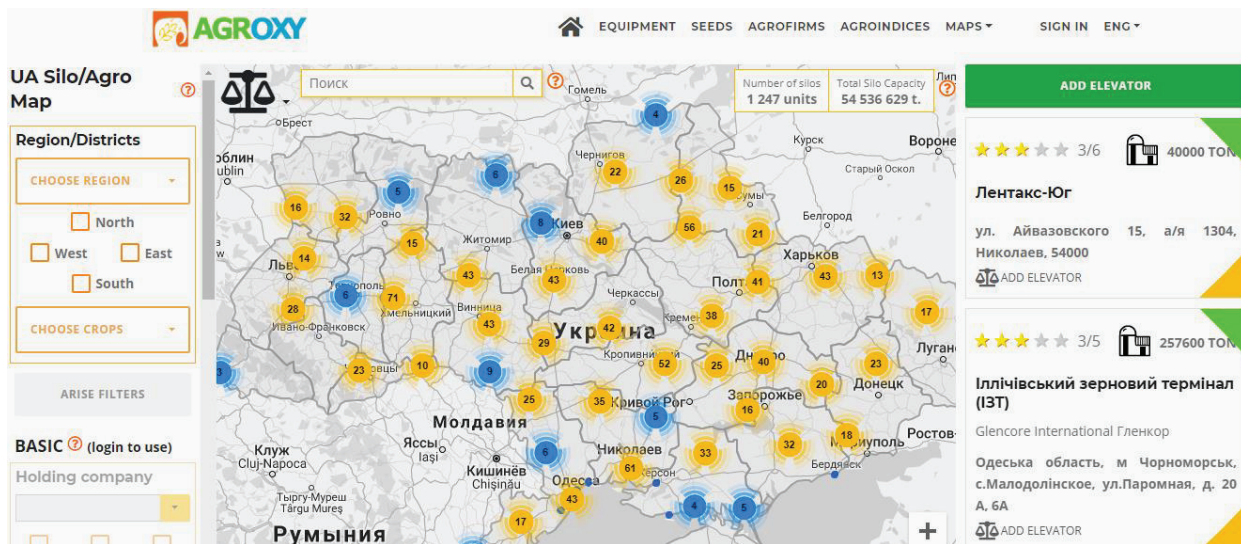


Fig .2. UA Silo/Agro Map on agroxy.com/elevators [14]

An experiment of remote implementation of an interactive task using network communications and technologies was extremely useful and deserves to be continued in any other possible forms of cooperation between an educational institution and practically directed companies. Students had the opportunity to present their work at the annual regional exhibition «Poltava Agro» in 2018-2019. The completion of the annual cooperation between AGROXY UKRAINE and PSAA became a common victory in the All-Ukrainian competition in the category "Business developing universities" conducted by the Center for Corporate Social Responsibility Development and Career Hub within the VI Forum "Business and Universities: Entrepreneurship for the Future" (a diploma of the first degree was received). The main issues of the forum: are the universities and businesses interested in developing of entrepreneurship? Are these two institutions ready to work together to help new entrepreneurs get on their feet and build their businesses?

At present time the work on preparing for the publication of a tutorial on e-commerce course is coming to the end. This manual includes all tested results of work with information systems used in modern companies with the formation of the modern market of agrarian services, including educational ones.

According to the authors, in this context, the application of the technology of augmented reality and mixed reality (MR) can be very effective.

The AR technology is already widely used for educational purposes and will radically update the learning and training process. This is especially the case for general individual training on basic skills and knowledge, as well as for very complex training missions. As example, such technology is used to provide pure written text and illustrations often found in books and tutorials. Offering an immersive experience and illustrations in 3D, AR and MR are often described to be novel and motivational. Such 3D tutorials will expand the individual

experience of students to progress their own pace, often providing a higher training standard for the majority of students. The cloud computing IS can be used as source for AR and MR Data in the education and training process to enhance situational awareness by providing common cross-community distribution. Cloud IS stores actual data used to build the typical categories of annotated AR symbols, also specific AR 3D virtual models, digital phantoms, anime, avatars, outline symbols of objects, which were recognized by artificial intelligence on the pictures and video streams, elements of synthetic environment, etc. Because artificial intelligence is the basis of future control networks, the implementation of AI is an important trend in the professional-oriented training of specialists in agrarian area as well. AI is useful in particular with respect to human resources in e-commerce and education: making collaboration systems for co-working; data exchange; working with fewer resources; improving timeliness (fast threat, numerous threats); derivation of intent, situational awareness and evaluation with help of AR etc. [15]. The main applications of artificial intelligence and machine learning in an agrarian service are to enhance communications (with AR), sensors, integration and interoperability with IT companies. As an education discipline in an agrarian area, AI includes several approaches, such as: machine learning (deep learning and reinforcement learning), machine reasoning (planning, scheduling, knowledge representation and reasoning, search and optimization), robotics (control, perception, sensors and actuators, as well as the integration of all other techniques into cyber-physical systems) [15].

#### 4. CONCLUSIONS

The results presented by the authors of this work are relevant in the context of the development of professional-oriented approaches in the organization of the educational process of training specialists of various specialties, including the agrarian sector. The experience of introducing information systems and technologies into the educational process has a powerful potential both for developing professional competencies of future specialists in various branches of the economy and contributes to the establishment of long-lasting mutually beneficial links between universities, business companies, software developers and, of course, agribusinesses. Each of the participants in such a collaboration, while working on education, gets far more benefits in the expanded information space that provides higher education institutions with different forms of activity.

Authors consider as the promising direction not only the involvement of new companies in cooperation, but also the creation of a modern digital platform in the form of a portal (digital hub) of business education, where there could be much more participants from each side: universities and colleges, IT companies, commercial and manufacturing enterprises. All this will raise the level of education and motivation to receive it among student youth and rating of diplomas of Ukrainian higher educational institutions.

The more systematic and strategic partnerships between industry and higher education institutions will benefit everyone.

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