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Telecommunication systems and technologies

Algorithm of Creating of an Efficient Cooperation Between Universities, Business Companies and Agriculture Enterprises During Studying and Implementation of Information Systems

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Abstract. **In this work there was described the algorithm of effective cooperation between universities and business companies during investigation of modern information systems which were destined for automation of production processes in agriculture enterprises. Common directions of work for higher education institutions, software developers, and manufacturing companies are based on identifying and combining their multilateral shared interests that are focused on training of qualified professionals, consulting of business companies and users at enterprises during the implementation of information systems.**

Key words: **university, information systems, agribusiness, partnership program, software developers, model of cooperation.**

I. INTRODUCTION

The inevitable changes, which are taking place in all spheres of the economy under the influence of dynamic markets, integration processes into the world community, are the cause of radical changes in the requirements for the skills and abilities of workers, their education level and professional experience. The list of professions and their positions in popularity and demand ratings is constantly updated, where the first steps are confidently occupied by information technology (IT) specialists, marketers, designers, specialists in state administration. On the background of these mentioned qualitative changes of the professional environment domestic universities faced with serious difficulties in preparing of specialists who would meet the needs of the labor market. Among the main reasons of such a situation is significant separation between practical preparation of students and real conditions of future activity. Therefore, one of the most important ways of overcoming the gap between the content of professional training of university graduates and the needs of the labor market is not only to update the list of specialties, but also to achieve close integration and interaction with leading business companies, manufacturing enterprises, and creation of conditions for places of passing real industrial practice.

Foreign institutions, which have always had a sufficient level of autonomy, for a long time have been partnering with local and international companies providing students with the opportunity to go through a variety of practices, internships with further employment. Well-known are educational projects with the participation of Google, Siemens group, Microsoft and others. Higher education institutions in Ukraine should also develop their own strategy to compete in the educational space and enable Ukrainian young people to study and get a decent job in their country.

II. ANALYSIS OF RECENT STUDIES AND PUBLICATIONS, WHICH DISCUSS THE PROBLEM

Detailed analysis of the situation on the labor market, presented in article [1] taking into account the data of the International Economic Forum [2], showed that Ukraine, despite one of the highest percentages of the population with higher education (76% by the end of 2015, the 14th a place from 140 countries, after Greece, the United States, Finland, Germany, etc.), in its quality occupies only 54th place [3]. Standard packages of higher education programs no longer meet the urgent needs of the labor market: companies seek to attract young workers, who can generate new ideas and adapt quickly to change and innovate.

A lot of papers [4-7] have been devoted to studying the directions of achieving 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 the very skills needed for workforce success are the same skills graduating student's lack - such as analysis and problem solving, collaboration and teamwork, business-context communication, and flexibility, agility, and adaptability [8]. The main trends in the organization of cooperation between universities and industrial companies are described in a collective

report based on the results of the international project TEMPUS CABRIOLET «Model-Oriented ApproaCh And Intelligent Knowledge-Based System for Evolvable Academia-IndustRy Cooperation in ELEctronic and CompuTer Engineering» (544497-TEMPUS-1-2013-1-UK-TEMPUS-JPHES) [9]. In particular, the authors describe the concept, principles and models of cooperation between universities and IT companies provide protocols (templates) for describing successful co-operation practices and related projects, the experience of which can be used by other educational institutions and enterprises.

Thus, illumination of the problem of the effective interaction between the institutions of higher education and the labor market is not one-year-old and has a solid bank of ideas. However, the issue of cooperation of agrarian enterprises with universities and IT companies in the implementation of IS agricultural automation has been given insufficient attention. For today universities often lack the innovative approach to the creation of constructive relationships with business companies to consider them not only as future graduate`s employers but also as participants in the educational process. Large and medium-sized business companies in turn express a lot of criticism about the quality of training of specialists, but they are not ready to provide training space and invest time and insignificant funds on counter projects in order to improve the quality of higher education and its competitiveness. The fact that the process moves slowly indicates that each part expects organizational decisions from a certain governing and coordinating center.

III. THE AIM OF RESEARCH.

The aim of the work is to study the peculiarities of the mechanisms of formation and development of the innovative concept of mutually beneficial multilateral interaction between universities, agrarian enterprises and business companies (on the example of the developers of domestic automated information systems), as well as state organizations, end the substantiation of the effectiveness of the algorithm for constructing such cooperation.

IV. MAIN RESULTS OF THE STUDY.

A number of successful innovative approaches to raising the level of quality and competitiveness of training specialists for one of the important sectors of the economy and the labor market, which is the agro-industrial sector, was put into practice in one of the oldest Ukrainian universities – Poltava State Agrarian Academy (further – PSAA). The leadership of the academy, the majority of scientific and pedagogical workers make a lot of effort in order to meet the requirements of the time and implement the most modern approaches to the formation of the content and directions of higher education that would meet the needs of the modern labor market and enable graduates to find a decent application in future professional activities. 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.

In the presented study the authors basing on their own experience and testing of innovative projects offer not only a general overview of possible forms of partnership with all interested institutions, but also describe the algorithm for organizing such mutually beneficial cooperation and the forms of its implementation on specific examples from the beginning to intermediate results and perspective development. Step one: on the basis of the SWOT-analysis (Strengths-Weaknesses-Opportunities-Treats), in terms of identifying the Strengths of each participant in the joint project that is the subject of this study and its needs (Opportunities) their following positions were determined (Table 1).

TABLE 1 ANALYSIS OF THE CROSSINGS OF STAKEHOLDER INTERESTS IN MULTILATERAL COOPERATION

Category of the cooperation participant	The main tasks and interests of each category identified at the beginning of the project and have an intersection areas
Universities (for example, PSAA) in relation to enterprises and business companies	- training of competitive specialists for enterprises in the agrarian sector; - application of innovative technologies in the educational process; - the possibility to use free software without additional technical equipment; - updating the content of discipline programs in order to providing modern competences for higher education graduates; - development of the graduates ability to adapt quickly to the work in the real conditions of enterprises and organizations.
Enterprises of agro-industrial complex of all forms of ownership in relation to the educational institution	- training of highly skilled workers with all modern professional knowledge and skills and ready for a quick start in work; - graduate's mastering with modern technologies for the processing of professional information, including means of information systems.
Business companies (software developers (IS)) in relation to universities and enterprises:	- providing agrarian enterprises with modern domestic IS capable of automating most of the management and monitoring of production processes; - promotion of its own product in the market by popularizing the program among potential customers, participation in conferences, exhibitions of various levels; - continuous improvement and expansion of IS functionality; - user training for IS and counseling on problem issues.

Step two. Summarizing the areas of intersection of the interests of each of the potential participants in the cooperation, the directions of interaction of project participants are presented in the scheme (fig. 1).
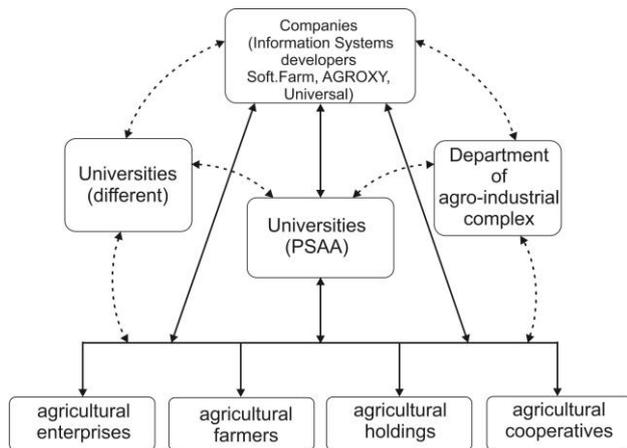

Figure.1. Directions interaction of project participants based on shared interests (dotted line indicated promising directions)

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. The feature of this model is that the university is an integrative link between many representatives of agricultural enterprises and business companies, providing educational and consulting services that each project participant needs.

Step three. The impetus for the beginning of multilateral cooperation was the search by progressively-minded representatives of the teaching staff of modern IS which would have become the subject of studying in the teaching of individual academic disciplines in leading specialties for agriculture: agronomists, managers, economists.

Step four. 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, there was selected for implementation in the educational process of the domestic IS Soft.Farm - free software for the organization and management of agricultural activities, developed by Quart-Soft company. The main advantage of this system is that it is based on cloud technologies and most of its modules are available for users for free. The system is developed for the needs of domestic agricultural producers (the database of reference books on the main components of agriculture, such as soils, pesticides, etc., the generation of electronic documents in accordance with the list and requirements of the current legislation) [10]. The basic scheme of organization of the IS Soft.Farm, located on the Amazon platform, is presented in fig. 2
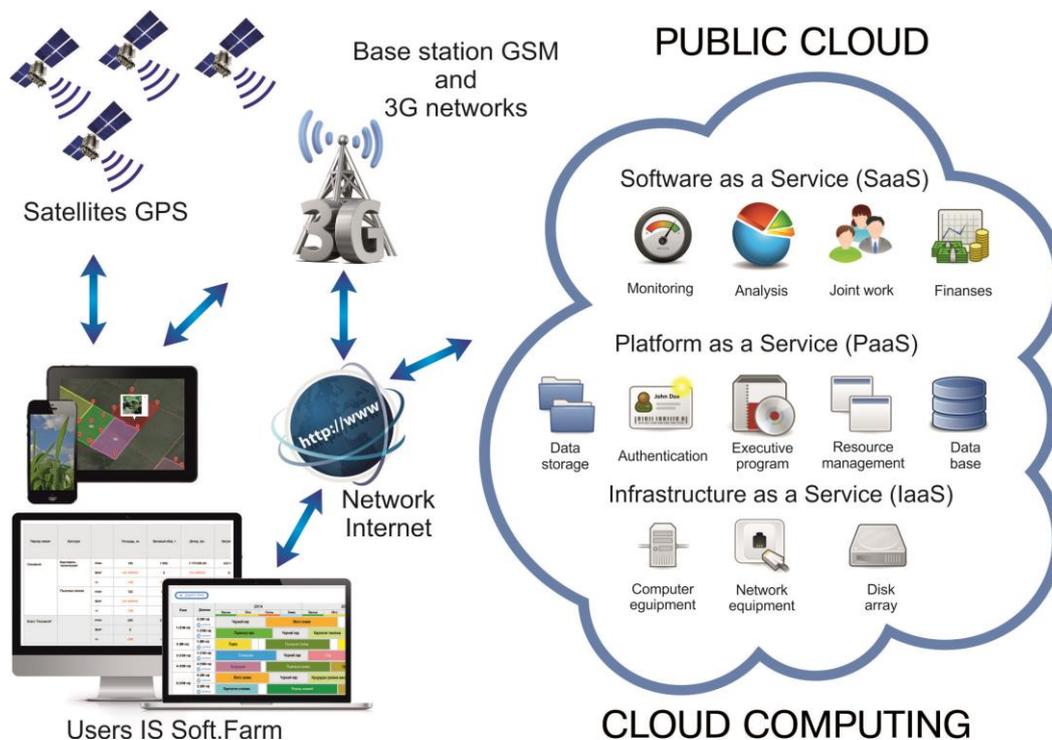

Figure.2. A scheme for constructing IS Soft.Farm and cloud services on the Amazon platform

The system provides users with the following online services (fig. 2): SaaS (fields monitoring, data analysis, data interoperability, financial analysis); PaaS (data storage, authentication, resource management, databases, and access to the executive program); IaaS.

The university in this functional scheme is included in the category of users since it uses a standard access channel, but with additional authority (special promotional codes for modeling of individual commercial operations).

Step five. The adoption of the final decision on bilateral cooperation was facilitated by the willingness of the development Quart-Soft company to develop separate training modules for holding classes with students. Confirming intentions for partnership cooperation was the signing of a cooperation agreement between the company Quart-Soft and the PSAA on April 24, 2016. The following is a brief description of the contents and the main stages of cooperation.

There is in the output of the algorithm. From September 1, 2016, a laboratory workshop was developed and tested within the discipline "Information Technologies" for students of the "Master" degree in the specialty "Agronomy". The course contains a detailed description and practical exercises on the application of IS Soft.Farm in the activities of the agronomist. The intellectual component of the participation of the teaching staff was to analyze the capabilities of the system and develop a cross-cutting situational problem in solving of which in the environment of IS students were able to reproduce the main elements of the agronomist's work in the conditions of a real enterprise. Such a practically-oriented learning caused a real interest from students. In parallel the system was tested for using in courses of other disciplines.

On October 12, 2016 the first meeting in the format of the round table was held, which invited the heads of the company Quart-Soft, the administration and teachers of the PSAA, representatives of state organizations for managing agro-industrial development as well as representatives of agrarian enterprises in order to familiarize them with advantages 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. The result was the transition to a new level of work of the project - the launch of the program under the general title "Support for AIC enterprises by means of modern information systems and technologies", which has already a year gone beyond the boundaries of the region.

In order to consolidate the main principles and directions of the joint activity of the University and company Quart-Soft a Center for the training of users of the Soft.Farm was created on a voluntary basis. With the consent of the partners for successful students of the course on work with the IS Soft.Farm in the study of discipline as well as for students of special scientific and practical seminars held in the "Center" the certification system was introduced after successful testing and a list of all certified users is located on the special section of the official company's website. Providing such certificates is an attribute of recognizing the professional abilities of a specialist in agronomy in the field of information technologies and at the same time an element of system marketing for a company-developer: an example of elementary realization of common interests. The participants of the seminars are the main specialists of agrarian enterprises for whom short training helps to master the basic skills of working with the system, to expand the concept of the possibilities of modern software and cloud technologies, to overcome the barrier that sometimes occurs before the older generation when working with computer programs. At the same time their readiness to implement this system increases many times, which also contributes to the commercial success of the company-developer.

In 2017, the experience of implementing IS Soft.Farm in the training process in the preparation of specialists in agronomy was fixed and described through the publication of a manual book [11] written in co-authorship of the leading teachers of PSAA and mentor of the project from Quart-Soft presented at several Ukrainian agricultural exhibitions.

Among other positive results of the announced cooperation between PSAA and Quart-Soft is worth noting also the fact that in a year and a half from the beginning of its implementation interest to the launched model has grown in the circles of most agricultural institutions of higher education. On the basis of the PSAA on October 11, 2017 a large-scale workshop on the exchange of experience was held with participants of up to 30 representatives of agronomic faculties. Today, several agricultural universities of Ukraine work on a similar system: Sumy, Kherson, Lviv, and others.

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, which is the developer of the system of electronic bidding of crop production on the modern platform, was signed. The business company presented their system at a large-scale seminar held on February 21, 2018 for commodity producers at the PSAA and also prepares a training module for conducting training simulations during e-commerce studies with students of the Faculty of Economics and Management. Educational materials prepared for students are also posted on the official site of the system as a step-by-step instruction for registration and start-up [12].

Representatives of the international company John Deere having high demands on the operators of the most

advanced technology, which has already been introduced at the enterprises, on the contrary, have a plan for organizing the training of students at universities immediately, instead of post-training courses and training at enterprises with a break from production. This will enable a certain part of university graduates to start a career in one of the world's leading companies with relevant competencies [13].

Representatives of state agricultural management companies at the regional level declare their interest considering universities and individual business companies as platforms for implementing state support programs for agricultural workers.

V. CONCLUSIONS AND PERSPECTIVES OF FURTHER RESEARCH

The model of multilateral cooperation between institutions of higher education, enterprises and business companies presented in this work has shown itself as effective, innovative and open as it reveals the potential and provides opportunities for development and growth for all participants. The scientific and pedagogical potential of the teaching staff of the educational institution can be successfully used both in the basic educational work and in providing consulting services to business companies, enterprises in solving practical and science-intensive tasks. Enterprises set particular training directions and become places for passing practice for higher education graduates provide opportunities for further employment.

From the beginning of the cooperation between the University, IT companies and agrarian enterprises the following results were achieved:
− 3 cooperation agreements between the university and IT companies (1,5 years) were signed;
− the course "Informational Technologies in Agronomics" for the Master level during the 2 academic semesters (totally 96 students, 7 laboratory works for course);
- a manual book was published, approved by the university's academic council [11];
− 2 sessions in the format of a round table for the administration and teachers of the University, as well as executives of IT companies, agrarian enterprises and representatives of the regional administration (once a year) were held;
− 5 scientific and practical workshops were held which include a theoretical part and practical training on work with IPs for representatives of agrarian enterprises (1-2 times per half a year, 6 hours per day) with the publication of handouts and special methodical support for participants;
− according to the results of successful training the system of user certification was introduced to students and seminar participants [10] (for more than 116 certificates issued over 1,5 years);

− during the period of cooperation the number of users of this IS increased by 18% according to developers;
− during two years two contracts for scientific and consulting services between the university and IT companies were concluded;
– for the developers of IS Soft.Farm it was suggested to introduce as a separate module a new scientifically grounded model of forecasting of crop yields, which is much more accurate than the standard method of the average indicators of NDVI.

On the basis of the obtained results the directions of further research in the field of cooperation are the creation of separate innovation units in higher education institutions that will be engaged in the development and implementation of innovations and work closely with business structures. Organizational forms of implementation of such structures of innovation direction can be laboratories, centers, creative and experimental laboratories, etc., which may also be independent legal entities. The experience of many European countries confirms the effectiveness of the existence of innovative centers that coordinate the innovative activities of structural units of a higher educational institution in particular institutes, faculties, departments, laboratories.

REFERENCES

[1] V. Pokidina, "Universities and business: international cooperation and perspectives for Ukraine", http://cost.ua/files/Universities%20and%20business_report.pdf
[2] Klaus Schwab. The Global Competitiveness Report 2015–2016. – Geneva: World Economic Forum, 2015. – 403 p. http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf
[3] http://www.unian.ua/society/1023767-ohoplennya-naselennya-ukrajini-vischoyu-osvitoyu-stanovit-76-institut-demografiji.html
[4] Ajmal, M., Helo, P., Kekale, T. "Critical factors for knowledge management in project business", Journal of Knowledge Management, 2014, Vol. 14, No. 1, pp. 156-168.
[5] Heisig, P., Dayan, R. "Knowledge management as a factor for the formulation and implementation of organization strategy", Journal of Knowledge Management, 2017,Vol. 21, No. 2., pp. 308-329.
[6] Schoen, A., de la Potterie, B. V. P., Henkel, J. "Governance typology of universities' technology transfer processes", The Journal of Technology Transfer, 2014, Vol. 39(3), pp. 435-453.
[7] Meister, J. C. Ten steps to creating a corporate university [Text] / J. C. Meister, J. W., Cortada J. A., Woods (Eds.) // The knowledge management yearbook. – 2000. – Vol. 201. – P. 180-188.
[8] Michael D. King, "Why higher education and business need to work together". - https://hbr.org/2015/07/why-higher-ed-and-business-need-to-work-together
[9] "University-industry cooperation. Model-oriented approach", Practical guide and cases, Ed. Kharchenko V.S. – Ministry of Education and Science of Ukraine, National Aerospace university them M. Ya. Zhukovsky "KhAI", 2017, 363 pp (in Ukrainian)
[10] "Soft.Farm - is a free software for organization and management of agricultural activities". - http://www.soft.farm/en/about
[11] M. M. Marenych, M. I. Kondratyuk, O. P. Kopishynska, and YU. V. Utkin, "Information technology in agronomy", Kharkiv, Phinart, 2017. – 352 p. (in Ukrainian)
[12] https://agroxy.com/blog/novye-tehnologii-i-innovacii-v-agrobiznes.html
[13] John Deere Careers, https://www.deere.com/en/our-company/john-deere-careers/