Identification of IT Sector Stakeholder's Requirements to Masters Program in Information System in Lviv Region

Ihor Oleksiv[1, 2][0000-0001-7387-6933]Ivan Izonin[1][0000-0002-9761-0096]

Viktoriya Kharchuk[1][0000-0003-4354-9549] Roman Tkachenko[1][0000-0002-9802-6799]

Anastasiya Doroshenko[1][0000-0002-7214-5108]

[1]Lviv Polytechnic National University, Lviv, S. Bandera, 12, 79013, Ukraine
{ivanizonin, victoria.kharchuk15, roman.tkachenko,
anastasia.doroshenko}@gmail.com
[2] University of Computer Science and Skills, Lodz, Rzgowska 17a, 93-008, Poland
ol.ih33@gmail.com

Abstract. The overall objectives of the study were to research the competences required by the graduates of master program in Information System (IS) to be effectively employed by the IT companies and to develop master program in Information System (IS) reflecting those requirements. Therefore, we conducted the survey among the main stakeholders of IT sector (employers and graduates of IT specialists) to identify their requirements to the IS program. The results of the survey appeared to be different for various Ukrainian regions. To be more specific, the requirements to IS program for Kherson region (mostly managerial skills) are different from the requirements to IS program in Lviv region (both technical and managerial skills). According to Tuning approach, the results of the survey were used as the ground for the development of master's program in Information System. As the outcome of the survey the core courses, which should be the part of IS program in every University participating in the project, were determined and elective courses which cover competences required in the specific region were selected. The findings of the study would be useful both to the Universities delivering master's in IS and to the practitioners in order to respond to the labor markets needs.

Keywords: Information System, Employers, Graduates of IT Specialists, Stakeholder's Requirements, Curriculum, Lviv Region.

1 Introduction

Today, one of the key trends in the development of modern enterprises is the introduction of effective information management systems that allows monitoring and optimization of all stages of company product value chain. Implementation of modern information systems at Ukrainian enterprises requires specialists with specific competencies that are not currently on the market. These competences include [1, 2, 3]:
- project management skills for the implementation of information systems,
- the ability to carry out strategic analysis and planning of information systems,

- risk management in the design and implementation of information systems,
- creative approaches to solving problems associated with the implementation of information systems,
- the ability to design an information system corresponding to the processes and interconnections occurring at the enterprise,
- etc.

Training of specialists with such competencies will enable the first to gain a competitive advantage by obtaining the knowledge and skills that are currently not sufficiently represented at the labor market of Ukraine.

In Ukraine, and in particular in its Western region, the educational supply of specialists in the field of information systems for company management is insufficient. Moreover, in the context of the rapid development of the Ukrainian IT industry, which is largely focused on providing outsourcing services, the share of projects that involve the development of information systems for the management of Ukrainian companies is steadily increasing. Therefore, the introduction of educational program in IS developed considering modern trends will contribute to the solution of problems stated above. In particular, the development of an educational program in Information Systems will enable us to meet the needs of large and small Ukrainian companies in specialists of IS profile and will help to increase the competitiveness of our graduates in the Ukrainian and world labor markets.

Currently, the most widespread approach to the development of educational programs the European Higher Educational Area is the one based on Tuning recommendations [4]. Such approach anticipates initial identification of requirements to educational program set by the stakeholders, development of learning outcomes and competences as the result of study and selection of courses expected to cover determined learning outcomes and competences.

The current paper is based on Tuning approach and contributes to academic and practical debates by identification of the IS specialist competences required by the stakeholders and building of the educational program using this information.

2   Pre-Research

Lviv is one of the main centers of the IT industry in Ukraine, which includes more than 200 IT companies. Four large (over 400 employees), a lot of medium (120-300 employees), and small (10-100 employees) companies are among them. About 90% of Lviv IT companies are outsourcing [5], while others are outstaffing and product companies.

Lviv IT companies work in the areas where people are mostly open to outsourcing. The city is rich in IT talents, while poor in IT businesspeople. The main problems that arise in the activity of Lviv IT companies are the following [6]:
— low rates of IT market development;
— headhunting;
— an insufficient number of IT events, conferences, hackathons etc.;
— lack of office space.

According to the research [6] today, there are more than 16 000 IT professionals and more than 5 000 freelancers and employees of IT departments in companies from other industries of the city. There are about 60 IT professionals by 1000 people of working population in Lviv. Approximately 48% of them obtained full higher education in IT and more than 18% of them work in their own IT startup companies [6].

Another important issue connected with popularity of IT sphere is the existence of the IT cluster. It includes the biggest IT companies and several technical higher educational institutions with innovative training capacities in the city of Lviv. The turnover of IT industry in Lviv is 14.4% of total GDP of Lviv city [5].

Currently in Lviv, there are 8 higher educational institutions with III-IV levels of accreditation and 10 colleges that train IT professionals. One of eight higher educational institutions of Lviv is Lviv Polytechnic National University (LPNU), where Institute of Computer Science and Information Technology provides the educational program in IS [7].

In addition, the first specifically IT higher educational institution of Ukraine is Computer Academy «IT STEP» which began its operations in Lviv in 2017. Among its main advantages is the newly created IT master's program in Data science and Artificial Intelligence. However, there are some problems connected with human capital of Lviv IT sector, which are the following [8-11]:
— shortage of skilled personnel;
— lack of knowledge of the English language;
— non-compliance of competencies acquired at the university to the real needs of business;
— insufficient level of creativity of young IT employees.

Based on the information presented above we can conclude that considering the large number of IT educational institutions, the growing demand for skilled professionals and relatively developed infrastructure of IT market, Lviv became a major center of the IT industry of Ukraine. Taking into account the problems of human capital especially regarding the quality of education, there is an urgent need to improve its efficiency. Realization of the latter is possible through the close interaction with IT employers and graduates employed by Lviv IT industry. Such approach will lead to the identification of essential competencies required from IT professionals by IT market companies.

3   Stakeholders Requirements

As it was mentioned earlier the working group of the MASTIS project applied the recommendations of Tuning methodology for the development of the master's program in IS [4].

According to the recommendations of Tuning, the key tasks of the development of educational programs is a preliminary analysis of market demand and the competences that should be obtained by specialists in the field of Information Systems.

To identify the requirements to master's program in IS the following stakeholders were targeted: IT employers and the University alumni in IT.

First, we present the results of survey conducted among IT employers. In order to do that in the framework of MASTIS project [12] we determined the potential employers in the region who are the main stakeholders [13, 14] in the training of highly qualified IT specialists. The identification of such employers allowed the MASTIS project group to conduct the survey target group. The list of large and small IT companies of Lviv region involved in the development of competencies for the master's program in Information Systems is presented in Table 1.

Due to the small number of large and small IT companies in Lviv region, it was not possible to conduct the statistical analysis of the survey. According to the expert advice [15, 16], when it is impossible to obtain data from large statistical sample, the organization of face-to-face meetings with the respondents is essential. Such approach permits to get deep understanding of the problem by interviewer from the discussion with the respondent.

Table 1. Large and small companies, which participated in the survey

Company name	Company main activities	Company size
WebCodium	Web Development	small
EPAM	Software development	large
Exoft	Desktop, web and mobile development	small
SoftServe	Software development and consultancy services	large
ArtBrains Software	Development and maintains of business software solutions	small
Lohika	Software development	large

Thereafter, a series of meetings with the representatives of IT employers to conduct in-depth interviews were organized.

The other important aspect of the study is that to increase the effectiveness of the survey the experience of international project partners was considered. In particular, the analysis of various international educational programs in Information System shows that competences required in this program are both technical and managerial. In particular, such situation is in the educational programs of the following universities: University Lyon2 [17], France, Guido Carli Free International University of Social Studies [18], Italy, University of Muenster [19], Germany, University of Maribor [20], Slovenia and University of Agder [21], Norway. This information and Global Competency Model for Graduate Degree Programs in Information Systems (MSIS 2016) [22] were used to develop questionnaire for the study. MSIS 2016 is a set of competencies that the students are expected to obtain as the result of master's program in Information Systems. MSIS 2016 was developed by an international team of experts from the USA, Singapore, Ireland, Portugal etc.

The MASTIS project team prepared a questionnaire containing nine competence areas with subclasses based on MSIS 2016. To answer the survey questionnaire the 1 to 5-point scale was suggested for use to the survey respondents. The scale mark "5"

is interpreted as the highly important competency for IS program graduates, and the scale mark "1" is defined as the least important.

The results of the survey were summarized and grouped by large (yellow column histograms) and small (blue column histograms) companies (see Fig. 1).

The project colleagues from Kherson conducted the similar survey among the employers of their region. The results and interpretation of their survey are presented in [23]. The next step of our analysis was to compare of the employer's evaluation of each competency area in Lviv and Kherson regions. The results of comparison are presented on Fig. 2.

As the result of analysis of data presented at Fig 2 we can conclude that employers of the Lviv region emphasized the importance of both technical and managerial competencies (areas 1-3, 9). Such situation may be explained by the fact that the best graduates of IT specialties usually become employers as their careers develop. At the same time, this group of stakeholders represents Lviv region large and small IT companies who are actively engaged in the practical design of information systems and conducting operational company management.
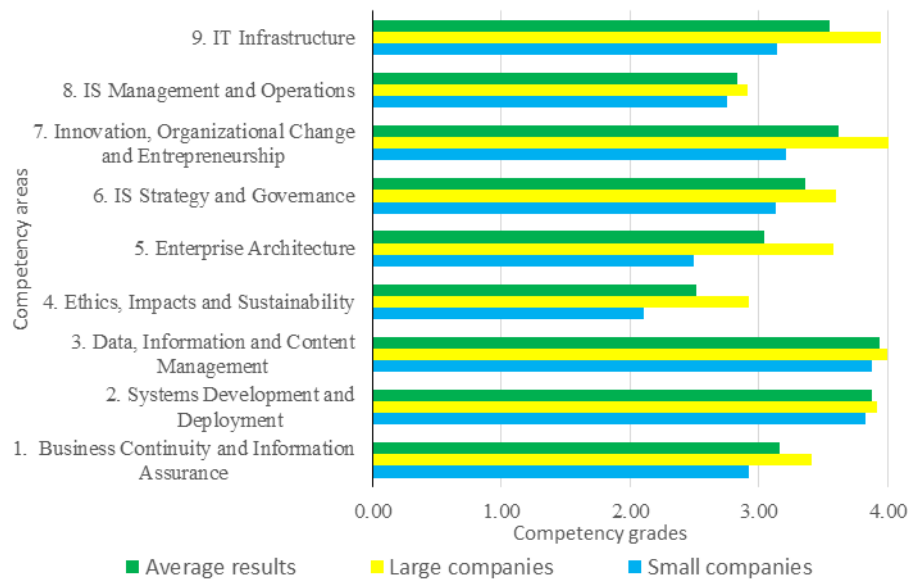

Fig. 1. Grading of IS competence areas by the representatives large and small IT companies of Lviv region.

Employers of Kherson region stated that the Information System specialists should have a narrower knowledge and skills. According to the opinion of Kherson region employers the master's program in IS should be more focused on the following competency areas: ethics and sustainable development, enterprise architecture, information systems strategy and management and innovation, organizational change and entrepreneurship.
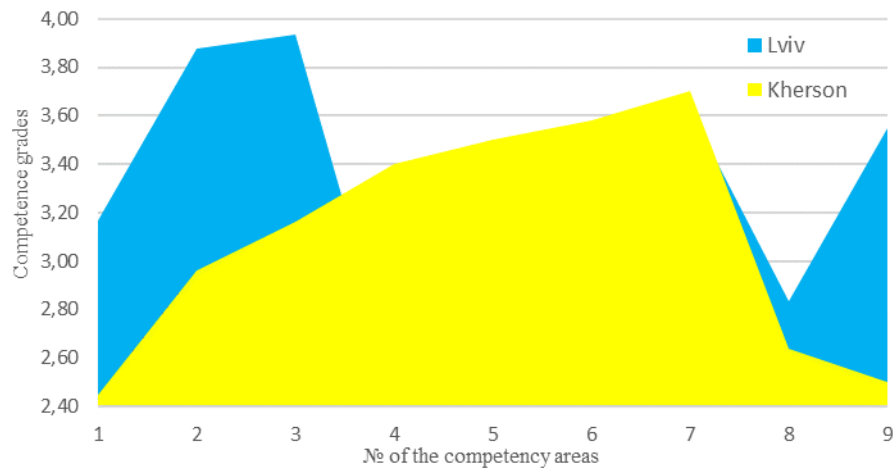
Fig. 2. Comparison of employer's survey results in Lviv and Kherson regions.

There is the other conclusion of the surveys. The employers of both regions suggested that competencies from "4-7" areas should be covered by courses of master's program in IS. In addition, the comparison of surveys permitted the project team to conclude that as a part of MASTIS project a set of core courses required in both regions can be developed.
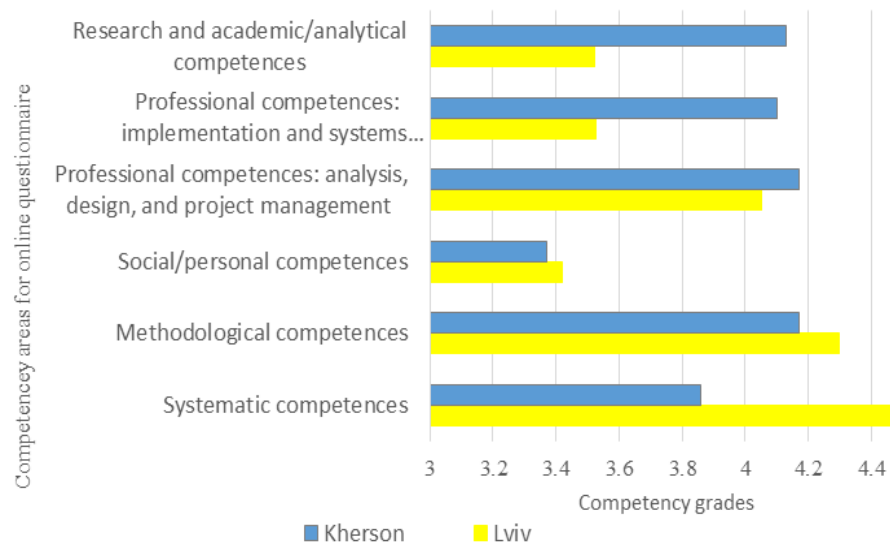

Fig. 3. Comparison of the results of the online survey for graduates of IT specialties in Lviv and Kherson regions. Source: based on the survey conducted in Lviv region by the article authors and Kherson MASTIS team in [23].

In order to increase the probability of data obtained as the result of in-person meetings, an online survey among the University graduates in IT was organized. For this purpose, an online questionnaire for graduates of IT specialties in the Lviv region was elaborated. The results of the comparison of online surveys conducted in Lviv and Kherson regions are presented on Fig. 3. It demonstrates the most important competencies according to the opinion of graduates of IT specialties of both regions.

4 Curriculum Development Based on Survey Results

The results of the survey were used to develop IS Master's Curriculums for each University-member of MASTIS project consortium. As a part of MASTIS project, the method of IS Master's Curriculums development anticipated the elaboration of core and elective courses. Eight suggested core courses are expected to be delivered in all project partner universities. The core courses are the result of identification of the most important competencies suggested by both groups of stakeholders from all regions of the partner Universities. In the same time, to present dissimilarities of stakeholder survey opinions for different regions of Ukraine, partner Universities developed elective courses.

Therefore, based on the survey's results for Lviv region Lviv Polytechnic University MASTIS team developed a set of courses that meet the needs of specifically regional IT companies. On the Table 2 some elective courses and relevant to them competency areas corresponding to the needs of Lviv region are presented. The set of core courses elaborated as a part of MASTIS project, is not included into the current paper.

Table 2. Some elective courses of new IS Master Curriculum.

Course	Competency areas
Professional and civil security	1. Business Continuity and Information Assurance
Innovative information technologies	2. Systems Development and Deployment
Data and knowledge engineering	3. Data, Information and Content Management
Information resources integration technology	9. IT Infrastructure
Information Management and Marketing	7. Innovation, Organizational Change and Entrepreneurship

To cover the technical competences necessary to the IS Specialists in Lviv region the following courses were developed: Professional and Civil Security, Innovative Information Technologies, Data and Knowledge Engineering, Information Resources Integration Technology. In the same time managerial competences will be developed in the IS students as a part of Information Management and Marketing course.

The suggested courses will cover both the technical and managerial competencies required by IS specialist to be successfully employed at Lviv Region IT-market.

5 Conclusion

The paper provides an insight into the determining managerial and technical competences for the development of master's program in IS. The competences were identified as the result of the survey conducted among employers and IT-specialties graduates. The complete list of competencies identified as the result of the survey helped to create a new master's program in Information Systems.

The methodology developed in this paper has several practical implications. The paper outlines the necessity to develop the courses in accordance to the competencies required by stakeholders. The competence approach to development of IS master's program was based on meetings (interviews) with the employers of the Lviv and Kherson regions and on on-line survey of IT-specialties graduates employed by IT companies. The results of the survey provides Universities participating in the project with a profound understanding of the most essential competencies required by IT labor market. The key contribution of this paper is provision of a detailed starting point towards the development of master's program in IS with a clear list of managerial and technical competences and relevant to them courses. Students will benefit from the courses taught at master's program in IS through continuous development of their competences based on requirements IT sector of particular region. As the result, students will have a chance to be successfully employed by IT companies of the relevant region.

6 Acknowledgements

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