



Bridging Business Analysts Competence Gaps: Labor Market Needs Versus Education Standards

Vitaliy Kobets¹ , Valeria Yatsenko² , and Lesia Buiak³ 

¹ Kherson State University, 27, Universitetska Street, Kherson 73000, Ukraine
vkobets@kse.org.ua

² Taras Shevchenko National University of Kyiv, 90-A, Vasulkivska Street, Kiev 03022, Ukraine
vy@man.gov.ua

³ Ternopil National Economic University, 11 Lvivska Street, Ternopil 46001, Ukraine
l.buiak@wunu.edu.ua

Abstract. Efficient human resource management needs accurate assessment and representation of available competencies as well as effective mapping of required competencies for specific jobs and positions. Thus, the definition and identification of competence gaps express differences between acquired and required competencies using a mathematical approach to support accurate competence analytics. Lack of skills and insufficient qualifications of employees are cited as major barriers to the adoption of new technologies in the context of Industry 4.0. These changes require skills for data analytics tasks. The purpose of this paper is to investigate gaps in the preparation of a business analyst between the requirements of the labor market and the standards of study programs. For the IT and other industries, the most important competencies from the study program of Ukrainian High Educational Institutes, which correspond to labor market requirements, were revealed using RStudio. Formation of business analysts' competencies required in the labor market is created both higher education (47%) and experience of applicants on the labor market (53%).

Keywords: IT education · Business analyst · Generic and specific subject competencies · Soft and hard skills · Competencies · Educational standards · Complementarities of requirements

1 Introduction

The European Higher Education Area promotes the design of curricula focused on the acquisition of competencies. Efficient human resource management needs accurate assessment and representation of available competencies as well as effective mapping of required competencies for specific jobs and positions. Thus, the definition and identification of competence gaps express differences between acquired and required competencies using a mathematical approach to support accurate competence analytics. Lack of skills and insufficient qualifications of employees are cited as major barriers to the

adoption of new technologies in the context of Industry 4.0. These changes require skills for data analytics tasks. Business analytics (BA) becomes increasingly important under a rapidly changing business environment. It requires a conceptual model for the professional profile of a Data Scientist in the field of Information and Communications Technology (ICT), namely in the European e-Competence (e-CF) framework and the Skills Framework for the Information Age (SFIA) are related with ICT competencies/skills, including programming, machine learning, and databases. The Data Scientist professional profile combining contributions from different areas, such as computer science, statistics, and mathematics. To analyze the impact of competencies on employment we subcategorized competencies into generic and specific subject competencies for different job types.

The results show that data management capability fully mediates between IT competence and BA use. The paper analyses how individual job competencies requirements impact wage changes.

The purpose of this paper is to investigate gaps and complementarities in the preparation of a business analyst between the requirements of the labor market and the educational standards.

The remainder of our paper is organized as follows: in Sect. 2 we analyze the Ukrainian IT market and the imbalance of quality in the IT labor market in Ukraine. In Sect. 3, we present and discuss the experimental model where we investigate specific subject competencies from high education institutes of Ukraine which significantly impact an average wage of a business analyst. Finally, the last section concludes.

2 Related Works

2.1 The Imbalance of Quality in the IT Labor Market in Ukraine

Despite the importance of higher education, IT specialists seem to prefer non- or informal education to receive updated professional skills and build a successful well-paid career. Based on a survey of 8,638 questionnaires of IT sector workers, a portrait of a modern Ukrainian IT specialist was drawn up. Thus, 87% of women and 82% of men working in this field, have higher education. It is interesting to note that 58% of women and 64% of men, who hold technical positions, have higher field-specific education [1]. Moreover, IT majors are also popular among second higher education students. “Information Systems” is becoming more and more popular in recent years [2]. However, the interest in higher education within technical majors (especially at the second level degree) gradually declines. The reasons are the irrelevance of some educational components and neglect of the diploma’s importance in the real labor market. Consequently, formal education hands to work experience and non-formal/informal education guaranteeing certificates, which are usually more significant for employers to compare with a prestigious university diploma. In long-term orientation, this tendency hides the risk to tear down fundamental basics of training of specialists within technical majors at classical universities, in favor of professional or informal training. As a result, universities can transform into a networking platform rather than being educational providers. For instance, a common report of the Western NIS Enterprise Fund and UNIT.City on the topic of IT ecosystem in Ukraine profiles 7 leading universities within technical majors

and 18 IT courses and schools. Moreover, the general number of students in IT courses and schools is 46.5 times bigger than at universities (Fig. 1).

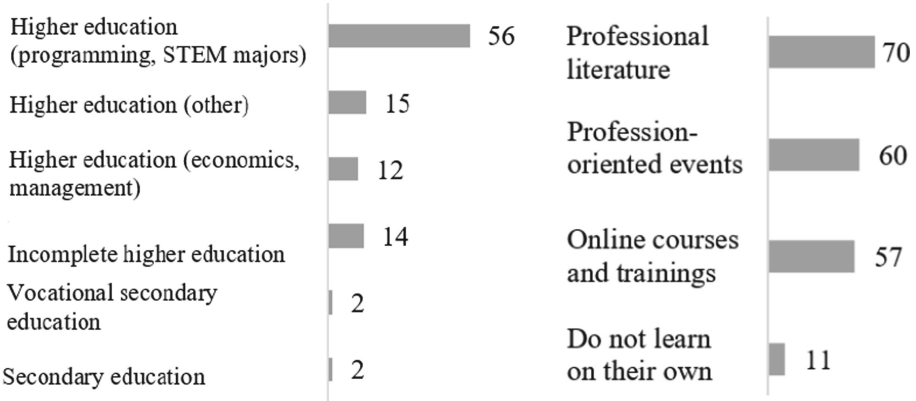


Fig. 1. Types of formal and non-formal education of IT specialists, % [1]

In 2018, 10% of employed and hired people in the Ukrainian IT sphere did not have a university diploma [3]. According to HeadHunter, around 56% and ITUkraine Association - 36% of domestic IT professionals do not have a university diploma and this indicator is gradually increasing both in Ukraine and all over the world [4]. Apple CEO Tim Cook has officially stated that half of the 2018 hires do not have a college degree because most colleges do not teach their students skills that are required by large corporations [4]. Despite old mathematical and IT schools, historically formed in Ukraine, modern systems of secondary and higher education in Ukraine are focused more on the acquisition and reproduction of fundamental knowledge, rather than skills and competencies: professional (ability to solve case studies), as well as soft skills (communication, presentation, organizational, teamwork), which are priorities for employers when being hired. Consequently, the government spends resources irrationally to teach future specialists, while business has been preparing their corporate roster for 3–6 months before hiring (Table 1).

Thus, to meet the current challenges of the labor market, IT representatives are forced to actively engage in self-education mostly aimed at learning foreign languages (often English) and developing soft skills through psychological and management training (most often in time management, team-building, leadership, project management, promotion, marketing) rarely in hard skills (different programming languages) [2]. A sufficient system of motivation for the IT work based on an assessment of their competence level should be a tool for solving the problems of IT education development [5].

In 2015, the reform of higher education in Ukraine began. It was aimed at acquisition competencies - Generic Competencies, closely connected with soft skills and Subject Specific Competencies.

To investigate the gap between the quality of higher education and the requirements of employers, we have selected a job position “Business Analyst”. Both IT specialists

Table 1. Institutional support for IT education in Ukraine [6]

#	Formal education		Nonformal education					
	Institutions	Students	#	Institutions	Students	#	Institutions	Students
1	Kharkiv National University of Radio Electronics	2,968	1	Blockchain-Hub Academy	30	10	Main Academy	6,000
2	Lviv Polytechnic National University	2,675	2	BrainBasket Foundation	6,000	11	Projector	1,500
3	National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute"	4,314	3	CyberBionic Systematics	3,000	12	Prome-theus	700,00
			4	GoIT	2,000	13	QALight	8,000
4	National Technical University "Kharkiv Polytechnic Institute"	2,105	5	"STEP" computer academy	95,000	14	Sigma Software University	600
5	National University "Kyiv-Mohyla Academy"	3,500	6	UNIT Factory	900	15	Ukrainian IT School	1,600
6	Taras Shevchenko National University in Kyiv	1,324	7	ITEA	11,000	16	SkillUP	18,850
			8	uData Schoo	90	17	iTalent	6,000
7	Zhukovsky National Aerospace University "Kharkiv Aviation Institute"	1,692	9	LITS (Lviv IT School)	2,000	18	SoftServe IT Academy	1,600
	<i>SUM</i>	<i>18,578</i>		<i>SUM</i>				<i>864,170</i>

and economists with analytical thinking and basic knowledge of programming can apply for this position (Fig. 2).

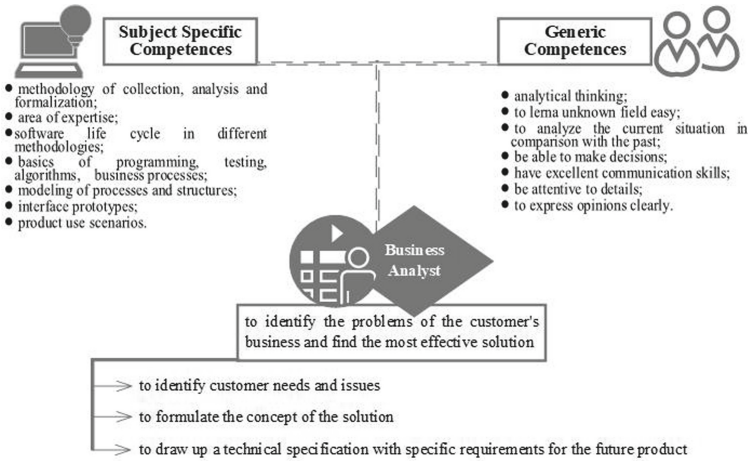


Fig. 2. Basic characteristics of a business analyst

As a consequence, graduates of three majors can work as business analysts: systems analysis (124), economics (051, specialization: economic cybernetics), and information systems and technologies (126).

2.2 Compare Analysis of BA Skills by IIBA and Ukrainian Education System

The importance of BA specialists, within IT and Industry 4.0 development, is difficult to overestimate. However, even developed countries [7, 8] and most corporations [9, 10] feel unmet demand from highly skilled specialists, especially in the field of STEM. As a result, the term gap skills have even emerged, which the American Society for Training & Development (ASTD) describes as “a significant gap between an organization’s current capabilities and the skills it needs to achieve its goals” [9]. The scale of this problem is underlined by the fact that gap skills have become inherent both for the micro-level and the labor market, which is a significant barrier to the new technologies [10] and thus can create a threat to the national economy. One of the reasons for the gap in skills is the gap in education and the real requirements of the labor market, which is especially evident in the rapidly growing IT sector [11, 12].

International Institute of Business Analysis (IIBA) identifies 6 roles of BA naming various skills, knowledge, and experience of each of them [13]. Among soft skills in demand, almost all of them are in Generic Competencies of higher education standards of Business Analyst in Ukraine and Ukrainian labor market except facilitation skill and ability to participate on multi-disciplinary work teams, which should be considered in detail (Table 2).

Comparing hard skills by IIBA, Ukrainian labor market requirements, and Specific Subject Competencies (Table 3), we can mention that in Ukraine BA focuses mainly on IT skills and knowledge, whereas abroad it includes strong business skills (Business rules analysis, Costs benefit analysis, SME, KPI, etc.).

Table 2. Compare analysis of BA soft skills by IIBA and Ukrainian education system [13].

Requirements	Business Requirements Analyst	Business Systems Analyst (BSA)	Systems Analyst	Functional Analyst	Service Request Analyst	Agile Analyst
Education	Undergraduate Degree			Undergraduate Degree		Undergraduate Degree
	College Diploma			College Diploma		
		Certificate				
		Degree			Degree	
					Work experience	
Soft skills	Good communications skills (oral and written)*			Effective work with diverse groups of people		
	Good interpersonal and consultative skills					
	Facilitation skills					
	Analytical thinking and problem solving					
	Detail oriented and committed to a high level of accuracy					
	Organizational skills					
				Ability to participate on multi-disciplinary work teams effectively		

* marked skills are common both for Ukrainian high education standards, Ukrainian labor market and research of IIBA

This is confirmed by many studies as well: C. Bullen and et al. [14] identified project and business skills as more important than technical; A. Aken and M. Michalisin established 4 skills types Soft, Technical, Programming, and Business [15]; T. Chakabuda said employers deem business interpersonal competency as one of the most important [16]. That is why the educational reform in Ukraine should take into account foreign experience of the business analysis sphere including the economic part.

There are different ways to limit the skills gap: certification of employees, skills certificates, on-the-job training, apprenticeship programs, training, and post-secondary education, etc. [9]. However, the last option is not highly effective, especially in the IT sector compare with work experience [7]. Instead, the improvement of BA skills should include two components: basic – update educational program at universities jointly with business, public sector, other stakeholders, and variable – practical courses provided by employers at the workplace, since “82% of organizations are increasing investments in reskilling their workforce” [10]. It requires common efforts from all parties, because “Businesses are beginning to realize the importance of collaborating with local education institutions, and vice versa” [9]. For instance, the Business analysis competency model by IIBA includes 3 components “knowledge, experience and choice of behavior, these together consistently create success” [13]. However, these items can not be developed independently, but only in cooperation (Fig. 3).

Table 3. Compare analysis of BA soft skills by IIBA and Ukrainian education system [13].

Business Requirements Analyst	Business Systems Analyst	Systems Analyst	Functional Analyst	Service Request Analyst	Agile Analyst
Knowledge of the BABOKR Guide					
+ IIBA Agile Extension					
Knowledge of business structure	Modeling notation (UML, Structured, BPMN)	Modeling: process, data, systems (UML, BPMN)	System enhancement requests elicitation, analysis, documentation and implementation	Modeling: data, processes	
Business rules analysis	Knowledge of software development lifecycle (SDLC)	Business rules analysis	System evaluation studies utilizing data analysis to identify quality/ performance improvements to system	Time boxing, Estimating	
Modeling processes using various notation (BPMN, Workflows) *	Models systems and data to a logical level, ... user interface design, and prototyping, decision tables/trees, data flows	Models systems and to a physical level, ...	Experience in requirements elicitation, fit/ gap analysis, and preparation of functional design documents	Knowledge of Scrum and/or XP, Lean and Kanban Software Development	
Stakeholder analysis	Writing unambiguous, verified requirements to a testable level	Subject matter expertise (SME) in the area served by the software (e.g. finance, HR, supply chain)		DSDM	
Knowledge of technology structures: networks, databases, internet communication	Knowledge of technology system interfaces and data integration;	Data extraction, ELT DBMS, output (report) design, data queries	Experience identifying opportunities for process and system improvements either in existing designs or by adopting new functionalities in the software	Feature Driven Development (FDD)	
Data analysis	networks, operating systems	Knowledge of technology system interfaces, application architecture and data integration;	Facilitating organizational change management plans/ strategies, tactics and approaches with different business units	User Stories	
Decision analysis		networks, operating systems, commercial-off-the-shelf software, web architecture	Measures and Key Performance Indicators (KPI)	Prototyping	
Costs benefit analysis			Provide SME content documentation for training material		
Organization modeling			Organizational readiness assessment		
Requirements workshops/ interviews/ observation					

* marked skills are common both for Ukrainian high education standards, Ukrainian labor market and research of IIBA

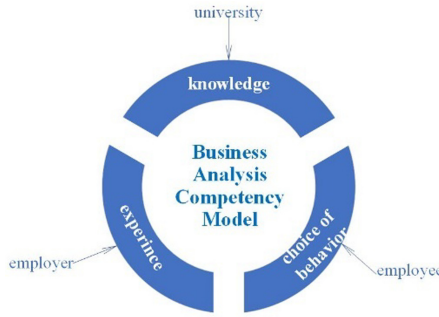


Fig. 3. Model of BA skills improvement

3 Experimental Model

3.1 The Gaps Between the Requirements of the Labor Market and the Educational Standards

Domestic higher education institutions in business analysts training should develop an educational program and frame educational process to form generic (GC) and subject specific competencies (SC) of graduates in a line with standards of the Ministry of Education and Science of Ukraine in System Analysis (124), Economics (051, economic cybernetics), Information Systems and Technologies (126) [17].

We have carried out a comparative analysis of generic and subject specific competencies according to the Ministry of Education and Science of Ukraine for majors 051, 124, 126 essentials to become a business analyst. As a result, we obtained 18 common generic (Table 4) and 22 common subject specific competencies (Table 5).

Table 4. Generic Competencies of business analyst by higher education institutions

N ^o	Generic competencies for business analyst
1	Ability to be critical and self-critical
2	Ability to learn and become proficient in modern knowledge
3	Ability to generate new ideas (creativity)
4	Ability to act socially responsible and consciously
5	Ability to abstract thinking, analysis and design
6	Ability to adapt and act in a new situation
7	Ability to search, process and analyze information from various sources
8	Ability to apply knowledge in practical situations
9	Ability to evaluate and ensure the quality of work performed
10	Ability to plan and manage time

(continued)

Table 4. (continued)

Nº	Generic competencies for business analyst
11	Ability to work independently
12	Ability to work in a team
13	Ability to make informed decisions
14	Ability to develop and manage projects
15	Ability to communicate in the official language orally and in writing
16	Ability to communicate in a foreign language and work in an international context
17	Information and communication technology skills
18	Interpersonal skills

Table 5. Subject specific competencies of business analyst by higher education institutions

Nº	Subject specific competencies of a business analyst
1	Ability to identify knowledge and understand the problems of the subject area, the basics of the modern economy at the micro, meso, macro and international levels
2	Ability to explain economic and social processes and phenomena through theoretical models, to analyze and interpret the results
3	Ability to formalize problems described in natural language, through mathematical methods as well, to apply common approaches to mathematical modeling of specific processes
4	Ability to build correct models of static and dynamic processes, and systems with distributed and lumped parameters, taking into account the uncertainty of external and internal factors
5	Ability to use modern information technology to implement machine-assisted realization of mathematical models and predict behavior of specific systems, namely: object-oriented approach in the design of complex systems of different types, applied mathematical packages, use of databases and knowledge
6	Ability to identify the main impact factors of the development of physical, economic, social processes, pick out stochastic and indeterminate indicators, formulate them in random or fuzzy quantities, vectors, processes and to study the dependencies between them
7	Ability to analyze and design complex systems, create relevant information technologies and software
8	Ability to design experimental and observational studies and analyze the results
9	Ability to analyze, synthesize and optimize information systems and technologies using mathematical models and methods

(continued)

Table 5. (continued)

№	Subject specific competencies of a business analyst
10	The ability to perform simulation experiments, to compare the results of experimental data and the solutions obtained
11	Ability to use computer technology and data processing software to solve economic problems, analyze information, and prepare analytical reports
12	Ability to analyze and solve problems in the field of economic and social-labor relations
13	Ability to predict socio-economic processes based on standard theoretical and econometric models
14	Ability to use modern sources of economic, social, management, accounting information to prepare official documents and analytical reports
15	Ability to conduct economic analysis of the operation and development of business entities, assess their competitiveness
16	Ability to identify economic problems in the analysis of specific situations, to offer ways to solve them independently
17	Ability to formulate optimization problems in the design of systems of management and decision making, namely: mathematical models, optimality criteria, constraints, management goals, choose rational methods and algorithms for solving optimization and optimal management
18	Ability to apply information technologies to create, implement and utilize quality management system and estimate the costs of its development and maintenance
19	The ability to manage the quality of products and services of information systems and technologies throughout their life cycle
20	Ability to develop business decisions and evaluate new technology offers
21	Ability to manage and use modern information and communication systems and technologies (including Internet based)
22	Ability to create new competitive ideas and implement them in projects (startups)

We have analyzed the general requirements of employers for the competencies of applicants for the position of business analyst on the sites for job search: work.ua, rabota.ua, djinni.co, linkedin.com, hh.ua, it-stars.ua, jobs.ua. Then, we have compared them with standards of the Ministry of Education and Science of Ukraine (Tables 4 and 5). As a result, we identified generic (Table 6) and subject specific (Table 7) competencies common both for the labor market and higher education institutions.

Table 6. Common generic competencies of a business analyst for higher education institutions and labor market

GC	GC by higher education institutions	GC by labor market
GC1	Ability to learn and become proficient in modern knowledge	Desire to learn
GC2	Ability to generate new ideas (creativity)	Creativity
GC3	The ability to act socially responsible and consciously	Responsibility
GC4	Ability to abstract thinking, analysis and design	Analytical and logical thinking, systems thinking
GC5	Ability to search, process and analyze information from various sources	Attention to detail
GC6	Ability to apply knowledge in practical situations	Problem solving
GC7	Ability to plan and manage time	Time management
GC8	Ability to work in a team	Teamwork
GC9	Ability to develop and manage projects	Organizational skills
GC10	Ability to communicate in a foreign language and work in an international context	English skills
GC11	Information and communication technology skills	Presentation skills
GC12	Interpersonal skills	Communication
GC13	NA*	Self-motivation

*NA – not announced

Based on open Internet sources of websites for job search, a data set of 118 vacancies for the position of the business analyst was created. This data set includes the name of the employer, vacant position the average salary, and required generic and specific subject competencies (Table 8), and wage distribution of business analysts (Fig. 4).

All vacancies can be classified by the following industries: IT consulting (48), Banks (23), Retail (12), Government Institution (6), Others (29) (include mobile operators, agriculture, oil, etc.).

To determine the relevance of the impact of generic and specific subject competencies on the average wage, we consider a multiple regression model:

$$w_i = b_0 + \sum_{j=1}^{13} GC_j + \sum_{k=1}^{15} SC_k + u_i \quad (1)$$

Table 7. Common subject specific competencies of a business analyst for higher education institutions and labor market

SC	SC by higher education institutions	SC by labor market
SC1	Ability to explain economic and social processes and phenomena through theoretical models, to analyze and interpret the results	Development of use-cases and user-stories
SC2	Ability to formalize problems described in natural language, through mathematical methods as well, to apply common approaches to mathematical modeling of specific processes	Requirements collection, negotiations with stakeholders, UML/BPMN
SC3	Ability to use modern information technology to implement machine-assisted realization of mathematical models and predict behavior of specific systems, namely: object-oriented approach in the design of complex systems of different types, applied mathematical packages, use of databases and knowledge	Hands-on experience with data visualization via reports and dashboards, Flow charts, Lucidchart MS Access, MS SQL Server, Oracle
SC4	Ability to analyze and design complex systems, create relevant information technologies and software	Experience in the development of technical documentation, requirements, software development processes (UML, Use Cases, Business Rules, Functional Non-Functional Specifications, User Interface Design Specifications, User Stories, Backlogs)
SC5	Ability to analyze, synthesize and optimize information systems and technologies using mathematical models and methods	Information systems
SC6	The ability to perform simulation experiments, to compare the results of experimental data and the solutions obtained	Data analysis, Database Management System, DBMS
SC7	Ability to use computer technology and data processing software to solve economic problems, analyze information, and prepare analytical reports	BA technics (interview, workshop, document analysis, estimation, mind mapping, etc.)
SC8	Ability to use modern sources of economic, social, management, accounting information to prepare official documents and analytical reports	Management accounting, corporate finance and financial statements/IC

(continued)

Table 7. (continued)

SC	SC by higher education institutions	SC by labor market
SC9	Ability to formulate optimization problems in the design of systems of management and decision making, namely: mathematical models, optimality criteria, constraints, management goals, choose rational methods and algorithms for solving optimization and optimal management	Algorithms, data structures, client-server application architecture, web application architecture, service-oriented architecture (SOA)
SC10	Ability to apply information technologies to create, implement and utilize quality management system and estimate the costs of its development and maintenance	CRM
SC11	The ability to manage the quality of products and services of information systems and technologies throughout their life cycle	Project management, Software Development, Software Development Life Cycle and MVP
SC12	Ability to develop business decisions and evaluate new technology offers	Business processes modeling, MS Visio
SC13	Ability to manage and use modern information and communication systems and technologies (including Internet based)	MS Access, MS Excel, MS Power Point
SC14	Ability to create new competitive ideas and implement them in projects (startups)	JIRA Confluence, MS Project
SC15	NA*	Understanding of agile development processes (e.g. Scrum, SDLC, Kanban)

*NA – not announced

where w_i – the average wage for a job i , GC_j – generic competence j , SC_k – specific subject competence k , u_i – error term. The following code snippets in R are used to calculate the regression parameters:

```
f <- read.csv("HEI and LM.txt", sep="\t", header=TRUE,
dec=".")
model1 <- lm(data=f, Wage~.)
summary(model_1)
f2<- read.csv("IT consulting.txt", sep="\t",
header=TRUE, dec=".")
model2 <- lm(data=f2, Wage~.)
summary(model2)
```

It has been obtained that by the sampling of all positions of business analysts:

1) use of information and communication technologies or Presentation Skills (GC11) can increase the average monthly wage by +UAH9361.9;

Table 8. Vacant position profile of business analyst competencies on the labor market

Nº	Employer	Position	Monthly wage, UAH	GC1	...	GC13	SC1	...	SC15
1	IT Specialist, Ltd	System analyst	35000	0	...	0	0	...	0
2	INNOWARE	Junior Business Analyst	35000	0	...	1	0	...	0
3	Proxima International	Business Analyst	50225	0	...	0	0	...	0
4	Betinvest Ltd	Business Analyst	18000	0	...	0	0	...	1
5	Linkos Group	System analyst	18000	0	...	0	0	...	0
6	Deep Consulting Solutions	Business Analyst	36000	1	...	1	0	...	0
7	PMLAB	Data/Business Analyst	44000	0	...	0	0	...	0
8	Paymentwall	Business Intelli-gence Analyst	35000	0	...	0	0	...	0
9	EPAM/Epam Systems	Senior Business Analyst	31000	1	...	0	0	...	0
...
118	Lifecell	System analyst	30000	0	...	0	0	...	0

2) the ability to apply knowledge in practical situations or Problem Solving (SC6) causes an average wage increasing by UAH 10009 (Table 9).

Among BA job applicants with GC11 competence; only 10% have SC6 specific subject competence simultaneously, and vice versa: if a candidate has SC6 competence, only every tenth has GC11 competence using library ggplot2 and following function in R (Fig. 5):

```
mosaic(data=f, ~GC11+SC6, shade=TRUE)
```

For the IT industry, the most important competencies were revealed as follow:

1) SC8 Management Accounting, Corporate Finance, and Financial Statements/IC determined an average monthly wage increase of +UAH 23376;

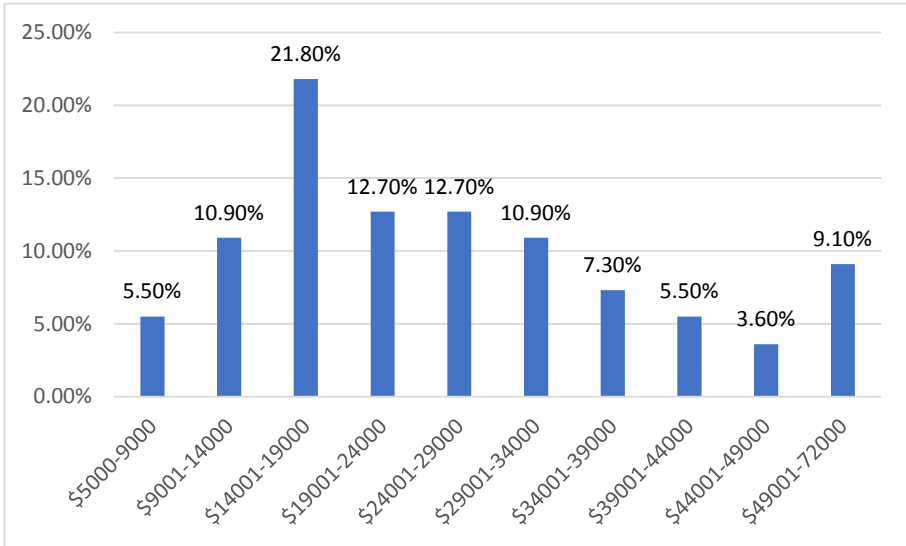


Fig. 4. Wage distribution of business analysts, UAH (2020)

Table 9. Statistically significant Competencies for the labor market

Model	Explanatory competencies	Marginal effect parameters (UAH)	R ² (%)
All	GC11 SC6	+9361.9 +10009	22,56
IT consulting	SC8 SC14	+23376 -9062	23,83
Banks	NA	NA	NA
Retail	NA	NA	NA
Others	SC13 SC14	+29896 +36683	87,3

2) SC14 The ability to form new competitive ideas and implement them in projects (start-ups) for graduates does not meet the requirements of the IT industry (JIRA Confluence, MS Project), and therefore leads to a decrease in salary by UAH 9062, which confirms the lack of competence in the HEA.

Among BA job applicants with SC8 competence, only 20% have SC14 specific subject competence at the same time. If the applicant has SC14 competence, only 10% have SC8 competence. Among BA job applicants with GC11 competence, only 10% have SC6 specific subject competence, and vice versa: if a candidate has SC6 competence, only every tenth has GC11 competence (Fig. 6):

```
mosaic(data=f2, ~SC8+SC14, shade=TRUE)
```

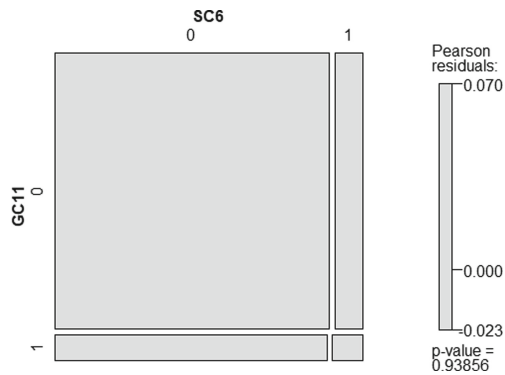


Fig. 5. Relationship between GC11 and SC6 competencies

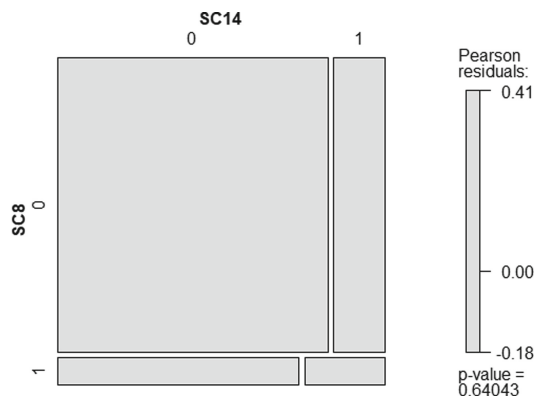


Fig. 6. Relationship between SC8 and SC14 competencies

As well as if the applicant has SC8 competency for the BA vacancy, his/her average wage remains lower than in the case of other competencies required:

```
g2 + facet_grid(SC8~SC14) (fig. 7)
gg0 + stat_smooth(method="lm") + facet_grid(~SC14) (fig. 12)
```

SC8's competence slightly increases the average wage, while in its absence the wage increases much faster. Therefore, the skills of an accountant in the labor market are worth much less than the skills of a business analyst (Fig. 8).

For other positions not covered by IT consulting, Banks Government Institutions, the most required competencies were revealed:

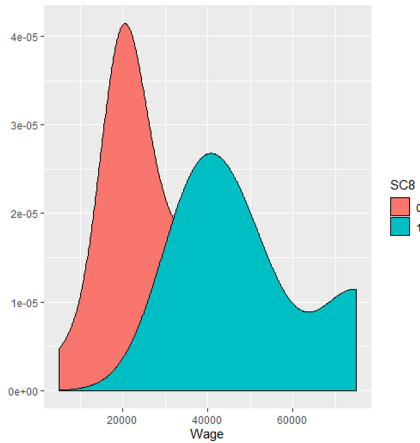


Fig. 7. Wage distribution for SC8 competence

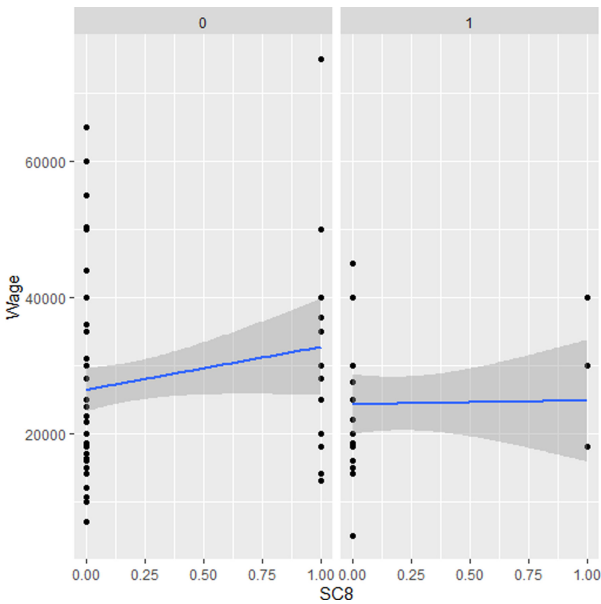


Fig. 8. Wage dynamics in the absence and availability of SC8 competence

1) SC13 Ability to manage and use state-of-the-art information and communication systems and technologies (including Internet-based ones, MS Access, MS Excel, MS PowerPoint) adds +UAH 29996 each month;

2) SC14 The ability to form new competitive ideas and implement them in projects (startups), JIRA Confluence, MS Project proves that this competence is formed for other industries and raises wages by an average of UAH 36683.

Thus, the wage distribution is set out as follows (Fig. 9), where the average wage per year is UAH 20,000 and has a significant potential to increase when additional required specific subject competencies in the labor market are presented.

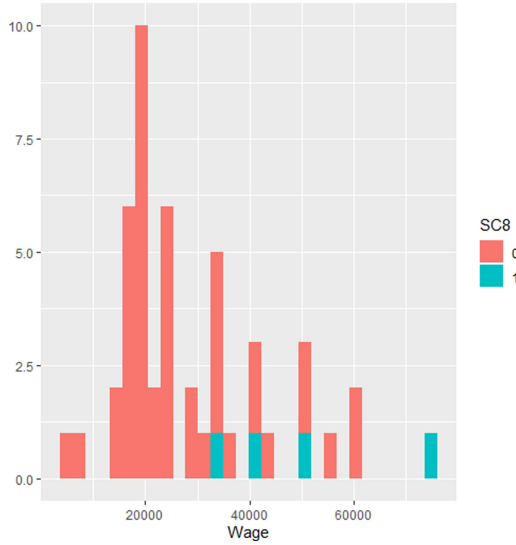


Fig. 9. Wage distribution for BA position

A system of certificates can be an effective tool to overcome a gap between educational programs [18–21] and employers’ requirements [22–25]. This system should be developed jointly by university representatives and companies and will certify the students’ competence in certain highly specialized fields of knowledge and confirm the quality of the education obtained through professional qualifications (Fig. 10).

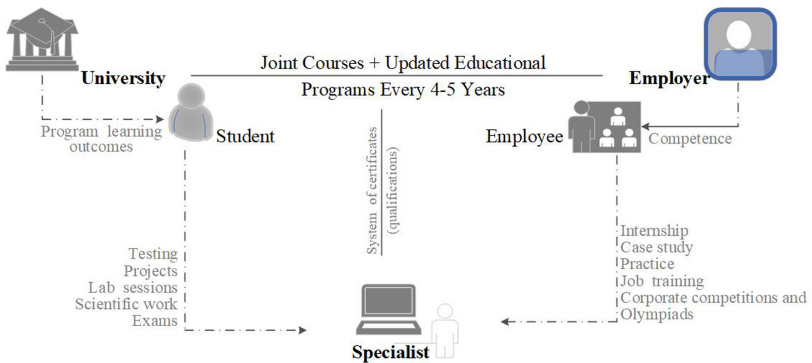


Fig. 10. Scientific-educational-practical complex of students teaching at IT majors

3.2 The Complementarities Between the Requirements of the Labor Market and the Educational Standards

Due to the results of the analysis of 325 vacancies from 107 companies in open Internet sources in the field of business intelligence (IT-consulting/Services/Equipment Manufacturing) (45%), Banks (20%), Retail (11%), Governmental institutions (6%) and Others (19%) demand for soft skills (general competencies) in percentage is determined by the following distribution (Fig. 11).

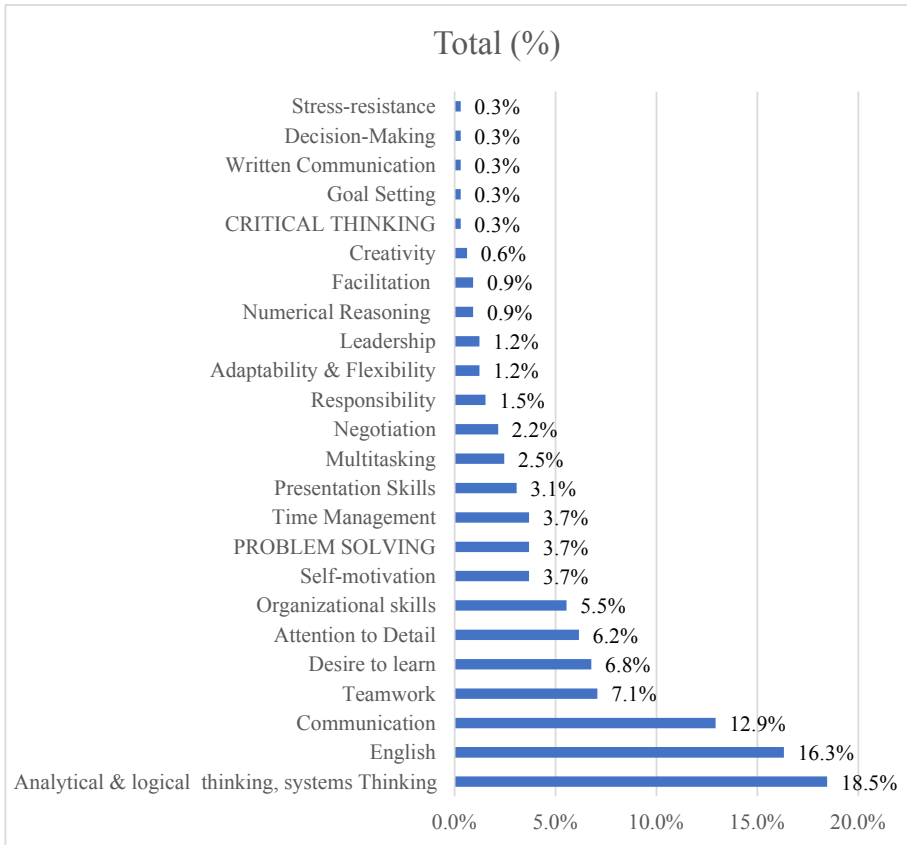


Fig. 11. The share of required soft skills for business analysts (%)

The most demanded soft skills (general competencies) are: GC_4 Analytical and logical thinking, systems thinking (18,5%), GC_{10} English (16,3%), GC_{12} Communication (12,9%), GC_8 Teamwork (7,1%), GC_1 Desire to learn (6,8%), GC_5 Attention to Detail (6,2%).

At the same time, more than half of vacancies for business analysts (55%) are in demand in the field of IT-consulting/Services/Equipment Manufacturing (Fig. 12). The most important soft skills are English (17.9%), Analytical and logical thinking, systems

thinking (12.8%), Communication (12.3%), Teamwork (7.3%), Attention to Detail (7, 3%), Desire to learn (7.3%).

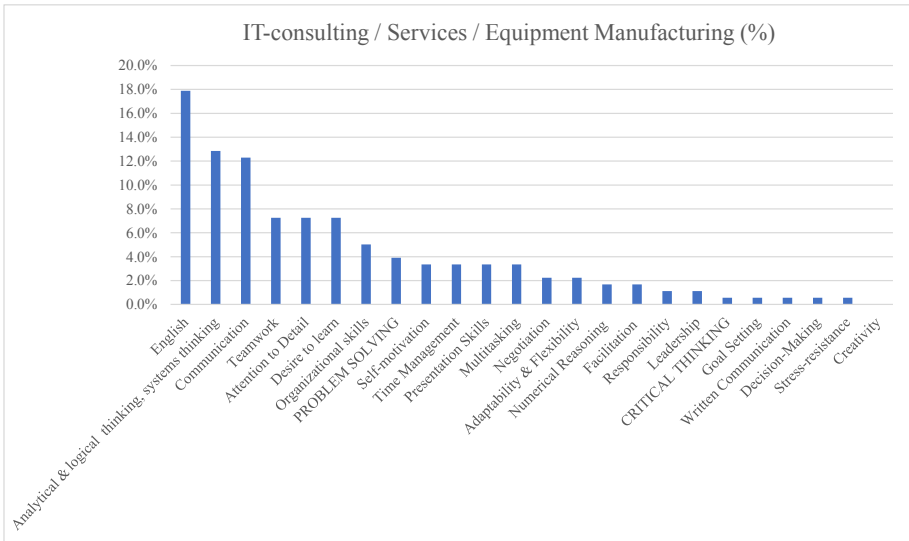


Fig. 12. Distribution of demanded soft skills for business analysts in the field of IT-consulting/Services/Equipment Manufacturing (%)

Some competencies are formed in students during higher education, others during full or part-time employment in the firms. With experience, employees develop more specific subject competencies in demand in the labor market. Combinations of these competencies create vacancies in the labor market. Formation of some competencies requires both higher education and experience in the firms.

According to the results of data analysis revealed statistically significant regression parameters between the demand for competence and the average years of schooling in higher education institutions ($y = b_0 + b_1 \cdot x_1$) and between the demand for competence and work experience (applicant’s experience) ($y = c_0 + c_1 \cdot x_2$) based on open data (Table 10), where b_1 shows how the number of vacancies with this competence will change with the increasing length of studies by one year; c_1 shows how the number of vacancies with this competence will change with increasing experience by one year. In parentheses near to each competence included in the vacancy, specific subject competencies in educational programs (standards) are indicated, if any.

Simple regression models in Table 10 show that the applicant is more likely to get a job due to work experience, rather than higher education. Simple regression is more relevant in this case than multiple one due to forming of some competences only under impact of higher education or only under work experience. Thus, the formation of the competence ‘Experience in the development of technical documentation, requirements, software development processes’ due to the additional year of study at the HEI allows to increase the number of vacancies by 4, while the formation of this competence due

Table 10. Formation of competencies under the influence of higher education and work experience

Specific subject competences (y), numbers required competences for different job positions	Formed under the impact of higher education (x_1), years	Formed under the impact of work experience (x_2), years
UML/BPMN (SC_2)	<input checked="" type="checkbox"/> $y = 1.3 + 2.8 \cdot x_1$ ($R^2 = 86\%$)	<input checked="" type="checkbox"/> $y = -13.3 + 9.6 \cdot x_2$ ($R^2 = 74\%$)
Experience in the development of technical documentation, requirements, software development processes (SC_4)	<input checked="" type="checkbox"/> $y = 3.9 + 4.0 \cdot x_1$ ($R^2 = 60\%$)	<input checked="" type="checkbox"/> $y = -19.2 + 14.8 \cdot x_2$ ($R^2 = 61\%$)
Understanding of agile development processes (e.g. Scrum, SDLC, kanban) (SC_5)	<input checked="" type="checkbox"/> $y = -0.1 + 3.4 \cdot x_1$ ($R^2 = 80\%$)	<input checked="" type="checkbox"/> $y = -19.5 + 12.4 \cdot x_2$ ($R^2 = 82\%$)
Business Process Improvement, Business Process Reengineering	<input checked="" type="checkbox"/> $y = -0.6 + 1.1 \cdot x_1$ ($R^2 = 58\%$)	<input checked="" type="checkbox"/> $y = -8.4 + 4.8 \cdot x_2$ ($R^2 = 77\%$)
Hands-on experience with data visualization via reports and dashboards, Flow charts, Lucidchart (SC_5)	<input checked="" type="checkbox"/> $y = 0.1 + 0.9 \cdot x_1$ ($R^2 = 70\%$)	<input checked="" type="checkbox"/> $y = -5.0 + 3.3 \cdot x_2$ ($R^2 = 68\%$)
JIRA Confluence (SC_{14})	<input checked="" type="checkbox"/> $y = 1.1 + 1.6 \cdot x_1$ ($R^2 = 86\%$)	
Development of use-cases and user-stories (SC_1)	<input checked="" type="checkbox"/> $y = -0.9 + 1.7 \cdot x_1$ ($R^2 = 62\%$)	<input checked="" type="checkbox"/> $y = -11.5 + 6.7 \cdot x_2$ ($R^2 = 71\%$)
Working with database, database management systems (SC_6)	<input checked="" type="checkbox"/> $y = -0.6 + 1.1 \cdot x_1$ ($R^2 = 58\%$)	<input checked="" type="checkbox"/> $y = -8.4 + 4.8 \cdot x_2$ ($R^2 = 76.9\%$)
Algorithms, data structures, client-server application architecture, web application architecture, service-oriented architecture (SC_9)	<input checked="" type="checkbox"/> $y = -0.02 + 1.6 \cdot x_1$ ($R^2 = 78\%$)	<input checked="" type="checkbox"/> $y = -8.4 + 5.5 \cdot x_2$ ($R^2 = 71\%$)
Software Development, Software Development Life Cycle and MVP (SC_{11})		<input checked="" type="checkbox"/> $y = -9.1 + 6.1 \cdot x_2$ ($R^2 = 76\%$)
Requirements collection, negotiations with stakeholders (SC_2)	<input checked="" type="checkbox"/> $y = -0.5 + 1.7 \cdot x_1$ ($R^2 = 66\%$)	
BA technics (interview, workshop, document analysis, estimation, mind mapping, etc.) (SC_7)		<input checked="" type="checkbox"/> $y = -5.4 + 3.9 \cdot x_2$ ($R^2 = 81\%$)
Web application architecture for IOS, Android (SC_9)	<input checked="" type="checkbox"/> $y = -0.3 + 1.1 \cdot x_1$ ($R^2 = 65.8\%$)	<input checked="" type="checkbox"/> $y = -7.5 + 4.4 \cdot x_2$ ($R^2 = 86\%$)
API, Rest Api, Corezoid	<input checked="" type="checkbox"/> $y = -0.3 + 0.8 \cdot x_1$ ($R^2 = 78\%$)	<input checked="" type="checkbox"/> $y = -4.8 + 2.9 \cdot x_2$ ($R^2 = 73\%$)
Managerial Accounting, corporate finance and financial statements / IC (SC_8)		<input checked="" type="checkbox"/> $y = -6.0 + 4.7 \cdot x_2$ ($R^2 = 81\%$)
Data analysis, Database Management System, DBMS (SC_6)		<input checked="" type="checkbox"/> $y = -5.7 + 3.9 \cdot x_2$ ($R^2 = 95\%$)
MS Visio (SC_{12})	<input checked="" type="checkbox"/> $y = 2.2 + 0.6 \cdot x_1$ ($R^2 = 55\%$)	
Testing, including SOAP UI	<input checked="" type="checkbox"/> $y = 0.7 + 1.0 \cdot x_1$ ($R^2 = 67\%$)	
Waterfall philosophy		<input checked="" type="checkbox"/> $y = -2.9 + 1.9 \cdot x_2$ ($R^2 = 55\%$)

to the additional year of experience increases the number of vacancies on average by 15. The chances to fill a vacancy with the formed competence 'Understanding of agile development processes in higher education and due to work experience is for each additional year 3.4 against 12.4, respectively.

If the formation of competencies requires both higher education and work experience, then according to Table 10, greater opportunities for the applicant open up through work experience than through higher education by an average of 3.4 times. The calculations are made based on coefficients of explanatory variables for both regressions of the Table 10 ($x_i, i = 1, 2$).

According to the results of the analysis of the relevance of higher education and work experience, the following results were obtained:

Table 11. Relevant factors that form the competencies of applicants

Specific subject competences	Number (%) of competencies
Competences that are formed both under the impact of higher education and work experience	10 (52.6%)
Competences that require higher education and are not affected by experience	4 (21.1%)
Competences that require experience and are not affected by higher education	5 (26.3%)

Table 11 demonstrates that the formation of business analysts' competencies required in the labor market is due to higher education (47%) and the experience of applicants (53%).

4 Conclusions

For the IT industry, the most important competencies were revealed as follow: Management Accounting, Corporate Finance, and Financial Statements determined an average monthly wage increase of +UAH 23376; the ability to form new competitive ideas and implement them in projects (start-ups) for graduates does not meet the requirements of the IT industry (JIRA Confluence, MS Project), and therefore leads to a decrease in salary by UAH 9062, which confirms the lack of competence in the HEA.

For other positions not covered by IT consulting, Banks Government Institutions, the most required competencies were revealed: the ability to manage and use state-of-the-art information and communication systems and technologies (including Internet-based ones, MS Access, MS Excel, MS PowerPoint) adds +UAH 29996 each month; the ability to form new competitive ideas and implement them in projects (startups), JIRA Confluence, MS Project prove that this competence is formed for other industries and raises wages by an average of UAH 36683. Formation of business analysts competencies required in the labor market is created both higher education (47%) and experience of applicants on the labor market (53%).

References

1. Portrait of an IT Specialist - 2018. Infographics. <https://dou.ua/lenta/articles/portrait-2018/>
2. Yakubiv, V.: Competent and social portrait of it-specialist in Ukraine: results of gamehub research. *Manag, Dev. Complex Syst.* **35**, 140–146 (2018)
3. In IT without a diploma. <https://dou.ua/lenta/articles/it-without-diploma-1/>
4. Does a successful specialist need a diploma? <https://dan-it.com.ua/uk/chi-potriben-diplom-uspishnomu-specialistu/>
5. Sokolova, L.V., Kolisnyk, O.V., Sokolov, O.Y.: Scientific and methodological approach to the assessment of specialists motivation at IT-enterprises based on competencies, 1, pp. 266–272 (2018)
6. Tech Ecosystem Guide to Ukraine 2019. https://data.unit.city/tech-guide/Tech_Ecosystem_Guide_To_Ukraine_En-1.1.pdf
7. Deborah, R., Mauricio, M.: Identifying the education needs of the business analyst: an Australian study. *Australas. J. Inf. Syst.* **18**(2) (2014). <https://doi.org/10.3127/ajis.v18i2.803>
8. Scholtz, B., Cilliers, C., Calitz, A.: Critical competencies for South African ERP consultants. Paper presented at International Business Conference (IBC), Mauritius (2011)
9. [ASTD] American Society for Training and Development (2012). Bridging the skills gap: Help wanted, skills lacking. Why the mismatch in today's economy? http://nist.gov/mep/upload/Bridging-the-Skills-Gap_2012.pdf
10. 7 Steps To Conduct An Effective Skills Gap Analysis. <https://harver.com/blog/skills-gap-analysis/>
11. Griesel, H., Parker, B.: Graduate Attributes: A baseline study on South African graduates from the perspectives of employers. Higher Education South Africa, South African Qualifications Authority, Pretoria (2009)
12. Lee, S., Koh, S., Yen, D., Tang, H.-L.: Perception gaps between IS academics and IS practitioners: an exploratory study. *Inf. Manag.* **40**(1), 51–61 (2002). [https://doi.org/10.1016/s0378-7206\(01\)00132-x](https://doi.org/10.1016/s0378-7206(01)00132-x)
13. Becoming a Business Analyst. https://analytics.infozone.pro/wp-content/uploads/2013/04/Driving_Your_BA_Career_Roles.pdf
14. Bullen, C., Abraham, T., Galup, S.D.: IT workforce trends: implications for curriculum and hiring. *Commun. Assoc. Inf. Syst.* **20**(1), 545–554 (2007). <https://doi.org/10.17705/1CAIS.02034>
15. Aken, A., Michalisin, M.D.: The impact of the skills gap on the recruitment of MIS graduates. In: Proceedings of the 2007 ACM SIGMIS CPR Conference on Computer Personnel Research: The Global Information Technology Workforce. SIGMIS CPR 2007, pp. 105–111. ACM, New York (2007)
16. Chakabuda, T.C., Seymour, L.F., Van Der Merwe, F.I.: Uncovering the competency gap of students employed in business process analyst roles — an employer perspective. In: IST-Africa Conference Proceedings (2014). <https://doi.org/10.1109/ISTAFRICA.2014.6880599>
17. Approved higher education standards. <https://mon.gov.ua/ua/osvita/visha-osvita/naukovo-metodichna-rada-ministerstva-osviti-i-nauki-ukrayini/zatverdzheni-standarti-vishoyi-osviti>
18. Maximum use of our potential: consolidation of the European higher education space. http://eurosvita.net/prog/data/attach/1851/bucharest_com.pdf
19. The Association for Computing Machinery. <http://info.acm.org>
20. Institute of Electrical and Electronic Engineers. <http://www.ieee.org>
21. Standards CC2001. <https://www.acm.org/binaries/content/assets/education/curricula-recommendations/cc2001.pdf>
22. Kravtsov, H., Kobets, V.: Implementation of stakeholders' requirements and innovations for ICT curriculum through relevant competences. In: Proceedings of the 13-th International Conference ICTERI 2017, Kyiv, Ukraine, 15–18 May 2017, vol. 1844, pp. 414–427 (2017)

23. Kravtsov, H., Kobets, V.: Evolutionary revision model for improvement of computer science curriculum. In: Ermolayev, V., Suárez-Figueroa, M.C., Yakovyna, V., Mayr, H.C., Nikitchenko, M., Spivakovsky, A. (eds.) ICTERI 2018. CCIS, vol. 1007, pp. 127–147. Springer, Cham (2019). https://doi.org/10.1007/978-3-030-13929-2_7
24. Kravtsov, H., Kobets, V.: Model of the curriculum revision system in computer science. In: 14-th International Conference ICTERI 2018, Kyiv, Ukraine, 14–17 May 2018, vol. 2104, pp. 488–500 (2018)
25. Kobets, V., Yatsenko, V., Mazur, A., Zubrii, M.: Data analysis of private investment decision making using tools of Robo-advisers in long-run period. In: 14-th International Conference ICTERI 2018, Kyiv, Ukraine, 14–17 May 2018, vol. 2104, pp. 144–159 (2018)