

An analysis of the survey of employers

Collection and systematization of information. As test subjects, job market vacancies in the field of computer information technology and system analysis were selected, namely: system analyst, project manager, information resource specialist (IRSP), information systems specialist (ISSP).

Identification of competencies presented by employers to graduates of higher educational institutions or applicants for a certain position was carried out using questionnaires (see questionnaire).

Over the course of one quarter of this year, two hundreds of employers' letters were examined from different employer websites indicating the knowledge, skills and abilities that an applicant for one of the above positions should possess. Each profession in the sample is represented by fifty requests. All collected information is structured as a MS Access database "Employers' Requirements". In total, the database has 1300 entries.

Recall that the requirements of employers mean their expectations about the competence of employees of a particular profession and a specific job level. A modern professional education system should have clear concepts about what kinds of professional activities they are preparing for, and not just prepare unified workers who have competencies, some of which may have become obsolete. In this regard, the analysis of the needs for knowledge and skills should be carried out on the maximum possible sample of enterprises, focused on development, since it is the only way to create benchmarks for the best examples of professional activity. That is why when collecting data, information was also taken into account of which area of the national economy (industry, production, science, knowledge) belongs to the employer. The list of areas of the national economy that are included in the database is shown in Table 1.

Table 1

Areas of the national economy included in the database "Employers' requirements"

Area_code	Area_name	Area_code	Area_name
1	Housing and utilities	21	Media
2	Non-productive types of consumer services	22	Analytics
3	Health protection, physical culture and social security	23	Power engineering
4	Education	24	Fuel industry
5	Finance, credit, insurance, pensions	25	Ferrous metallurgy
6	Culture and art	26	Non-ferrous metallurgy
7	Science and scientific service	27	Mechanical engineering and metal working
8	Management	28	Chemical and petrochemical industry
9	Party and public associations	29	Forestry, woodworking and pulp and paper industry
10	Geological exploration	30	Building materials industry
11	Trade	31	Industry of building constructions and details
12	Building	32	Glass and porcelain-faience industry
13	Transport and logistic	33	Light industry
14	Service Companies	34	Food Industry
15	Telecommunications	35	Microbiological industry
		36	Flour-and-cereals and mixed fodder industry
		37	Medical industry (production of medical equipment and

16	IT	instruments)
17	Design	38 Pharmaceutics
18	Advertising	39 Other industries
19	Security	
20	Tourism	

Results of analysis of collected information. The presentation of the material of this item will be carried out according to the following scheme: 1 - setting of the specific analysis task (goal), 2 - preliminary data processing, 3 - input data structure for solving the task, 4 - interpretation of the results, conclusions and recommendations.

Task 1. In what area of the national economy, science or industry are the most popular professions?

In the database, a query of the fields is formed: "respondent's code", "industry code", "profession".

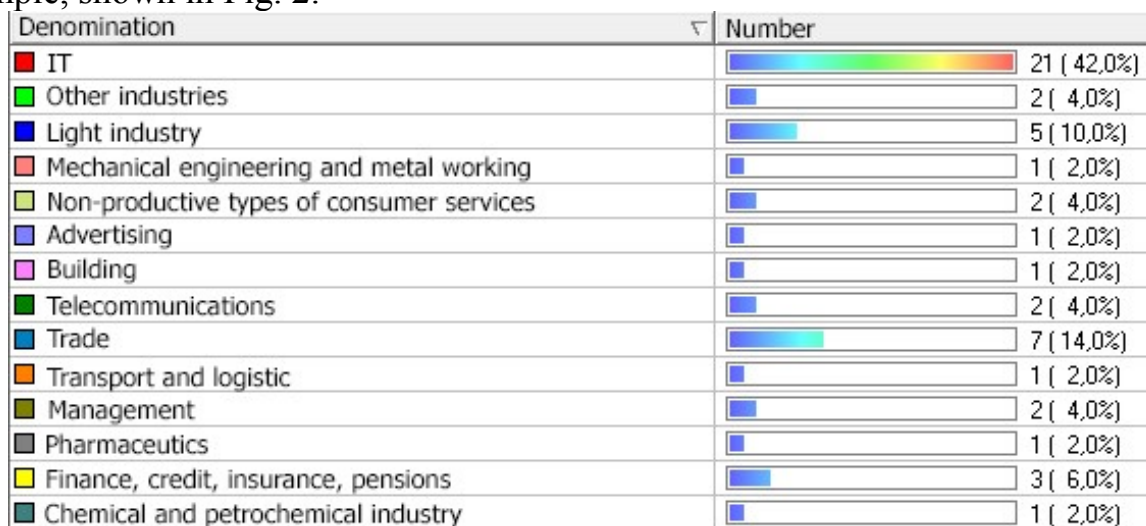
With the help of the Deductor 5.2 platform, a cross-tabulation with fact aggregation is constructed, which displays the number of respondents in a particular industry who expressed their opinion about the competence of specialists in the relevant profession (Table 2).

Table 2

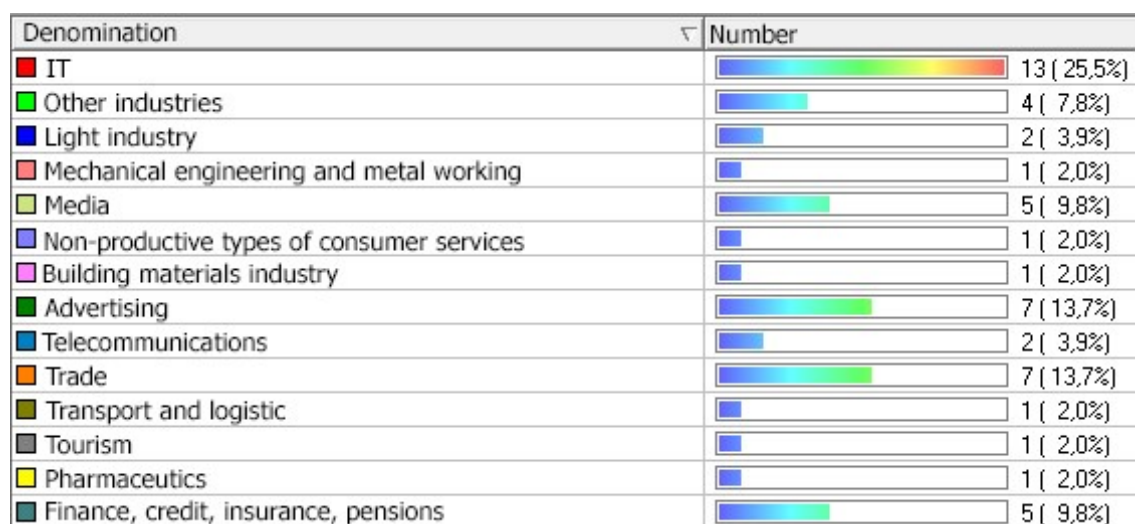
Cross-table "Profession - Branch of the National Economy"

Profession	11	12	13	15	16	18	2	20	21	24	27	28	3	30	33	38	39	5	8
	esp	esp	espo	espo	espo	esp	esp	esp	espo	espo	espo	esp	esp	espo	espo	esp	esp	esp	esp
Project manager in the IT field	7		1	2	13	7	1	1	4		1			1	2	1	4	5	
System analyst	7	1	1	2	21	1	2				1	1			5	1	2	3	2
IR specialist	9			1	9	10	8	1	1		4		2		1		1	1	1
IS specialist	7		1	4	13	2	6		1	3					1	2	2	8	1

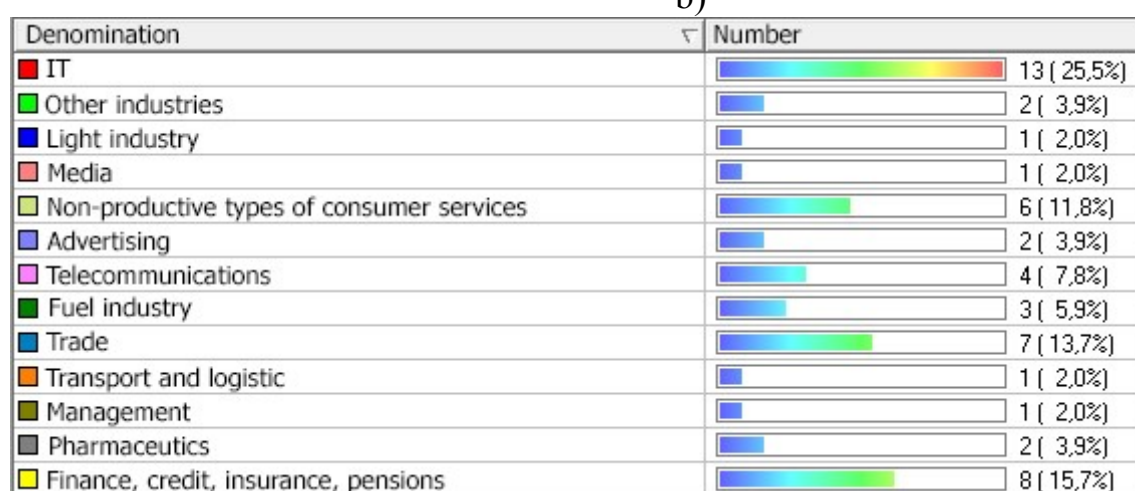
The received information can be visualized in the form of diagrams, for example, shown in Fig. 2.



a)



b)



c)



d)

Fig. 2. Interest in specialists: a) - system analyst; b) Project Manager; c) IT specialist; d) IS specialist

So, 1) the specialists of all four professions in question are most in demand in IT and trade, and if in the first area the need for system analysts significantly exceeds the others, in the second - all professions are fairly widespread and almost evenly;

taking into account the latter, it is possible to make recommendations on the availability in the educational programs of specialists in these professions of selected disciplines, for example, with regard to both audit and marketing; 2) specialists in information resources are equally in demand in such areas as IT, trade, advertising, non-productive types of consumer services; 3) specialists in information systems, except IT and trade, are also involved in the areas of finance and credit, insurance, telecommunications; 4) the profession of the IT project manager is also characteristic for the advertising, finance, media and other (not represented in the database) industries.

Task 2. Search for sets of the most common competencies for each particular profession. For the profession System Analyst 25 popular sets of competencies, for an IS specialist and IT project manager - 25 for each. Some of these sets of competencies for system analysts are shown in Fig. 3.

Sets: 25 of 39		Filter: Minimum support = 15.65		
№	Number of set	ab. Elements	Support	
			Number	%
1	37	Analytic skills	8	16.00
		Attention to details		
		Responsibility		
2	36	Analytic skills	8	16.00
		Attention to details		
		Knowledge of Excel		
3	32	Knowledge of Excel	10	20.00
		Ability to work with large volumes of information		
4	27	Attention to details	8	16.00
		Confident user of MS Office, Microsoft Project		
5	26	Attention to details	9	18.00
		Responsibility		
6	25	Attention to details	9	18.00
		Knowledge of Excel		
7	24	Analytic skills	10	20.00
		Level of English - Upper-Intermediate		
8	23	Analytic skills	8	16.00
		Ability to work with large volumes of information		

Fig. 3. The most popular sets of competences based on the results constructing associative rules for the profession System Analyst

Using the discovered sets of competences, rule trees are built - two-level trees by antecedent or by consequent. When constructing the rules tree by antecedent, the nodes (with the antecedent) are on the first (upper) level, and the nodes with the consequent at the second level. The second variant of the rules tree is a tree constructed by the consequent. Here at the first level are the nodes with the consequent. As an example, in Fig. 4 shows the rules tree, built on the basis of the most popular sets of competences for the profession of Information Systems Specialist. Here - 5 rules. Their details are shown in Fig. 5, and the interpretation can be:

- if the employer requires analytic skills from the candidates for the post of IS specialist, then in 25.5% of cases together with this will require attention to detail;

Rules: 5 of 5		Filter: Without filtering				
№	Rule number	Antecedent	Consequent	Support		Confidence
				Number	%	
1	1	Attention to details	Analytic skills	6	11.76	85.71
2	2	Deep knowledge of Oracle D	Level of English - Upper-Int	6	11.76	60.00
3	3	Level of English - Upper-Inte	Level of English - Upper-Int	7	13.73	87.50
4	4	Confident user of MS Office,	Confident user of PC	9	17.65	64.29
5	5	Confident user of PC	Confident user of MS Office	9	17.65	90.00

Fig. 4. Rules for compiling the sets of competencies of an IS specialist

- if the employer has the opinion that the level of English at the pre-applicant for the position of an IP specialist should be Upper-Intermediate, then in 12% with it the applicant must have a deep knowledge of Oracle DBMS, SQL programming languages, PL / SQL, etc.

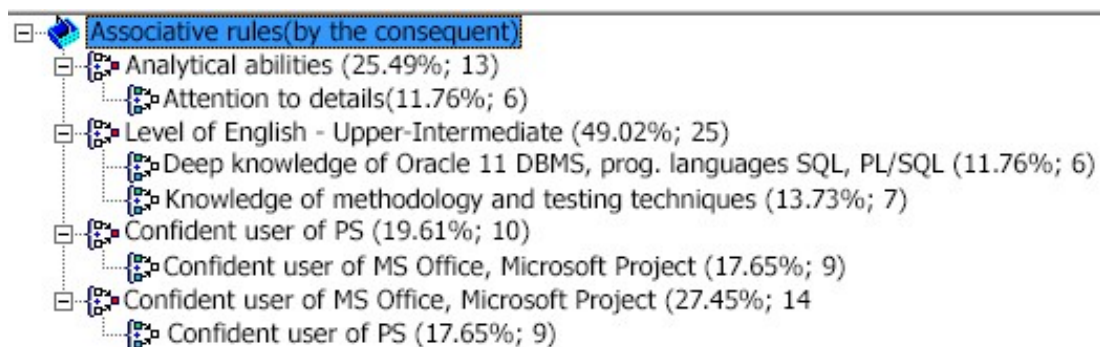


Fig. 5. Details of the rules tree on compiling sets of competences IS Specialist

In Fig. 6 presents details of some rules regarding the composition of the competencies of the system analyst for the requirements of the employer.

Denomination	Number
IT	13 (25,5%)
Other industries	4 (7,8%)
Light industry	2 (3,9%)
Mechanical engineering and metal working	1 (2,0%)
Media	5 (9,8%)
Non-productive types of consumer services	1 (2,0%)
Building materials industry	1 (2,0%)
Advertising	7 (13,7%)
Telecommunications	2 (3,9%)
Trade	7 (13,7%)
Transport and logistic	1 (2,0%)
Tourism	1 (2,0%)
Pharmaceutics	1 (2,0%)
Finance, credit, insurance, pensions	5 (9,8%)

Fig. 6. Detailing the rules for compiling sets of competences

In general, with the above parameters, rules such as " antecedent - consequent " are constructed: for the system analyst - 20 for the IT project manager - 6. Using the rules tree, analyzing the composition of the most popular sets of competences for all the professions in question, you can trace the interrelation between these professions.

In Table. 3 shows the general competencies for candidates for the post of system analyst, information systems specialist, information resource specialist and IT project manager, who were able to find out by analyzing the information gathered about the requirements of employers. Such summary data demonstrate the similarity of the above occupations and can be useful in the development or comparison of educational training programs.

With the help of Data Mining methods, it is possible to identify those competencies that employers think are inherent only in one profession. And consequently, by eliminating those knowledge and skills that have support, less than a certain threshold, it is possible to form a list of competencies that will determine the specificity of a particular profession.

Table 3

General Competencies for Professions System Analyst, IS Specialist, IR Specialist, IT Project Manager

Type of competence	Name of competence	Professions
Professional production (PP)	The level of English - Upper-Intermediate	Information Systems Specialist (IS_S)
	Ability to create and work with test documentation	
	Ability to work with 1C, Confident user of PC, Confident user of MS Office, Microsoft Project	
	Subject area, Understanding the principles of SEO	
	Understanding the basic principles of software development	Information Resource Specialist (IR_S)
	The Basics of HTML / PHP / MySQL / JavaScript	
	Fundamentals of Management, Knowledge of CRM system, Knowledge of Excel	
	Correct oral and written language	
	Deep knowledge of e-commerce systems	System Analyst (SA)
	Fundamentals of SQL, Web programming	
Personal	Purposefulness, multitasking, stress tolerance, decency	IT Project Manager (PM)
	Ability to set goals and achieve them	
	Ability to work with large volumes of information	
	diligence, self-discipline, Responsibility, initiative, accuracy, Focus on the result,	
	Creative approach to finding solutions	
	Attention to details, Ability to learn quickly	
	Analytical skills, Active life position	
Social	High level of communication skills	
Managerial	Ability to organize the work of the team and work in it	
Professional production	Understanding the structure of web development	System Analyst (SA)
	The skills of working with project documentation (BRD / FSD / UMD / MRD)	
	The skills of working with Redmine / JIRA	
	Fundamentals of QA (testing), Project management skills	
	Analytical skills (client base analysis, marketing research, client profile, database segmentation, TA definition)	IT Project Manager (PM)
	The skills of working with BPMN Business Process Modeling System	
Personal	Self-confidence, Logical thinking	

Social	Ability to conduct presentations, negotiation skills The ability to create and maintain a long-term relationship with the client	
Managerial	Ability to monitor and bring workflow to their full completion	IS_S SA PM
PP	The skills of working with ERP systems	
Professional production	Skills in testing API, web and mobile applications Knowledge of Unix shell / awk Deep knowledge of Oracle 11 DBMS, SQL programming languages, PL / SQL	IS_S SA
PP	Knowledge of the advertising market	IR_S PM
	Knowledge of graphic editors	
Personal	Утукпнб erudition	
Personal	Ability to work with search engines	IR_S, SA
PP	Web design	IR_S, IS_S