System for Professionals – monitoring employers' demands for key competences in Wielkopolska

M. Szafrański, M. Goliński

Abstract – The article presents a proposal for activities aimed at acceleration of access to information regarding key competences. It gives justification of why key competences are currently important for the effectiveness and efficiency of enterprises. System for Professionals, operating in Wielkopolska since 2013 is characterized. It was created and is being developed in order to monitor competences, especially key ones. An integral element of the system is the IT tool, facilitating data and information preparation for users, who are at the same time subjects of the System for Professionals. Sample results of monitoring carried out within the system are presented. They concern the needs of entrepreneurs in the Wielkopolska voivodeship for key competences. The survey included 918 enterprises registered in the system.

Keywords – key competences, IT system, skills, acceleration

I. Introduction

ACCELERATION of activities aimed at achieving objectives of individuals must be accompanied by acceleration of creating knowledge resources in enterprises. This problem is discussed by M. Szafrański [1].The faster the environment of enterprises changes, the faster adaptation activities must take place in those enterprises. In the knowledge-based economy, one of the key factors for effective and efficient functioning on the market is knowledge. As a resource at the origin of processes in an enterprise, it should respond in a dynamic and continuous way to the changing needs resulting from targets. In workstations, it is necessary to increase knowledge, especially professional skills, in a continuous way. It is equally important, though, for the employees to possess well-developed key competences. Improvement of methods of monitoring the needs for key competences in businesses results in shortening the access time to information about gaps in these competences. Consequently, both businesses and institutions responsible for educational processes may react faster to minimize those gaps both in educational systems and in the labour market. One solution supporting acceleration of access to information about employers' needs for competences, including key competences, is the System for Professionals, operating in Wielkopolska since 2013. This article presents sample survey results on monitoring the skills which are part of key competences.

II. Key competences as an element of knowledge

Knowledge and skills are often perceived as separate elements, especially in the pedagogical perspective – in education. For example, European Qualifications Framework, in accordance with the recommendation of the European Parliament and the Council of the EU of 23 April 2008, divides learning outcomes [2, p.13] into knowledge, skills and competences (personal and social). Similarly, skills and knowledge are treated as separate categories in Dublin descriptors [3, p.27]. Management science, on the other hand, as well as some other sciences (e.g. praxeology), describe skills as a category of knowledge. In some sources [4, pp.31-33], [5, p.12], knowledge is divided into four different categories:

1) know-what – operational; it is a base for ordinary, everyday work; easy to describe with words and easy to transfer;
2) **know-how** – operational; hidden in human mind; connected with experience of how something is done and how this 'something' operates; difficult to describe with the language of signs; obtained through personal experience; may be identified with **skills**;
3) know-why – including awareness of goals defined in a business and justification for achieving them; identified with the awareness of changes taking place in the surroundings, knowledge of the context of actions undertaken;
4) know-who – knowledge on who is who and what knowledge they possess both in the surroundings and inside a business; knowledge on the role and status of subjects of activities within and outside an organisation.

G. Probst, S. Raub and K. Rombards treat skills as a component of knowledge. They suggest understanding knowledge as 'all information and skills possessed by the subject of actions' [6, p.9]. This paper also treats skills as a category of knowledge.

While analyzing literature, a great variety in classifying skills may be noticed. Skills are most often grouped in sets called competences. E. Kolanowska [7, pp. 321-322] undertook to organize various categories into competences, and although she mentions several, they should be treated as a set of notions rather than a classification. Detailed classifications of professional skills (e.g. [8]) are available, but with non-professional ones, there is a great variety when giving them names. This makes communication difficult between parties interested in information exchange

concerning skills. It concerns especially communication between employers who look for candidates possessing a certain set of skills or – putting it more widely – non-professional competences, and candidates themselves.

A special set is the set of key competences that are essential both socially and for most entrepreneurs. Literature of the subject describes this group of skills in detail. Assuming recommendations of the European Parliament and the Council of the EU, the following can be listed [9]:

1) communication in the mother tongue,
2) communication in foreign languages,
3) mathematical competence and basic competences in science and technology,
4) digital competence,
5) learning to learn,
6) social and civic competences,
7) sense of initiative and entrepreneurship,
8) cultural awareness and expression.

These competences may be divided into two sub-groups: traditional and horizontal ones [10]. Traditional competences include the first four from the above list, sometimes adding literacy [10], the latter four create the sub-group of key competences [10], [11].

III. System for Professionals – organizational-technical innovation for monitoring competences in the labour market

A motivation to carry out work in the System for Professionals was the AWT® programme [12]. AWT® is a programme, started in 2006 at Poznań University of Technology, called Technical Knowledge Accelerator (Akcelerator Wiedzy Technicznej®), aiming at increasing effectiveness and efficiency of activities shaping relationships between the educational systems and the labour market. Assumptions of designing the future are realized through acceleration. Innovative, unusual solutions are frequently chosen, since they are often more effective and more economical compared to classical, less effective ones, but ones with a lower risk of failure. Focus research and individual surveys aimed at analyzing the needs of employers showed that there is a lack of up-to-date, detailed and reliable information on competences and qualifications of candidates for jobs in enterprises. The needs of employers were the reason why goals realized in the System for Professionals are being developed. However, the System concentrates on managing information regarding the needs of the labour market. An innovative vision on solving the existing problems was essential for the creation and development of the system. Innovations are mainly of organizational character and are integrated networked [13, p. 37]. The digital solution – the central tool of the System for Professionals – developed and adapted every functionality in cooperation with its users, taking into consideration mutual relations in the labour market, and even in education. Cooperation of numerous subjects, frequently of varied character, is nowadays the basis for success of the innovation [14, 15]. Each of the modules of the system serves to realize a separate function, is evaluated and improved in each design and implementation iteration – agile software development [16]. Put together, the modules create a system of information exchange within the same databases, the same

authorization and authentication system. Easy access to information ensures a cohesive interface The structure of the software (source code) and the composition of databases allow developing the tool through functional modifications and day-to-day improvement of the interface. Due to a large scope of tasks realized in the System and numerous groups of users, the system is composed of modules. In the latest version of the System, released in 2015, the following functionalities can be listed:

Module for the entrepreneur – the most important functionality of the system – enables to define precisely requirements for an employee in a particular position. The structure of the user interface gives an intuitive solution to create an offer for an employee, apprentice or trainee. The system makes it possible to describe the profile of competences, and thus plays the role of a mobile recruitment system. Free registration and use of the System help minimize costs and shorten the time – two significant parameters of recruitment process evaluation [17, 18].

Module for students/graduates is a base describing the potential of vocational schools students. The potential employee presents their competence profile, which is automatically compared against job offers in the base. The module provides for the evaluation of employee's competences based on 360º degree method [19].

Module of career counselling – enables planning the educational path and support in professional development. Referring to the structure of job description – built in a hierarchy from basic skills through competences and qualifications – the module may be used for the description and evaluation of a single job position [20] or to characterize human capital in the organization as a whole [21].

Module of manager of practical training – the module allows facilitating the process of managing trainings at the employer's site and to organize forms of employment other than full-time/partial-time, expected by employers [22].

Module of trainings – training companies publish their offers of courses and trainings in response to the needs of the labour market and complement the formal – school education.

E-learning module – along the System for Professionals there is a module of distance learning. It is a form of integrated education and self-education system, which together with 'anticipatory' vocational practice takes the form of triplex education – as a developed form of dual education [23].

Analytical module – allows generating real-time reports and bipartite analyses on the labour market and education in the Wielkopolska region; it also provides complex reports already generated and commented.

A dynamic growth in the number of the system users and positive opinions of institutions evaluating the System give the right to claim that it is a useful tool, bringing expected benefits.

IV. Examples of monitoring key competences with the use of the system for professionals

A. The significance of key competences

System for Professionals makes it possible to create numerous analysis sections. For example, significance of a competence from the perspective of employers can be

examined. Due to priorities accepted for the Wielkopolska region, the system currently gives the possibility to examine the employers' demand for skills obtained on the level of secondary vocational level only. According to Central Statistical Office of Poland, in the year 2012, there were as many as 8.56m out of 15.59m of economically active employees (i.e. nearly 55%) with secondary vocational education, post-secondary education or vocational education. In spite of this, entrepreneurs find a deficit of employees with professional skills. A similar situation can be observed in the region concerned. Therefore as early as in 2008, a bill [24] was passed by the Board of the Region of Wielkopolska. It defined the frames of vocational education development. Formal vocational education is perceived by enterprises as an element of preventive action, which M. Szafrański described in the context of vocational apprenticeship [25]. Adaptation of education towards acceleration of providing graduates with **professional skills** is one of the priorities of the educational system. However, employers expect candidates for jobs, apprenticeships and trainings to show a proper level of **skills that constitute key competences.** According to the representatives of employers who were interviewed, these skills accelerate employees' adaptation to work after hiring them [1]. Current scope of implementation of the System for Professionals assumed the classification of professions and skills as given by the Act of Law of Minister of Education on the curriculum for vocational education [8] (state law).

In the System for Professionals it is entrepreneurs who publish their offers of job, apprenticeship and training. These offers are received mainly by graduates of technical schools and vocational schools, but also by students of these schools (in case of apprenticeship and training). The offers include general information, indications of vocational skills and key competences expected by employers. As a result of the classification accepted [8], all skills are divided in the system into three sets:
1) skills common for all professions,
2) skills common for individual areas of education,
3) professional skills.

Skills common for all professions are in fact skills that constitute key competences. They are skills that – from the perspective of the Polish vocational education system – all graduates of vocational schools should possess. Therefore, employees with vocational education should also possess them. Monitoring offers published in the system by employers gives information as to which skills are most important from their point of view, and how demand for these skills evolves over time. It concerns also skills that constitute key competences, called 'common' in the system, in reference to all professions included in the classification of professions published by the Ministry of Education (MEN).

More than two years after the implementation of the system (January 2013 to April 2015), the number of common skills (connected to key competences) in the system is greater than the number of skills in the classification prepared by MEN, which was used as the starting point. A reason for this is also the language used in enterprises, substantially different from that of the curriculum, formalized to a large extent. Most employers reject partially the language of the curriculum, and since the 'life' of the system depends greatly on the

entrepreneurs' activity, the skills classification in the system evolves, showing imperfections of adapting the official systems of skills descriptions to practice. System for Professionals facilitates monitoring linguistic differences and similarities of two different environments (education and economy). On the one hand, it introduces phrases demanded by employers, and on the other hand, it helps keep the order of definitions, systemizing the language proposed by employers. Employees use most often colloquial language, which is imprecise, ambiguous, the use of which results in blurred notions. To use a completely deformalized language in the system of information exchange would inhibit communication between parties participating in the information exchange. M. Szafrański [1] described the problem of ambiguity of phenomena connected with knowledge management defined by employers. It was manifested during research between 2010-2012, while creating the system in the part led by the author.

Although this article discusses key competences, and research results presented below concern skills related to them, it is necessary to add that professional skills included in the System for Professionals are those attributed to certain professions. Common skills in individual areas of education are connected to the area of education described in detail in the Act of Law on the curriculum in vocational education [8].

The basis for research on the demand for key competences in enterprises of the Wielkopolska region are data from the System for Professionals. On 10 April 2015 there were 918 enterprises registered in the system – they are the research sample. These enterprises, publishing offers of job, apprenticeship and training between 1 January 2013 and 10 April 2015, indicated demand for 112 common skills.

Monitoring shows that enterprises which use the system, indicate the demand for common skills in accordance with the Pareto-Lorenz principle. 70% of all indications of common skills occurring in offers translate to about 21% of skills, i.e. only 24 out of 112 mentioned in the offers as desired, in other words – necessary. **Indication** of a given skill means that the employer indicated it as expected from the candidate in the offer of job, apprenticeship or training. The offer may indicate many skills. The total number of indications of a given skill in the period concerned means that this skill was indicated in all offers that many times. Based on the above observation it may be stated that for enterprises which use the system, nearly 80% of common skills indicated at least once are unimportant or of marginal importance. The Pareto-Lorenz principle also applies to SMEs (70% of indications of 23 skills, constituting 21% of all 109 common skills indicated by SMEs) and large enterprises (70% of indications of 26 skills, constituting 26% of all 99 common skills indicated by large enterprises) regarded separately.

Even these basic results are a source of valuable information not only for enterprises, but also for institutions responsible for the educational policy and educational processes in the region. This information may translate into planning actions which would accelerate the increase of the level of key competences, essential for enterprises, and thus for the whole economy.

Research carried out suggests that only between 7 and 10 of common skills indicated in the System for

Professionals are those which make up 30% of all employers' indications (table 1).

Research up to date shows common skills for professions most often indicated by employers in the system. They are:
1) respect the rules of behaviour and ethics (4.5% of indications),
2) cooperate in a team (4.1%),
3) respect confidentiality (3.7%),
4) be creative and consistent in task realization (3.6%),
5) be able to cope with stress (3.4%),
6) be open to changes (3.4%),
7) foresee results of action taken (3.4%),
8) update knowledge and develop professional skills (3.3%).

These eight skills indicated in employers' offers as required were 29.4% of all 4078 indications of common skills registered.

Table 1. Relationships between common skills most often indicated and all common skills indicated in the System for Professionals: CS–common skills, SP–System for Professionals.

Period	All CS indicated at east once in SP	# of CS in all offers of job, apprenticeship an training in SP	About 30% of all indications of CS in SP (30%*[3])	Skills indicated in 30%	
				Number of skills from the list where all skills are ordered from the most frequently indicated to the least frequently indicated	% of skills indicated [5] / [2]
[1]	[2]	[3]	[4]	[5]	[6]
SMEs					
01.2013 -06.2014	69	2622	863	8	12%
11.2013 -04.2015	109	2834	919	9	8%
01.2013 -04.2015	109	3470	1041	8	7%
LARGE ENTERPRISES					
01.2013 -06.2014	61	258	83	6	10%
11.2013 -04.2015	99	481	150	10	10%
01.2013 -04.2015	99	525	161	9	9%
ALL ENTERPRISES					
01.2013 -06.2014	69	2864	853	7	10%
11.2013 -04.2015	112	3315	1048	9	8%
01.2013 -04.2015	112	3995	1182	8	7%

The frequency of skills indication is slightly different when enterprises are divided into SMEs (including micro enterprises) and large enterprises. For SMEs, the first eight common skills indicated in offers are those listed above. The list was created when analyzing indications of all enterprises. For large enterprises, however, the following skills were less important: *foresee results of action undertaken* (9th in indications of large enterprises) and *update knowledge and develop professional skills* (10th in indications of large enterprises). From the perspective of large enterprises in the period analyzed, more important were the following skills: *be able to plan a working day* (5th in indications of large enterprises, whereas in case of small enterprises it was 22nd), *be able to organize own workstation* (6th in indications of large enterprises, whereas in case of small enterprises it was 23rd). As research in large enterprises co-creating the System for Professionals in the analyzed period shows, planning and organizational skills are of more importance. They are related to fulfilling the managing function in enterprises. These skills were not so significant for SMEs examined. The question may be posed – whether they are less important in this category of enterprises, or if persons preparing job offers undervalue functions of planning and organization in SMEs. Or perhaps, work positions for which these offers were published by large enterprises had a different specific character. These questions could be answered to some extent by analyzing the detailed content of the offers published in the system. Nevertheless, research results obtained by analyzing data from the system may be fodder for other research, pondering the reasons for discrepancies in the perception of key competences in enterprises of various sizes.

Apart from examining the importance of individual skills constituting key competences, the change in importance of these skills over time may also be examined in the System for Professionals. One may attempt at setting change trends of the skill importance by calculating the percentage of indications of a given skill in the total number of all indications. Figures 1-4 present importance changes over time of chosen common skills for professions.
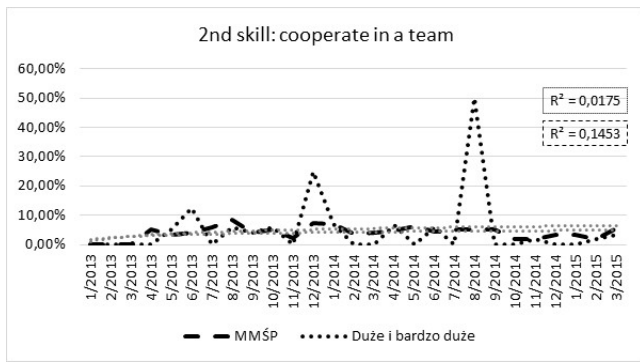
Fig. 1. Importance change over time for the skill *respect the rules of behaviour and ethics* in SMEs and large enterprises based on skill indications in offers of job, apprenticeship or training published in the System for Professionals.

Fig. 2. Importance change over time for the skill *cooperate in a team* in SMEs and large enterprises based on skill indications in offers of job, apprenticeship or training published in the System for Professionals.

Fig. 3. Importance change over time for the skill *respect confidentiality* in SMEs and large enterprises based on skill indications in offers of job, apprenticeship or training published in the System for Professionals.
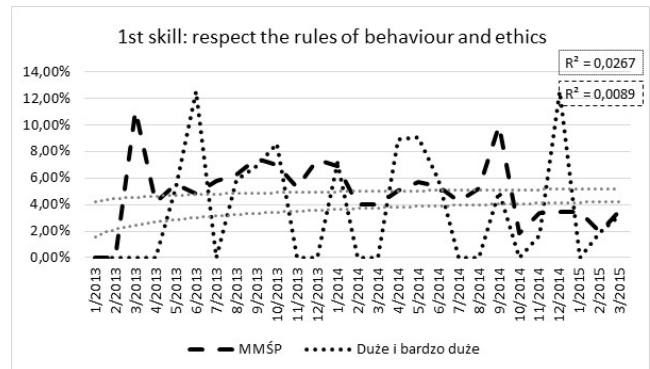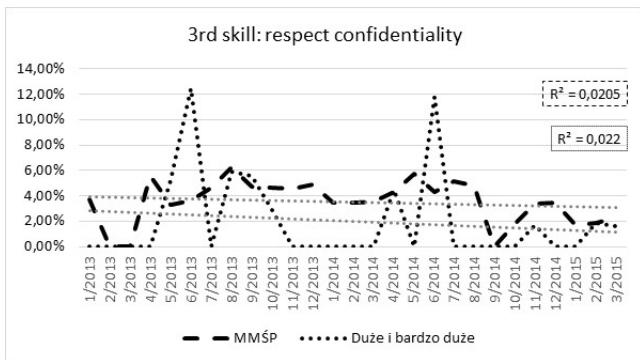

Fig. 4. Importance change over time for the skill *be creative and consistent in task realization* in SMEs and large enterprises based on skill indications in offers of job, apprenticeship or training published in the System for Professionals.

Trend lines on the graphs are solely examples. An in-depth analysis should decide whether the aspect of seasonal changes should be taken into consideration.
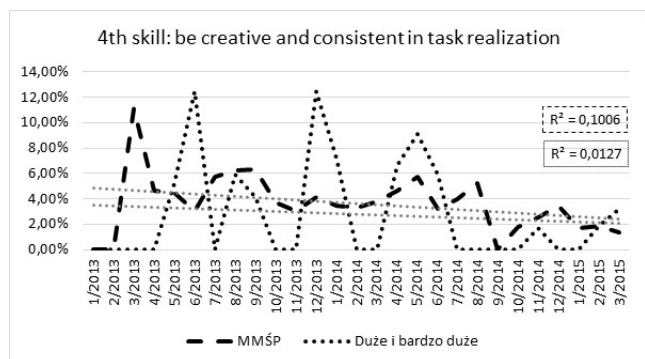
B. Space analysis

System for Professionals is dedicated to entrepreneurs looking for employees with certain competences. Among many expectations related to the detailed character of employee profile, key competences play a special role. Due to the varied availability of employees in the area of the Wielkopolska region, an important factor is the declaration of mobility by persons looking for a job. Frequently, the main factor when choosing a job is the distance between place of residence and place of work [26]. Mobility and related decisions of choosing a job very often influence the professional career of an employee. Employees' choices are reflected by employers' decisions connected with managing the business (opening a branch, remote work) and payroll policy (commuting and housing expenses compensation).

Authors of this article realized projects connected with the problem of mobility and optimization of information describing locations, which were used to create the System for Professionals [27], [28], [29]. In practical business management, the problem of availability of employees with certain key competences has a strong influence on human capital costs, and in consequence – on the future development of the business. More and more often, availability and cost of human potential expressed in qualifications possessed decide about the location of a

business. All these parameters are directly or indirectly reflected in the data gathered by System for Professionals. Both job offers and employees' job applications are identified by the address, allowing geolocation. It is essential due to costs of work of the candidate and the possibilities of building a steady bond with the enterprise. A declaration of the commuting distance is also an initial criterion of the choice of employees – optimizing the recruitment process. A varied structure of employment and flexible changes of competences in enterprises were taken into account while designing the System for Professionals. An employer may find forms of partial employment (including remote work), carry out internal recruitment in the Module of career counselling or increase employees' competences through E-learning. All these factors may be subjects of analyses in the System, especially of space analyses.

System for Professionals assumes not only day-to-day, detailed communication between employers and employees, but also the possibility to draw conclusions on the labour market. Based on the data from the System for Professionals, synthetic one-subject reports or detailed thematic studies are published.

An example of conclusions regarding the labour market in space grouping of the data from the System for Professionals may be the use of hierarchical clustering. Based on offers published by 918 employers (most of them published more than one offer), space analysis of competence needs in the region was carried out. Due to the limitations of this article, only potential analytical-prognostic possibilities of the System for Professionals are presented. For the needs of this article, competences for regions and sub-regions in Wielkopolska were aggregated. It is, however, possible, to analyze individual sub-regions.

Table 2. Space analysis of factors in sub-regions in search of similarities based on offers published in the System for Professionals – common skills for professions most frequently expected by employers.

Region	Area [km^2]	Unemployment [#of people]	Job offer	Common skills for professions
City Poznań	261	13 800	155	459
Leszno region	3 602	13 856	19	38
Kalisz region	5 786	24 823	150	224
Konin region	6 397	23 955	21	75
Piła region	6 459	21 995	29	140
Poznań region	9 541	41 018	207	282

Table 2 presents a chosen possibility to select homogenous groups of data based on Euclidean distances. Factors accepted for the analysis of sub-regions in the example concerned the unemployment rate in the sub-region, the number of job offers and the number of common skills for professions, most frequently expected by employers (the skills were discussed in point A). As a result of comparison of the qualities mentioned above, characterizing the labour market and the needs of employers' looking for employees through the System for Professionals, a diagram of average differences was created – fig. 5. Based on the analysis of concentration, the following typology groups can be defined: a) Kalisz region and Konin region, b) lower gravity between Leszno region and Piła region and c) no connections between the city of Poznań and Poznań region. The analysis carried out is a starting point for in-depth research, based on less synthetic

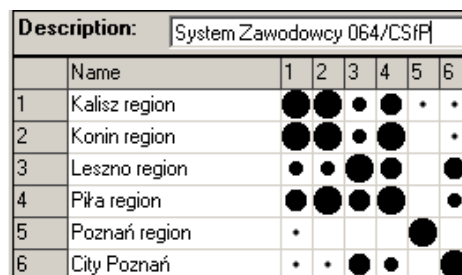data, and for conclusions on the needs of business management.

Fig. 5. An example of hierarchical clustering, grouping regions of similar typology based on offers of SMEs from the System for Professionals – common skills for professions most frequently expected by employers.

Table 3. Space analysis of factors in regions, searching for similarities, based on offers published in the System for Professionals – common skills for professions expected by employers.

Region	Area [km^2]	Common skills for professions	Unemployment [#of people x 1000]
Rawicz region	553.23	10	2.3
Śrem region	574.41	48	1.6
Jarocin region	587.7	138	3.2
Kępno region	600.39	149	1.1
Środa region	623.18	2	3.0
Grodzisk region	643.72	66	1.8
Wolsztyn region	680.03	14	1.4
Chodzież region	680.58	44	2.7
Września region	704.19	45	4.0
Pleszew region	711.91	27	2.6
Oborniki region	712.65	3	2.2
Krotoszyn region	714.23	174	3.1
Kościan region	722.53	8	2.1
Międzychód region	736.66	46	1.1
Ostrzeszów region	772.37	254	2.2
Leszno region	804.65	59	3.7
Gostyń region	810.34	4	3.6
Słupca region	837.91	119	3.7
Turek region	929.4	0	3.6
Koło region	1011.03	18	5.2
Nowytomyśl region	1011.67	267	1.5
Wągrowiec region	1040.8	11	4.0
Szamotuły region	1119.55	276	2.8
Kalisz region	1160.02	99	5.8
Ostrów region	1160.65	206	5.4
Gniezno region	1254.34	124	6.6
Piła region	1267.1	117	5.8
Konin region	1578.71	106	12.9
City Poznan	1637.81	1675	4.0
Złotów region	1660.91	3	4.1
Czar-Trzci region	1808.19	100	4.0
Poznań region	1899.61	681	6.0

Table 3 presents parameters characteristics of the labour market. Among the qualities mentioned, common skills for professions expected by employers and the unemployment rate are given.
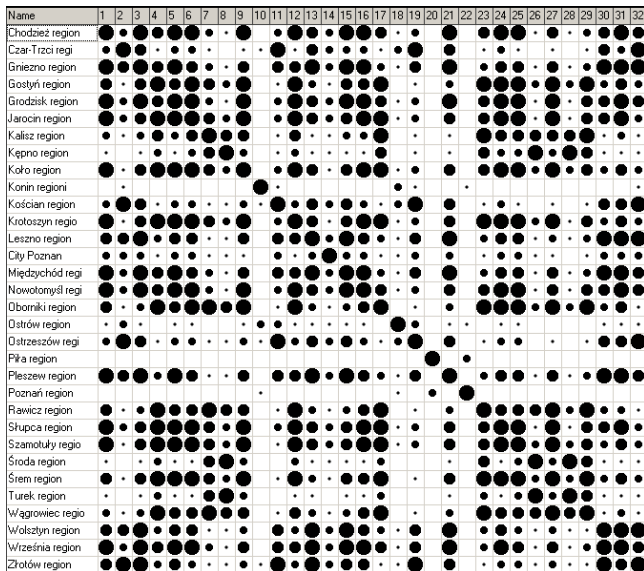
Fig. 6. An example of hierarchical clustering, grouping regions of similar typology based on System for Professionals – common skills for professions expected by employers.

Based on groups of sub-regions according to chosen factors, fig. 6 shows several segments showing similarities. Three groups possess qualities enabling mutual gravity and four regions show individuality. This type of grouping may be an initial selection for further analysis. Another step should be to find special factors for similar groups of regions. Analyses of this type may help entrepreneurs decide on the location of the branch or explain difficulties connected with finding a given competence in that region. Local authorities may use such analyses to forecast the educational potential or the necessity to introduce courses and trainings developing competences. As the System develops and data grows, entrepreneurs and local authorities will be offered more precise analyses and forecasts.

V. Conclusion

The problem of systems of computer aided for business environment monitoring is present in the literature for a long time [30]. Development of Information Technology and Management is responsible for their improvement. The article presented only chosen possibilities of how to use the System for Professionals. At this stage of development, analyses may be enhanced with the factor expressing the expected level of certain skills. It is also possible to compare evaluation of employers and candidates. One of the most important activities is currently improvement of quality of data used in research. In the nearest future, it is planned to:

1) increase the number of users to enable conclusions for sub-regions, poviats (counties) or big cities,
2) transfer the system to other regions and target groups of users in order to lower unit costs of the system and also to examine the influence of cultural differences as well as demographic, social, geographical and other characteristics on the evaluation of the importance of key competences,
3) attribute skills from the system to key competences in a less ambiguous way, to create aggregated factors,
4) prepare automatic reports and develop a system of fast information about changes in the importance of a skill over time and space,

5) further popularize the system among entrepreneurs,
6) prolong the lifespan of users in the system through the development of mechanisms of building relationships with them.

On 16 April 2015, the Board of the Wielkopolskie Voivodeship invited Poznań University of Technology to a seven-year partnership, which will involve, among others, development of the System for Professionals, including development of the research system. Other activities are undertaken to encompass groups of candidates other than students and graduates of secondary vocational schools.

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