Professional and critical competencies in human capital formation

Z Kapelyuk[1] and A Aletdinova[2*]

[1] Siberian University of Consumer Cooperation, 26 Karla Marksa prosp., Novosibirsk 630087 Russia
[2] Novosibirsk State Technical University, 20 Karla Marksa prosp., Novosibirsk 630073 Russia

E-mail: aletdinova@corp.nstu.ru

Abstract. The authors consider the appointment of professional competencies in the implementation of labor functions, as well as critical competencies in ensuring innovative development and the transition to the next technological structure. Based on the intellectual analysis of data on competencies, the features in their needs are highlighted. Environmental competencies remain the least sought by the employers and are rarely indicated in the questionnaires of applicants for positions. Regional features of the demand for competencies are determined by the population density, the share of rural / urban residents, the predominance of large cities and cities, large industries, research centers and business incubators.

Keywords: human capital, technological structure, competencies, professional and critical competencies

1. Introduction

In the conditions of transition to the sixth technological order, the level of requirements for education, length of service, and critical competences of workers are growing in Russia. This explains the development of a new education model based on the transition to the concept of an "entrepreneurial university," which ensures the formation of "competency portfolios" based on an assessment of the future demand of business and the development of scientific and technological progress. R. White highlighted the concept of competence, describing personal characteristics and motivation (R. W. White, 1959). Competence is a subject area in which the individual is knowledgeable and willing to perform activities [1]. Often, the content of competencies that lie in the plane of professional behavior affects the differentiation of workers' wages.

In our opinion, two types of competencies should be highlighted: professional and critical. According to V. L. Kasyutin, the concept of professional competence should be considered as the ability of a professional subject to perform work in accordance with official requirements [2]. A. A. Ilidjev examines them in the context of training highly qualified workers in Russia, proposing the following definition: professional competences are the requirements for the training of students that are predetermined and presented in federal state standards of higher professional education [3]. E. Yu. Pantseva, O. A. Toysheva distinguish several interpretations of professional competences:

- Mastering knowledge, abilities, and skills necessary for working in their specialty with simultaneous flexibility and autonomy develope cooperation with colleagues and professional interpersonal environment;
- Designers of educational standards, representing "elementary competencies" as a scope, measuring quality and required knowledge;
- Effective use of abilities that allow one to fruitfully carry out professional activities according to the professional requirements;
- Integrated combination of knowledge, attitudes, and abilities that allow a person to work in modern conditions [4].

Thus, number of scholars consider professional competence as an employee's use of knowledge, abilities, and skills for the implementation of their professional functions and components of educational standards.

The term "critical competence" is derived from the similar term "critical materials" (in the USA, strategically necessary materials are viewed basically as a five-year supply, which is supposed to be available in the country in case of a military invasion) [5]. Literally, from English, critical technologies are translated as scarce, essential technologies. The term "key technologies" is a synonymous of critical technologies [6]. In our opinion, the employees' critical competences are the most demanded sets of knowledge, skills, and abilities in a specific area to ensure a change in the technological structure [13].

A set of competencies determines the formation of human capital. We can say that human capital is a combination of skills, knowledge, competencies, health of particular employees involved in the functioning and development of the national economy.

2. Materials and Methods

The following methods were used in the work: system analysis, data mining, including content analysis, summary method, and grouping. Additional methods were monographic, observation methods, as well as a tabular method for presenting research results.

System analysis is based on the consideration of the object of study as a system with interrelated elements and subsystems. It makes possible to single out features of the formation of human capital, in particular, groups of critical competences of workers.

Mining in relation to the identification of requirements for critical competences of workers is impossible without first developing an ontology. Employers could describe the same competence with different phrases, their selection was necessary at the initial stage of the research. Accordingly, the development of ontology was one of the first steps in the study. The technology of Data Mining allows one to extract useful knowledge, important patterns, ensuring the adoption of management decisions, the formation of knowledge bases. Intelligent data analysis is the process of identifying new, correct, and potentially useful knowledge based on large data sets [7]. It can use various software products to find online data and perform a specific list of tasks: classification (determining the class of an object by its characteristics); content analysis (text analysis procedure); regression analysis (building functional dependencies, justifying the quality of a regression model, modeling and forecasting based on it); searching for associative rules (finding frequent dependencies between events or objects); clustering (search for independent groups and their characteristics in all analyzed data). Such scholars as D.T. Larose, W. Van der Aalst [7, 8] engaged in the description of the tools for data mining. M. A. Bakaev, A. A. Aletdinova [9] regularly conduct an online monitoring and analysis of wages of the Russian workers.

One of the areas of its application was the monitoring of labor market indicators, in particular, the demand for critical competences. At the Department of Automated Control Systems (NSTU), the program is developed. It is capable of collecting online data of arbitrary nature and processing them. It was used to extract data from vacancies published in the public domain in the Internet, in particular, on the site "HeadHunter" [10]. In addition, the summary and grouping methods ensured that the results of online data collection and conclusions were processed.

3. Results

In the scientific literature, various approaches to grouping competencies have already been analyzed [11, 12]. Based on this and taking into account the economic digitalization and the need to implement the Sustainable Development strategy, the critical competences of employees are divided into six groups in the framework of our research: intellectual educational (reflecting the ability for continuous learning); communication (providing effective contact with people); motivational-volitional (forming resilience, the achievement of goals); management (responsible for the effective work of the team, self-organization); networking (showing ownership of information and communication technologies); environmental (ensuring the implementation of the provisions of the Sustainable Development concept).

An analysis of employers' ads on the HeadHunter website as of December 1, 2018 allowed us to identify various requirements for the competences of workers (Table 1).

Table 1. Examples of employers' description of critical employee competencies.

Competence groups	Competency description by employers
Intellectual educational	Grammatically correct speech; Retraining, professional development, attending seminars and other events; Willingness to learn; Analytical abilities, systematic thinking; The ability to systematically solve tasks, using both ready-made solutions and non-standard approaches, etc.
Communicative competencies	Communication and presentation skills; Friendly attitude to "difficult customers"; Communication in a foreign language, etc.
Motivational-volitional competencies	Desire to grow; Initiative; Stress resistance; The ability to quickly switch between tasks; Orientation to the result; Discipline and perseverance in achieving results, etc.
Management skills	Ability to motivate a team; Teamwork skills; Ability to work in a team of specialists to achieve the necessary objectives; Experience of project management, etc.
Networking	Knowledge of the specialized management software (DP, DC); Knowledge of PC hardware and fault diagnosis methods, 1C software products Administration (AD, DNS, DHCP). Internet Marketing tools; Conducting contextual advertising campaigns (Yandex.Direct and Google Adwords); Development of information systems and databases; Information security; PC user, etc.
Ecological competencies	Knowledge of modern requirements for the disposal of biological waste and compliance with environmental parameters; Compliance with the rules of labor and production discipline, safety and labor protection, fire safety, industrial hygiene and biosafety, etc.

The demand for critical competences in employees by the employers has its own specifics. For comparison, five areas of economic activity are chosen: agriculture, IT, health care and pharmaceuticals, mining industries, finances (Table 2).

Table 2. The presence of requirements for the critical competencies of workers in employers' vacancies on the website "HeadHunter."

Directions of economic activity	Total ads, pcs.	The share of ads containing the requirements for the presence of competencies, %
Agriculture	4,333	68.18
IT sector	44,358	93.60
Healthcare, pharmaceutical industry	19,682	85.71
Mining industries	4,321	51.61
Financial sector	33,648	88.89

The total number of analyzed ads is 106,342 pcs. On December 1, 2018, there were 4333 vacancies for the agricultural sector on the HeadHunter website. 68.18% (or 2,954 pieces) of them contained requirements for critical competencies. In the IT sector, 44,358 vacancies existed, 93.60% (or 41,519 pieces) of the proposals analyzed contain requirements; 19,682 vacancies were offered in the field of health and pharmaceuticals, and 85.71% (16,870 items) of them contained these requirements; in the mining industries, 4,321 vacancies were available, only 51.61% (2,230 pieces) of which had job requirements; in the financial sector there were 33,648 vacancies, and 88.89% (299,108 items) of which were with requirements.

Analyzing the needs for critical competences in a regional context clearly demonstrates that their difference is determined by the following factors: population density; share of rural areas / cities; the predominance of large regional industries (for example, mining, fishing, etc.); availability of research centers, business incubators. An analysis of the requirements for the level of education has shown that its lowest level is in the extractive industry (of those reviewed). In the sectoral context, we can talk about the predominance of a shortage of specialists with higher education in rural areas.

4. Discussion

Thus, the employers analyzed not only want to have workers with education and experience, but also those with critical competencies. At the same time, depending on the direction of economic activity, certain critical competences become in demand; therefore, human capital is formed by professional and critical competences. At the same time, it should be noted that for a number of specialties in modern conditions, their professional competences have become critical. Moreover, when changing the technological structure, their components also change.

Intellectual and educational competencies are most in demand in the agricultural sector, health care, and pharmaceuticals. Communicative competencies are most in demand in the field of health and pharmaceuticals. Motivational and volitional competencies are most in demand in the extractive industry, as well as management in the agricultural sector, network interaction in the financial sector, the extractive industry, IT sector, and the agricultural sector. The requirements for environmental competences are very low, there are only vacancies for the agricultural sector, health care and pharmaceuticals. In our opinion, this is a clear underestimation of their importance.

5. Conclusion

In the conditions of the digital economy and the innovative economic development, the requirements for the workers' critical competences have been formed. Intellectual-educational, management, communication, motivational-volitional, and networking competencies have become the most sought-after ones. In the labor market, the transition from the balance of employment of workers to the management of the balance of their competencies has arisen. The next challenge will be to ensure the proposals of specialists with critical competencies. We believe that this is possible only with the creation of decent working conditions.

6. Acknowledgments

The study was carried out with the financial support of the Russian Foundation for Basic Research and the Government of the Novosibirsk Region as part of a research project No. 19-410-540003 "Rural labor market in the Novosibirsk region: current state and problems of development."

References

[1] Volkova A A, and Zorin K A 2018 On the need to study the competencies of the head of the media *Vestnik of the Katanov Khakass State University* **23** pp 96-98
[2] Kasyutin V L 2009 Social technologies as a method of management optimization in modern regional print media of the Russian Federation *Nauchnyye Vedomosti of the Belgorod State University Philosophy. Sociology. Low Series* **7(2(57))** pp 97-106
[3] Ilidjev A A 2015 Professional competences of the VO GES VPO in the field of "Law": conceptual and terminological analysis *Applied Legal Psychology* **2** pp 209-214
[4] Pantseva E Yu, and Toisheva O A 2015 Professional mathematical competences as a category of higher school *Humanities, Socio-Economic and Social Sciences* **3-2** pp 74-77
[5] Sokolov A V 2007 Forsyth: a look into the future *Forsyth* **1(1)** pp 64-75
[6] Louvet J P 2000 *Les principaux résultats de l'étude "Technologies clés 2005"* (Ministère de l'Économie, des Finances et de l'Industrie)
[7] Larose D T, and Larose C D 2014 *Discovering knowledge in data: an introduction to data mining* (New York, NY: John Wiley & Sons)
[8] Van Der Aalst W 2011 *Process mining: discovery, conformance and enhancement of business processes* (Springer)
[9] Aletdinova A A, and Bakaev M. A 2017 Human capital in the information society and the wage difference factors *Proceedings of the International Conference IMS-2017* (Denmark: ACM Press) pp 98-101
[10] HeadHunter Online Labor Exchange website Available at: https://hh.ru (Accessed 01 12 2017)
[11] Henry J 2007 *Creative management* (Honolulu, HI: Atlantic International University)
[12] Butenko V, Polunin K, Kotov I , Sycheva E (Eds) *Russia 2025: from cadres to talents* 2017 Available at: http:// image-src.bcg.com/Images/Skills_Outline_web_tcm27-175469.pdf (Accessed 05 02 2018)
[13] Bogoviz A, Sandu I, Ryzhenkova N 2018 Scientific basis of innovative development of the agro-industrial complex: The mechanism of public-private partnership in venture capital investment *MATEC Web of Conferences* **212** 07006