

Competencies of Personnel in Economy 4.0: Challenges and Solutions

Nina Chala ^{a,*}, Oksana Poplavska ^b, Nataliya Danylevych ^b, Mariya Maksma ^b

^a Department of Marketing and Business Administration, National University of Kyiv-Mohyla Academy, Kyiv, Ukraine,

^b Department of Human Resources Management and Labor Economics, Kyiv National Economic University named after V. Hetman, Kyiv, Ukraine,
Received 25 May 2020; Revised 16 June 2020; Accepted 17 June 2020

Abstract

The article is dedicated to the analysis of the transformation of the worker's competencies model in the Economy 4.0 conditions, to the identification of the causes for the increase of the labor redundancy and mismatch on the labor market. The authors identified key competencies that are important for Ukrainian businesses and made a forecast of required competencies for 2030. The analysis of the compliance of training programs of educational institutions with market requirements has practical value. The authors also proposed the roadmap for coordination of the program of the human resource manager competencies development. An important result came out to be the developed matrix of the necessary level of development of staff competencies for various divisions of the company depending on the decision-making center.

Keywords: employee competency model, education, labor market, the matrix of key competencies and required level of their development

1. Introduction

Digitalization and scientific innovations are rapidly changing the structure of the economy, which many today call "economy 4.0." The labor market is changing under the influence of digitalization (Greve B., 2019). Automated production is ever more emerging, some activities are gradually disappearing and others are developing. As a consequence, there is a change in the content and nature of labor. The OECD notes that 14% of jobs are likely to be automated, and 32% are experiencing significant changes in the quantity and quality of functional responsibilities (OECD, 2019). In this regard, employers are changing the requirements for employees' knowledge and skills. Scientific studies of the impact of digitalization on the labor market show that there is an increasing demand for sustainable motivation for lifelong learning and the ability to solve problems comprehensively. Scientists also note the high risks of increasing the imbalance of supply and demand for labor in the labor market (Chala N., Poplavska O., 2017; Ford M., 2015). And, it is caused mostly by the mismatch of competencies acquired by future employees in educational institutions with the needs of employers regarding certain knowledge, skills and the like. Unfortunately, OECD studies have found that 15% of adults do not have basic digital skills and 13% do not have elementary numeracy skills; on average, 6.6% of young graduates in the OECD have low literacy and mathematical skills (OECD, 2019). Therefore, if no steps are taken, more and more workers will not have the necessary competencies in the future, and sustainable development will be impossible. Therefore, the solution to the problem described above is

equally relevant for all - the state, businesses, and workers alike.

The purpose of this article is to create an employee competency model based on the trends of "economy 4.0" development on the example of Ukraine and to create the matrix of competencies for the necessary level of workers' development for different divisions of the company. The methodological basis of the study is the methods of statistical analysis of changes in the structure and quality of supply and demand in the labor market, sociological research and expert assessments of competencies that will be required in the future. The sociological research and expert assessments are based on the survey of the heads of companies and their divisions, managers of the personnel of the leading companies of Ukraine (the participants are representatives of organizations of different scopes of economic activity: science - 8%, education - 15%, trade - 31%, IT-sphere - 10%, production and infrastructure - 26%, culture - 4%, and public sector - 6%).

Over the last decade, scientists' attention to the issues of employee competence formation in the context of Industry 4.0 does not diminish, however at the same time there is no unified vision of the employee competencies model in Economy 4.0, its regional and branch peculiarities are not specified. For example, (Prifti L., Knigge M., Kienegger H., and Krcma H. Prifti, L.; Knigge, M.; Kienegger, H.; Krcmar, H., 2017) offer a flexible model of employee competencies, with the following key competencies: Systems, Computer Science, Engineering and

*Corresponding author Email address: n.chala@ukma.edu.ua;

Economics. This model narrows the possibility of using this approach for some companies, for example, in healthcare and culture. A wider selection of competencies are offered by Grzybowska K., Łupicka A. (Grzybowska K., Łupicka A., 2017), which correlate with the estimates presented in "The future of jobs report" by the World Economic Forum (WEF Report, 2018), but are focused only on top management. Fitsilis P., Tsoutsas P., Gerogiannis V. (Fitsilis P., Tsoutsas P., Gerogiannis V., 2018) present a model with basic competencies - technological, transversal and contextual - that need to be evaluated in certain areas (proficiency, technology, Industry Sector, Product Lifecycles, Job Profile, and Transversal Skills).

This approach allows to take into account dynamic changes in the market and to adequately assess the need for competencies, but it is not sufficient for the prospective planning of employee training to acquire certain competencies.

2. Methodology

To develop a road map, it is primarily vital to realize the difference between robotics applications, artificial intelligence, and human performance. A distinctive feature of humanity was and remains curiosity (cognitive activity) and creativeness, i.e. the invention of something new (in science or art). Based on this, training should comply with philosophical laws of switching from quantity to quality (accumulation of knowledge through perception leads to improved quality of life) and the unity and struggle of opposites (a result of training is the selection of the most capable individuals in a particular activity without discriminating and violating the structure of personality, its harmony).

When creating a road map, the peculiarities of socio-labor relations and the socio-cultural traditions of the country should also be taken into account. We believe this approach to be justified, as the lack of a global open labor market imposes restrictions on personnel selection, recruitment procedures, and labor mobility. Moreover, the state is entitled to choose the most appropriate system for reproducing the labor force and developing the economy.

From the authors' perspective, the roadmap should contain several points for the successful implementation of Economy 4.0 and the knowledge economy:

1) Developing new flexible integrated learning systems. Such systems include training programs (courses), which consist of modules. It is important that modules can be extended or modified without compromising the quality of training and they all contain a basic level (essential for every field of the occupation) and professional (it is divided into sub-levels: sufficient, detailed, extended);

2) Planning and updating training programs continuously, where the state and businesses collectively determine the list of necessary knowledge and skills;

3) Constant monitoring of the labor market and socio-economic development of the countries - world leaders in order to anticipate the future demand for labor;

4) Active participation of research centers in the planning of training programs at the professional level; educating (training) potential students;

5) Conducting research on the abilities of children (high school pupils, university students, interns) to develop recommendations for the selection/change of the profession.

Thus, the process of compiling educational programs should be ongoing; the demands of the current and prospective market (medium and long term) should be taken into account.

Let us review a roadmap of interaction between the educational center, state, and business during training experts of the economic profile (for instance, HR-managers). Furthermore, we recommend creating an electronic platform and a database for the operational work of partners. Also, to enhance the status of employers who actively participate in the preparation of educational programs and cooperate with universities, we recommend to rate businesses and establish the title 'Best employer of the year. Looking forward through the prism of education'. (Table 1).

The road maps of the interaction of educational institutions with businesses and the state in training technical specialists will be a mandatory component of practical training and internships in the business field.

Thus, the successful implementation of the road map essentially depends on coordinating the communication between universities (Institute of education and science), business and government. Consequently, it is important not only to regulate this issue but to increase the social responsibility of businesses and educational institutions.

It bears noting that while determining the content of the qualification and training standards, it is vital to focus on the future demand for competencies. Based on the needs of the labor market, a list of skills required for a successful employee in Economy 4.0 will be formed. Many professional skills indicated in the report of the World Economic Forum "The Future of Jobs" will be of great demand: Cognitive Abilities, Content Skills, Prose Skills, Social Skills, Complex Problem-Solving Skills, System Skills, Resource Management Skills, Technical Skills (WEF Report, 2016). Some authors compile the top list of skills and abilities, such as judgment and decision making, fluency of ideas, active learning and social perception (Vander A. T., 2017). However, the authors believe that extreme responsibility, the similarity of values (between company and candidate), motivation for development (continuous training) should be the crucial skills of a successful employee in the future. It is these components that will determine how much a particular candidate is perfect for the job, providing equal professional evaluations. The authors present the general vision of personal skills (they can also be called flexible) crucial for Economy 4.0 in Table 2. Professional skills are also important. There are a lot more variations; however, everybody should possess technical skills and knowledge (ability to work with different software products, gadgets, computers, office equipment, and principles of algorithmization).

Table 1
Roadmap for training HR managers

Stage	State	University	Business
Stage 1. Labor market analysis (determining trends over the past 5 years, identifying trends)	<ul style="list-style-type: none"> - coordinates the interaction by means of creating and supporting electronic platforms, databases (constantly); - updates negotiation processes between business (employers organizations) and field-oriented educational institutions (annually); - evaluates the quality of education (once in 5 years) 	<ul style="list-style-type: none"> - analyzes the future trends and current business requirements to the competencies of the employee; determines the degree of compliance of program tasks with business requirements (annually); - provides concerned parties with information about the program plans for training students (forms a database of training software products and their results) (annually) 	<ul style="list-style-type: none"> - recruitment agencies release public statistics on professional demand (annually); - employers organizations, large companies cooperate with the field-specific universities to determine the qualification profile of the employee (constantly); - adds relevant information into the database of requirements towards the employee's competency (constantly)
Stage 2. Elaboration/improvement of training programs	<ul style="list-style-type: none"> - updates the legal documents to determine the qualification of the employee (Classifier of professions); - approves the educational standard of the profession (once in 5 years); - determines the correlation of the occupation to particular professions (once every 5 years) 	<ul style="list-style-type: none"> - provides for discussion of the expert anticipation on the development of the labor market (annually); - brings curricula, training programs into compliance with business requirements and considers the anticipation of progress on the labor market (annually) 	<ul style="list-style-type: none"> - supervises (coordinates) curricula, training programs in field-oriented universities (annually); - coordinates educational standards, the classifier of professions and the correlation of the occupation to particular professions (once in 5 years)
Stage 3. Implementation/promotion of agreements	<ul style="list-style-type: none"> - monitors the implementation of educational standards by the corresponding institutions (once every 5 years) - determines and awards the best employer – the partner of the university (annually) 	<ul style="list-style-type: none"> - conducts the learning process (constantly) 	<ul style="list-style-type: none"> - participates in forums, discussions on expert training with field-specific universities (constantly)
Stage 4. Monitoring, updating rules and principles of interaction	<ul style="list-style-type: none"> - evaluating the relevance of the regulatory framework from the perspective of effective interaction between the parties (every 5 years); - updating the regulatory framework (in the context of reasonable proposals from the parties-partners) (annually) 	<ul style="list-style-type: none"> - monitoring the quality of education (constantly) 	<ul style="list-style-type: none"> - monitoring of compliance of acquired personnel competencies (university graduates) with business requirements (constantly); - identifying inconsistencies in the competence of the employee (university graduates) with the requirements of the company; informing the partners (constantly)

Table 2
Matrix of the most important human abilities in terms of Economy 4.0 by levels of decision-making and their role in the production system (for various levels/decision-making centers of a company)

Levels	Reference code	Most crucial abilities (flexible)								
		Sociability	Abstract thinking	Ability to summarize, make conclusions	Strategic thinking (ability to see perspective, results, consequences)	Mathematical abilities	Efficiency of decision-making	Discretion	Responsibility	High motivation for professional growth
Management level (top management)	D 1	high	+	+	+	+	high	full	full	+
Middle management committee	D2	high		+		+	medium	partial	partial	+

Executives (analytics)	C1	medium		+	+	+	high	full	full	+
Executives (technical tasks)	C2	low	+	+	+	+	high	partial	full	+
Executives (office tasks)	C3	high		+			medium	limited	partial	+
Operators (monitoring equipment, systems)	B1	low	+	+		+	high	limited by instructions	full	+
Infrastructure personnel (technical component)	A2	medium	+	+	+	+	medium	limited	partial	+
Infrastructure personnel (social component)	A1	high		+	+		medium	limited	partial	+

Unfortunately, it is quite difficult in the present climate to acquire necessary skills and abilities; the learning process is changing, the education system is inflexible, graduates and students do not receive proper career guidance. Self-education also has a number of limitations, although recently many online resources allow obtaining partial knowledge; however, it can be very problematic to improve skills online.

3. Results and Discussion

After analyzing the labor market in Ukraine, the authors identified the following features (Fig. 1 and Fig. 2). Over the last 6 years, there has been a steady increase in the need for staff, especially skilled workers. The lack of demand growth is inherent only in a group of professionals. Namely, they are graduates of higher education institutions. At the same time, the surplus in supply for one job over demand (load level per workplace) is decreasing insignificantly and is high as compared to other European countries. A feature of the labor market conditions in Ukraine is the fact that jobs that require training or special training are most required by employers. At the same time, a high level of workload for one vacancy indicates that the supply structure (i.e. the number of employees of a certain qualification) does not match the needs of employers. Also, the country's labor market is characterized by the high turnover of young people in various companies, and finding a new place of work may often imply a change of profession. The Ukrainian labor market has also a high unemployment rate among people over 50.

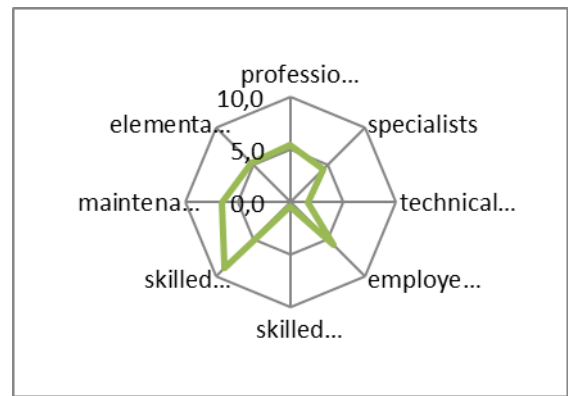


Fig. 1. The need for staff by occupational groups (average value for 2013-2018), thousands of pers. Built by the authors based on the data from the official website of the State Statistics Committee of Ukraine. URL: <http://www.ukrstat.gov.ua/>

Asking why graduates of higher education institutions often change their professional activity after graduation, the authors conducted an expert survey (Danilevich N., Poplavskaya O., Puzirevska Y., 2019) and analyzed published studies (Amber D., Domingo J., 2016; Baran M., Klos M., 2014; Campbell T.A., 2018). The results indicate that the graduates are not motivated to work at the company if their expectations regarding the work schedule, the level of remuneration and career opportunities are not met. Analyzing the reasons why it is more difficult for people over 50 to find a job in Ukraine, the authors noted the low inclusion level of the educational services market. Besides, according to employers, even with a large selection of candidates for a vacant position, there is a problem of finding an employee with certain competencies. According to the results of a sociological survey conducted by the authors, employers are not satisfied with the competencies acquired by employees in educational institutions, including Higher education institutions (Table 1). At the same time, the greatest number of complaints from

the employers concerns such competencies as critical thinking and the ability to solve problems comprehensively.



Fig. 2. Load level per one vacant workplace by occupational groups, on average for 2013-2018, pers. Built by the authors based on the data from the official website of the State Statistics Committee of Ukraine. URL: <http://www.ukrstat.gov.ua/>

To test the hypothesis of a direct dependency of the level of development/display of employee competencies required by the employer on the quality of training programs, their compliance with market requirements, the authors analyzed

the standards and training programs of various professions (*Ministry of Education and Science of Ukraine Report, 2018; Report, 2019*) in those competencies that employers identified as important and/or necessary in the authors' sociological research. The results presented in Table 3 confirm the initial authors' hypothesis and explain the peculiarities of the Ukrainian labor market.

Overcoming those discrepancies and improving the labor market is possible with the joint efforts of state bodies, businesses, and educational institutions. Since different types of work require a different set of competencies and the level of their development, the authors have developed a roadmap for training the human resource manager. This choice is determined by the fact that by their functional responsibilities, the personnel manager must be able to correctly formulate competencies and build competency models for all company officials. Also, the personnel manager can in the future become an active mediator (communicator) between businesses and educational institutions on the issues of preparation and meaningful formation of quality training programs.

Table 3

The degree of satisfaction of employers with the inherent competencies of candidates for vacant positions and staff of the organization, forecast for 2030 *

2015		2018		2030
Employer requirements and degree of satisfaction with the quality	Taking into account the requirements of the employer by educational institutions	Employer requirements and degree of satisfaction with the quality	Taking into account the requirements of the employer by educational institutions	Key competencies of employees for Ukrainian companies
1) Comprehensive problems solving (12%)	partially	1) Comprehensive problems solving (13%)	partially	Ability to predict future market changes, evaluate potential benefits and risks in the future
2) Coordination of interaction (40%)	partially	2) Critical thinking (24%)	partially	Ability to solve complex problems (dealing with dilemmas, controversies, and ambiguities)
3) Managing people (55%)	yes	3) Creativity (77%)	yes	Responsible and caring attitude towards the environment; Ability to produce innovative solutions
4) Critical thinking (38%)	yes	4) Managing people (56%)	partially	Demonstration of socially responsible behavior
5) Interaction, negotiation skills (60%)	partially	5) Coordination of interaction (60%)	partially	Creativity
6) Quality control (54%)	yes	6) Emotional intelligence (10%)	no	Customer Orientation (Creating Value for Others)
7) Service Orientation (72%)	yes	7) Making judgments and making decisions (70%)	yes	The ability to use the knowledge of fundamental sciences and specialized subjects

8) Making judgments and making decisions (44%)	yes	8) Service Orientation (75%)	yes	Coordination, interaction, ability to work in a "network" environment
9) Active listening (20%)	partially	9) Interaction, negotiation skills (52%)	partially	Cognitive flexibility
10) Creativity (80%)	partially	10) Cognitive flexibility (4%)	no	Emotional intelligence

* Built by the authors based on the results of the author's sociological research, expert survey, and materials of the official website of the Ministry of Education and Science of Ukraine. URL: <https://mon.gov.ua/ua/osvita/visha-osvita/naukovo-metodichna-rada-ministerstva-osviti-i-nauki-ukrayini/zatverdzeni-standarti-vishoyi-osviti> (competencies are ranked by importance for the employer, where the number of competencies corresponds to its rank, and the percentage number is the degree of satisfaction with the development of this competence in candidates for vacant positions and personnel of companies)

4. Conclusion

The last decade has brought many changes, and scientific research has strengthened the evidence of the importance of labor quality for the competitiveness of the company and the sustainable development of the state. At the same time, the accumulated problems in the realm of personnel competencies formation in the Economy 4.0 exacerbated, and this was especially evident in countries with underdeveloped market relations, in Ukraine in particular.

The ways of reconciling business needs in certain competencies and capabilities of educational institutions and the state suggested by authors are based on empirical research. The authors predicted the need for certain competencies of workers in the labor market of Ukraine for 2030, taking into account the foresight, where key positions are given to the ability to predict, assess risks, demonstrate socially responsible behavior. The competence matrix for enterprises of the innovation sector of the economy differs from the proposed competencies model for 2030, in that it is universal and takes into account the levels of decision-making, areas of responsibility, describes the required degree of manifestation/development of given competence/quality of the employee. At the same time, the authors consider it advisable to continue working on developing competency models based on industry characteristics and linking them to the motivational profiles of employees, which will maximize the potential of each employee.

Acknowledgments

The authors are grateful to the master's level students and the graduates of the Department of personnel management and economics of labor of Kyiv National Economic University named after V. Hetman, who helped to conduct the sociological research.

References

Amber D., Domingo J. (2016) The Discourse on the Unemployment of People over 45 Years Old in Times of Crisis. A Study of Spanish Blogs. Journal of Social Research & Policy, Vol. 7, Issue: 2, 63-78

- Baran M., Kłos M. (2014) Managing an intergenerational workforce as a factor of company competitiveness. Journal of International Studies, Vol. 7, No 1, 94-101.
- Campbell T.A (2018). A phenomenological study of business graduates' employment experiences in the changing economy. Journal for Labour Market Research. 52:4.
- Chala N., Poplavska O. (2017) The 4th industrial revolution and innovative labor: trends, challenges, forecast. Man - Society - Economy. Intellectualisation and Humanisation of Work. Zielena Gora. 4, 141 – 155
- Danilevich N., Poplavska O., Puzirevska Y. (2019). Motivation of young professionals: features, recommendations. Economic space. 142, 53-64
- E2030 Conceptual framework key competencies for 2030 (DeSeCo 2.0) OECD Directorate for education and skills education policy committee. 9-10 November. 2016. Beijing, China.
- Fitsilis P., Tsoutsas P., Gerogiannis V. (2018). Industry 4.0: Required personnel competences. INTERNATIONAL SCIENTIFIC JOURNAL "INDUSTRY 4.0. 3, 130-133.
- Ford M. (2015) Rise of the robots. Technology and the Threat of a Jobless. Kyiv: Nash Format. 400c.
- Gray A. (2016) The 10 skills you need to thrive in the Fourth Industrial Revolution. World Economic Forum.
- Greve B. (2019) The digital economy and the future of European welfare states. International Social Security Review. Vol.72, Issue3. Special Issue: Social security and the digital economy. 79-94.
- Grzybowska K., Łupicka A. (2017). Key competencies for Industry 4.0. Economics & Management Innovations (ICEMI). Vol.1(1), 250-253.
- Higher education standards. Official site of the Ministry of Education and Science of Ukraine.
- Launch of the 2019 Skills Outlook: Thriving in a Digital World. Remarks by Angel Gurría. OECD Secretary-General. 9 May 2019 - Paris, France.
- Prifti, L.; Knigge, M.; Kienegger, H.; Krcmar, H. (2017): A Competency Model for "Industrie 4.0" Employees, in Leimeister, J.M.; Brenner, W.

- (Hrsg.): Proceedings der 13. Internationalen Tagung Wirtschaftsinformatik 46-60.
- The Future of Jobs 2018. Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution. Global Challenge Insight Report. World Economic Forum.
- The Global Competitiveness Report 2018. World Economic Forum.
- Vander Ark Tom (2017). The Future of Skills: Employment in 2030.
- Vocational education standards. 2019. Official site of the Ministry of Education and Science of Ukraine.
- World Economic Forum (2016). The Future of Jobs. Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution.

Chala, N., Poplavska, O., Danylevych, N. & Maksma, M. (2021). Competencies of Personnel in Economy 4.0: Challenges and Solutions.
Journal of Optimization in Industrial Engineering, Special issue 2021, 53-59.

http://www.qjie.ir/article_677818.html
DOI: 10.22094/joie.2020.677818

