

Competency based model for logistics and supply chain management

S. Leonova

Lviv Polytechnic National University, Lviv Polytechnic National University,

Email: sofia.v.leonova@lpnu.ua

O. Dovhun

Lviv Polytechnic National University, Utrecht University of Applied Sciences

Email: oksana.s.dovhun@lpnu.ua

N. Hayvanovych

Lviv Polytechnic National University, Utrecht University of Applied Sciences

Email: nataliia.v.haivanovych@lpnu.ua

I. Petryk

Lviv Polytechnic National University, Utrecht University of Applied Sciences

Email: ilonapetryk19@gmail.com

Abstract

The key logistic competencies that are a prerequisite for the formation of a common logistic space and integration into global supply chains have been identified and systematized. The interrelation of professional training with the growth of competencies of supply chain managers is studied, the analysis of requests for such specialists in the labor market is carried out. The structure of the logistic efficiency index was studied, and a comparative analysis of the positions of Ukraine, Poland and Germany was conducted. The results of the analysis reflect the positive dynamics of LPI in Ukraine, but at the same time a significant lag behind the leaders in the European market. A correlation-regression analysis of the dependence of the level of GDP of Ukraine on the efficiency of logistics, labor force and export volumes was carried out. The constructed multifactor model proves the existence of a close relationship, so it is advisable to use it to assess and forecast the impact of these indicators on GDP. Given the identified trends in both Ukraine and Europe in general, a high overall level of logistics efficiency and each of the components of LPI in particular can be achieved by forming an effective set of infrastructure. The most important part of the complex will be to ensure a high level of competence of logistics services through appropriate training of highly qualified workforce for the needs of logistics. A survey of senior students of Ukrainian, Polish and German universities on the prospects for the development of logistics. The results of the study actualize the leading role of competencies to increase the reliability and sustainability of supply chains, effective use of innovative technologies, logistics integration, preparation and adoption of optimal logistics management decisions. The results of the survey provide recommendations using a differentiated approach depending on the level of development of each country. In order to take a systematic approach to the implementation of the above measures, a structural and logical scheme for the implementation of a competency-based management model in an unstable market environment has been developed.

Index Terms— supply chain, logistics competencies, competency model, logistics efficiency, LPI.

Introduction

The market success of each organization depends upon the efficiency of connections

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between different enterprises involved in the formation of value for the end user. The obligations of the Logistics Manager include the management of the flow of information and materials within the enterprise, management of the supply chains and network.

Under the conditions of an unstable market environment, the study of the key competencies of SC-Managers and the formation of the optimal competence models is a dominant element in the formation of the enterprise added value. The task of the Logistics Managers is to manage the connections between the logistic operations, members, and resources involved in the processes associated with the materials and information flow from the resource to the final consumption stage. This correlation should be identified and considered at the strategic, tactical, and operational levels. The logistic supply chains are formed based on the supply of logistic products conforming to the consumers' expectations towards the goods and services of the necessary quality and form that should be elaborated considering the customers' demands based on the application of the logistic principles [8]. The accessibility of the Internet, wide mobile network, and low price of air transportation facilitate the shortening of the distance between the regions, countries, and continents. It means that from the logistic companies the customers expect a reduction in delivery time, growth in accessibility, and reliability. The logistic companies that secured the market privileges try to enhance the logistic processes performance and increase the client orientation. Under the unsteady conditions of the market environment, the Logistics Managers should demonstrate a prompt response to the new possibilities and risks through rational and useful decisions for the enterprise, constantly adjusting their own competencies to the market demands.

Analysis of the last research.

Studying different sides of the issue of assessment and enhancing logistic performance is widely discussed in the works of both Ukrainian and foreign scholars. Among them: A. M. Hadzhynskyi, A. H. Kalchenko, Ye. V. Krykavskyi, L. B. Myrotina, M. A. Oklander, Brian S. Fugate, John T. Mentzer, Theodore P. Stank, Terry L. Esper, Mark Lofgren, Mark Berwick, Funda Sahin, etc. Despite the substantial scientific heritage, the issue of the formation and implementation of the competence models of management for logistic performance enhancement remains understudied.

Analyzing the literature on the subject, let us generalize the factors of the market environment influencing the transformation of knowledge and competencies of SC- managers and single out the specific knowledge and competence having a substantial impact on the development of logistic processes. These include, in particular, the following:

1) Impact of the Logistics Managers' competencies on the success in SCM. Analysis of multiple studies focuses on three important elements of success in SCM: people, processes, and technologies [2]. When formulating the strategy, the consumers' needs are one of the key factors of the companies development. The Companies should build up efficient relations with all stakeholders of the supply chain, minimizing the costs throughout the whole supply chain and efficiently manage the work of teams at different levels (Kayakutlu and Buyukozkan, 2010; Zhao et al., 2011; Barnesl and Liao, 2012), and the ability to plan and involve the necessary number of qualified managers helps to efficiently operate globally (Harvey and Richey, 2001) [1].

Murphy and Poist (1994) assume that the Top Logistics Managers should possess management competencies, competencies in the sphere of logistics, and business

competencies. Hammerlard and Larson (2001) elaborated a three-way competence model which includes the skills of interpersonal communication/management, technological competencies, and competencies of supply chain management. Wu's work (2006) presents 7 groups of 57 skills, mainly: 1) digital skills; 2) international trading/procurement; 3) labor/customs/tax laws; 4) control of finance/expenses; 5) quantitative analysis; 6) planning/assessment; 7) skills of work with the logistic center. Wu states that the logistics specialists should possess the logistic competencies to provide for the efficient functioning of SCM [7].

In [1] the authors concentrate on two major competencies; Technical knowledge and management competencies. The results show that the listed competencies, roles, and obligations of the supply chain management complement each other providing for a higher level of supply chain integration. Based on the results, technical knowledge, and the ability to apply them are the important factors of the inner integration and integration with the clients, while management skills are decisive in the facilitation of integration with the suppliers [1].

2) Impact and interrelation of the appropriate training on the improvement of the growth of the supply chains managers' competencies, analysis of the demand for such specialists.

Onar et al. (2013) considered the post-graduate programs at 15 European universities and singled out 31 competencies necessary for the SC-managers. The first-line SC managers should possess different skills with a focus on the hard skills and less on the soft skills. The working environment demands a high level of soft skills from the top managers to manage the inter-functional operations for internal and external cooperation [5, 7].

Some articles [5, 7] showed substantial differences between the competencies and a gap between the industry-specific demands concerning the positions connected with the logistics and content of programs to obtain the educational level. Thai (2012) enumerates 68 types of competencies and compares them to the managers' view of the current and future demands to the work, besides, the competencies are subdivided according to the work experience and hierarchy level [5,7].

Noteworthy that in the educational demands before 2020 of the European Union Growth Strategy, 4 common objectives are determined for the settlement of problem in the systems of education and studying. The Strategy provides for the implementation of lifetime education and mobility, improvement of the quality of education, facilitating fairness, stresses the social unity, social activism, facilitation of creativity and innovations, including the Entrepreneurship at all educational levels (European Commission, 2010) [2].

The authors in [5] singled out over 280 competencies describing the necessary scope of skills of the Logistics Managers. They found the domination of initiative and entrepreneurial competencies. After the analysis of the job advertisements extraction, the authors [5] outlined the feeling of initiative and entrepreneurial spirit as the major skills. Empiric results [5] confirm the importance of the functional and social competencies for the performance of logistic tasks, and the importance of cognitive competencies, although to a lesser extent. From the point of view of the new competencies formation, the development at the workplace is an important issue in the logistic industry. Concerning university education and training, the results show that the students of higher educational institutions should get profound skills and competencies and be open to constant training at work [5].

According to multiple studies, taking into account that the academic institutes should

implement and develop educational programs to form the necessary knowledge, and competencies in the sphere of the supply chains, and facilitate their development, it is important to find the possibilities for partnership between the academic institutions, industry associations, and corporate sector in the elaboration of the educational curricula and formation of post-graduate programs for training the managers and specialists [1,2,5,7].

Objectives of the research

The main objectives of research are as follows:

- to study key logistic competencies preconditioning the formation of the common logistic environment - integration into the global supply chains;
- to substantiate the impact of the logistic performance on the GDP level of Ukraine;
- to formulate the key stages of implementation of the competence models in managing the supply chains.

The main results of the research.

The concept of chains management is the most progressive in establishing the relations between the company, its partners, and the formation of value for the whole market. This is due to the cooperation that the logistic processes performance can be enhanced. The environmental aspects should be taken into consideration since the environment is a part of the Triple Bottom Line conception, also known as 3P (from En. People, Profit, Planet) [15]. Ignoring these aspects harms the reputation of the supply chain stakeholders, which means that the next task of the Logistics Manager is managing the logistic processes according to the concept of sustainable development. Taking into account the set tasks and a set of the other important development factors determined separately for each company, it is reasonable to create a system of competencies requiring the specific resources, appropriate environment, and skills of the workers. Formation of the management competencies framework should always start from the identification of objectives, analysis of the problems, and searching for the ways and methods of their settlement. SC-manager should be able to assess the logistic processes extensively, in particular, towards the issues of the material and immaterial resources formation. Noteworthy that not only the company workers are involved in most of the logistic processes but also the numerous business partners. Therefore, the major task of the Logistics Manager is to coordinate the mutual interests of different stakeholders based on the systemic approach. Besides, the important factor is also the formation of the optimal strategy of cooperation with the top manager, HR, Finance Division, IT, and Marketing Department. The literature frequently stresses the necessity of the improvement of the skills of the informal behavior models. The development of the logistic organization closely associated with the changes and ability of prompt response essentially depends upon the extraordinary skills of managers and their appropriate behavior in the organization. The competencies of the modern managers will influence the quality of work, interpersonal relations, and the level of cooperation with the trade partners which, in its turn, is transformed into the efficiency of the separate elements and, from the holistic point of view, the efficiency of the whole supply chain.

At the international level, the integral assessment of the logistic performance in separate countries is assessed based on complex indicators, of which the LP index of the World Bank [14] is the most widespread and popular. The LPI assessment methods are based on the results of polling the global logistic operators (forwarding agents and express transporters).

Analyzing the dynamics of Ukraine's LPI, the positive tendency should be outlined. In *Res Militaris*, vol.12, n°3, November issue 2022

2010 Ukraine occupies the 102nd position in rating and in 2018 it occupied the 66th position (LPI = 2.83). The timeliness of cargo delivery (3,424) was evaluated as the highest among the LPI indexes of Ukraine in 2018 and the quality of infrastructure as the lowest (2.22). The index in 2020 has not been determined so far. Comparing these indexes to the position of Germany occupying the leading position in rating (LPI=4.20) and Poland, which is the major logistic competitor of Ukraine in the European sector (LPI=3.58), the LPI index of Ukraine was 1.48 and 1.25 times lower correspondingly (fig. 1).

Considering the level of quality and competence of logistics in the LPI 2018 rating, Ukraine occupies the 61st position with 2.84 points (fig. 1). The index of quality and competence of Ukrainian logistics as compared to the same indexes of Germany and Poland in 2018 was 1.52 and 1.26 times lower correspondingly, which almost identically reflects the correlation of the integral LPI indexes [14]. The quality and competence of logistics reflecting the level of qualification of the logistic personnel in the country is one of the key objects of the LPI index assessment.

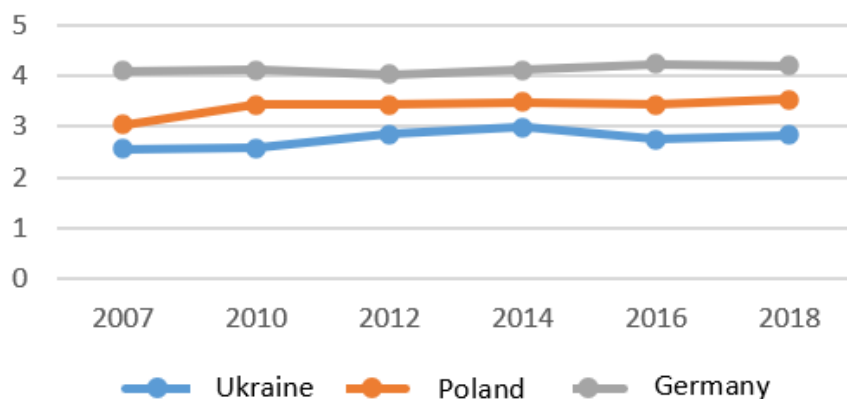


Fig. 1. Dynamics of changes in the LPI logistics efficiency index for the period 2007-2018

Source: generalized base on [14].

According to the experts, the most important element is the “Quality and competence of logistics” (0,4166 in 2018).

Considering the above, it is important to assess the power and direction of influence of the indexes of quality and competence of the logistics included in the index of the logistic efficiency at the level of the country’s GDP. For this purpose, let us build a multivariate regression model taking into account the Logistic Performance Index, the total labor force (mln. Pers.), and the index of trading volume - export in Ukraine (table 1) as the factorial features.

To study the impact of the logistic performance on the GDP of Ukraine, total labor force, and export volume, the economic and mathematical modeling of the dependence of the GDP of Ukraine upon the system of separate factors, such as x1 (Logistic Performance Index (LPI)), x2 (size of the labor force, mln. pers.), x3 (index of the volume of trading - export) was carried out. Checking these factors for multicollinearity, according to the Pearson criterion, shows the absence of multicollinearity between three variables, which testifies to their independence.

We used the Excel function LINEST MS to make up the multivariate model, we get the following model:

$$Y = -245,045 + 32,04 X_1 + 8,33 X_2 + 0,79 X_3 \quad (1)$$

The determination coefficient R^2 is 0,75, which testifies to the close connection between the factorial and resultant features. Fisher's criterion confirms the model's adequacy to the statistic data of general totality.

Generally, the correlation and regression analysis proves the close connection between the GDP of Ukraine, logistic performance, size of the labor force, and volume of export. The received multivariate model can be reasonably used for the assessment and prediction of the impact of these values on GDP.

Table 1. *Input data for building a multivariate regression model*

	Y (GDP, billion dollars)	X₁ (LPI)	X₂ (labor force, mln.p.)	X₃ (trade volume index - export)
2007	142,58	2,55	21,9	187,68
2008	179,82	2,55	21,8	179,82
2009	117,11	2,55	21,74	117,11
2010	136,01	2,57	21,66	172,76
2011	163,16	2,57	21,62	163,16
2012	175,78	2,85	21,39	186,65
2013	183,31	2,85	21,5	183,31
2014	133,5	2,98	20,89	147,16
2015	91,031	2,98	20,88	91,031
2016	93,35	2,74	20,68	130,64
2017	112,19	2,74	20,55	112,19
2018	130,8	2,83	20,27	131,29

Source: generalized using data of the World Bank.

Considering the identified tendencies both in Ukraine and in Europe in general, the high level of logistic performance and performance of each LPI component, in particular, can be achieved through creating an efficient complex of infrastructural support, of which the guarantee of the high level of competence of the logistic services through the appropriate training of well-qualified labor force for the logistic needs will be the high-priority element.

To assess the level of the educational services market adaptation in terms of the timely provision of knowledge, and skills for the students in the sphere of logistics (development of necessary competence) constituting the tool of the competitive growth of the graduates in the labor market, the national and foreign scholars study the students' priorities when choosing the future workplace.

The perspectives of the future logistic education in Poland and Ukraine are described in [9] showing the results of the comparative analysis of the students' awareness of the logistic profession in Polish and Ukrainian higher educational institutions (the results are approximately the same and show the mean level of awareness), the results of the student's perception of the future profession specificity and availability of the necessary knowledge and skills show the substantial difference.

Noteworthy are the motives of choosing the future profession declared by the students: for the representatives of Polish higher educational institutions the level of salary and type of professional activity were in the first place, while for Ukrainian students - the level of salary and possibility of realization of the professional knowledge and skills. The problems connected with future employment can be noticed mostly in responses of the Polish students, most of

whom are not sure they will find work in the specialty in Poland [9].

The study [11] dealt with the assessment of the efficiency and adequacy of education provided to the students, identification of the necessary knowledge and skills to get the desired work, and possibility of the Polish university graduates to work abroad. This questioning shows that migration of the qualified youth abroad connected with a higher salary is a substantial problem for the Polish labor market. Besides, the selection of specialties considering the desired income in the future can be noticed.

Thus, Polish universities faced a challenge to reduce the tendencies of the graduates' migration from the country through the unification of two "worlds" - the world of the graduates and the world of employers. Similar problematic aspects regarding finding a job by profession and the outflow of graduates abroad are also inherent in the Ukrainian market.

These problems are settled through the implementation of the newest education methods, extension of offers concerning internship and work placement, implementation of flexible forms of studying, and extension of the interdisciplinary lectures, courses, and seminars.

The answers on the questioning by the authors of publication, assessed the view of the logistic development perspectives by the graduate students of Ukrainian and Polish universities. Answers on 2 questions showed on *fig. 2-5*.

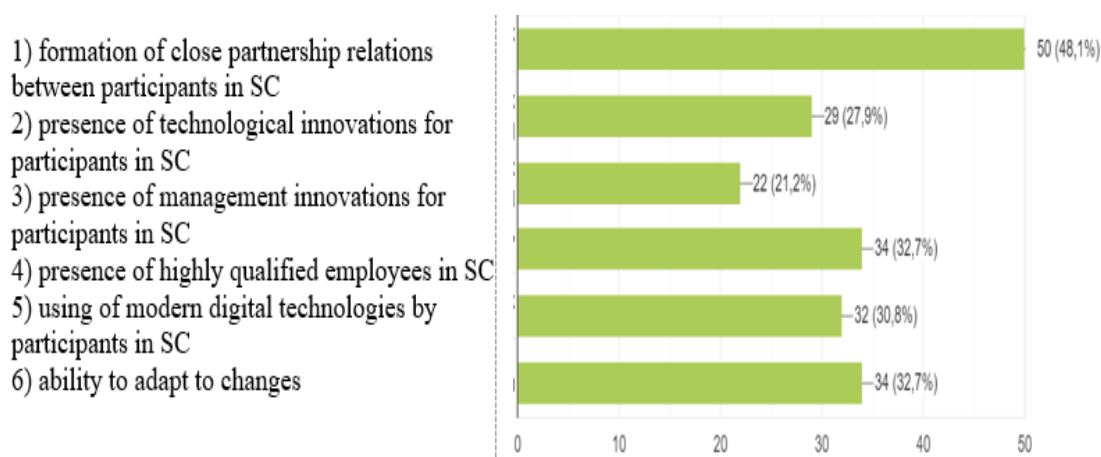


Fig. 2. Opinions of Ukrainian respondents regarding the identification of key factors for the successful functioning of supply chains.

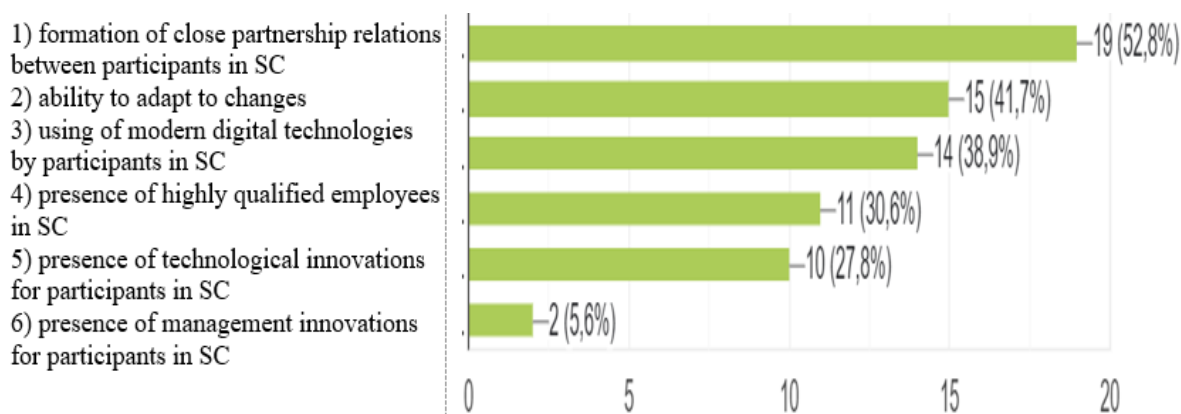


Fig. 3. Opinions of Polish respondents regarding the identification of key factors for the successful functioning of supply chains.

- 1) the state of the country's transport infrastructure
- 2) lack of logistics specialists
- 3) unfavorable investment climate
- 4) an insufficiently developed educational environment
- 5) lack of political will to make important legislative decisions
- 6) environmental movements
- 7) monopolization of certain segments of the transport market

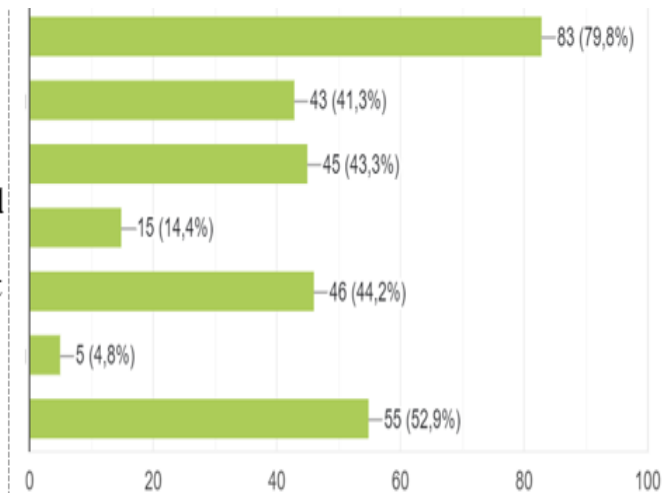


Fig. 4. *Opinions of Ukrainian respondents regarding the identification of the main factors that inhibit the development of logistics in Ukraine.*

- 1) the state of the country's transport infrastructure
- 2) lack of political will to make important legislative decisions
- 3) monopolization of certain segments of the transport market
- 4) unfavorable investment climate
- 5) lack of logistics specialists
- 6) an insufficiently developed educational environment
- 7) environmental movements

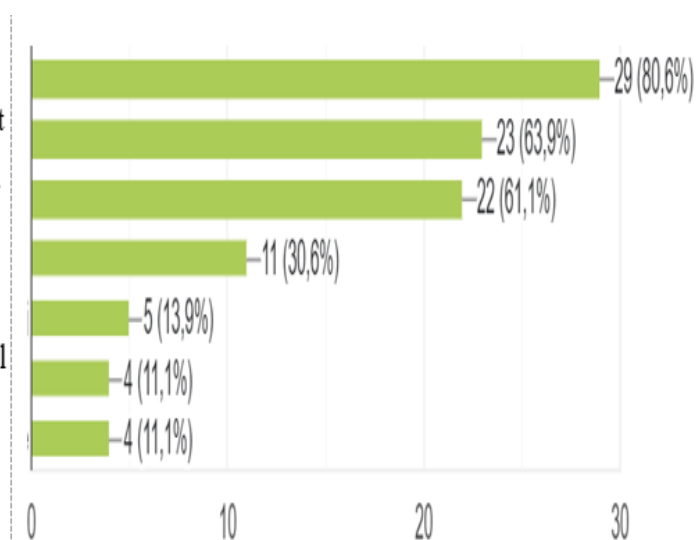


Fig. 5. *Opinions of Polish respondents regarding the identification of the main factors that inhibit the development of logistics in Poland.*

The questioning carried out in addition to the other studies shows the importance to maintain close partnership relations between the supply chain stakeholders, the necessity of implementing managerial innovations, methods of fast adaptation to changes, the necessity to apply the new digital technologies, and the environment protection practices. The main inhibiting factors include the weakness of the transport infrastructure, monopolization of the separate market segments, deficiency of political will for important decisions, unfavorable investment climate, and shortage of logistic specialists.

The analysis of the studies and mentioned data show that mastering the necessary competencies by the logistic industry specialists may eliminate the qualification gaps, facilitate the diffusion of the application of the newest digital technologies, and help to adapt to the market changes through the management innovations implementation. The growth of quality and competence of logistics will influence the growth of LPI which will bring Ukraine to a higher position in the rating of the European countries.

The results of the studies actualize the necessity of a systemic approach to the projection of the supply chain management skills framework. The structural and logical framework of the

implementation of the competence management model in the VUCA environment is presented below (fig. 6).

Thus, at the first stage of the competency based model, the key knowledge, logistic drivers, and directions of the future logistic development and supply chains are identified. The issues of sustainable development, COVID problems, and logistic market issues are actualized: Infrastructure + clients' expectations, and internal problems of the supply chain: Skills + coordination + cooperation in SC, digital competence, logistic competencies. Thus, the innovations and creativity of approaches, cooperation, coordination, and partnership are provided, as well as the sustainability, flexibility, efficiency, transparency, sustainability professionalism, intellectualization, coordination, and synchronization of the activities.

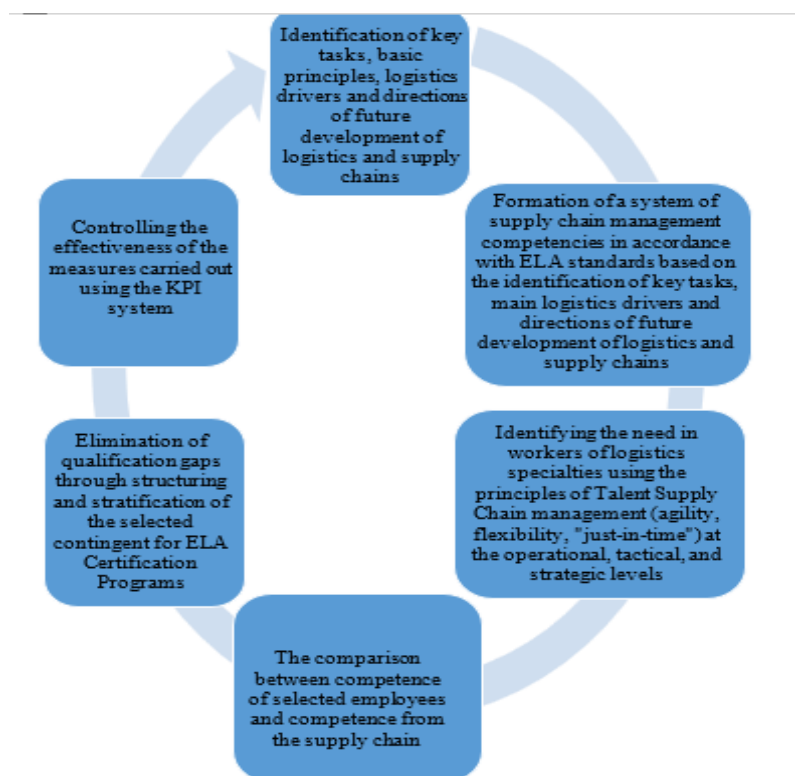


Fig.6. *Competency based model for supply chain management using adaptive competence mechanisms of personnel management in VUCA environment.*

Source: developed by the authors.

At the second stage, the system of competence of the supply management chains is formed in conformity to the ELA standards based on the identification of the key knowledge, main principles, logistic drivers, and directions of the future development of logistic and supply chains.

The competencies system includes the following components: (1) business component, (2) logistic component, (3) management component, (4) ethics component, (5) VUCA-RESIST component based on the Agile Talent Management Model providing for the formation of a wide specter of the process development scenarios, the flexibility of the workers, processes, self-updating of processes, education, and settlement of unexpected problems, focus on the innovations, operative training, rapid growth of talents, rapid talents liberation, agile job instructions, talent outsourcing).

At the third stage, the need for the logistic staff with the application of Talent Supply

Chain management (agility, flexibility, “just-in-time”) is identified at the operational, tactical, and strategic levels. Main activities include the planning of the need for talents, identification of talents, future needs for talents, and minimization of risks from the shortage of talents.

The fourth stage is for the comparison of competencies of the selected staff from the supply chain management skills framework. Here the KPI system for each level is formed considering the constantly changing set of demands to the worker’s competencies and demands to the position and identification of qualification gaps between the necessary and available set of competencies of the staff. The fifth stage presupposes the elimination of the qualification gaps through the structuring and stratification of the selected cohort for ELA Certification Programs.

ELA Certification Programs include the following ones. EJLog - supervisory/operational management: For the managers playing the operative role and for the frontline managers in logistics/supply chains. ESLog - senior management: for the managers or consultants planning, coordinating, and controlling different parts of logistics. EMLog - strategic management: for the senior managers, senior consultants, or directors (CEO, general managers, top managers of supply chains) with substantial experience in logistic management.

The programs of the national certification centers: Testing programs organized and carried out by the national certification centers in different countries. Accredited programs - cELog: Many universities throughout the world offer accredited ELA programs in logistics and supply chains management: Cranfield University in Great Britain, IMF Business School in Spain, HO Gent in Belgium, etc. [10].

And at the sixth, the final stage, it is necessary to carry out the control of the efficiency of events with the KPI application. After this, the key tasks and directions of the logistic and supply chains development should be specified (clause 1 of the structural scheme) and the shift to clause 2 is realized, where the supply chain management competence framework is formed and periodically updated according to the market demands, and all following stages of algorithm are realized.

Conclusions

Considering the modern condition of the logistic sphere and world trends of logistics development, the implementation of the new logistic technologies and equipment, wide application of digitalization and environment protection, the optimization of human resources, and provision of the logistics activity of the state enterprise with the professional logistic specialists should become an important direction of improving the logistic performance in Ukraine.

Based on the analysis of research of the specialized publications of scholars and specialists and our research, the key logistic competencies preconditioning the formation of the common logistic environment and integration into the global supply chains are identified and systematized. Besides, studying the impact of the supply chain manager’s competencies and logistic specialist’s competencies for succeeding in SCM is a systemization criterion. In addition to this, the level of impact and interrelation of the appropriate training on the improvement of the supply chains managers’ competencies are studied and the demands to such specialists are analyzed. The LPI framework is studied, and the comparative analysis of Ukraine and Poland is carried out which testifies both to the positive tendency of Ukraine’s

LPI and to the retardation from the leaders of the European market.

The correlation and regression analysis of the dependence of Ukraine's GDP upon the logistic performance, size of the labor force, and export volume was carried out. The constructed multivariate model proves the close connection, therefore, it can be reasonably used for the assessment and prediction of the impact of these values on GDP. The students of Ukrainian and Polish higher educational institutions were questioned concerning the perspectives of logistic development, which showed the leading role of competencies in the improvement of the reliability and sustainability of the supply chains, efficient application of innovative technologies, logistic integration, preparation, and passing the optimal logistic management decisions.

The research results allow the formulation of specific recommendations concerning the development of underdeveloped directions. It would be reasonable for Ukraine to reduce the dependence upon the national and international institutions, work on the development of the partnership cooperation conditions, maintain efficient communication within the supply chains, search for resources globally, and develop the "digital" and "green" sectors, identify the key competencies of the workers and work upon the elimination of qualification gaps. The European countries are focused on the following stages of logistic development - development of partnership, maintenance of efficient communication, application of the new technologies and digitalization, competence approach in management, "talent management" tools in the human resources management, shifting from the major supply chains, constant improvement of the staff qualification,

For the systemic approach to the realization of the mentioned activities, the structural and logical framework of the competence management model implementation under the conditions of an unstable market environment was elaborated.

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