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MODEL OF BUSINESS PROCESSES OF DELIVERY OF GOODS DURING MARTIAL LAW

Purpose. To analyze the difference in the business-processes of the goods delivery during martial law and to develop an optimization model of the business processes of the supply of goods in these conditions.

Methodology. The methods used are: system analysis – to establish the fact that the main risk of supplying goods under martial law is the integral operational risk; content analysis – for detailed impact of operational risk; comparative analysis – to establish the fact that the risk can provoke crisis in the supply chain in the conditions of war; abstracting – to establish the fact that there is significant probability of the formation of “domino effect” in related areas of activity; inductions and deductions regarding the importance of setting the rate of risk for forecasting and planning of business processes; analysis and synthesis – to develop a model algorithm; mathematical formalization – for the formation of a program trigger for matching the rate of risk change and the rate of the business cycle.

Findings. It is proven that the influence of risk in dynamic conditions can have a character of “domino effect” both in the main and in adjacent areas of activity. Therefore, it is important not only to quantify the risk, but also to determine its rate of change. Inadequate adaptability of enterprise management to external conditions is established. It is indicated that the reliability of goods supply is the main criterion of efficiency in the conditions of martial law.

Originality. An optimization model of the business processes of the goods supply in the conditions of martial law is developed. An indicator for changing the forms and methods of work while comparing the rate of change in risk and the rate of the business cycle is proposed.

Practical value. The proposed model of business processes for the supply of goods under martial law conditions and an indicator of the comparison of the rate of risk change and the rate of the business cycle can be widely used by scientists and practitioners.

Keywords: *model, business process, supply of goods, military status*

Introduction. Russian military aggression has led to significant losses for the business of supplying goods. Some of the enterprises in this sphere have been destroyed, others are located in the territories occupied by the aggressor.

External challenges for business in Ukraine nowadays are dynamic in nature. In a short time, conditions for the execution of business processes can become risky, and risks can take on unacceptable values. This requires quick and error-free management actions to neutralize the consequences of business risks or certain organizational changes in the forms and methods of business processes. Therefore, it is becoming urgent to develop and introduce such models of business processes for the supply of goods that would meet the requirements of wartime.

Military actions, missile attacks, bombardment of cities and transport hubs with salvo fire systems leads to the destruction of product supply routes, logistics chains of external supplies, and poses a threat to personnel and potential customers. Under the conditions of evacuation, a certain part of qualified personnel and a significant part of customers in certain locations left for safe places. This greatly complicates business processes, reduces the volume of sales and, therefore, requires new models of business process realization.

At the same time, during the state of war, the importance of additional components of the business of supply of goods – social and political ones – is revealed, since the supply of goods is also a necessary element of ensuring the livelihood of the population. There are certain groups of goods without which people in specific locations cannot survive. For example, food products, medicines, etc.

This determines the task of forming new logistics chains at the state, regional and local levels, and also the need for direct contact of the business management of the goods supply with the military and civil administrations of the regions. And this contact should be in real time.

This imposes additional conditions and additional responsibility for business and, therefore, requires consideration of these conditions while building organizational business models.

Literature review. A significant number of scientific works is devoted to the modeling of business processes of goods delivery. In particular, this is evidenced by the detailed analytical reviews of the problem used in our study to compare modeling methods: a review of theoretical models from 2014 to 2019 [1] and a scientometric analysis of supply chain management (SCM) [2]. There are also studies on models of the effects of risks on business processes in this sphere: modeling according to structural equations to ensure flexibility of supplies under risk conditions [3]; identifying the relationship between the logistics capabilities of the enterprise, uncertainty, supply chain risk and logistics efficiency [4]; whether the risk of supplying goods decreases with the supplier’s participation in their development [5]; development of a model to determine the relationship between the topological characteristics of complex supply networks under risk conditions and their ability to be renewed [6]; study on the results of supply chain risk management (SCRM) [7]. Some aspects of the algorithmization presented in the above sources were useful for our research, but, in general, all these models are designed for moderate risk values and a slow rate of their change, which is not typical for the supply of goods under martial law.

A number of scientific works consider models that are not adapted for use under significant risks and crisis conditions, but with the proposal of methods, the elements of which we consider useful for use in conditions of martial law. Thus, in [8] modeling of mobile technologies, which ensures the growth of business process productivity (BPP) is proposed. In [9], a model for taking into account dynamic changes in external factors in the food supply chain is proposed. In [10], a study on a dyadic set of buyer-supplier data confirms the significance of goods delivery of institutional influence for business processes, which emphasizes the need to take into account institutional factors in models for this sphere in Ukraine. The model [11] is developed for a “turbulent environment” by structural equations for use between organizational systems (IOS). It is between organizational systems that a significant level of uncertainty for the business processes of goods delivery is created. The use of information business systems (BSL) to mitigate the consequences of uncertainty and increase the productivity of the supply chain is proposed in [12].

Much less work is devoted to the modeling of business processes of goods delivery under conditions of crisis and, even more so, of a state of war. In particular, in [13], the application of Shuhart’s control charts for coordinating business processes in supply chains in crisis conditions and determining the source of potential losses was proposed, which was used in our work. In [14], structural equation modeling was used for this, but according to our analysis, the use of such an approach does not seem reliable. In [15], the influence of global trade policy on the formation of business processes under the conditions of the war in Ukraine is studied. In [16], it is detailed and noted that in wartime, business is in a situation that requires a quick response to dynamic changes. This, in turn, requires quick and well-founded decisions from the management. For this, it is necessary to have an appropriate team of managers and form a requirement for the reorganization of this team. In [17], in order to solve the specified problem, the need to reorganize operational management to ensure effective logistics during the war is highlighted. Their approach was used in our study. In [18], it is indicated that the management’s habit to look for compact logistics chains to reduce costs per unit of production, makes logistics chains vulnerable in wartime. Timely delivery of goods is the prerogative of stable times, but consideration of risks ensures reduction of losses.

The practical experience of reforming the model of the goods supply in the conditions of war in Ukraine, and the goods vitally necessary for the population – medicines, is analyzed in [19, 20], which turned out to be extremely useful for the formation of our model.

Unsolved aspects of the problem. A detailed analysis of the scientific work on this problem of modeling business processes of goods supply during martial law indicates an insufficient level of study on the peculiarities of the implementation of business processes of goods supply during a large-scale war and the lack of reliable models, which can lead to significant negative social, environmental and other losses.

The purpose of the article. To analyze the difference in the business processes of the supply of goods during martial law and to develop an optimization model of the business processes of the goods supply in these conditions.

Methods. Using the method of system analysis, it was established that the integral operational risk is the main risk for the effective business processes of goods supply during martial law. Based on the method of content analysis, the impact of operational risk was detailed, i.e. it was established that the generally accepted definition of operational risk, for example, according to the European Union Directive 2009/138/EC, is “the risk of a change in value caused by the fact that the actual losses incurred due to inadequate or unsuccessful internal processes, people and systems, or from external events (including legal risk), differ from expected losses”. But, as the result of applying the comparative analysis method shows, in the phase

of active hostilities, the operational risk in a short time can take on values that provoke a crisis in the supply chain, for example, the destruction of the cargo, or its detention for such a period as to make the goods unsuitable for use.

The abstraction method made it possible to establish that, even if the crisis is avoided, the probability of problems with the quality and timeliness of supply under the specified conditions becomes extremely high. There is also a significant probability of a “domino effect” – a crisis situation among consumers and, even, in related areas of activity. The “domino effect” of disruption of the supply chain can lead to significant social, environmental, and financial losses. This led to the application of the criterion of reliability of supplies in contrast to the mentioned criteria of quality and timeliness of supplies.

The conditions of large-scale war and martial law limit the use of traditional risk management methods and models. This is caused, in particular, by the fact that the value of risk for the business processes of the goods supply can quickly move from a moderate and acceptable level to a super-crisis level.

Therefore, it is important, as it is established by the use of the method of induction and deduction, not only to quantitatively assess the value of the risk, but also to determine its pace. This is necessary in order to predict the value of risk in a relevant way during the execution of the business process and the planning of business activities.

The use of the method of induction and deduction also made it possible to point out that under the conditions of dynamic changes in the integral risk, the requirements for managing the business processes of goods delivery also change.

To reduce the impact of risk, it is suggested to form a tree of possible options for the execution of business processes in their totality and by individual stages of their execution.

Using the method of analysis and synthesis, this required the development of an algorithm for the optimization model of the business processes of the goods supply during martial law and when applying the method of mathematical formalization of the formation of a program trigger for changing the forms and methods of work by comparing the rate of change in risk and the rate of the business cycle.

The concept of business cycle is considered in our study as a system execution of a complex of interrelated business processes.

Results. The conducted research established that under the conditions of dynamic changes in the integral risk, the requirements for managing the business processes of goods delivery change.

In particular, business process management methods require management to introduce such business models that form:

1. Ability to quickly make effective decisions.
2. Mobilization building of the organizational structure.
3. Greater level and pace of adaptability to risks.
4. Greater level of innovation and initiative.
5. Transition from the implementation of criteria of quality and timeliness of goods deliveries to the application of the criterion of reliability of deliveries.
6. Accelerated mode of implementation of the latest information technologies for managing business processes.

The importance of item No. 1 of the requirements for the management of business processes for the delivery of goods is due to the fact that a late management response to the dynamic manifestation of risk is, by definition, ineffective and can lead to losses.

The importance of item No. 2 of the requirements is due to the fact that only a significant level of mobilization of the company’s team is able to ensure the effectiveness of the business cycle, that is, the group of business processes, and the viability of the company. In particular, this refers to the willingness of employees to work outside the schedule, perform related duties, quickly retrain, etc.

The need to increase the pace of adaptation to new challenges (item No. 3) is due to the rapidity of the situation in the conditions of war.

As for point No. 5 of the requirements for the management of business processes for the delivery of goods, its use largely depends on whether the enterprise is small, medium or large.

This is determined not only by the fact that only powerful enterprises are able to pay significant sums for the latest information technologies.

With the enterprise increasing, the burden on managers of all ranks increases significantly, and the responsibility for the decisions of senior executives increases as well.

Also, under the conditions of martial law, the management of external logistics requires significant changes – on the scale of the state and each of the regions separately. Regional logistics and logistics in individual locations cannot use typical methods, models, and approaches, since each of the regions is in different conditions, the degree of destruction is different, and the level and types of threats change radically according to the region. Therefore, it is necessary to limit the use of typical methods and models, which is especially relevant for network structures and enterprises working simultaneously in different areas of the country.

For efficient external logistics, it is necessary to open new logistics centers in Western Ukraine in addition to the already existing ones. The work of logistics companies should also be reformed.

If needed, it is necessary to form the possibility of rapid maneuvering of commodity stocks between regions and at the level of retail chains, at the level of enterprises, and at the state level.

Business entities in the affected regions also need certain institutional preferences, in particular, preferences regarding the performance of economic activities in wholesale and retail trade for certain types of goods, combining these activities with the production of goods, etc.

Nowadays, there are certain institutional shifts in this direction. In particular, the Cabinet of Ministers of Ukraine (CMU) adopted a Resolution No. 314 on March 18, 2022 “Some issues of ensuring the conduct of economic activities during the period of martial law”, which also facilitates the execution of business processes for the supply of goods.

But, as the analysis shows, the level of adaptation of enterprises to work in new conditions is extremely low.

This indicates the insufficient organizational mobilization of management of a significant number of enterprises, the unreadiness of the top management of these enterprises to use the new institutional opportunities provided by the government.

In order to analyze the level of organizational mobilization of management, the presence of an initiative to use new institutional opportunities, the activities of enterprises supplying pharmaceutical goods during the period of martial law were analyzed.

The choice of pharmaceutical supply companies was due to the fact that pharmaceutical supply companies were among the first to recover from the shock of the first weeks of large-scale hostilities. The analysis was conducted taking into account the fact that as of mid-February 2022, more than 27,000 pharmacies and other establishments distributing pharmaceutical goods were operating in Ukraine, by mid-March ~5,000, and at the time of the analysis – at the end of April, there were 12,000 pharmaceutical establishments [19, 20].

The analysis of the distribution of the share of enterprises of the distribution network of pharmaceutical goods by region, which submitted requests for granting a permit for economic activity during the period of martial law in accordance with the requirements of Resolution of the CMU No. 314 (Fig. 1) is a vivid example of the insufficient organizational mobilization of management of a significant number of enterprises, the unreadiness of the top management to use new institutional opportunities.

As it was established by the conducted research, the value of the specified share of enterprises does not correlate with the level of destruction of the region’s infrastructure as a result of hostilities or the proximity of enterprises to the front line. In particular, as shown by Fig. 1, Kyiv region, which suffered significant destruction (well-known names of towns in the region – Bucha, Hostomel) showed a significant level of contribution to the total number of enterprises that showed readiness to work in new conditions – 24 %.

At the same time, the regions with no military actions: Rivne, Volyn, Ivano-Frankivsk demonstrate the lowest results.

Odesa region, which is known for a significant level of entrepreneurial initiative, showed a result of 5 %, which is approximately equal to the result of the three above-mentioned regions [19].

With regard to the distribution of establishments that submitted requests for a permit for economic activity during the period of martial law in accordance with the requirements of CMU Resolution No. 314 by types of commercial pharmaceutical enterprises: chains of pharmaceutical establishments make up 78.9 %, small and medium-sized commercial enterprises make up 17.8 %, wholesale pharmaceutical enterprises (warehouses) – 2.9 %, production and trade structures – 0.3 %. These data are correlated with the structural data of enterprises in the sphere of pharmaceutical goods trade.

The correlation coefficient of the share of enterprises that expressed a desire to work according to the new requirements with the number of enterprises of the specified activity profile in the region before the beginning of large-scale hostilities is 0.47. This indicator is important but not too significant. That is, the number of enterprises of the specified profile of activity in the region before the start of large-scale hostilities is not the main factor in the formation of the share of initiative enterprises that expressed a desire to work according to the preferential requirements of Resolution of the CMU No. 314.

This confirms the results of the conducted research, according to which a special role in ensuring not even efficiency, but the possibility of execution of business processes in crisis conditions begins to be played by:

- leadership qualities of managers who run the relevant sphere of the enterprise and of senior executives;

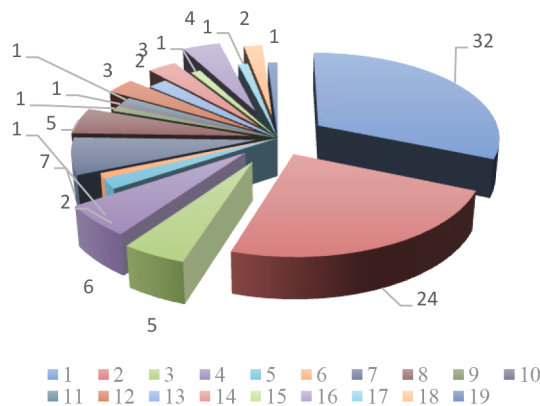


Fig. 1. The share of enterprises of the distribution network of pharmaceutical goods by region, which submitted requests for the granting of a permit for economic activity during the period of martial law in accordance with the requirements of the Resolution of the CMU No. 314:

1 – Kyiv city; 2 – Kyiv region; 3 – Zhytomyr region; 4 – Vinnytsia region; 5 – Khmelnytskyi region; 6 – Chernihiv region; 7 – Dnipropetrovsk region; 8 – Odesa region; 9 – Mykolaiv region; 10 – Kharkiv region; 11 – Luhansk region; 12 – Rivne region; 13 – Volyn region; 14 – Lviv region; 15 – Ivano-Frankivsk region; 16 – Poltava region; 17 – Kirovohrad region; 18 – Kherson region; 19 – Ternopil region

- initiative, independence in making decisions of the appropriate level, the ability to assume responsibility in crisis conditions of middle and lower rank managers.

In view of this, the analysis of the share of enterprises of the distribution network of pharmaceutical goods by region, which submitted requests for the granting of a permit for economic activity during the period of martial law in accordance with the requirements of Resolution of the CMU No. 314 (Fig. 1), indicates a certain lack of managerial personnel who have the proper leadership qualities, as well as middle and lower ranking managers with an appropriate level of initiative.

In order to form the appropriate level of effectiveness of management decisions regarding the business processes of supplying goods during martial law, an optimization model is proposed that can be implemented as a support and decision-making system in this sphere.

The developed algorithm of the optimization model of business processes of goods supply during martial law is presented in Fig. 2.

This algorithm is realized according to the block principle in an iterative way.

Factors of external conditions for the execution of business processes of goods supply are stratified according to the relevant blocks, since their sources, type, units of measurement are not identical.

Blocks of conditions allow stratification of influencing factors as follows; institutional, military, global market conditions, local market conditions and others.

The indicated factors of external conditions for the execution of business processes of the goods supply providing the realization of the corresponding program procedure (PP), form a block of data, on the basis of which another PP calculates risks.

Depending on the level of risks and their localization, logistics routes are formed for both external goods deliveries and goods deliveries provided by the company.

Under automatic risk analysis, measures to minimize risk impact or neutralize risks are proposed for consideration by management.

The specified steps form a model of business processes in which the following factors are determined in stages: the cost of goods delivery, the retail price, the dynamics of changes in the volume of goods according to the nomenclature, the dynamics of financial indicators, and the profit level of the business cycle.

If the profitability is too low, management, organizational and other measures are taken to optimize the level of profit.

The proposed model required the introduction of a clearly defined program trigger for changing the forms and methods of work. The methodical basis for this was a comparison of the rate of change in the integral risk and the rate of the business cycle, which, as indicated above, is a systematic realization of a number of business processes.

The integral risk of business activity in certain locations is determined by the additive function of local risks taken under statistical conditions in risk management

$$R = \sum_1^n a_i R_i, \quad (1)$$

where R is the value of integral risk; R_i is a local risk value; a_i is local risk weight factor; index $i = 1, 2, 3, \dots, n$ corresponds to each specific type of local risk.

Then the rate of change in the integral risk is defined as the first derivative of the value of the integral risk over time, and the acquisition of the critical value by the integral risk can be controlled as follows

$$\int_{t_1}^{t_m} \frac{dR}{dt} dt \leq Q, \quad (2)$$

where $\frac{dR}{dt}$ is the value of the integral risk derivative; t is time variable; Q is the critical level of integral risk; t_1 is the initial value of the time interval; t_m is the final value of the time interval.

The critical value of the time interval during which the integral risk can reach a dangerous level, $\Delta t = t_m - t_1$, is determined by the time required for the end of a certain business cycle in a specific location. The location is determined by the type of business process and the logistics leg of the product delivery: within the country, within the region, etc.

The specified mathematical model of the program trigger for changing the forms and methods of work by comparing the rate of risk and the rate of the business cycle should be used in the "Check for legibility" block of the algorithm of the optimization model of business processes for goods supply during martial law.

This makes it possible to realize the model of business processes of goods supply effectively.

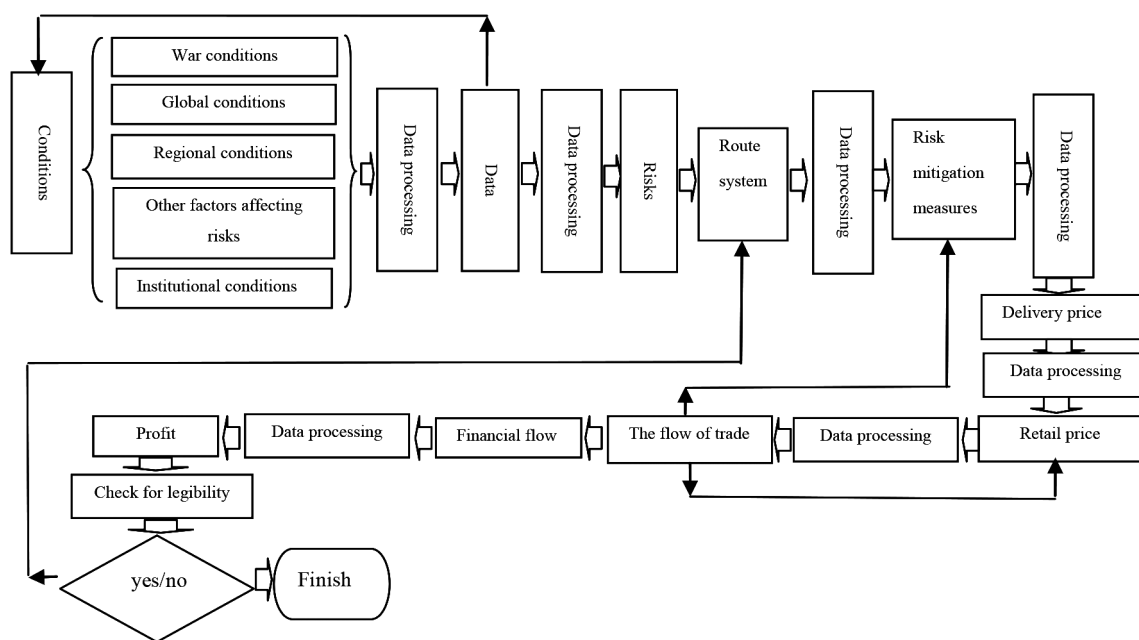


Fig. 2. Algorithm of the optimization model of business processes for the goods supply during martial law

Conclusions. It has been established that the integral operational risk is the main risk for the effective execution of business processes for the supply of goods during martial law.

It is indicated that the operational risk of the business processes of the goods supply during the martial law can in a short time take values that provoke a crisis in the supply chain, for example, the destruction of the cargo, or its detention for such a period as to make the goods unusable.

It is indicated that the impact of this risk can have the character of a “domino effect” both in the main and in related spheres of activity.

It is indicated that the “domino effect” from a disruption in the supply of goods can lead to significant social, environmental, and financial losses. This led to the application of the reliability criterion to determine the effectiveness of the delivery business processes, in contrast to the criteria of quality and timeliness of deliveries, which are usual in peacetime for this sphere of activity.

It is established that the conditions of large-scale war and martial law limit the use of methods and models of traditional risk management. This is caused, in particular, by the fact that the risk values for the business processes of the supply of goods from the current value, defined as a moderate and acceptable level of threat, may quickly move to an above-crisis level.

This made it possible to prove that, under these conditions, it becomes important not only to obtain a quantitative assessment of the risk value, but also to determine its pace. If the business cycle time is known, this allows one to accurately predict the result of the business process and, thus, to plan business activities relevantly at a given time interval, which is extremely important given the significant dynamics of the situation during martial law.

It also made it possible to establish that a dynamic change in the integral risk causes a change in the requirements for managing the business processes of goods delivery. These requirements are given in the article. Among such requirements the need to increase adaptability to risks and a greater level of innovation and initiative, in particular, regarding the use of preferences provided by institutional structures during martial law is indicated. Based on this factor, the conducted analysis established a low level of adaptation of business management in a certain direction in the sphere of goods delivery.

To reduce the impact of risk, it is suggested to form a tree of possible options for the execution of business processes in their totality and by individual stages of their execution.

To increase the efficiency of management in the sphere of goods delivery, an algorithm for the optimization model of business processes of the supply of goods during martial law was developed. The formation of a program trigger for changing the forms and methods of work by comparing the rate of change in risk and the rate of the business cycle is proposed.

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Модель бізнес-процесів постачання товарів під час військового стану

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Мета. Проаналізувати відмінність бізнес-процесів постачання товарів під час військового стану та розробити оптимізаційну модель бізнес-процесів постачання товарів в цих умовах.

Методика. Використані методи: системного аналізу для встановлення, що основним ризиком постачання то-

варів за військового стану є інтегральний операційний ризик; контент-аналізу – деталізовано вплив операційного ризику; порівняльного аналізу для встановлення, що, в умовах війни, ризик за короткий час може спровокувати кризу в ланцюзі поставок; абстрагування для встановлення, що є значна вірогідність утворення «ефекту доміно» в суміжних сферах діяльності; індукції й дедукції щодо визначення важливості встановлення темпу ризику для прогнозування та планування бізнес-процесів; аналізу й синтезу для розробки алгоритму моделі; математичної формалізації для формування програмного тригера узгодження темпу зміни ризику й темпу бізнес-циклу.

Результати. Доведено, що вплив ризику в динамічних умовах може мати характер «ефекту доміно» як в основній, так і в суміжних сферах діяльності. Тому важливо не тільки кількісно визначати ризик, але й оцінювати його темп. Проведеним аналізом встановлено неналежний рі-

вень адаптації бізнес-менеджменту до зовнішніх умов. Указано, що основним критерієм ефективності бізнес-процесів за умов військового стану стає надійність поставок товарів.

Наукова новизна. Розроблена оптимізаційна модель бізнес-процесів постачання товарів в умовах військового стану. Запропоновано показник для зміни форм і методів роботи за порівняння темпу змінювання ризику й темпу бізнес-циклу.

Практична значимість. Запропонована модель бізнес-процесів постачання товарів в умовах військового стану та показник порівняння темпу змінювання ризику й темпу бізнес-циклу, що можуть бути широко використані науковцями та практиками.

Ключові слова: *модель, бізнес-процес, поставка товарів, військовий стан*

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