UDC 615.12:658.8:339.18
DOI: 10.15587/2519-4852.2023.290171

METHOD APPROACHES TO ASSESSING THE ADAPTATION POTENTIAL OF THE INDUSTRIAL PHARMACEUTICAL ENTERPRISE TO CHANGING ECONOMIC CONDITIONS

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The aim *of the article is to develop a methodology for assessing the potential of IPE adaptation to changes in external conditions and internal influencing factors.*
Materials and methods. *The research used the methods of theoretical generalization, analysis and synthesis, correlation analysis and expert survey.*
Results*. It is proposed to define the essence of the adaptation potential of an industrial pharmaceutical enterprise to changes in business conditions, under which it is appropriate to understand the enterprise's readiness to respond flexibly, quickly, and adequately to changes occurring in the external and internal environment, in order to increase its level of competitiveness. A technique for determining the level of industrial adaptation potential (the technique cannot be a model; the technique is stages that are related to each other) and a ranking model by its degree by parametrization is proposed. Based on the study of scientific works and the experience of global companies, it was determined that the model for ranking the level of adaptation potential by parameterization involves ranking elements according to the degree of readiness of the management system of an industrial pharmaceutical enterprise for adaptation. The components of parameters for assessing the adaptation potential of an industrial pharmaceutical enterprise have been formed. The limits of adaptation potential are defined.*
Conclusions*. A methodology for assessing the adaptation potential of industrial pharmaceutical enterprises to the influence of external factors (martial law, the outflow of qualified personnel, a decrease in the purchasing power of the population, etc.) and taking into account the internal capabilities of the enterprise (resources (material, financial, labour, information, service, etc.), organizational structure and management decision-making) with the aim of increasing the competitiveness of the enterprise and its fulfilment of the social component of functioning, namely timely provision of the population with high-quality medicines in full in the right place at affordable prices*
Keywords*: resource factor adaptive management, industrial pharmaceutical enterprise, management, organization, adaptation potential, influencing factors, macro environment*

How to cite:
Cherniavskyi, A., Tarasenko, D., Nikitiuk, V., Sahaidak-Nikitiuk, R., Demchenko, N. (2023). Method approaches to assessing the adaptation potential of the industrial pharmaceutical enterprise to changing economic conditions. ScienceRise: Pharmaceutical Science, 5 (45), 90–98. doi: http://doi.org/10.15587/2519-4852.2023.290171

1. Introduction

Changes in economic relations caused by military aggression against Ukraine, global informatization and digitalization, and other influencing factors necessitated the development and implementation of new approaches to the management of industrial pharmaceutical enterprises (IPE), which would allow them to adapt to today's conditions. It is worth noting that the existing state of the national economy and the variability of the external environment have led to the fact that traditional approaches to enterprise management no longer respond to changes occurring in the world.

As evidenced by the practice of leading foreign pharmaceutical companies, the most effective approach to enterprise management is adaptive management, the use of which is due to the existence of certain serious threats to IPE, namely growing competition compared to imported pharmaceutical products; rising prices for active pharmaceutical ingredients, basic and auxiliary materials; lack of close ties with suppliers of active pharmaceutical ingredients, basic and auxiliary materials; concentration of production capacities in large metropolises; ineffective marketing policy; the absence of reliable forecasts of the rate of fluctuations of the external environment, etc., which, in turn, leads to a decrease in the level of use of the available production capacities of the enterprise, its overall efficiency of production and economic activity and competitiveness in general [1, 2].

The need to implement adaptive IPE management is due not only to the opportunity to provide the enterprise with the appropriate level of competitiveness, obtain new opportunities and develop the system of motivating employees, but also has a large social aspect and allows paying more attention to the training and retraining of personnel, establishing partnership relations between the management and personnel of enterprises, and also establish an effective process of resistance to change.

The ratio of the accuracy and speed of the management response to changes in the external environment and the speed of changes in the macro environment is of particular importance for the adaptive management of the enterprise, that is, the ratio of the accuracy and speed of directed changes in the internal environment of the enterprise compared to the speed and direction of changes in the external environment [3, 4]. Another problem that the adaptive management of IPE aims to solve is the resource provision of the enterprise, since its development depends on the quality, timeliness and volume of available resources, and quality management of resources is a way to solve a large number of problems in the existing economic conditions [5, 6].

Rapid changes caused by the high speed of the spread of innovations and the variability of the external environment, manifested in the strengthening of competition on the pharmaceutical market, the emergence of new production and management technologies, create conditions for realizing the potential of IPE, which necessitates the development of techniques, methods and mechanisms for adapting the management process to modern challenges and actualizes the development of the methodological basis of adaptive management of IPE.

The issue of adaptive management of enterprises was considered by many scientists from different perspectives, namely: the mechanism of adaptation of the corporate association of enterprises [7]; system of adaptive cost management [8, 9], adaptive training practices [10], adaptive management of transport logistics [11], adaptive algorithm in enterprise management [12], knowledge-intensive adaptive structure of business process management [13], adaptive co-management in tourist destinations and process adaptation [14], adaptive procurement and supply management during the COVID-19 pandemic [15], the influence of the external environment on organizational adaptation [3], the organization of adaptive management of enterprise competitiveness [2, 16], the quality of adaptive management [17] and others. The issue of forming and evaluating the adaptation potential of enterprises was studied mainly in relation to the adaptation potential of agricultural enterprises to changes in climatic conditions of management [18]. At the same time, research on the mentioned question regarding IPE was carried out by scientists.

At the same time, despite a significant number of publications on adaptation and adaptive management, the existing toolkit used in management practice was not focused on solving the tasks of adapting IPE to the constantly changing conditions of the external environment and internal influencing factors.

The aim of the work was to develop and work with a methodology for assessing the potential of IPE adaptation to changes in external conditions and internal influencing factors.

2. Planning (methodology) of research

The research was conducted in six stages (Fig. 1).

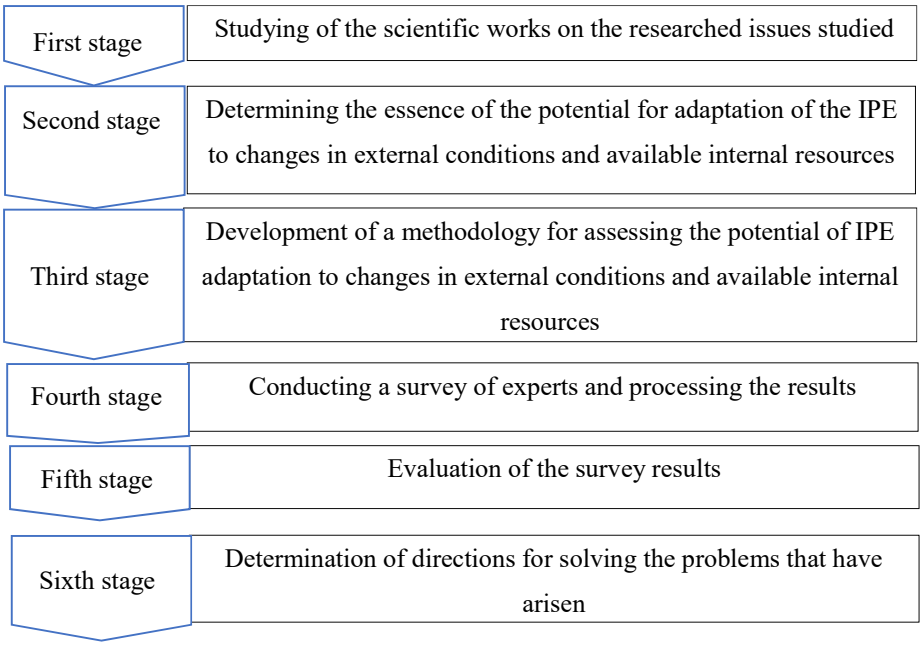

Fig. 1. Algorithm of the research

The first stage of the research is devoted to the study of the works of scientists in relation to adaptive management, followed by a generalization of the determination of the essence of the potential of IPE adaptation to external conditions (political, economic, demographic situation in the country, regulatory and legislative framework, etc.) and available internal resources. At the third stage, based on the generalization of the works of scientists and the analysis of the experience of leading global enterprises, a methodology was developed for assessing the potential of IPE adaptation, considering the factors of the external environment and determining directions for improving the potential of its adaptation. At the next stage, an expert survey was conducted to determine the opinions of experts regarding the weight of the parameters and their assessment in points. At the fifth stage, the evaluation of the received results of the expert questionnaire regarding the assessment of the adaptation potential of the industrial pharmaceutical enterprise to changes in business conditions took place. At the last stage, directions for solving the identified problems were formed.

3. Materials and methods

The expert survey was conducted from December 2022 to August 2023 at pharmaceutical enterprises located in Kyiv, Kharkiv and Poltava regions.

The representativeness of the sample is ensured by its design, which is determined by the characteristics of the

general population and the goals of the study, and the calculation of its minimum volume. The size of the sample is determined using the algebraic transformation of the formula of the marginal error of the sample:

$$N_{\min} = 0.5\left(\frac{3}{E}+5\right), \quad (1)$$

where E – the maximum permissible relative error determined before the start of the survey.

Considering the maximum permissible relative error (E=0.1) determined before the start of the survey, the minimum sample size is 17:

$$N_{min}=0.5\times(3/0.1+5)=17.$$

Therefore, the involvement of 41 people for the expert survey is sufficient and representative.

An objective method was used to assess the competence of experts, namely the documentary method, which involves the selection of experts based on their professional characteristics. Experts must have a relevant specialty and work experience in it. The experts include middle (heads of logistics, sales, chief technologist, logistics, warehouse managers) and lower management. 96 % of experts have higher education, 4 % have secondary special education. 87 % of experts are women, 23 % are men. By age, experts are divided as follows: 22–30 years – 18.6 %, 31–40 years – 22 %, 41–50 years – 35.2 %, over 50 years – 24.2 %. By length of service: up to 5 years – 12.4 %, from 5 to 10 years – 24.2 %, from 10 to 20 years – 36.6, over 20 years – 26.8 %.

The proposed questionnaire consists of an introduction describing the purpose and format of the survey and instructions for filling it out; the main block (questions put to experts and filter questions, the purpose of which is the selection of competent experts); socio-demographic characteristics of the expert. The questions were grouped by the factors of the external and internal environment of the IPE functioning. To determine the importance of the specified factors, experts were asked to determine the ranks of the factors and their importance on a five-point scale.

The Statistica StatSoft application program package was used to process statistical data.

The concurrence of experts' opinions was assessed using the concordance coefficient, which should exceed the normative value (0.75). According to the results of processing the experts' opinions, the estimated concordance coefficient is 0.88, which indicates the agreement of the experts' opinions.

The functional dependence of complex adaptive capabilities of IPE on local ones is as follows:

1) for external factors:

– adaptive capabilities according to the "resources" parameter $\left(A_r^e\right)$:

$$A_r^e = f\left(F_c^e, B_c^e, R_c^e, L_c^e, C_c^e, T_r^e\right), \quad (2)$$

where $F_c^e, B_c^e, R_c^e, L_c^e, C_c^e, T_r^e$ – corresponding components of complex adaptive capabilities according to the "resources" parameter;

– management procedure $\left(A_p^e\right)$:

$$A_p^e = f\left(O_p^e, I_e^e\right), \quad (3)$$

where O_p^e, I_e^e – corresponding components of complex adaptive capabilities according to the "management procedure" parameter;

2) internal factors:

– adaptive capabilities according to the "resources" parameter of the IPE $\left(A_r^i\right)$:

$$A_r^i = f\left(F_c^i, B_c^i, R_c^i, L_c^i, M_c^i, C_c^i, T_r^i\right), \quad (4)$$

where F_c^i, B_c^i, R_c^i, L_c^i, M_c^i, C_c^i, T_r^i – relevant components of complex adaptive capabilities according to the "resources" parameter of IPE;

– adaptive capabilities according to the "management capabilities" parameter $\left(A_c^i\right)$:

$$A_c^i = f\left(O_c^i, I_e^i\right), \quad (5)$$

where O_c^i, I_e^i – corresponding components of complex adaptive capabilities according to the "management capabilities" parameter;

– adaptive capabilities according to the "possibility of making a management decision" parameter $\left(A_r^i\right)$:

$$A_r^i = f\left(R_c^i, P^i, R^i, R_k^i\right), \quad (6)$$

where R_c^i, P^i, R^i, R_k^i – corresponding components of complex adaptive capabilities according to the "management capabilities" parameter;

– integral indicator of the adaptive capabilities of IPE (A):

$$A = f\left(A_c^e, A_c^i\right), \quad (7)$$

where A_c^e, A_c^e – relevant components of the integral adaptive capabilities of IPE.

Element-by-element assessment of IPE adaptation potential will allow to calculate its integral value considering the processing of the received score characteristics of each component. The integral value of the adaptation potential of IPE is defined as the weighted sum of the point estimates of its individual components, which are based on the weight and point estimate of each of them.

The methods used in the research include the methods of theoretical generalization (study of approaches to determining adaptive management and adaptation potential), analysis and synthesis (to analyze changes occurring in the environment), correlation analysis (to determine the pairwise correlation coefficient for potential factors adaptation of IPE) and an expert survey (to determine the constituent parameters of the assessment of the potential of IPE adaptation).

4. Results

Management of an industrial enterprise is characterized by multicriteria [19], many elements of different nature [20], hierarchy [21].

Adaptive management IPE is a flexible management system that quickly adapts to any changes occurring in the external and internal environment and is capable of self-organization and restructuring.

In order to determine the level of adaptation of IPE to external factors and internal conditions, it is appropriate, in our opinion, to determine the potential of its adaptation, by which it is appropriate to understand the readiness of the enterprise to respond flexibly, quickly and adequately to changes occurring in the external environment (martial law, the coronavirus pandemic, economic the crisis in the country, the globalization of the world economy, in particular the pharmaceutical sector of the economy, the demographic situation, namely the outflow of skilled labour between the ages of 25 and 50, the mobilization of men to the ranks of the Armed Forces of Ukraine, changes in the legal framework due to the requirements of the European Union and challenges of modernity; informatization and digitization of all branches of the economy, etc.) and affect the state of the internal resources of the enterprise (material, financial, information, service and labour), with the aim of increasing its level of competitiveness and timely provision of the population with the necessary quality medicines in the required amount in the specified place taking into account its purchasing power and changes in the assortment of medicines and medical products that are in demand and necessary to preserve the life and health of the population. The study of literary sources related to econometrics [22, 23] and the experience of global companies.

To assess the potential of IPE adaptation to changes in external business conditions and internal influencing factors, a method consisting of eleven stages is proposed (Fig. 2).

At the first stage, a selection of traditional indicators, which are most often used by scientists when assessing the adaptation of IPE to external and/or internal factors of influence, was carried out, based on which a preliminary list of possibilities (resources) of adaptation of enterprises was formed and a number of indicators reflecting the specifics of pharmacy were proposed.

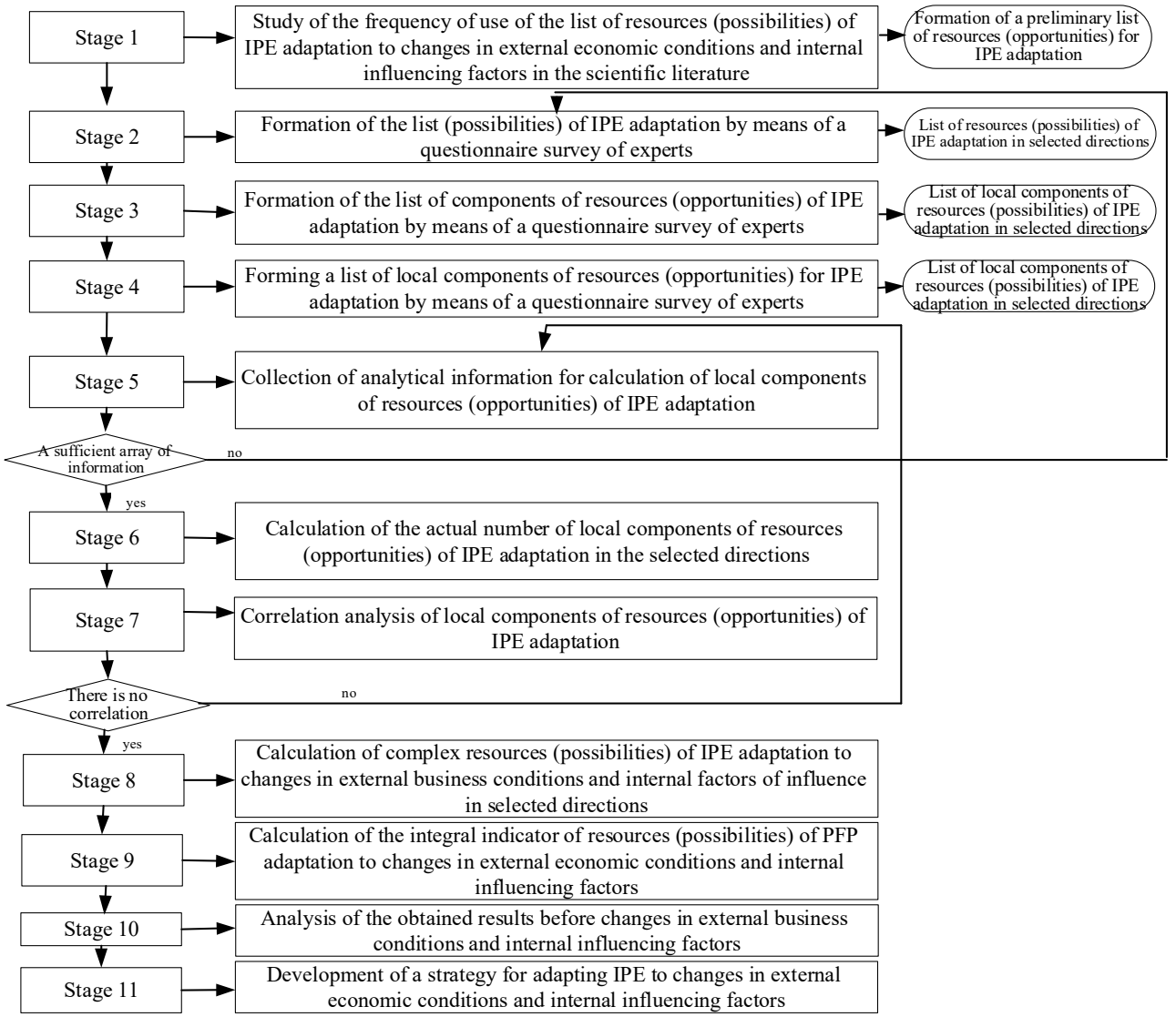

Fig. 2. The proposed algorithm for assessing the potential of IPE adaptation to changes in external conditions and internal influencing factors

At the second stage, experts from the proposed preliminary list of selected resources (possibilities) for IPE adaptation selected indicators that will be used to assess the company's adaptation potential to changes in external and internal influencing factors. Specialists of middle management (heads of logistics, sales, chief technologist, logistics, warehouse managers) and lower management were involved as experts. At this stage, indicators with a weighted average score of more than 4.5 points were selected (Fig. 3).

At the next stage, a correlation analysis was conducted to eliminate the phenomenon of autocorrelation. From the final list of resources (possibilities) of IPE adaptation in the selected areas, indicators with a pairwise correlation coefficient of more than 0.8 were excluded.

The final list of selected resources (possibilities) for IPE adaptation to changes in external economic conditions and internal influencing factors is given in Table 1.

At the next stage, adaptive capabilities were formed by parameters and their weight was determined, their results are shown in the Table 2.

The criteria for evaluating parameters and their elements is the range from 0 to 5:

$$K_i = \begin{cases} 0 - \text{absence of an element}, \\ 1 - \text{minimal element}, \\ 2 - \text{below average}, \\ 3 - \text{average level}, \\ 4 - \text{above average}, \\ 5 - \text{correctly developed option}. \end{cases} \quad (8)$$

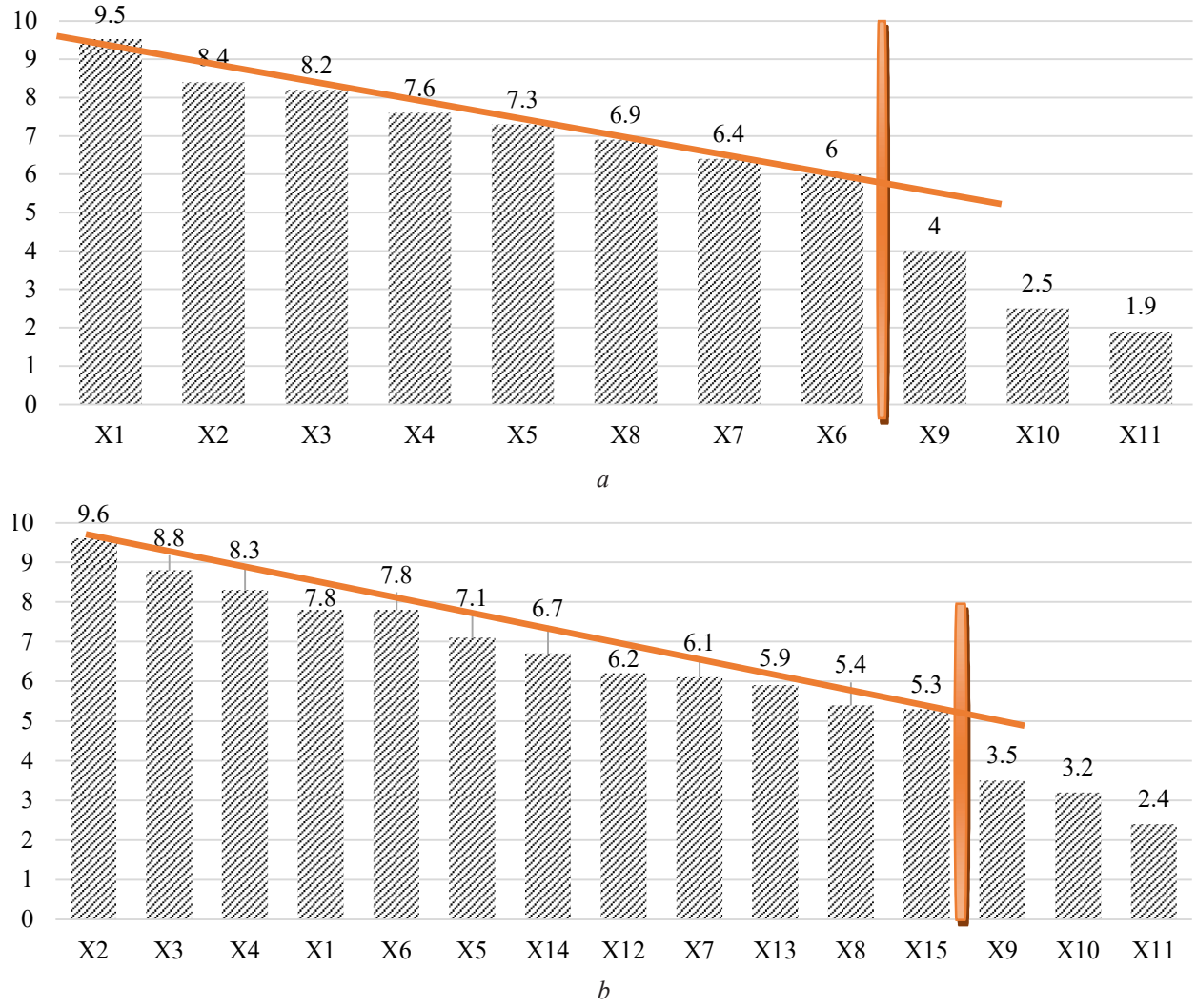

Fig. 3. The results of an expert survey regarding the resources (possibilities) of IPE adaptation to changes in external business conditions and internal influencing factors: *a* – external influencing factors: X1 – production capabilities (technical and technological), X2 – financial resources, X3 – material resources, X4 – logistic resources, X5 – labour resources, X6 – information support, X7 – organizational and legal factors, X8 – marketing resources, X9 – socio–cultural factors, X10 – political situation, X11 – environmental situation; *b* – internal influencing factors: Y1 – production capabilities (technical and technological), Y2 – financial resources, Y3 – material resources, Y4 – logistic resources, Y5 – labor resources, Y6 – information support system, Y7 – organizational structure, Y8 – marketing resources, Y9 – investment opportunities, Y10 – innovative opportunities, Y11 – environmental opportunities, Y12 – the goal of a management decision, Y13 – studying the problem that arose in front of IPE, Y14 – developing alternative management solutions, Y15 – making a management decision

Table 1

A proposed system of resources (opportunities) for IPE adaptation

No.	Indicator	Characteristics of the indicator
1	External factors	–
1.1	Resource parameters (opportunities)	Availability of various resources at the country level
1.1.1	Financial opportunities	Adaptation financial fund
1.1.2	Production capabilities	Volumes of domestic pharmaceutical products
1.1.3	Market opportunities	Volume of the domestic pharmaceutical market
1.1.4	Logistic possibilities	Logistics infrastructure
1.1.5	Resource capabilities	Provision of resources
1.1.6	Job opportunities	Supply of labour resources
1.2	Management procedure	–
1.2.1	Organizational and legal factors	Norms, rules, procedures, distribution of rights and responsibilities, hierarchy of subordination, etc.
1.2.2	Information support	Provision of information resources
2	Internal factors	–
2.1	Resource parameters (opportunities)	Availability of various types of resources (financial, material, labor, etc.)
2.1.1	Financial opportunities	Provision of financial resources
2.1.2	Production capabilities	The possibility of increasing the volume of production of pharmaceutical products
2.1.3	Market opportunities	The possibility of satisfying the demand for pharmaceutical products on the market
2.1.4	Logistic possibilities	The possibility of minimizing service time, costs for moving flows and resource costs, increasing the level of logistics service for consumers
2.1.5	Marketing capabilities	modern marketing tools
2.1.6	Resource capabilities	Norms of provision of resources
2.1.7	Job opportunities	IPE staff
2.2	Management capabilities	–
2.2.1	The organizational structure	The possibility of adapting the organizational structure to changes
2.2.2	Information support system	Provision of IPE with information technologies
2.3	The possibility of making a management decision	Security of the system of rules on the execution of organizational, informational, and other operations leading to the solution of the tasks facing the management system
2.3.1	The purpose of the management decision	Formulating the goal of a management decision under the influence of factors of the external and internal environment
2.3.2	Studying the problem that arose before IPE	The possibility of studying the problems faced by the enterprise in connection with changes that occur under the influence of external and internal factors
2.3.3	Development of alternative management solutions	The possibility of developing alternative management solutions
2.3.4	Making the final management decision	The possibility of making a final management decision adapted to the conditions of external and internal influencing factors

It was established that the value of the IPE adaptation potential is within (0;5]:

$$K_i = \begin{cases} (0-1-\text{no adaptation potential}, \\ 1-2-\text{minimum adaptation potential}, \\ 2-3- \text{ average adaptation potential}, \\ 3-4-\text{above average adaptation potential}, \\ 4-5-\text{maximum adaptation potential}). \end{cases} \quad (9)$$

The elements of the parameters of the IPE adaptation potential, obtained by experts, are given in the Table 3.

To illustrate the obtained results, the values of the adaptation potential of the investigated IPEs are shown in Fig. 4.

The dynamics of the adaptation potential of the studied IPEs is shown in Fig. 5.

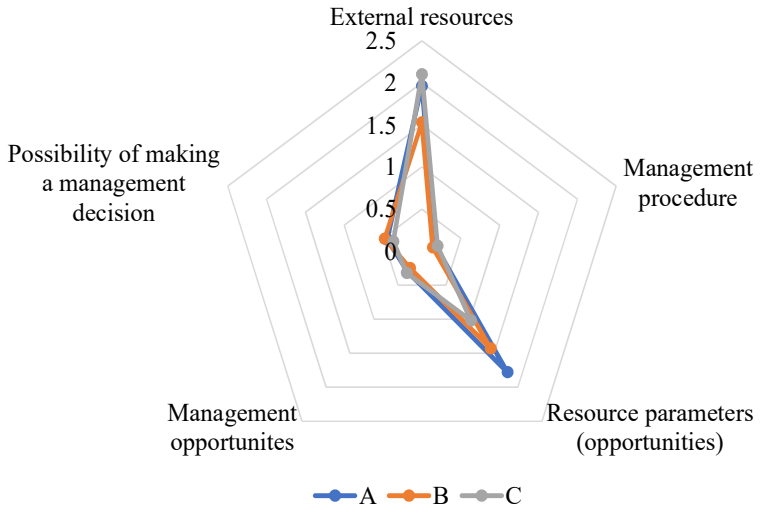

Fig. 4. Radar diagram of the adaptation potential value by the components of the studied IPE

Table 2

Weight values of adaptive capabilities of IPE by parameters

Parameter	Element	Element weight
External resources		
Resource parameters (opportunities)	Financial opportunities	0.17
	Production capabilities	0.13
	Market opportunities	0.12
	Logistic possibilities	0.12
	Resource capabilities	0.12
	Job opportunities	0.11
Management procedure	Organizational and legal factors	0.04
	Information support	0.05
Internal factors		
Resource parameters (opportunities)	Financial opportunities	0.13
	Production capabilities	0.1
	Market opportunities	0.08
	Logistic possibilities	0.075
	Marketing capabilities	0.055
	Resource capabilities	0.09
	Job opportunities	0.07
Management capabilities	The organizational structure	0.1
	Information support system	0.1
The possibility of making a management decision	The purpose of the management decision	0.05
	Studying the problem that arose before IPE	0.05
	Development of alternative management solutions	0.05
	Making the final management decision	0.05

Table 3

The results of developing the methodology for assessing adaptation potential (on the example of IPE "A")

Parameter	Element	Element weight	Score, points	Level of IPE adaptation
External factors				
Resources	Financial opportunities	0.17	3	0.51
	Production capabilities	0.13	3	0.39
	Market opportunities	0.12	2	0.24
	Logistic possibilities	0.12	3	0.36
	Resource capabilities	0.12	2	0.24
	Job opportunities	0.11	2	0.22
	Total by resources			1.96
Management procedure	Organizational and legal factors	0.04	2	0.08
	Information support	0.05	2	0.1
	Total by management procedure			0.18
Total by external factors		0.6	–	2.14
Internal factors				
Resource parameters (opportunities)	Financial opportunities	0.13	4	0.52
	Production capabilities	0.1	3.5	0.35
	Market opportunities	0.08	3	0.24
	Logistic possibilities	0.075	2	0.15
	Marketing capabilities	0.055	2.5	0.1375
	Resource capabilities	0.09	2.5	0.225
	Job opportunities	0.07	2.2	0.154
	Total by resources			1.7765
Management capabilities	The organizational structure	0.1	2	0.2
	Information support system	0.1	1	0.1
	Total by management capabilities			0.3
Possibility of making a management decision	The aim of the management decision	0.05	3	0.15
	Studying the problem that arose before IPE	0.05	1	0.05
	Development of alternative management solutions	0.05	2	0.1
	Making the final management decision	0.05	3	0.15
	Total by possibility of making a management decision			0.45
Total by internal factors		0.4	–	2.5265
Adaptability level of IPE				2.3

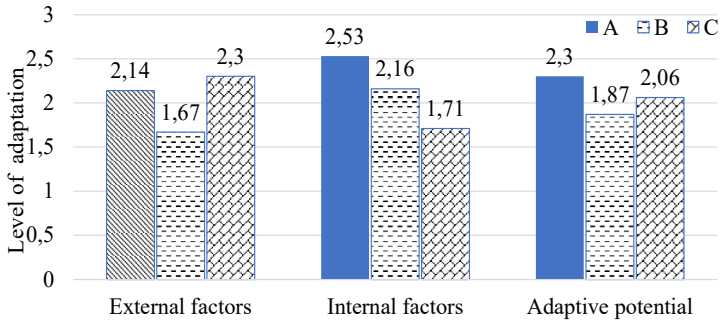

Fig. 5. Dynamics of the integrated indicator of the adaptation potential of the studied IPEs

5. Discussion

Based on the results of the calculations, it was established that the level of adaptation of the studied IPE to changes in economic conditions is 3.47, that is, it is in the zone above the average and positively characterizes the IPE management system.

According to the results obtained using the proposed methodology, it can be concluded that external factors exert a significant influence on the adaptation of IPE (2.58 points out of five possible), since the enterprise cannot adjust them or influence them, which is also confirmed by scientific works [2, 3].

Among the external factors, resources have the greatest impact (1.725 out of five possible points), which is understandable and is caused by the state of war in the country, the disruption of established supply chains, the decrease in the purchasing power of the population, damage to the infrastructure at the macro level, the outflow of qualified labour, delays at customs, a decrease in sales markets, etc.

It is worth noting that resources as an internal factor also exert a significant influence. Thus, experts noted a significant impact on the possibility of IPE adaptation to external changes, changes in the qualitative and quantitative composition of labour resources (0.22 points), insufficient material resources (0.275 points), a decrease in logistics activity (0.275 points) as a result of damage to the infrastructure of enterprises.

According to the organizational structure of management, the experts note the urgency of its improvement (reorganization), transition to new approaches, rules, etc.

In the conditions of informatization and digitization of the entire global society, Ukraine does not remain aside and implements new digital technologies, which forces IPE to adapt to today's challenges in relation to both the external and internal environment.

The obtained integral assessment of the adaptation potential of the studied IPEs indicates their low level, which makes it necessary to develop adequate managerial influences aimed at eliminating the weak positions of the enterprise.

But it is worth noting that adaptation is significantly influenced by the speed of management decision-making, so there is a need, considering the specifics of the pharmaceutical business and the peculiarities of the organization of IPE management, to develop directions for improving the effectiveness of adaptive IPE management.

Study limitations. Limitations of the study are changes in the influence of the external environment, which have different effects on both the activities of the pharmaceutical enterprise and the approaches used in the process of its management. We include martial law, the coronavirus pandemic, damage to infrastructure, changes to the legislative framework, the demographic situation, and the economic crisis to such changes.

Prospects for further research. The perspective of further research should be the assessment of the effectiveness of the resource-factor adaptive management of IPE, which will allow to determine the directions for improving the resource-factor adaptive management of the enterprise.

6. Conclusions

Today, the pharmaceutical sector of Ukraine is a complex socio-economic structure that includes a set of business entities that ensure the production and sale of pharmaceutical products and solve the most important social task – providing the population with high-quality medicines and timely pharmaceutical assistance. In connection with the social orientation, IPE activities must quickly adapt to changes in business conditions (coronavirus pandemic, military actions on the territory of Ukraine, disruption of established supply chains, economic crisis, etc.).

It is suggested that the potential of adapting IPE to external factors of influence and its internal capabilities should be understood as the readiness of the enterprise to respond to changes occurring in the external environment (martial law, globalization, digitization, etc.) taking into account the existing capabilities of the enterprise, with the aim of increasing its level of competitiveness and fulfilment of social obligations – timely provision of effective and affordable medicines to the population.

To assess the potential of IPE adaptation to changes in the external environment and its internal capabilities, it is proposed to use a weighted sum of the points of its individual components, considering the weight of each of them.

Conflicts of interest

The authors declare that they have no conflict of interest in relation to this study, including financial, personal, authorship, or any other, that could affect the study and its results presented in this article.

Funding

The study was performed without financial support.

Data availability

Data will be provided upon reasonable request.

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Received date 26.06.2023
Accepted date 26.10.2023
Published date 31.10.2023

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