

# SCIENTIFIC AND PRACTICAL APPROACHES TO THE DEVELOPMENT AND IMPLEMENTATION OF THE INTEGRATED PHARMACEUTICAL LOGISTICS CHAINS

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## **Abstract**

The article deals with the issues of improving the theoretical foundations and development of scientific and practical recommendations for tools and technologies to integrated management stream processes implementation in activities of participants in the pharmaceutical market in Ukraine to improve the quality and availability of medicinal maintenance of the population.

**Key words:** pharmaceutical company, integrated pharmaceutical logistics, integrated pharmaceutical logistics chain.

## **Introduction**

The modern economy of Ukraine increasingly turns to the system of structural reforms focused on logistics. Today a real need for integration is inherent in enterprises of various branches. In addition, the necessity of passing to innovation and investment model of development, declared by the Government of Ukraine, also actualizes the need to unite industrial, commercial enterprises and companies in the integrated logistics system. They are able to implement the production and supply of quality products to the consumer quickly, timely and at minimal cost (Bowersox, Closs 2008; Molina 2003).

The essence of innovation paradigm of logistics is to provide logistic process as a single entity in a through supply chains from the development and production to its delivery to the final consumer this leads to a higher degree of integration of logistics business processes (Donald 2010; Stock et al. 2005).

As evidenced by the world practice, the establishment and operation of integrated logistics chains contributes to: increase productivity of logistics staff by 30-40%; reduction of cost and processing time of orders by 20-40%; reduce time-to-market by 15-30%; decrease procurement costs by 5-10%; decline in volumes of stocks by 20-40%; decrease manufacturing costs by 10-15%; increase profits by 5-15%. So, in the world practice the most efficient and competitive companies are those which are actively introducing technologies and tools for integrated logistics (Kaplan, Norton 1996).

It should be noted that although the theoretical and practical aspects of logistics are widely studied nowadays in the works of domestic and foreign specialists, but the current problems of implementation and development of integrated logistics in activity of the pharmaceutical market participants (PhMP) require a certain comprehension and consideration of the specific conditions of their work.

Therefore the goal of this paper is to study the feasibility of implementing pharmaceutical logistics innovative approaches in PhMP's management practices as the modern concept of integrated management flow processes to optimize the activity of all participants of the logistic chains.

## 1. Analysis and discussion

As research shows, today in Ukraine can be identified five sectors of the economy where supply chain management (SCM-concept) is a major tool for improving the efficiency of business: aircraft; automotive; electrical engineering; wholesale and retail trade; pharmacy (Posylkina, Sagaidak-Nikityuk 2011).

It should be noted that the present state of pharmaceutical logistics development in Ukraine is characterized by the following features: the process of movement of pharmaceutical products is carried out not only in economy, but also in social sphere; parameters of flow processes and methods for their control are determined by the specific features of medicines; circulation of pharmaceutical products is inextricably linked to the provision of medical services, which act as a logistics pulse; medicines space motion has an international inter-state character, it causes a significant role of imported pharmaceutical products; the process of moving drugs is carried out in a strong diversification of pharmaceutical products; movement of numer-

ous analogues and modifications of domestic and imported pharmaceutical products must be determined not only by commercial factors, but also by medical reasons; wholesale pharmaceutical companies create its own distribution (pharmacy) chains for effective retail of pharmaceutical products sales; to improve the organization of traffic flow processes a specialized logistics infrastructure is formed with the requirements of the drug treatment regulation; traffic flow processes management is carried out by marketing support, it generates information about the market of pharmaceutical products; active preparatory work for establishing of business relationships to suppliers (rationale approaches for the selection of suppliers, creation the conditions for future business negotiations), has special position; dispatching of flow processes in all levels of the pharmaceutical supply chain – from drugs developing to final consumers (patients), is gradually developing; there is a high degree computerization of the PhMP; rationalization of transport and storage operations in PhMP activity is observed etc. (Buylin 2008, Posylkina, Sagaidak-Nikityuk 2011).

In the evolution of pharmaceutical logistics the level of logistic activity integration in PhMP is continuously increased. This integration has gradually evolved from infrastructure integration across organizational and informational (Posylkina, Khromykh 2011).

Generalization of the results of scientific researches allowed to determine the reasons causing the relevance of the integration of logistics processes and systems in the pharmaceutical industry: expansion of national and global pharmaceutical markets, the globalization processes development; constant growth of customer requirements to the level of logistics services; the need for rapid response to PhMP's changing demands; the acceleration of scientific and technological progress in communications; introduction into business practices of domestic pharmaceutical companies (PhC) computer aids of new generations; introduction of modern information technologies in PhC; increase in prices for resources and necessity of its more efficient use, cost savings for the pharmaceutical supply chain to ensure the affordability of medicines; reducing life cycle of pharmaceutical products; growth rate, intensity and complexity of material, financial and information flows, the need for synchronization to improve the physical, pricing and availability information medicinal maintenance of the population; increasing quality requirements for pharmaceutical products and the need to create conditions for the management of its quality throughout the pharmaceutical supply chain; introduction of PhMP process management technologies and standards of logistics services to streamline their operations and improve the final socio-economic results; expansion of outsourcing as a modern form of logistics business processes optimization; understanding by the PhC

management the benefits of internally branded and inter-firm integration, partnership development as the basis for long-term relationships and getting on that basis synergistic effect; increased attention to environmental issues, logistics recycling by optimization processes of waste disposal in pharmaceutical production; necessity to use modern technologies and tools to protect pharmaceutical products from counterfeits; creation the added value for consumers (clients) due to the necessary level of logistics services and supply required pharmaceutical products to the desired place at the right time, in the necessary quantity at low cost; appearance of the new logistics concepts that are being actively implemented in the practice of foreign and domestic PhC and significantly increase their effectiveness and competitiveness etc. (Posylkina et al. 2014).

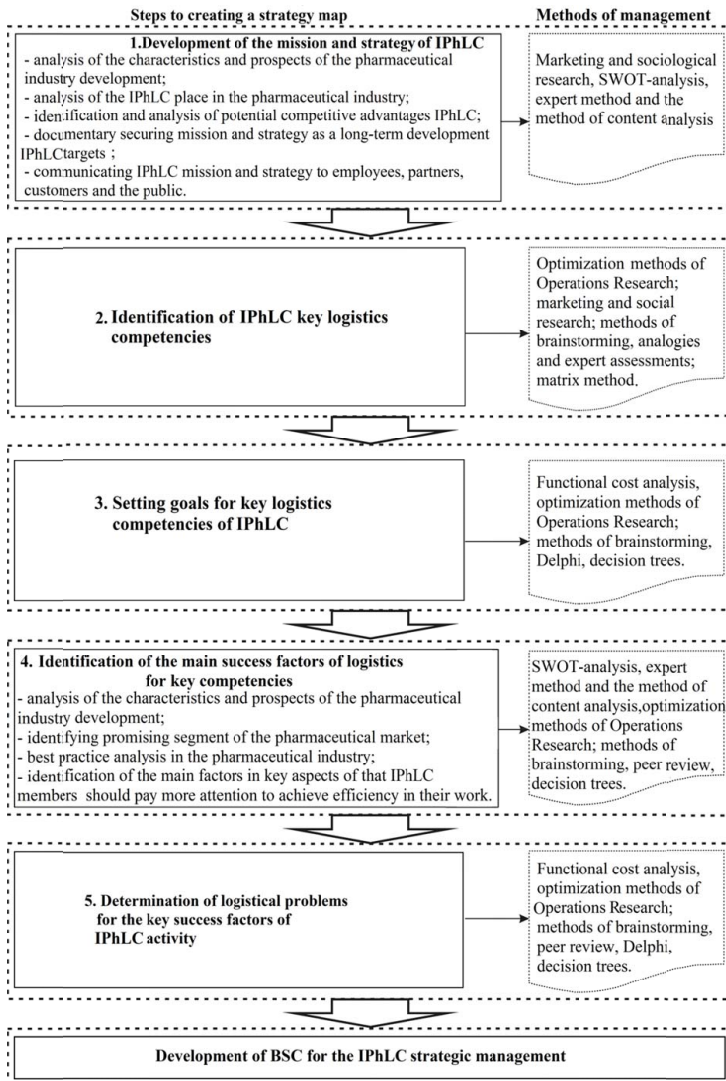
Given all the above, it can be argued that an integrated pharmaceutical logistics chain (IPhLC) – is a systematic approach to managing interdependent and interrelated logistics systems. It includes design, coordination, motivation of relationship between logistics systems, which forms a supply chain and provides regulation and integration of basic logistics business processes, starting with the development of medicines and ending with it delivery to end-users to fullest satisfaction of their needs and getting an additional effect of partnership among all of participants in an integrated chain (Posylkina, Sagaidak-Nikityuk 2011; Posylkina et al. 2014).

Today the pharmaceutical market in Ukraine is actively implemented enterprise management model, which is based on the requirements of the international quality standards. Philosophy of the ISO Standards assumes orientation to customer needs, strategy of the company, introduction of the process approach, continuous improvement of the company, making decisions based on evidence, forming long and mutually beneficial relations with suppliers and enterprises, etc. (Posylkina et al. 2014). Balanced Scorecard (BSC) is a tool that, on the one hand, allows providing orientation of the entities to the implementation of the chosen strategy, on the other hand, provides balance, accountability and motivation of a different business units and IPhLC members. Thus, the BSC introduction as IPhLC strategic management tool contributes to the strategic management by key logistics competencies of the chain and of each participant. Based on these studies, the authors proposed an algorithm to construct the strategic map of efficiency for IPhLC management. This algorithm can be presented as follows (Figure 1).

IPhLC processes contribution into PhMP competitiveness maintenance is to preserve the quality of medicines at all stages of IPhLC due to compliance storage technologies, transport, control of expiration dates of pharmaceutical products (to avoid causing harm to health of final consumers

(patients); reducing of logistics costs, contributing to decrease the prices of pharmaceutical products (successfully compete in modern pharmaceutical market can only those that offer high quality products at affordable prices); ensuring a high level of logistics customer service that positively affects the image of the PhMP (geographically well-developed logistics network, a developed system of urgent delivery of pharmaceutical products in pharmacies is a precondition for effective medicinal maintenance of the population (Ampuero et al. 1998; Kaplan, Norton 1996).

Figure 1. Algorithm for the formation of the strategic map for managing of IP hLC



The conducted analysis showed that today in many domestic enterprises a strategy of development is characterized by conditional almost abstract character, and rather little formalized. Typically, PhMP activity during the formation and implementation takes into account interests of only one side – the owner. An employee usually does not aware of overall development strategy. Therefore they act without coordination within interests of certain groups. Additionally, most PhMP at budgeting ongoing activities ignores their strategic goals. Modern methods of assessment the level of customer satisfaction and efficiency of key business processes practically are not used (Posylkina, Sagaidak-Nikityuk 2011). In practice, the BSC introduction in foreign PhC allows to implement the requirements of Standards ISO 9001:2000 for orientation to consumers, helps to attract all of employees for effective implementation the strategy, contributes to the analysis and evaluation of key business processes and improve business results of an enterprise. But, at the same time constructed BSC does not apply to logistic activities, does not include the requirements of International Standards ISO 9001:2000 for the implementation of the process management approach does not aimed on the development of integration processes etc. This confirms the relevance of further developments of using BSC for IPhLC strategic management (Posylkina, Khromykh 2011; Posylkina et al. 2014). As mentioned, the main advantage of BSC implementing in management is that this system relies on key management competencies which are aimed on satisfying needs of customers, partners, owners and BSC provides involvement of all participants to implementation of general IPhLC objectives. It improves the motivation of employees to quality performance of their duties.

The main functions of the BSC for IPhLC are: to ensure effective management of flow processes within IPhLC; to provide the necessary information IPhLC members for effective management decisions, etc. (Kaplan, Norton 1996). Introduction of BSC in IPhLC governance begins with building of the Strategy map of efficiency. Development of Strategy map efficiency includes IPhLC mission statement, formulation of objectives that are defined by the mission on following key competencies: “Customers”, “Partner”, “Finance”, “Internal Logistics Processes” and “Development”; establishing of the factor of efficiency in IPhLC functioning, which ensure the implementation of its strategic goals; justification of the assessment indicators list for the above key competencies. Quantitative and qualitative characteristics for the purposes of the BSC for IPhLC are suggested indicators. During forming the BSC for IPhLC it’s necessary to comply the basic principles of its construction: the simplicity of the system parameters; their limited quantity (less than 7); measurability indicators of the possibility of quantification; determination of the “specific weight” of each indicator, significance of its impact on the

effectiveness of the IPhLC in general. Specific construction principle of BSC for IPhLC is a coherence of system of indicators to GxP requirements of good practice and international quality standards ISO consideration, not only in economic but in social aspects in activity of all PhMP (Posylkina et al. 2014).

Based on the literary sources analysis and expert survey of leading specialists in the field of pharmacy, the authors selected indicators of efficiency for each key logistics competence that embody the above principles and reflect the main socio-economic priorities of IPhLC activity.

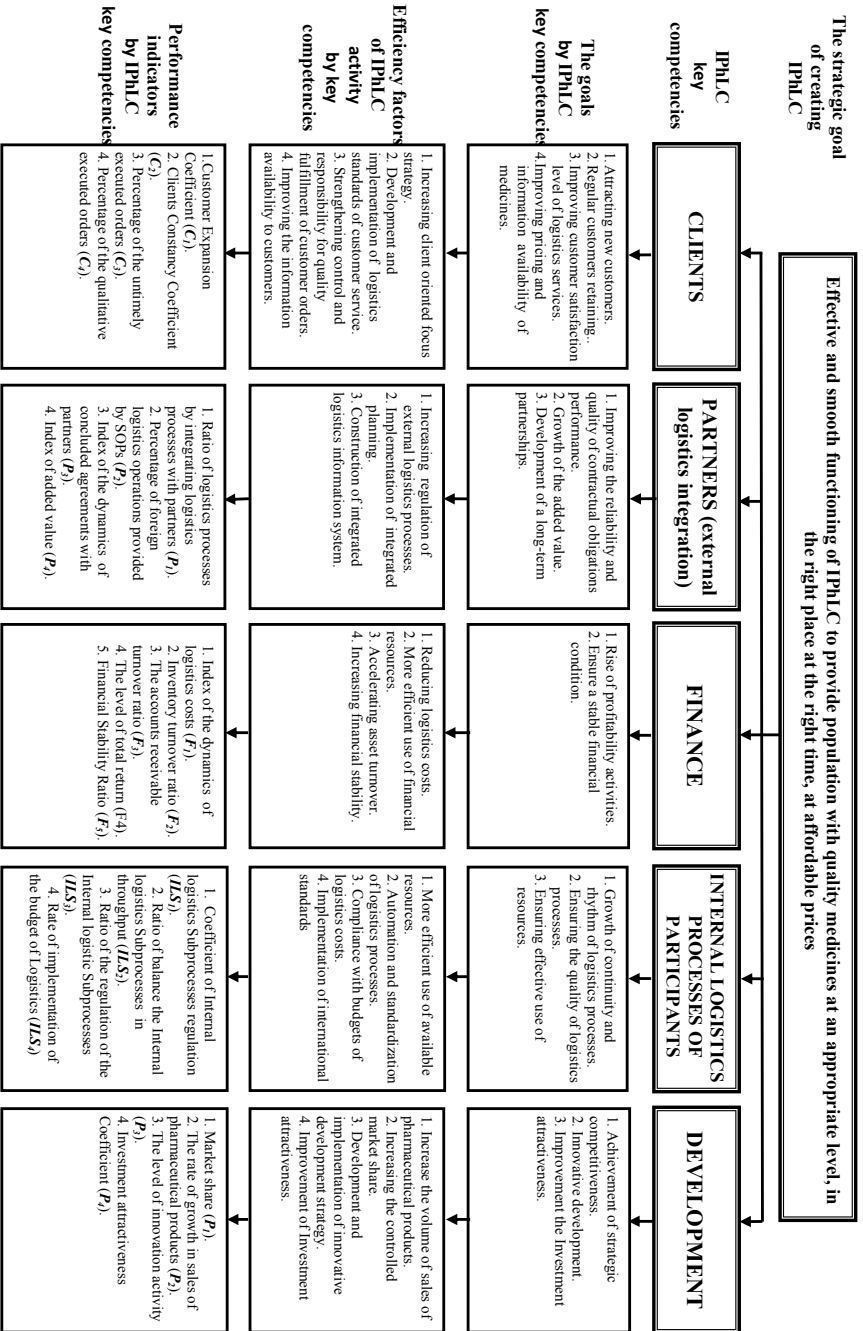
Peer review was carried out with the involvement of 250 respondents. The experts were specialists who have practical experience in pharmacy – managers and specialists in logistics services, marketing, distribution companies, pharmacy chains, specialized logistics companies and others. Consistency of experts findings is assessed by the using concordance coefficient of rank matrices by efficiency indicators for each key competence of IPhLC. The concordance coefficients are in the range 0,94-0,96, which indicates a high consistency of the findings of experts. Calculated values of the Pearson criterion were compared with the critical level for a given confidence probability of 0.95. Hypothesis consistency of expert opinion is taken when an empirical criterion value is more than in the table space. In comparing, we obtain the following calculated value  $\chi^2_{\phi} > \chi^2_{\text{table space}}$ . As a result, we can conclude that the coherence of expert opinions – is not accidental.

For the final selection of indicators the method of pair correlations was used. Based on this method the coefficients of pair correlation between selected indicators for each key logistics competence were calculated. The calculations showed that the values of pair correlation coefficients for the analyzed sample did not exceed 0.9.

It confirms feasibility in selected IPhLC efficiency indicators, because too high degree of correlation shows presence of the effect of autocorrelation between selected indicators. Recommended for IPhLC Strategy map of efficiency that contains the mission, goals, factors and indicators of efficiency for key logistics competencies is shown in Figure 2.

In addition, the recommended BSC allows to control the decision of actual current problems facing IPhLC. Among them: increase regulation of external logistics processes (the percentage of external logistics operations provided by Standard Operating Procedures); more effective use of financial resources (level of overall profitability, turnover ratio of receivables); automation and standardization of logistics processes (balance rate of internal logistics throughput subprocesses, adjustability of internal logistics processes coefficient); increase of market share controlled by IPhLC; creation and implementation of innovative development strategy (level of innovative activity); management of investment.

Figure 2. The offered strategic map for efficiency of IPhLC attractiveness (Investment attractiveness Index) and others





Thus, the introduction of BSC for strategic IPhLC' management allows, on the one hand, to objectively assess the state of overall logistics strategy implementation of each individual participant and IPhLC as a whole, to raise efficiency of use the resources at all levels of the chain; on the other hand, to carry out IPhLC' management with the requirements of International Quality Standards (Ampuero et al. 1998; Paggel 2004).

The example of BSC constructing for IPhLC in PJSC «Farmak» based on offered Strategic map of efficiency is shown in Figure 3.

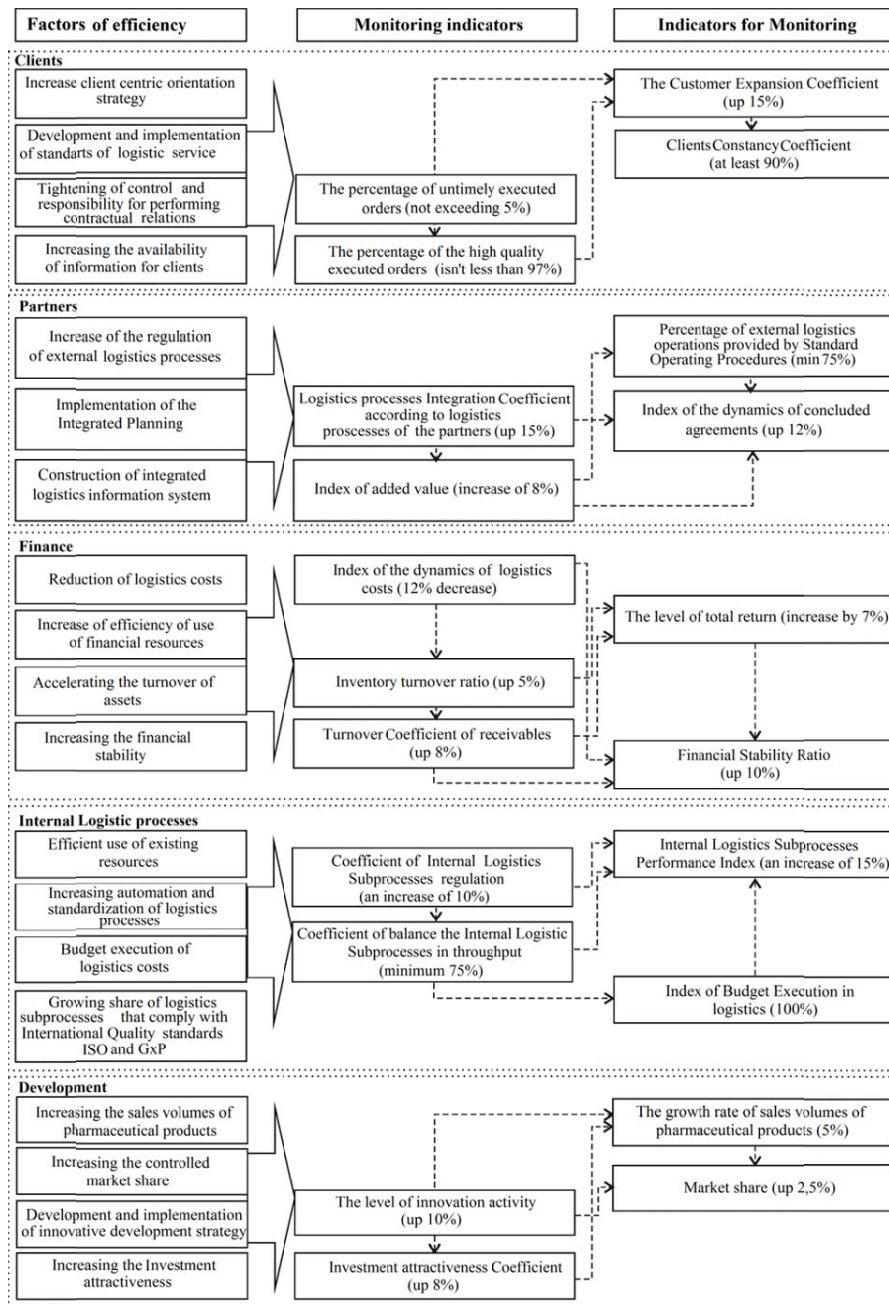
To evaluate the effectiveness of the IPhLC strategy implementation, at first the desired (etalon) values of local indicators of efficiency in logistics activity for each key competence should be calculated, it conforms to logistics strategy.

They are determined by the needs and expectations of clients and other stakeholders, projected changes in factors of internal and external environment and the best actual values of these indicators for previous periods. Based on the desired (etalon) value of local logistics performance of each IPhLC participant the desired (etalon) Index of Efficiency in logistic activity for each key competence are determined. On the basis of these parameters the desired (etalon) values of Integral Index of Efficiency in logistic activity for each participant are determined. For each key competence within IPhLC settlements are carried out according to a similar algorithm. Comparison of actual Integral Index of Efficiency in logistic activity reflects the desired degree of IPhLC strategy implementation in the reporting year. If the resulting value higher or equal to one, the logistic strategy implementation is successful.

To evaluate the results of qualitative analysis of Integral Index of Efficiency in logistic activity for each key competence for each participant of the chain following scale is proposed:

- $K_j^i = 1$  – a strategic goal of IPhLC for the key competence is completely implemented;
- $0.95 \leq K_j^i \leq 1$  – a strategic goal of IPhLC for the key competence is almost implemented;
- $0.85 \leq K_j^i \leq 0.94$  – an acceptable level of implementation of the strategic goal of IPhLC for key competence;
- $K_j^i \leq 0.84$  – a strategic goal for the key competence requires rethinking and adjusting.

Figure 3. Construction by the example of IPhLC in PJSC “Farmak”



The proposed scale should be used for qualitative efficiency assessment of IPhLC Integral Index in general ( $I_{IPhLC}$ ).

Results of constructing the generalized matrix of efficiency assessment for participants and IPhLC in PJSC “Farmak” in general is given in Table 1.

The proposed matrix, as a tool for IPhLC strategic management, has advantages that corresponds to assessment of the logistics strategy implementation for each participant and key competences, and IPhLC as a whole.

Balance on key competences in logistical activity of IPhLC participants underline bilateral and mutually beneficial partnerships at all levels of the chain. A high degree of differences in the actual value of the logistics integration between PJSC «Farmak» and «NOVA-CHEM» can be explained by the short duration of their business relationship. However, achieving balance in logistics processes for IPhLC participants is not evidence the lack of capacity development. Given the different meanings of key competences in PJSC “Farmak” and others IPhLC, desired level value for each individual competence for them may not be the same.

Taking into account that some values of key competencies of logistics PJSC «Farmak», JSC «BaDM», «Good Day» Pharmacy are the same, the calculated values of the desired level of logistics integration are also very close. Given the low values of key competencies of efficiency in logistic activity for JSC «NOVA-CHEM» in comparison with other participants of IPhLC the calculated desired level of logistics integration of this participant is considerably different. For the purpose of implementing the general IPhLC strategy actual value of Integral Index of Efficiency in logistics activity was designed, it was equal to 0.813. The desired (etalon) value of the Integral Index during the period was set at 0.843. Value of the actual value of the Integral Index of Efficiency in logistics activity and its desired level in the reporting period was equal to 0.96. It shows that PJSC «Farmak» pays enough attention and takes pains for the successful implementation of the IPhLC strategy.

Thus, the use of the proposed BSC is able to solve the main issues for the development of individual PhMP and IPhLC in general – to support implementation of strategic planning in logistics activity, to ensure assessment of the effectiveness in logistics management within the chain to form a control system over the execution of tasks, stimulate the growth of productivity of IPhLC participants etc.

## Conclusions

1. The results of the research suggest that integrated logistics today is of particular importance for the future development of the domestic pharmaceutical industry.

Table 1. The matrix of generalized estimation of efficiency of functioning IPhLc in PISC "Farmak"

IPhLc Participants	PISC "NOVA-CHEM" (Kyiv)	PISC "Farmak"	LLC "BADM" (Kyiv)	CE "Kyiv Regional Clinical Hospital"	"Good day" Pharmacy (Kyiv)
Key Competence					
Comprehensive indicator in key logistics competence "Clients"	$K_{eC}^S = 0,736$ $K_{fC}^S = 0,747$	$K_{eC}^P = 0,872$ $K_{fC}^P = 0,881$	$K_{eC}^D = 0,736$ $K_{fC}^D = 0,727$	$K_{eC}^{HCF} = 0,698$ $K_{fC}^{HCF} = 0,709$	$K_{eC}^{Ph} = 0,822$ $K_{fC}^{Ph} = 0,592$
Comprehensive indicator in key logistics competence "Partners"	$K_{eP}^S = 0,789$ $K_{fP}^S = 0,702$	$K_{eP}^P = 0,812$ $K_{fP}^P = 0,853$	$K_{eP}^D = 0,899$ $K_{fP}^D = 0,922$	$K_{eP}^{HCF} = 0,987$ $K_{fP}^{HCF} = 0,965$	$K_{eP}^{Ph} = 0,865$ $K_{fP}^{Ph} = 0,834$
Comprehensive indicator in key logistics competence "Finance"	$K_{eF}^S = 0,638$ $K_{fF}^S = 0,742$	$K_{eF}^P = 0,899$ $K_{fF}^P = 0,896$	$K_{eF}^D = 0,945$ $K_{fF}^D = 0,896$	$K_{eF}^{HCF} = 0,895$ $K_{fF}^{HCF} = 0,761$	$K_{eF}^{Ph} = 0,955$ $K_{fF}^{Ph} = 0,927$
Comprehensive indicator in key logistics competence "Internally Logistic Processes"	$K_{eILP}^S = 0,885$ $K_{fILP}^S = 0,768$	$K_{eILP}^P = 0,973$ $K_{fILP}^P = 0,948$	$K_{eILP}^D = 0,895$ $K_{fILP}^D = 0,845$	$K_{eILP}^{HCF} = 0,825$ $K_{fILP}^{HCF} = 0,886$	$K_{eILP}^{Ph} = 0,747$ $K_{fILP}^{Ph} = 0,794$
Comprehensive indicator in key logistics competence "Development"	$K_{eD}^S = 0,827$ $K_{fD}^S = 0,671$	$K_{eD}^P = 0,794$ $K_{fD}^P = 0,696$	$K_{eD}^D = 0,827$ $K_{fD}^D = 0,828$	$K_{eD}^{HCF} = 0,933$ $K_{fD}^{HCF} = 0,938$	$K_{eD}^{Ph} = 0,957$ $K_{fD}^{Ph} = 0,975$
The integral indicator value of efficiency of functioning for each participant of IPhLc	$I_S^E = 0,770$ $I_S^{fact} = 0,726$	$I_P^E = 0,868$ $I_P^{fact} = 0,850$	$I_D^E = 0,857$ $I_D^{fact} = 0,841$	$I_{HCF}^E = 0,862$ $I_{HCF}^{fact} = 0,846$	$I_{Ph}^E = 0,865$ $I_{Ph}^{fact} = 0,812$
Evaluation of the strategy implementation for each participant of IPhLc	$\frac{I^{fact}}{I^{Ealone}} = 0,942$	$\frac{I^{fact}}{I^{Ealone}} = 0,980$	$\frac{I^{fact}}{I^{Ealone}} = 0,981$	$\frac{I^{fact}}{I^{Ealone}} = 0,982$	$\frac{I^{fact}}{I^{Ealone}} = 0,939$
The integral indicator value of efficiency of functioning for IPhLc as a whole	$I_{IPhLc}^E = \sqrt[5]{0,726 \times 0,850 \times 0,841 \times 0,846 \times 0,812} = 0,813$				
Evaluation of the strategy implementation for IPhLc	$I_{IPhLc} = \sqrt[5]{0,942 \times 0,980 \times 0,981 \times 0,982 \times 0,939} = \frac{0,813}{0,843} = 0,96$				



2. It is proved that the integrated management of flow processes improves balance and transparency of all SFR and their attractiveness, comprehensive quality management, environmental performance, risk and safety of pharmaceutical production in accordance with international quality standards ISO and good practice GxP, as well as to optimize all resources used in development, production, sale of medicines, improve logistics customer service to increase competitiveness of the PhMP.
3. The features of the present stage of development of the domestic pharmaceutical logistics are investigated. The necessity of developing PhMP logistics integration concept, which will take into account the specificity of the medicines as a commodity and the specific requirements for the functioning of PhMP as a socially-responsible organizations, is justified.
4. It is proved that one of the most effective tools of strategic management IFL in modern conditions is the introduction of the BSC. The main advantage of implementing the IPhLC management is that the system relies on key management competencies that are aimed at satisfying the needs of customers, partners and owners of PhMP and introduces participants to implementation of general objectives of IPhLC. This improves motivation of employees to quality performance their duties.
5. The strategic indicators of efficiency on key competencies of IPhLC specific activity are identified. Efficiency strategy map is constructed, it reflects and allows the major socio-economic priorities of logistic activity of individual participants of IPhLC and the chain as a whole in the conditions of quality management implementation.
6. It is proved that the implementation of the offered BSC in domestic PhMP will help to diagnose bottlenecks in the logistics processes management on the individual links of IPhLC, and to identify shortcomings in IPhLC functioning in the context of its key competencies.

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