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Adaptation of business structures of wholesale and retail trade in food products to crisis phenomena using logistics mechanisms

Abstract. Logistics adaptation mechanisms in food trade provide a flexible response to market changes through supply optimisation, interaction between wholesale and retail, digitalisation, and cost reduction while maintaining quality. The paper examined the adaptation of wholesale and retail trade structures to economic and social instability caused by war, inflation, changes in

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demand and digital transformation through the use of logistics mechanisms. The purpose of the study was to improve logistics strategies, considering the specifics of the functioning of various types of commercial enterprises. The methodological basis was the structural and functional approach, comparative typological analysis, and the construction of economic and mathematical models. Analysis of the dynamics of retail enterprises in 2010-2023 revealed a significant reduction in their number in all segments, which indicates a structural transformation of retail and wholesale trade in the context of digitalisation and changes in consumer practices. The paper systematised participants in wholesale and retail trade in food products in Ukraine, considering specialisation, scale, and logistics functions. The features of the market, the level of logistics integration, and the adaptability of operators to external changes were determined. Based on statistical data for 2014-2023, an analysis of the volume of sales of food products and the dynamics of value added in the wholesale and retail trade sectors was carried out. In 2023, the volume of sales in retail trade in food products amounted to: in non-specialised stores – 594.0 billion UAH; in specialised stores – 28.0 billion UAH; from stalls and markets – 0.3 billion UAH, while in wholesale: in specialised stores – 670.0 billion UAH; in non-specialised stores – 107.7 billion UAH. The highest relative change in value added in terms of production costs from 2023 to 2014 can be traced in specialised wholesale enterprises and amounted to 747.4%. Two mathematical models were proposed: for wholesale enterprises – with the priority of supply stability, effective inventory management and minimisation of logistics costs; for retail enterprises – with a focus on rapid rotation of the range, flexible response to demand, and maximisation of profitability. A flowchart of the adaptive decision-making algorithm in logistics was constructed. The practical significance of the study was to develop tools for improving the sustainability of commercial enterprises in the face of external threats

Keywords: market turbulence; changes in the business environment; forms of trade; flexibility of commercial structures; sales models; logistics management

INTRODUCTION

In the conditions of market turbulence caused by war, economic fluctuations and rapid technological development, enterprises of wholesale and retail trade in food products face the need for prompt adaptation to changes in the business environment. Logistics plays a key role in ensuring the sustainability of such enterprises, allowing them to quickly respond to external challenges, optimise supply chains, reduce costs, and ensure continuity of trade turnover. In this context, the study of logistics mechanisms as adaptation tools that allow commercial enterprises to remain competitive and function effectively even in times of crisis is particularly relevant.

The study by N. Zhao *et al.* (2023) highlighted the different roles of three supply chain sustainability capabilities: absorption capacity (before failures), reactivity (during failures), and recovery capacity (after failures), which have different effects on supply chain efficiency. The efficiency of the supply chain is particularly important in the light of the transformations taking place in

the agri-food markets of Ukraine as a result of the full-scale invasion of Russia. According to N. Kutsmus *et al.* (2024), the war caused not only direct physical losses in the agricultural sector, but also profound disruptions in the supply chains of food and processed products. In response to restrictions on sea transportation, rising logistics costs, loss of storage facilities and transport capacity, the market began to reorient to new logistics corridors (in particular, land routes to the EU and alternative routes through the Danube Region). As indicated by O. Bodnar *et al.* (2024), due to international initiatives, pressure on the domestic food market was significantly reduced, which allowed retail chains to maintain stable supplies and mitigate risks to food security. However, doubling the cost of logistics due to limited access to sea and alternative land routes has created additional barriers for small and medium-sized enterprises, forcing them to look for flexible domestic solutions. In this context, wholesale and retail food companies are not only consumers of

new logistics formats, but also active participants in the transformation of agri-food logistics. Adaptation to new conditions involves, in particular, diversification of supply sources, investment in multi-channel transport systems, development of our own logistics centres, and the use of digital technologies to optimise operations. Special attention is paid to the development of sustainable partnerships with Ukrainian agricultural producers, which allows maintaining local supply chains even in times of crisis. Thus, logistics mechanisms become not only a tool for survival, but also a lever of strategic development for enterprises that seek to maintain market positions, respond to challenges of instability and participate in the restoration of national agri-food potential.

It should be noted that problems in the activities of wholesale and retail enterprises in the food sector arose not only as a result of a full-scale invasion – they occurred earlier. In particular, based on the results of analysis, V. Lukianova & M. Kyryliuk (2024) identified the following key difficulties: lack of a clearly formulated development strategy for wholesale enterprises; insufficient development of warehouse infrastructure and existing infrastructure restrictions; excessive concentration of logistics centres; imperfect services of resellers that do not always meet the needs of certain categories of consumers; and weak information support for business processes and insufficient level of customer support.

S. Bolila (2024) agreed that the war in Ukraine created a number of challenges for retail, but simultaneously opened up a chance for those players who decide to innovate. Her review of the retail market indicates a large-scale transformation, which will only increase under the influence of digitalisation and changing consumer preferences. These processes force retailers to switch to more efficient and technologically advanced business models that meet current trends and can quickly respond to an unstable external environment.

The study by S. Tereshchenko & N. Dehtiar (2025), which focused on the functioning of wholesale food trade in a competitive environment, found that in order to effectively implement the chosen strategy, wholesale enterprises should focus on several key areas. In particular,

this refers to the introduction of digital transformation tools – such as CRM, ERP, warehouse management systems, etc. – which allows automating operational processes, minimising the number of errors, and increasing overall productivity. It is also important to improve logistics processes, in particular, delivery, storage and processing systems for goods, which helps to reduce costs and shorten delivery times. In addition, the strategic task is to expand the product range and improve the quality of customer service. As noted by M.M. Mamchyn & V.V. Naida (2025), given the difficult situation facing the Ukrainian retail sector, companies must implement a comprehensive approach to adaptation and ensuring sustainable operations. Among the priority areas of development, they highlighted customer orientation through a high level of service and flexible assortment formation; intensive expansion of online sales channels and optimisation of logistics to meet the needs of the digital buyer; establishing partnerships with local manufacturers to strengthen supply chains and reduce costs; rationalisation of costs, in particular, through logistics efficiency.

The purpose of the study was to substantiate and improve the logistics mechanisms of adaptation of wholesale and retail trade enterprises with food products to crisis phenomena and transformations of the business environment by analysing their interaction, the effectiveness of sales of goods, and the development of applied adaptation models. The objectives of the study were to investigate the features of the functioning of wholesale and retail enterprises with food products in the context of crisis changes, in particular, to analyse the volume of sales of food products and created added value; to determine the logistics relationships between wholesale and retail trade, and to identify differences in the mechanisms of their adaptation to an unstable environment; to develop economic and mathematical models of logistics adaptation for wholesale and retail enterprises and to build an algorithm for making logistics decisions in accordance with the specifics of each type of trade.

MATERIALS AND METHODS

The structural and functional method was used to study the logistics interaction between

wholesale and retail trade enterprises in the field of food sales. This method allowed considering the trade logistics system as a set of interrelated links (wholesale, retail, and logistics support between them), each of which performs separate functions aimed at achieving a common goal – efficient and continuous delivery of products to the end user. Within the framework of the method, the following tasks were carried out: identification of structural components of the logistics chain (wholesale, logistics, and retail links); determination of the functional load of each link in creating added value; analysis of methods of logistics support for enterprises' activities; identification of relationships and consistency of actions between system elements. The result of applying the method was the generalisation of the functional roles of each link in the table, which allowed systematically assessing the effectiveness of logistics solutions, identifying potential optimisation points, and formulating recommendations for improving the adaptability of trade logistics in the context of business environment transformations.

The study used official statistical data of the State Statistics Service of Ukraine (n.d.) for the period 2014–2023. As of the beginning of 2025, the summary statistical indicators for 2024 were not fully published, so they were not included in the analytical array. This determined the time frame of the study and served as a methodological constraint that was taken into consideration when interpreting the results. When applying the grouping method, food wholesale enterprises were grouped into groups: non-specialised and specialised enterprises, and retail: non-specialised stores, speciality stores, and businesses that sell from stalls in markets. Methods of absolute and relative values were used to analyse the activities of wholesale and retail trade enterprises with food products. The following indicators were investigated: the number of retail and wholesale enterprises divided into groups; the volume of food products sold by wholesale and retail enterprises; value added by production costs of wholesale and retail enterprises. The analysis of time series in the study was a methodological approach that allowed investigating trends in the development of wholesale and retail food trade enterprises based on data

for 2014–2023. This method included analysis of changes in the number of retail and wholesale enterprises divided into groups; in the volume of food products sold by wholesale and retail enterprises; in value added by the production costs of wholesale and retail enterprises.

In the course of the study, the method of comparative typological analysis was applied, which allowed systematically characterising the key participants in wholesale and retail trade in food products in Ukraine. The sources of information were open data on enterprises, in particular, the official websites of key participants in wholesale and retail trade in food products in Ukraine. Information posted on the web resources of the following companies was analysed: ATB-Market (n.d.), Fozzy Group (n.d.), METRO Cash & Carry (n.d.), Flagman (n.d.), Agroprodukt (n.d.), Milkiland (n.d.), MHP (n.d.), Kernel (n.d.), Nibulon (n.d.), Stolychnyi Wholesale Market (n.d.), Shuvar Wholesale Market (n.d.), and online trading platforms: Rozetka (n.d.), Zakaz.ua (n.d.), Prom.ua (n.d.), Allbiz (n.d.), Agrotorg (n.d.), Biologic.ua (n.d.), Lavka Tradiciy (n.d.). Not all companies analysed in the study have official websites with up-to-date information on logistics processes, business scales or distribution channels (TEDIS Ukraine, Fruitline, Nezhdana, Novus, Varus, ECO-Market, Tavria-V, Klass, Rukavychka, Nash Krai, LotOK, OKKO mini-market, WOG market, Good Wine, Eco-Lavka). In such cases, information from aggregated platforms (B2B catalogues, news resources, public registers) was used or a descriptive presentation was stored based on the author's expert analysis, without reference to the corporate source. These sources allowed getting up-to-date information about the specialisation of enterprises, the scale of their activities, logistics infrastructure, availability of IT solutions, and channels of interaction with B2B or B2C segments. The method included: a comparative assessment of market entities according to the criteria of specialisation, scale of activity, logistics functions and security features; typologisation of enterprises by functional roles in the logistics chain: large distributors, specialised suppliers, agro-industrial holdings, wholesale markets, electronic platforms (for the wholesale segment); national networks, regional operators, convenience stores, specialised

retail outlets, online retailers and farmers' cooperatives (for the retail segment). The application of this method allowed forming generalised tables reflecting the structural diversity and logistics specialisation of enterprises, and outlining their role in ensuring the effective functioning of the food supply chain.

To build effective models of adaptation of logistics systems to the conditions of unstable external environment, an integrated approach was applied, which provides: comparative typological analysis of the functioning of wholesale and retail food trade enterprises; economic and mathematical modelling of adaptive behaviour considering industry specifics, risks and resource constraints; formalisation of the logic of managerial decision-making in the form of a flowchart describing the sequence of adaptive actions. The highlighted differences in the adaptation mechanisms of wholesale and retail enterprises led to the need for separate modelling of logistics solutions for each type of enterprise. For wholesale enterprises, the logistics adaptation model was aimed at minimising costs, provided that a guaranteed level of supply was ensured. The following factors were considered: number of suppliers, planning periods; projected demand, inventory volumes; logistics costs and supplier reliability level; inventory balance and service level requirements. For retail enterprises, a model has been built that focused on maximising demand satisfaction with limited supplies and flexible assortment management. It considered: the dynamics of product availability; demand forecast and profitability of categories; supply restrictions, the number of items in the range, and the presence of key products. Based on the constructed models, an algorithm for adapting logistics solutions has been developed, which demonstrates the stages of assessing demand, resources, risks, and substantiating the choice of management actions for wholesale and retail trade in food products.

The bibliographic method in the study of enterprises of wholesale and retail trade in food products consisted in the systematisation and analysis of scientific sources (Kutsmus *et al.*, 2024; Kovalenko & Yashchenko, 2024; Tereshchenko & Dehtiar, 2025), and analysis of statistical data (State Statistics Service of

Ukraine, n.d.). The use of logical generalisation allowed, based on empirical data and real observations, forming general theoretical and applied conclusions that can be extended to wider groups of objects or situations.

RESULTS AND DISCUSSION

Logistics adaptation mechanisms include a system of measures that allow food trading enterprises to respond effectively to changes in the business environment. These are complex processes that ensure rapid adaptation to new conditions by optimising supplies, reallocating resources, and changing logistics strategies. Logistics adaptation may include changing suppliers, delivery routes, changing the composition of products or packaging options depending on market requirements or market conditions. Logistics in crisis situations is characterised by the need to respond quickly to unpredictable changes. During periods of economic and political crises or transformations of the business environment, the requirements for flexibility and speed of change in logistics chains increase. In such conditions, it is important to ensure the stability of supply, minimise transportation and storage costs, and control the quality of goods, which is especially important in the food trade. Innovative technologies and automation are often used for adaptation, which allows enterprises to adapt to new conditions without significant financial losses. Logistics is an integral part of the strategy of adapting food trading enterprises, as it determines how the product gets from the supplier to the end user, and is crucial for maintaining competitiveness. In a changing market, the adaptation strategy requires adjusting logistics processes to the most effective management of supply, distribution of goods, and communications with suppliers and consumers. Logistics strategies should be flexible and include measures to quickly change or optimise existing supply chains, ensuring a prompt response to market changes.

The practice of Ukrainian enterprises confirms the effectiveness of applying adaptive logistics strategies. Fozzy Group (n.d.) in response to the destabilisation of supplies from certain regions, optimised delivery routes through western hubs, and increased the use of

its own warehouses and transport to ensure the sustainability of the supply chain. MHP (Nasha Ryaba) (MHP, n.d.) implemented automated demand forecasting systems considering regional changes in consumer activity, which reduced logistics costs. Online platform Zakaz.ua (n.d.) adapted logistics through dynamic routing and integration of omni-channel services, which provided flexibility of delivery even in unstable conditions. The Shuvar Wholesale Market has

activated electronic orders and distribution of local products, reducing dependence on interregional supplies (Shuvar Wholesale Market, n.d.). The interaction of wholesale and retail trade in food products in the logistics aspect, as shown in Table 1, is a critical component of the effective functioning of the supply chain. Each link in the chain has its own functions, but the interaction between them ensures optimisation of the movement of goods and reduces costs.

Table 1. Logistics interaction between enterprises of wholesale and retail trade in food products

Link	Role in the trade chain	How it generates added value	Logistics support
Wholesale trade	Buys large quantities from manufacturers and resells them to retailers or sellers.	Warehousing and sorting of goods; breaking down batches; ensuring regular deliveries; accumulation of demand from different customers; risk management (prices, balances, demand); granting payment deferrals.	Distribution centres; warehouse management systems; systems for accounting for goods; own or outsourced transport; centralised supply planning.
Logistics support (between wholesale and retail)	Provides continuous, optimised movement of goods between wholesale suppliers and retail outlets.	Ensuring timely deliveries; minimising logistics costs; reduction of losses and damage; acceleration of inventory turnover; quality control at all stages; flexibility of supply according to demand.	Cold chain; cross-docking; GPS, tracking systems; electronic data exchange; IT systems; dynamic route planning; control of deadlines and refunds.
Retail trade	Sells food products to the end user in stores, online, or through other channels.	Providing services and consultations; creating a customer experience; packaging, placement, showcase; providing easy access 24/7; marketing campaigns; flexible pricing; sale in convenient packaging.	Delivery from distribution centres or local warehouses; systems with sales analytics; automatic replenishment of inventory; systems for personalisation; balance control; shelf planning; omni-channel solutions (couriers, pickup).

Source: developed on the basis of research conducted by the authors

Interaction between these links ensures continuous and optimised movement of goods, reducing costs, increasing the speed of circulation of goods and ensuring a high quality of service to end users. This is an important aspect in the successful functioning of food trade in the face of constant changes in demand and market conditions. The effectiveness of logistics cooperation is confirmed by the positive

dynamics of the volume of goods sold and added value in both segments – wholesale and retail trade. According to the State Statistics Service of Ukraine (n.d.) in 2023, specialised wholesale enterprises sold products worth 670.0 billion UAH, which is 301.9% more than in 2014, and value added increased by 747.4%.

METRO Cash & Carry (n.d.) implements a B2B model with wholesale service for more

than 300 thousand enterprises, using a delivery planning system with an accuracy of up to an hour. This reduces storage costs and reduces the share of losses of perishable goods to less than 1.5% – against 3-5% in individual networks without an integrated chain (Agrotorg, n.d.). The effectiveness of logistics interaction is demonstrated by large trade groups that combine wholesale and retail functions. In particular, Fozzy Group (n.d.) provides more than 40% of its own retail turnover at the expense of centralised wholesale depots and distribution centres. ATB-Market company (n.d.) has its own logistics infrastructure of more than 10 warehouse complexes with a total area of more than 250 thousand m², which ensures daily delivery of goods to more than 1,300 stores throughout Ukraine.

In retail trade, non-specialised stores also recorded an increase in sales volumes from 170.6 billion UAH (2014) to 594.0 billion UAH (2023), and value added increased almost 5 times. This indicates an increase in logistics efficiency, scaling of operations and adaptive capabilities of trading structures. However, the volume of trade from stalls and markets declined rapidly (-92.3%), which confirms the gradual optimisation of supply chains in favour of organised forms of logistics interaction.

Logistics in the field of food trade largely depends on the effective activities of key players in both the wholesale and retail segments. The efficiency of their operations depends on the stability of supply, timely delivery, preservation of product quality, the level of logistics costs, and the speed of response to fluctuations in demand. Wholesale enterprises play a leading role in centralising purchases, consolidating commodity flows, optimising storage and managing large volumes of goods (Didukh & Artiukh, 2023; Holovchak *et al.*, 2023). Their logistics solutions, such as the introduction of cross-docking, zonal distribution, or digital tracking systems, significantly affect the efficiency of subsequent delivery steps (Mamchyn & Naida, 2025). Retailers, in turn, determine the rhythm and frequency of deliveries, form stocks in accordance with changes in demand, implement omni-channel service strategies and introduce innovations in interaction with the end user (for example,

automated replenishment of stocks, last-mile delivery, click&collect, etc.) (Fedorenko, 2020; Kovalenko & Yashchenko, 2024). Close interaction between these segments creates end-to-end logistics processes, where solutions at one stage significantly affect the efficiency of the entire supply chain. As a result, it is the logistical consistency between wholesale and retail enterprises that ensures the minimisation of losses, high speed of trade turnover, and stability of consumer support even in conditions of crises or market transformations (Dankeieva, 2023). The role of these enterprises is not only to move products from the manufacturer to the consumer, but also to form logistics standards, innovative solutions and adaptive models for responding to market changes, in particular, in times of crisis or digital transformation.

The wholesale market is represented by both large distributors and specialised suppliers, agro-industrial holdings, wholesale markets, and electronic platforms. In particular, the largest distributors include Fozzy Group (one of the leading trade and logistics groups with their own networks and logistics hubs), METRO Cash & Carry (wholesale trade for small businesses and HoReCa), MHP (Meat, Agro- and Export Logistics), Kernel and Nibulon (cereals, oilseeds, with integrated logistics complexes). Specialised operators include agricultural products (meat, fish, dairy products), Flagman (seafood), and Dairy Alliance (dairy products). Among the wholesale markets, the key ones are Shuvar (Lviv) and Stolychnyi (Kyiv), which provide a physical platform for wholesale trade. In the electronic space, wholesale interaction is implemented by platforms Prom.ua, Agrotorg.net, All.biz, Zakaz.ua. These entities ensure large-scale movement of goods, support regional diversification, and integrate logistics technologies (Kuzo & Kosar, 2022; Tereshchenko & Dehtiar, 2025).

The retail segment, in turn, covers a wide range of participants – from nationwide chains to regional and niche operators, online stores and cooperative initiatives. The largest national chains are ATB-Market (more than 1,000 stores in Ukraine, a discount format model), Silpo (premium segment of Fozzy Group), VARUS, ECO-Market, Novus, Fora, and Tavria V. Regional and specialised operators include

Kopiyka (south of Ukraine), Nash Krai, LotOK, Lavka Tradiciy (eco- and farm goods). Online channels are dominated by Rozetka (with a growing FMCG segment), Zakaz.ua (delivery of goods from supermarkets), and Prom.ua, which unites small commercial enterprises. Cooperative initiatives, such as online farm stores or local supply communities, are also being developed. They

play a key role in ensuring consumers' access to food products through convenient trade formats, personalised service, and logistically efficient delivery channels (Shcherbak, 2022; Pepchuk & Palonna, 2023). Table 2 shows significant changes in the dynamics of the number of operating business entities engaged in wholesale and retail trade in food products during 2010-2023.

Table 2. Dynamics of the number of enterprises of wholesale and retail trade in food products in Ukraine in 2010-2023, units

Indicator	Year						Absolute change from 2023 to 2010	Relative change from 2023 to 2010, %
	2010	2015	2020	2021	2022	2023		
Wholesale trade								
Non-specialised enterprises	6,454	4,446	3,474	3,113	2,535	2,806	-3,648	-56.52
Specialised enterprises	21,832	19,707	17,285	16,177	13,659	15,676	-6,156	-28.20
Retail trade								
Non-specialised stores	173,900	130,922	112,324	107,111	86,642	92,013	-81,887	-47.09
Speciality stores	41,724	38,041	36,203	35,428	30,731	34,819	-6,905	-16.55
Businesses that trade from stalls in markets	63,319	39,228	29,953	27,163	22,847	23,296	-40,023	-63.21

Source: developed by the authors based on the number of active economic entities by types of economic activity in 2010-2023 (n.d.)

Table 2 shows indicators for 2010, 2015, 2020-2023. The choice of intervals was determined by the availability of official statistical data: 2010 was chosen as the base for displaying long-term dynamics, then the values are presented at intervals of five years (2015 and 2020), which allows tracing medium-term trends without overloading the table. The details for recent years (2021-2023) reflect current changes in the context of crisis transformations caused by the pandemic and war in Ukraine. This approach provides a balance between representativeness of data and compactness of presentation.

The analysis of the dynamics of wholesale and retail trade development for the period 2010-2023 shows a steady trend of reducing the number of enterprises in most segments, which may indicate structural transformations in the trade industry of Ukraine. In particular, among

non-specialised wholesale enterprises, there is a significant decrease – from 6,454 in 2010 to 2,806 in 2023, that is, by 3,648 units or almost 57%. A similar trend is typical for specialised wholesale enterprises: a decrease from 21,832 to 15,676 units (by 6,156 or 28%). The decline in the retail segment is particularly pronounced: non-specialised stores lost 81,887 units (-47.1%), which may be due to both the digitalisation of trade and the growth of e-commerce, and a decrease in the purchasing power of the population. Speciality stores show a moderate decline of 6,905 units (-16.6%), which indicates a relatively stable niche of these entities. The largest decrease is observed among enterprises that trade from stalls and markets: from 63,319 to 23,296 units (-63.2%), which confirms the trend of replacing the informal sector with network and digital trading. In general, these tables

illustrate the process of reducing the number of traditional retail outlets, which is likely accompanied by market concentration, the development of e-commerce and changing consumer habits.

The following tables (Tables 3 and 4) summarise the main participants of wholesale and retail trade in Ukraine, with an emphasis on their specialisation, scope of activity, and logistics features. The wholesale market of food products in Ukraine is formed with the participation of a wide range of players: from large distribution

companies to specialised suppliers, agro-industrial holdings, wholesale markets, and electronic platforms. These participants perform critical logistics mediation functions – purchasing from manufacturers, consolidating and distributing goods, managing inventory, transportation, and IT systems. Due to the scale, technological equipment and logistics infrastructure, it is wholesale that ensures the stability of supplies, the regional presence of products and adaptability to market fluctuations (Table 3).

Table 3. System of business structures of wholesale trade in food products in Ukraine

Company / market name	Scope of specialisation	Notes
Major distributors		
ATB-Market (wholesale division)	Wide range of food products	Own logistics, all-Ukrainian coverage
METRO Cash & Carry	HoReCa and business products	Wholesale store format
Fozzy Group (Silpo, wholesale depots)	Groceries, beverages, and food products	Own wholesale logistics
TEDIS Ukraine	Beverages, partially food	Powerful distribution network
Specialised suppliers		
Flagman	Fish products	Import, processing, wholesale
Agroproduct	Meat, sausages	Retail supply
Frutline	Vegetables, fruits	Import, wholesale distribution
Dairy Alliance	Dairy products	Own production
Agro-industrial complex – holdings with wholesale		
MHP (Nasha Ryaba)	Chicken, semi-finished products	Own wholesale network
Kernel	Vegetable oil, cereals	Domestic market and exports
Nibulon	Grain, agricultural products	Logistics, grain elevators, ports
Wholesale markets		
Stolychnyi Market (Kyiv)	All types of products	One of the largest in Ukraine
Shuvar (Lviv)	Vegetables, fruits, meat	Has an electronic procurement system
Nezhdana (Kherson Oblast)	Vegetables, melons	The largest in the south of Ukraine (now under occupation)
Electronic platforms		
Prom.ua	Food products wholesale	B2B marketplace
Zakaz.ua (business version)	Online grocery delivery service	For small and medium-sized businesses
Allbiz, Agrotorg	Food products	Electronic advertisements and transactions

Source: developed on the basis of research conducted by the authors

The retail sector is the final link in the logistics chain, directly in contact with the end user. This segment includes both nationwide super-market chains and regional companies, convenience stores, specialised points of sale, on-line platforms, and farmers' cooperatives. They provide convenient shopping, a wide range of products, marketing support, and adaptive

service formats. The logistics efficiency of retail trade depends on automated inventory replenishment systems, CRM solutions, an omni-channel approach to delivery, and digital technologies that allow quickly responding to changes in consumer demand (Zhao *et al.*, 2023; Bolila, 2024; Kovalenko & Yashchenko, 2024) (Table. 4).

Table 4. System of business structures of retail trade in food products in Ukraine

Company name	Trademarks / specialisation	Notes / features
Nationwide retail chains		
Fozzy Group	Silpo, Le Silpo, Fozzy Cash & Carry	Market leader, premium and mass segment
ATB-Market	ATB	The largest chain by the number of stores
Novus	Novus	Medium and premium segment
METRO Cash & Carry	METRO	Wholesale + retail format
Varus	Varus	Centre and south of Ukraine
ECO-Market	ECO	Average price segment
Regional retail chains		
Tavria-V	Tavria-V	South of Ukraine, own logistics centre
CLASS	CLASS	Kharkiv, hypermarkets + online
Rukavychka	Rukavychka	Lviv, western Ukraine
Nash Kray	Nash Kray	West and centre, "near home" formats
Furshet (before merging)	Furshet	Kyiv, partially integrated into Novus
Convenience stores / minimarkets		
Thrash!	Thrash!	Discounter format
LotOK	LotOK	Mini format from Fozzy Group
OKKO mini-market	OKKO mini	Format near gas stations
WOG market	WOG market	Format near gas stations
Speciality food stores		
Good Wine	Wine, delicacies, imports	Premium format
Eco-Lavka	Organic products	Focus on eco-products
Le Silpo (Delicatessen)	Gourmet products	Premium, Fozzy Group
Biologic.ua	Eco- and bio-products	Online and physical presence
Online food trading		
Rozetka	Food, groceries, beverages	Large online retailer
Zakaz.ua	Delivery from Metro, Auchan, Novus	Works with physical networks
Foodex24 / Foody	Online supermarkets	Without physical stores
Glovo / Bolt Food	Grocery delivery from supermarkets	Courier delivery
Cooperatives and farm shops		
Lavka Tradiciy	Products from local manufacturers	Focus on regional authenticity
Family farms	Meat, dairy, vegetables	Farmers' direct sales
Cooperative stores	Products from local manufacturers	Work with communities

Source: developed on the basis of research conducted by the authors

Retail trade in food products requires updating business processes. The use of innovations in retail can reduce business risks. The development of Ukrainian retail trade is accompanied by the following features: the process of consolidation continues: competition displaces small retailers, strengthening the positions of large network retailers; the processes of centralisation of procurement activities are being improved; the development of own brands of network retailers continues; the number of mergers and acquisitions of various brands is growing; retail

networks are expanding to regions and remote localities (Fedorenko, 2020).

During 2014-2023, food wholesale and retail enterprises in Ukraine underwent significant transformations due to both internal economic crises and external shocks, in particular, the COVID-19 pandemic and a full-scale war. Under these conditions, the ability to quickly adapt and ensure the continuity of commodity supply becomes of strategic importance (Ilchuk *et al.*, 2023; Ilchuk *et al.*, 2025). It is logistics mechanisms that have become a key tool for ensuring

the sustainability of trade processes, maintaining competitiveness, and increasing added value. That is why the analysis of the dynamics of sales volumes and added value in the wholesale and retail sectors of food trade in 2014-2023 was carried out to identify effective logistics practices and directions for their further improvement in the context of crisis phenomena and structural changes in the business environment.

Analysis of the dynamics of volumes of food products sold and added value of wholesale and

retail enterprises in 2014-2023 (Table 5) demonstrates significant changes in adaptive approaches to logistics support for businesses in a turbulent environment. During the study period, there is a general tendency to strengthen the positions of structured and specialised forms of trade, which confirms the effectiveness of implemented logistics mechanisms in response to crisis phenomena – in particular, political instability, the COVID-19 pandemic, military operations, and the transformation of consumer behavioural models.

Table 5. Volume of food products sold and value added by production costs of wholesale and retail enterprises in 2014-2023, billion UAH

Indicator	Year						Absolute change from 2023 to 2014	Relative change from 2023 to 2014, %
	2014	2019	2020	2021	2022	2023		
Specialised wholesale enterprises of trade in food products, beverages, and tobacco products								
Volume of goods sold	166.7	392.8	441.3	509.2	461.7	670.0	503.3	301.9
Value added by production costs	21.5	65.7	90.0	86.0	117.2	181.9	160.5	747.4
Non-specialised wholesale enterprises of trade in food products, beverages, and tobacco products								
Volume of goods sold	54.7	90.9	88.1	90.2	81.4	107.7	53.0	96.9
Value added by production costs	8.9	13.0	14.8	13.6	17.0	18.3	9.4	105.6
Retail businesses in non-specialised stores sell food, beverages, and tobacco products								
Volume of goods sold	170.6	410.8	459.8	524.6	465.6	594.0	423.5	248.3
Value added by production costs	20.8	72.2	69.0	152.0	75.5	103.7	82.9	398.5
Retail enterprises in specialised stores selling food products, beverages, and tobacco products								
Volume of goods sold	13.7	28.4	33.0	46.8	21.8	28.0	14.3	104.3
Value added by production costs	2.1	4.6	6.3	8.3	7.3	9.9	7.9	384.1
Retail businesses sell food, beverages, and tobacco products from stalls and markets								
Volume of goods sold	3.9	c/s	6.5	8.5	0.2	0.3	-3.6	-92.3
Value added by production costs	0.8	c/s	1.4	1.4	0.1	0.2	-0.6	-75.0

Note: c/s – confidential statistics. Indicates that the data is not published by the State Statistics Service of Ukraine for reasons of confidentiality or lack of reliable sampling

Source: developed by the authors based on Turnover of business entities by type of economic activity in regions in 2014-2023 (n.d.), Value added of business entities by type of economic activity in regions in 2014-2023 (n.d.)

The highest growth rates were demonstrated by specialised wholesale enterprises, where the volume of goods sold increased from 166.7 billion UAH to 670.0 billion UAH (+301.9%), and value added – from 21.5 billion UAH to 181.9 billion UAH (+747.4%). Such dynamics indicate a significant logistics restructuring, in particular, the transition to multi-channel supply systems, the introduction of analytics for forecasting

demand, and the digitalisation of inventory management (Table 5). A prime example is Metro Cash & Carry (n.d.) that works in a wholesale format and actively uses digital tools to optimise supply chains, implements electronic document management, manages inventory in real time, and uses a centralised purchasing model. Another example is Fozzy Distribution, wholesale division of Fozzy Group, which provides

centralised deliveries to more than 700 retail outlets in Ukraine, including through its own distribution centres operating on the principles of cross-docking and zonal logistics (Fozzy Group, n.d.). Such enterprises have adapted their logistics systems to the conditions of high market turbulence, introducing automation, IT analytics, and flexible supply planning, which allowed them to achieve volume growth and increase efficiency in conditions of instability. This allowed such enterprises not only to maintain operational stability, but also to significantly increase the efficiency of production and sales chains. Indicators of non-specialised wholesale enterprises also show growth, although much slower (sales volume +96.9%, value added +105.6%). This may indicate a relatively lower flexibility of logistics systems in these structures, or that they have implemented innovative logistics approaches to a lesser extent. In crisis conditions, this limited their ability to quickly rebuild commodity flows and adapt to new conditions of supply and demand (Table 5). Some major players in the non-specialised wholesale segment, such as wholesale divisions of ATB-Market, METRO Cash & Carry or logistics depots of Fozzy Group, have demonstrated successful adaptation to new market conditions. In particular, they implement multi-channel supply chains, centralised inventory management, dynamic pricing, and use consumer analytics data to make logistics decisions. This allows such businesses to maintain supply efficiency even in the face of high demand turbulence and supply chain disruptions.

Despite the existing positive trends in the development of food wholesale enterprises, its organisational and functional foundations are still insufficiently coordinated with the needs of related links – production and retail trade. This is primarily due to the imperfection of the internal organisational structure, management system, and economic mechanism of functioning of wholesale enterprises. As a result, such enterprises are not always able to fully meet the needs of the retail segment regarding the range, supply volumes, and price parameters of products (Holovchak *et al.*, 2023). During 2014–2023, there was an active concentration in Ukrainian retail trade, as a result of which retail chains have

taken a key position. Unlike individual stores, retail chains have significant market power and use it to redistribute in their favour a portion of the added value created in the processing industry (Shcherbak, 2022).

The analysed data of Table 5 give grounds to assert that retail enterprises in non-specialised stores (supermarkets, hypermarkets) retained the leadership in sales volumes, increasing sales from 170.6 to 594.0 billion UAH (+248.3%), and added value – from 20.8 to 103.7 billion UAH (+398.5%). These structures effectively used the logistical advantages of scaling, centralising purchases, and integrating IT solutions into supply and service processes. In addition, flexibility in working with online sales channels and quick setup of product delivery from the nearest warehouse, pick-up point or hub directly to the end user have become key factors for maintaining competitiveness. For example, the Silpo network (Fozzy Group, n.d.) actively develops its own e-commerce area through the platform shop.silpo.ua and a mobile application that provides delivery via its own courier service or partner services. Due to the integration of online orders with the network's logistics systems, delivery routes are automatically generated, and the presence of decentralised hubs allows serving orders as quickly as possible, often on the day of registration. This model significantly reduces the time of the logistics cycle and increases the level of customer satisfaction, which directly affects the competitive position of the retail network. At that time, specialised retail stores (for example, delicatessen, wine, and farm products stores) showed lower absolute volumes, but high rates of value-added growth (+384.1%). This indicates the effectiveness of logistics strategies of narrow specialisation, focused on niche consumers with a higher willingness to pay for the quality, freshness, and origin of goods. The introduction of origin tracking technologies, partnerships with local manufacturers and reduced logistics chains have provided such enterprises with high adaptability even in turbulent conditions. For example, the Good Wine chain is actively implementing a product origin tracking system that allows customers to get detailed information about each product – from the manufacturer to the store shelf. Partnerships with

local farmers and suppliers ensure fast delivery of fresh produce, minimising the time spent on goods in the logistics chain. This approach not only increases consumer confidence, but also reduces logistics costs, which has a positive impact on business profitability. But trading from stalls and markets experienced a catastrophic decline – the volume of sales decreased by 92.3%, and value added – by 75.0% (Table 5). The reasons for this were limited opportunities for logistics modernisation, lack of infrastructure for contactless services, weak integration into digital channels, and regulatory pressures. This segment was the least adaptive to crises, which indicates the exhaustion of its role in the current format of food distribution.

Overall, the above data demonstrate that the effectiveness of logistics mechanisms – including digital transformation, supply chain management automation, inventory optimisation, and the introduction of flexible distribution channels – has directly affected the ability of merchants to adapt to shocks and maintain economic viability. The greatest advantages were given to those entities that were able to combine specialisation with innovations in logistics, choosing a model of flexible adaptation as a strategic response to the challenges of a transformational business environment. For example, specialised wholesale companies such as METRO Cash & Carry (n.d.), actively implemented multi-channel supply chains, which helped to quickly redirect commodity flows in response to changes in demand and supply disruptions. ATB-Market (n.d.) implemented digital demand forecasting systems based on Big Data analytics, which optimised inventory and reduced logistics costs, and launched its own delivery service, which provides fast customer service through local warehouses. Other examples are Fozzy Group (n.d.), which integrated omni-channel approaches, combining conventional stores with online platforms and automated sorting centres for last-mile delivery, and agricultural holding MHP (n.d.), which uses advanced digital batch tracking systems and flexible logistics management to maintain quality and timely delivery. Such practices allow enterprises to quickly respond to external challenges, minimise losses, and increase the level of customer satisfaction,

which is the basis of the flexible adaptation model in modern logistics chains.

Since the business environment is characterised by a high level of instability, food trading enterprises are forced to constantly adapt their logistics systems to changes in external and internal conditions. In the context of crisis disturbances – such as inflationary fluctuations, supply chain disruption, resource scarcity – there is a need to model an adaptive logistics system that is able to ensure the effective functioning of the enterprise through the rational use of internal logistics resources. D. Ivanov (2024) argued that supply chain sustainability is now on the agenda for both the academic community and businesses like never before. A powerful catalyst for this phenomenon was the COVID-19 pandemic, which opened an era of global uncertainty and vulnerability, and the outbreak of the Russian-Ukrainian war further disrupted supply chains. The resilience of the latter manifests itself when the network is able to withstand, adapt and recover from failures to meet the needs of customers and ensure operational efficiency (Yang *et al.*, 2021). Therefore, the model should consider not only the available inventory, supplier network and costs, but also the dynamics of changes over time – in particular, the transition from a stable pre-war state to a crisis period and further adaptation. In addition, it is necessary to consider the target management function – minimising logistics costs or maximising the level of customer service in conditions of limited resources. Considering the difference in the functional specifics of wholesale and retail enterprises, it is advisable to develop models separately: for the former – with a focus on ensuring the stability and flexibility of logistics links, for the latter – with an emphasis on the speed of circulation of goods and adaptability to changes in consumer demand.

To build effective models for adapting logistics systems to an unstable environment, it is important to consider not only general factors of influence, but also the specifics of the functioning of various types of commercial enterprises. When building models, special attention is paid to the differences in adaptation mechanisms in wholesale and retail trade in food products. This approach helps to more accurately

formulate tasks for modelling and substantiate the choice of relevant management tools. The comparison below (Table 6) demonstrates key differences in goals, resources, time horizons, and

technologies underlying the adaptive behaviour of wholesale and retail businesses. This, in turn, determines the structure of the economic and mathematical models that are proposed later.

Table 6. Differences in adaptation mechanisms in wholesale and retail trade in food products

Comparison criteria	Wholesale companies	Retail businesses
Adaptation focus	Supply stability, inventory accumulation	Prompt response, fast turnover of goods
Key resource	Warehouses, contractual relations with suppliers	Store shelf, end-user demand
Response time	Medium- and long-term planning	Short-term, day-to-day management
Product range flexibility	Limited (depends on the terms of contracts and purchases)	High (frequent rotation of goods in accordance with changes in demand)
Target function	Minimising supply and logistics costs	Maximising current demand satisfaction
Technological tools	WMS, TMS, supply management platforms	POS systems, CRM, demand analytics, online sales channels

Note: WMS – Warehouse Management System; TMS – Transportation Management System; POS – Point of Sale; CRM – Customer Relationship Management

Source: developed on the basis of research conducted by the authors

Adaptation mechanisms depend on the type of enterprise and its role in the supply chain. Wholesalers focus on cost optimisation and guaranteed retail network support, while retailers focus on flexibility, response to consumer behaviour, and effective assortment management in conditions of variable demand. These features determine the structure of economic and mathematical adaptation models, which should be considered when developing logistics strategies. Therefore, since the model deals with adaptation to an unstable environment, it must consider: external disturbances (crisis, inflation, supply disruptions); internal logistics resources (inventories, suppliers, supply chains, costs); the objective function (minimising costs or maximising customer service with limited resources); time dynamics (transition from pre-war conditions to crisis and further adaptation).

Models should be built separately for: wholesale enterprises – focus on supply stability, warehousing flexibility, adaptation of logistics links; retail enterprises – focus on turnover speed, diversification of supply channels, adaptive assortment management. In the context of an unstable external environment, wholesale enterprises need tools that ensure reliable supply at an optimal level of costs. This need determines

the development of a logistics adaptation model that considers the key parameters of internal resources, demand, supplier properties, and time dynamics of changes. The main goal of the model is to minimise the total costs associated with ensuring continuity of supply, considering the risks of supply. The model structure is designed to reflect the balance between the economic feasibility and logistics stability of the system over different time periods. Below are the parameters, target function, and constraint system that characterise the logic of decision-making at the wholesale supply level.

The goal of adapting logistics processes for wholesale enterprises with food products is to minimise the costs of logistics adaptation, provided that a stable volume of supplies is ensured. Model parameters for wholesale food enterprises: I – number of suppliers; t – number of planning periods; $i=1...I$ – supplier index; $t=1...T$ – number of planning periods; D_t – projected demand at time t ; S_t – amount of inventory in the warehouse at time t ; O_{it} – order from the i -th supplier at the time t ; C_{it} – logistics costs for delivery from the supplier and at the time t ; R_i – reliability (rating) of the supplier i ; α , β – weighting coefficients of cost significance and risk.

Target function for wholesale enterprises with food products:

$$\min \sum_{t=1}^T \sum_{i=1}^I (\alpha C_{it} + \beta \frac{1}{R_i}) O_{it}. \quad (1)$$

Restrictions for wholesale businesses with food products:

Inventory balance:

$$S_{t+1} = S_t \sum_{i=1}^I O_{it} - D_t, \forall t. \quad (2)$$

Constraint (2) reflects changes in inventory in each planning period: inventory for the next period is formed as the sum of available inventory, order volumes, and projected demand. Designation $\forall t$ means that the balance is fulfilled for all planning periods.

Guaranteed level of service:

$$S_t \geq D_t^* \gamma, \gamma \in [0.9, 1.1], \quad (3)$$

γ – service level coefficient, which reflects the share of projected demand that must be guaranteed by available inventory at each time point. The parameter value is set within $[0.9; 1.1]$, where: at $\gamma = 1$, the enterprise forms reserves equal to the expected demand; at $\gamma > 1$, an insurance reserve is created in case of demand growth or supply interruptions; at $\gamma < 1$, partial non-fulfilment of demand is allowed due to limited resources or priority of other criteria (for example, cost minimisation).

Restrictions on order volumes:

$$0 \leq O_{it} \leq O_i^{max}, \forall i, t. \quad (4)$$

The order volume limit (4) determines the acceptable purchase limits for each supplier in each period. Orders cannot be negative and must not exceed the maximum allowed volume O_i^{max} , which considers production or logistics restrictions on the part of the supplier. The model of logistics adaptation of wholesale enterprises is aimed at minimising total costs, considering the risks associated with supplier reliability, while ensuring inventory stability and timely satisfaction of projected demand. It combines inventory parameters, order volumes, supplier reliability, and time planning dynamics to make informed decisions for optimal supply chain management in an unstable external environment.

In the face of fluctuations in demand and limited supplies, retail enterprises are forced not

only to respond quickly to changes in consumer demand, but also to flexibly adjust their product range. The goal of the model for such enterprises is to maximise total profit (meet demand) due to the optimal selection of product categories with available reserves and resource constraints. To do this, the dynamics of availability by category, projected demand, profitability of each category, and decisions about including it in the assortment at any given moment are considered. Below is a target function and a system of constraints that reflect the logic of adaptive product range and inventory management at the retail level. The goal of the logistics adaptation model for food retail enterprises is to maximise demand satisfaction with limited supplies and adapt the range. Parameters for food retail businesses: A_{jt} – volume of availability of category j at time t ; d_{jt} – projected demand for category j at time t ; p_j – profitability of a category j product; $x_{jt} \in \{0, 1\}$ – inclusion of product j in the adapted range at time t .

Target function for food retail businesses:

$$\max \sum_{t=1}^T \sum_{j=1}^J p_j * \min(A_{jt}, d_{jt}) * x_{jt}. \quad (5)$$

The function maximises the total profit from the volume actually sold $\min(A_{jt}, d_{jt})$ those products that were selected in the range $x_{jt} = 1$.

Restrictions for retail businesses with food products:

The volume of posts does not exceed the limit:

$$\sum_{j=1}^J A_{jt} * x_{jt} \leq L_t, \forall t. \quad (6)$$

In each period t , the total volume of goods selected for sale cannot exceed the available supply limit L_t . This reflects restrictions on the area of the trading floor, the speed of replenishment, or logistics capabilities.

Adaptive product range restriction:

$$\sum_{j=1}^J x_{jt} \leq N_t, \forall t$$

(maximum number of product items). (7)

The number of product items in the updated product range is limited to N_t . This limit may be conditioned by merchandising opportunities, the number of shelves, or a marketing strategy to focus on key categories.

Guaranteed availability of key products:

$$x_{jt}=1, \text{ for } j \in j_{key}, \forall t. \tag{8}$$

For categories that are defined as critical j_{key} , the model must ensure their presence in the assortment in each period. This ensures that the minimum expectations of customers are met and the image of the retail network is maintained. The adaptive assortment and inventory management model in retail is aimed at

maximising total profit by optimally selecting product categories, considering limited supplies and resources. It considers inventory dynamics, projected demand, product profitability, and guarantees the presence of key items in the product range, providing flexibility in responding quickly to changing market conditions and consumer priorities. To generalise the logic of logistics adaptation at the level of wholesale and retail enterprises with food products, a block diagram of decision-making is constructed (Fig. 1).

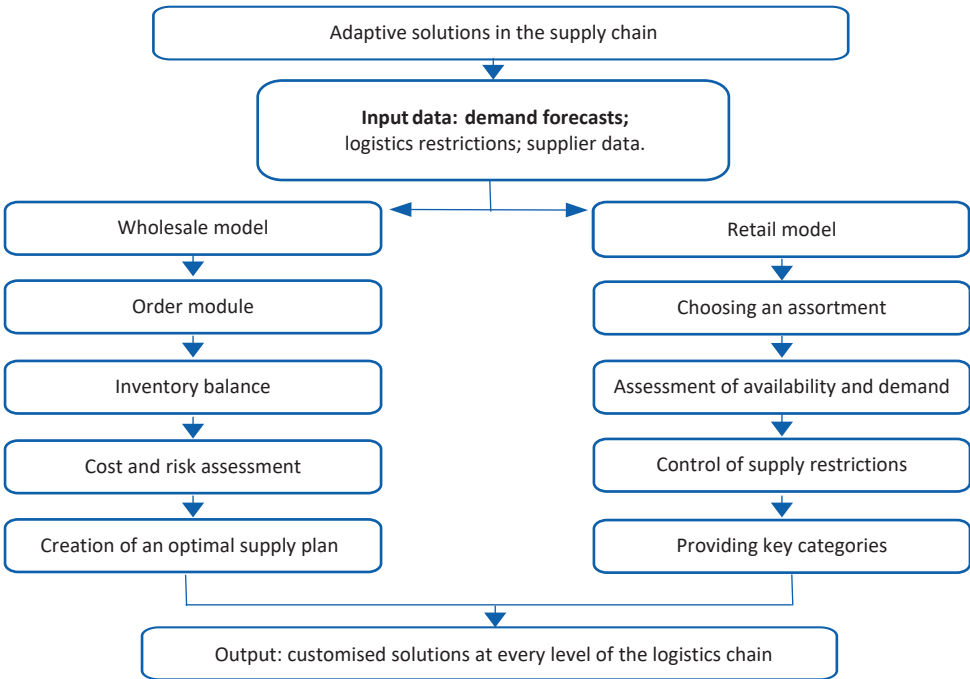


Figure 1. Algorithm for adapting logistics solutions at the level of wholesale and retail enterprises with food products

Source: developed on the basis of research conducted by the authors

The algorithm reflects the sequence of actions related to forming order volumes, selecting suppliers, adapting the product range, and considering restrictions. The flowchart illustrates how solutions are formed based on projected demand, available inventory, logistics constraints, and risk parameters aimed at achieving targets – minimising costs in the wholesale model and maximising profits in the retail one. Thus, the proposed models and structural flowchart allow formalising the process of logistics

adaptation at different levels of commodity flow management. Their integration provides a systematic vision of the relationships between supply, demand, resource constraints, and optimisation criteria. This creates an analytical basis for making informed management decisions on adapting logistics processes in a changing environment, considering the specifics of wholesale and retail enterprises with food products.

The proposed model of logistics adaptation is theoretical in nature and is designed to create

an analytical tool for systematic assessment and optimisation of commodity flow management processes at the wholesale and retail levels. At the time of the study, there were no real examples of public application of such a complex model in enterprises, which is due to the high complexity of integrating multi-factor models into practical business processes, and limited access to internal logistics data of companies. However, the scientifically based structure of the model and its parametric nature allow simulating various adaptation scenarios, which potentially allows enterprises to use it in the future as a basis for developing their own solutions, considering the specifics of operational activities and external conditions. This approach is consistent with best practices in applied logistics, where mathematical models are first formed to describe complex systems, after which they are adapted to specific production and commercial contexts. Thus, the proposed model serves as a conceptual platform that can be expanded and tested through further empirical research and practical implementation at wholesale and retail enterprises of food products. This opens up prospects for further research and implementation of innovative logistics strategies, increasing the competitiveness and sustainability of enterprises in an unstable market.

The results of the study were confirmed by N. Valinkevich & M. Kotsenko (2024), who claimed that the pandemic and the war in Ukraine caused significant negative consequences: many commercial enterprises were destroyed, supply and sales chains were disrupted, the number of qualified personnel decreased and trade turnover decreased. However, despite all the difficulties and challenges, wholesale and retail trade enterprises were able to adapt to the crisis phenomena and transformations of the business environment.

The conducted study of logistics mechanisms of adaptation of enterprises of wholesale and retail trade in food products in a crisis and transformational environment has common points of contact with the conclusions of N.O. Didukh & T.M. Artiukh (2023), who focused on developing a commodity strategy for wholesale trade in agricultural products in conditions of uncertainty. Both studies emphasised the need to adapt enterprises to destabilising

factors of a military and economic nature, the need to update strategic planning, and increase the flexibility and technological equipment of trade activities. However, the main focus of the study is on logistics adaptation – as a systematic tool for ensuring supply continuity, minimising costs, and maintaining functional interaction between the wholesale and retail segments. Instead, N.O. Didukh & T.M. Artiukh (2023) focused primarily on product policy: product range formation, product management risks, product strategy development algorithms, and implementation methods. The study also contains elements of mathematical modelling of logistics behaviour of enterprises, while the compared paper focuses on the conceptual algorithm for developing a product strategy. Thus, the research complements each other: one – with an emphasis on assortment and strategic planning, the other – on logistics functions that ensure the implementation of these strategies in practice.

Comparison of the results of the conducted study with the approaches outlined by N.E. Kuzo & N.S. Kosar (2022) shows that there is a common vision of the importance of the adaptive role of logistics in the context of crisis and martial law. Both studies focus on the need to introduce relevant approaches to management in wholesale trade and use marketing flexibility tools. The idea of strengthening the role of wholesale enterprises as logistics intermediaries between manufacturers and the retail chain is also common, with an emphasis on ensuring continuity of supply and minimising losses. The difference lies in the focus of the analysis: the study by N.E. Kuzo & N.S. Kosar (2022) focused primarily on the transformation of marketing solutions of wholesale trade entities under martial law, while the author's study considered logistics adaptation more comprehensively – as a systematic mechanism for responding not only to military challenges, but also to structural changes in the market, digitalisation, changes in demand, and the institutional environment.

S. Pepchuk & T. Palonna (2023) claimed that Ukrainian retail companies are characterised by high competition and a variety of formats and channels. Recent events, such as pandemics and war, have accelerated the development of online sales, which requires rapid adaptation and

competition for fast delivery. In times of war, an omni-channel strategy is becoming increasingly popular among retailers, which involves combining online and offline sales channels to meet the needs of consumers. Further growth of the Ukrainian retail market is projected, especially in the e-commerce sector, but the unstable environment will require constant adaptation and innovation for successful operation. In general, the analysed enterprises continue to develop and adapt to new realities, using innovative technologies and strategies to meet the needs of consumers and ensure business success.

Analysis of the approaches presented in the study by O. Dankeieva (2023), allows outlining both general ideas and conceptual differences in views on the development of the trade sector under martial law. The researcher focused on finding possible scenarios for the transformation of food retailers, considering the impact of exogenous shocks, the relocation of retail infrastructure, and changing consumer behaviour. But the author's research focused on logistics as a functional framework that provides flexibility and stability for both wholesale and retail trade links. While O. Dankeieva (2023) based strategic planning on empirical observations of the activities of leading networks, the models proposed in this study are analytical in nature and focused on building universal adaptation algorithms. As a result, both studies highlight different aspects of the same problem – the adaptation of trade in conditions of extreme uncertainty, complementing each other: one – through a macro-strategic vision of retail trade, the other – through micro-level logistics efficiency.

O. Kovalenko & L. Yashko (2024) deeply analysed the transformation of food trade in Ukraine under the influence of a multidimensional crisis, which largely echoes the author's conclusions regarding the logistics adaptation of commercial enterprises. Both studies emphasised that full-scale warfare has become a catalyst for changes in the structure of food distribution, supply chain configuration, and end-user behaviour. The general position is to strengthen the role of logistics as a critical factor of sustainability: both in the macro-system of food security and within individual retail operators. The researchers also emphasised the need for regional

diversification of logistics channels, which fully corresponds to the author's conclusions about the need for flexible routes, alternative warehouses and adaptive solutions for resupply. In addition, both papers focus on the growing importance of digital solutions for real-time supply chain management, which allows compensating for infrastructure failures and ensuring prompt response. Thus, what is common to both studies is the understanding of logistics not as an auxiliary function, but as the core of the strategy for the survival and development of enterprises in the context of long-term crisis impacts.

Confirmation of the author's proposals regarding the need to introduce the latest technological tools in logistics is reflected in the study by M. Huseynova *et al.* (2025), who stated that current logistics requires constant development of structural elements of supply chains, which is conditioned by the use of advanced innovative achievements. Innovative logistics is a critical component of logistics activities aimed at assessing the need and opportunities for applying cutting-edge innovations in flow process management. It focuses on identifying and using additional resources by optimising management processes.

Thus, the analysis of contemporary research and the results of this study confirm that logistics adaptation is a key factor in the sustainability and efficiency of commercial enterprises in the context of crisis challenges and a transformational environment. The introduction of innovative technologies, digital solutions, and flexible supply chain management strategies allows wholesale and retail businesses to maintain supply continuity, optimise resources, and respond quickly to market changes. Thus, logistics adaptation is the basis for ensuring the competitiveness and sustainable development of food trade in Ukraine.

CONCLUSIONS

As a result of the study, it was found that the efficiency of functioning of wholesale and retail food trade enterprises in the context of crisis phenomena and transformations of the business environment largely depends on the flexibility and adaptability of their logistics mechanisms. It was revealed that the best results are demonstrated by those enterprises that combine technological

modernisation with adaptation of business models, digitalisation of logistics processes, implementation of multi-channel strategies and optimisation of assortment management. Logistics in such conditions is transformed from an executive function into a strategic tool for maintaining competitiveness, effective risk management and ensuring supply continuity.

The analysis of the dynamics of the number of wholesale and retail enterprises in 2010-2023 showed a significant reduction in traditional retail outlets: the number of non-specialised wholesale enterprises decreased by 56.5% (from 6,454 to 2,806 units), specialised – by 28.2%. In retail, non-specialised stores decreased by 47.1%, specialised stores – by 16.6%, and businesses trading from stalls and markets – by 63.2%. Simultaneously, an active digital transformation of logistics practices was recorded, including automation of warehouse and transport operations, electronic data exchange, and integration of demand forecasting systems. Significant logistical advantages were given to those operators who were able to diversify supply sources, reduce delivery chains, and provide omni-channel customer service. In terms of sales and value added for the period 2014-2023, specialised wholesale enterprises increased sales by 301.9% (from 166.7 billion UAH to 670.0 billion UAH) and value added by 747.4% (from 21.5 billion UAH to 181.9 billion UAH). Non-specialised wholesale enterprises increased their volumes by 96.9%, and added value – by 105.6%. In retail, non-specialised stores increased sales by 248.3% (from 170.6 billion UAH to 594.0 billion UAH) and value added by 398.5% (from 20.8 billion UAH to 103.7 billion UAH), while speciality stores increased sales by 104.3% and 384.1%, respectively. However, enterprises that trade from stalls and markets experienced a catastrophic decline: sales volume decreased by 92.3%, value added – by 75.0%.

A comparative typological analysis of the main participants of the wholesale and retail segments was also carried out, which allowed systematising them by specialisation, scale of activity, functional role in logistics, and level of

technological integration. Key logistics tasks for each type of enterprise were identified, which can become the basis for the development of targeted adaptation strategies in conditions of instability. The necessity of a separate approach to building models of logistics adaptation for wholesale and retail enterprises with food products in an unstable external environment was substantiated. Considering the specifics of the functioning of each level of the supply chain, optimisation models were formed, including the corresponding parameters, target functions, and a system of constraints. For wholesale companies, the model aimed to minimise total costs, considering the reliability of suppliers and demand volumes, while the model for the retail level provided for maximising the profitability of an adapted range in conditions of limited throughput. The proposed flowchart visualised the logic of adaptive mechanisms functioning at both levels.

As a result of the study, it was proved that logistics adaptation was not only a response to external challenges, but also a means of long-term strengthening of market positions. The practical significance of the proposed models and algorithms lies in the possibility of using them to form logistics strategies at the level of enterprises, industry or region to increase supply efficiency, reduce costs, ensure sustainability, and meet consumer demand even in turbulent conditions. The prospects for further research are related to the deepening of the analysis of the impact of digital technologies on the adaptability of logistics systems, and the development of recommendations for the integration of Ukrainian logistics systems into European supply chains in the post-war recovery.

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Адаптація підприємницьких структур оптової та роздрібної торгівлі харчовими товарами до кризових явищ з використанням логістичних механізмів

Анотація. Логістичні механізми адаптації в торгівлі харчовими товарами забезпечують гнучке реагування на ринкові зміни через оптимізацію поставок, взаємодію між оптом і роздробом, цифровізацію та скорочення витрат при збереженні якості. У статті досліджено адаптацію оптових і роздрібних торговельних структур до економічної та соціальної нестабільності, зумовленої війною, інфляцією, змінами попиту та цифровою трансформацією, через використання логістичних механізмів. Метою дослідження було удосконалення логістичних стратегій з урахуванням специфіки функціонування різних типів торговельних підприємств. Методологічною основою стали структурно-функціональний підхід, порівняльно-типологічний аналіз, а також побудова економіко-математичних моделей. Аналіз динаміки торговельних підприємств за 2010-2023 рр. виявив суттєве скорочення їх кількості в усіх сегментах, що свідчить про структурну трансформацію роздрібної та оптової торгівлі в умовах цифровізації та зміни споживчих практик. У роботі систематизовано учасників оптової та роздрібної торгівлі харчовими товарами в Україні з урахуванням спеціалізації, масштабів і логістичних функцій. Визначено особливості ринку, рівень логістичної інтеграції та адаптивність операторів до зовнішніх змін. На основі статистичних даних за 2014-2023 рр. проведено аналіз обсягів реалізації харчових товарів та динаміки доданої вартості у секторах оптової та роздрібної торгівлі. У 2023 р. обсяг реалізації у

роздрібній торгівлі харчовими товарами становив: в неспеціалізованих магазинах – 594,0 млрд грн; в спеціалізованих магазинах – 28,0 млрд грн; з лотків і на ринках – 0,3 млрд грн, тоді як у оптовій: в спеціалізованих – 670,0 млрд грн; в неспеціалізованих – 107,7 млрд грн. Найвища відносна зміна доданої вартості за витратами виробництва з 2023 до 2014 р. простежується в спеціалізованих оптових підприємствах та становить 747,4 %. Запропоновано дві математичні моделі: для оптових підприємств – із пріоритетом стабільності поставок, ефективного управління запасами та мінімізації логістичних витрат; для роздрібних – з орієнтацією на швидку ротацію асортименту, гнучке реагування на попит і максимізацію прибутковості. Побудовано блок-схему алгоритму адаптивного прийняття рішень у логістиці. Практичне значення дослідження полягає в розробці інструментів для підвищення стійкості торговельних підприємств в умовах зовнішніх загроз

Ключові слова: турбулентність ринку; зміни у діловому середовищі; форми торгівлі; гнучкість комерційних структур; моделі збуту; логістичне управління