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Assessment of domestic trade performance in developing economies: Integrated metrics, factor prioritization and strategic implications

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ABSTRACT

Domestic trade constitutes a critical driver of sustainable economic growth in emerging markets. However, assessing its efficiency remains challenging due to fragmented indicators and the absence of a unified methodology. This study aims to develop a comprehensive metric for evaluating the performance of the trade sector and identifying strategic priorities for its development. Using data from the Bureau of National Statistics of the Republic of Kazakhstan for the period 2001–2023, the analysis employs factor and regression analysis methods, complemented by expert evaluations to weight priority factors and enhance the precision of the aggregated indicator aligned with strategic development objectives. The study identifies four key groups of efficiency determinants socio-economic, production, infrastructure, and price-behavioral factors with purchasing power, employment, and the condition of trade infrastructure exerting the most significant influence. Production and infrastructure factors demonstrate a moderate impact, while price gross value-added variables gain importance under inflationary pressures. The proposed methodology offers a reliable diagnostic tool for monitoring sectoral sustainability and supports the development of targeted economic measures to enhance trade efficiency. Although the findings, based on the context of Kazakhstan, may require adaptation for broader application, the methodology remains pertinent for other emerging economies, considering differences in data availability and institutional maturity. Practical implications include providing policymakers and stakeholders with actionable insights to stimulate domestic production, improve logistics and institutional infrastructure, and strengthen strategic planning processes. This study presents a scalable framework for assessing trade efficiency and its impact on supply chain resilience in emerging markets.

Contribution/ Originality: This study contributes to the existing literature by developing a novel composite metric for evaluating domestic trade efficiency in emerging economies. It integrates macroeconomic, institutional, and behavioral factors into a unified framework. The study is one of the few that quantitatively prioritize trade performance drivers to support evidence-based strategic planning.

1. INTRODUCTION

The efficiency of domestic trade is a key economic indicator that has a direct impact on the formation and implementation of industry development strategies. When measured correctly, trade performance indicators provide

policymakers and industry executives with valuable insights into market dynamics, the level of competition, and potential growth points in a national economy.

Typically, assessments of domestic trade performance include multidimensional analyses of transaction costs, market access, pricing mechanisms, supply chain integration, and the regulatory environment (Chopra & Meindl, 2022; Porter, 1985; Williamson, 1986). Such assessments reveal not only the current state of the market but also structural strengths and weaknesses that require attention at the strategic level.

The current challenges facing domestic trade are caused by a number of systemic problems, including high turnover of goods and resource flows, significant logistical costs incurred during transportation and storage of products, reduced profitability of operations, as well as inefficient resource allocation across the stages of trade and technological processes (Srivastava, Mehta, & Swami, 2023; Stoyanov, 2021).

The impact of trade performance assessment on industry strategy is realized through multiple channels. First, this assessment helps prioritize resource allocation by identifying sectors with the greatest growth potential. Second, it allows for the identification of bottlenecks and institutional barriers that require intervention. Third, it provides benchmarks for monitoring progress over time.

Studies confirm that internal trade problems such as high costs, low profitability, and inefficient use of resources negatively impact the financial and economic activities of enterprises (Ikpe & Shamsuddoha, 2024; Lim & Jones, 2017; Parvasi, Taleizadeh, & Thaichon, 2025; Sorescu, Frambach, Singh, Rangaswamy, & Bridges, 2011). The practical solution to such problems most often occurs in a haphazard manner, by trial and error, through the direct influence of management on the characteristics and conditions of an operation or business process.

Under these conditions, the widespread practice of subjective assessment of the state of the business processes of enterprises seems irrational, since: the process and results of such analysis cannot be sufficiently formalized, which makes the analysis of commodity movement processes unnecessarily labor- and cost-intensive; in the process of subjective assessment, the expert is based only on his/her own experience and intuition. This leads to a high probability of accidental or intentional errors.

Solving these problems poses new tasks for trade enterprises to analytically support the process of developing management decisions related to the need to build: a system of indicators aimed at a comprehensive assessment of the state of financial and economic activities in the field of trade; a system of economic and mathematical models aimed at identifying the causes of problems and assessing their impact on the performance indicators of the operation, processes, and enterprise as a whole; a system of economic and mathematical models aimed at determining development priorities and making rational management decisions.

The relevance of this study is due not only to the need to assess the effectiveness of trade in the context of the structural transformation of the economy of Kazakhstan but also to the limitations of existing methodological approaches in international and domestic literature. Despite the presence of various indicative and rating systems, they mostly cover fragmented aspects of assessment without taking into account the relationship between microeconomic results, industry processes, and macroeconomic effects.

However, in most cases, the practical solution to these problems is carried out haphazardly and intuitively, in the form of reactive management based on empirical experience and subjective interpretation of the situation. This approach not only limits opportunities for scalable improvement but also hinders the institutionalization of best practices in trade process management.

Thus, the study aims to fill the current methodological gap identified in the scientific literature through the formation of a comprehensive concept for measuring and analyzing the effectiveness of domestic trade in developing economies. Unlike the fragmented approaches used in previous studies, this study offers an integrated analytical tool that simultaneously takes into account macroeconomic, institutional, and operational factors affecting trade efficiency. This makes the contribution of the work particularly important for the development of sustainable trade policy. Since, with a correct assessment, the parameters of trading efficiency become critically important for making informed

management decisions, allowing the government and business to identify potential growth points, assess the level of market integration, and prioritize institutional development.

The choice of the Republic of Kazakhstan as an example for assessing the effectiveness of domestic trade is due to a number of economic, institutional, and strategic factors that make it possible to consider this country as a representative case for developing economies.

First, trade plays a significant role in the structure of Kazakhstan's economy. According to the Bureau of National Statistics, the trade industry consistently ranks among the three leading sectors, contributing approximately 18.2% to the country's GDP. Additionally, more than 1.5 million people, or about 16.5% of the employed population, work in this sector, highlighting its importance not only for economic growth but also for social stability.

Second, Kazakhstan's domestic trade sector has demonstrated stable growth between 2018 and 2023. The average annual growth in trade amounted to 105.5%, with a change from 107.6% to 111.3% (Figure 1), which makes this sector one of the most dynamically developing in the country. However, there is a decrease in profitability and an increase in structural imbalances, which indicates the need for a thorough analytical assessment of the effectiveness of the trading system.

Third, Kazakhstan is increasingly integrated into international economic processes, creating both opportunities and challenges for its domestic trade. According to the Global Retail Development Index (GRDI) from A.T. Kearney, Kazakhstan ranks 7th among 40 developing countries (Kearney, 2023) which indicates high investment and market potential.

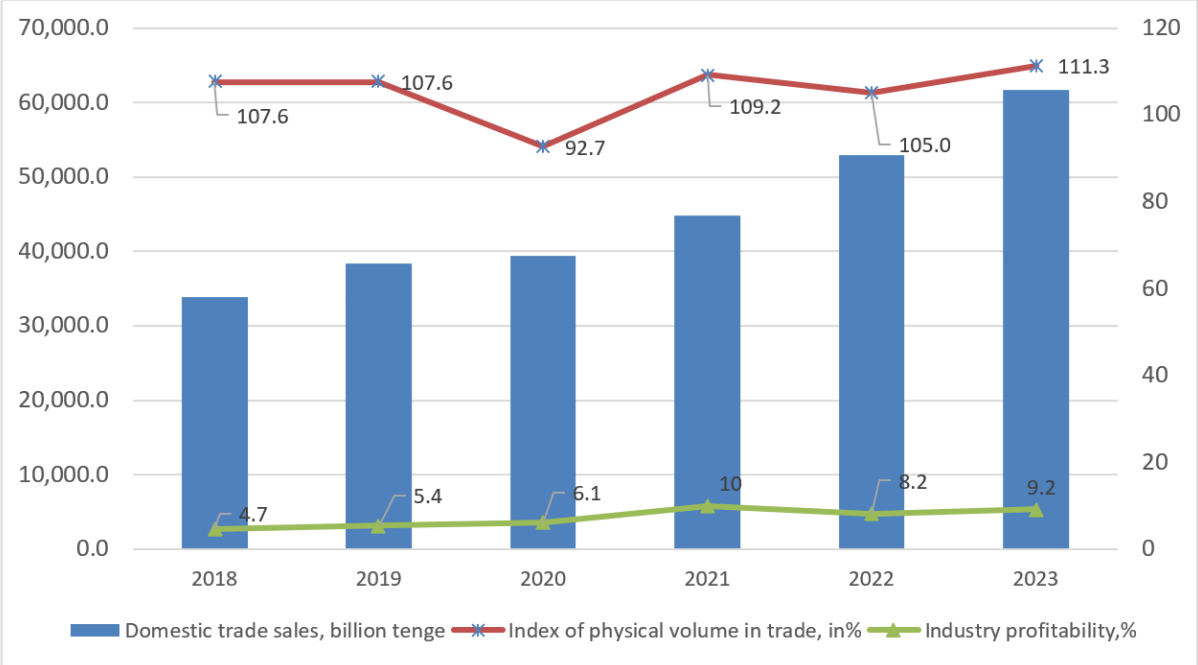

Figure 1. Volume of commodity turnover (wholesale and retail trade) in Kazakhstan, billion KZT.

Source: Bureau of National Statistics of the Republic of Kazakhstan (https://stat.gov.kz/).

Fourth, the country is in the process of transforming its trade structure. Against the background of a decrease in the share of small enterprises and the strengthening of the positions of large retail chains, the domestic market is showing signs of consolidation. This requires the adaptation of management strategies and the application of new approaches to evaluating performance at macro and meso levels.

Thus, the choice of Kazakhstan is justified by its economic significance, structural features of the trade sector, availability of data, and relevance of issues, which make the country an excellent research platform for testing the proposed methodological approach. This allows both the formation of an assessment toolkit for a given country and

the development of scientifically sound recommendations relevant to other countries with a similar level of socio-economic development.

The study is organized as follows. Section 2 describes the theoretical and methodological aspects of assessing the effectiveness of trade development; Section 3 describes the data and methodology; Sections 4 and 5 present the results and discussions. The final section includes the conclusion, consequences, limitations, and recommendations.

2. THEORETICAL ANALYSIS OF EFFICIENCY OF DOMESTIC TRADE

2.1. Methods and Models for Assessing the Efficiency of Domestic Trade

The effectiveness of domestic trade, as a key link in the national economy, requires an integrated approach to evaluation, including both qualitative and quantitative methods. In recent decades, there has been active development of tools focused on the use of economic and mathematical models, which is due to the complexity of trading systems and the need for accurate diagnosis of factors affecting their functioning.

Previous studies Leonova (2005); Krasilnikova and Timiryanova (2013); Novikova (2015); Pogrebnaya and Gissin (2017) and Sheng, Yunxia, and Feng (2021) emphasize the importance of mathematical modeling in evaluating trading activities. The most common approaches include procurement optimization models that aim to maximize profits while minimizing costs (Zalozhnev & Chistov, 2023). However, the complexity of trading enterprises as multifunctional systems requires not only the assessment of individual parameters but also an integral analysis of internal relationships.

Use of econometric models (Gray, 1985; Greene, 2008) allows building multifactorial relationships between internal variables and trade efficiency indicators, taking into account the dynamics of processes and predicting development.

The use of one-factor models (Ilyash, Vasyltsiv, Lupak, & Get'manskiy, 2021) made it possible to highlight key indicators (for example, turnover, profitability, inventory turnover) that reflect both the static and dynamic efficiency of trading enterprises.

A separate line of research focuses on the assessment of regional trade efficiency (Barna, 2015) where the influence of socio-economic and environmental factors on the development of trade is analyzed. The use of cluster analysis (Korolyova, 2020) also enables the identification of territorial differences and the development of regional strategies.

Among the modern approaches and methods for analyzing the effectiveness of domestic trade, the following are distinguished:

- Econometric modeling, which applies multivariate analysis to assess the impact of internal and external variables on trade efficiency (Greene, 2008; Ilyash et al., 2021).
- Data Envelopment Analysis (DEA) is used to evaluate the technical efficiency of trade enterprises (Halkos & Tzeremes, 2008; Okur & Ercan, 2022; Yu & Ramanathan, 2008).
- Gravity models, applied to estimate domestic and regional trade flows (Economou, Gavriilidis, Gebka, & Kallinterakis, 2023; Haini & Loon, 2023; Yotov, 2022).
- Multi-index scoring methods and competitiveness indices used to analyze trade conditions and comparative advantages (Cervantes-Martínez & Villaseñor–Becerra, 2023; Shevchenko, 2015).
- Balanced Scorecard (BSC) frameworks (Kefe, 2019).
- Integral performance indicators, as proposed by Matos, Martins, Simoes, and Simoes (2023) allow ranking enterprises according to the degree of use of their resource potential.

At the same time, the existing systems of indicators, as well as the methods of economic analysis of the enterprise, generally focus on assessing the financial result of the enterprise as a whole and do not allow for considering the root causes of problems that arise and the impact of the rationality of material flow operations on the indicators of the economic efficiency of the enterprise, which complicates the implementation of the main provision of the strategy of the trade enterprise.

Additionally, emphasize the significance of traditional performance indicators, such as ROA and ROE, over economic value added (EVA) in explaining market value added (MVA), which underlines the importance of focusing on fundamental financial metrics in the evaluation of trade enterprise efficiency.

The variety of methods for assessing the effectiveness of domestic trade confirms the need for further research on the integration of these approaches into the system of strategic planning and regional management of trade.

2.2. Factors Affecting Domestic Trade

There are many factors affecting domestic and foreign trade (Androsova, 2020; Bostan et al., 2023; Piatnytska & Zhukovska, 2015). The analysis of the literature made it possible to determine, in aggregate, the following factors affecting domestic trade: production (Raimbekov et al., 2024), socio-economic (Dix-Carneiro & Kovak, 2017; Neverauskienė & Pranskeviciute, 2018; World Bank, 2021), infrastructure (Wei & Liu, 2023), environmental and institutional (Kox & Lejour, 2005; Raimbekov, Syzdykbayeva, & Sladkovsiy, 2022), behavioral and non-behavioral based on literature review and synthesis (Economou et al., 2023). The key figures used in each factor group may differ in quantity and quality. This allocation is due to the presence of a corresponding element in the system structure.

The set of specific indicators in each of these groups may vary, which is associated with the peculiarities of the structure of the national economy. All these factors together affect the efficiency and competitiveness of the trading industry (Di Berardino, D'Ingiullo, & Sarra, 2017).

Among the most significant external factors are urbanization, growth in consumer demand, focus on quality and safety of products in high-income countries, regulatory framework, institutional environment, innovative infrastructure, development of facilities, and services (Alexander, Tavasszy, & Van Damme, 2018; Dybskaya & Sverchkov, 2017; Kearney, 2023; Raimbekov et al., 2022).

Separate studies in ASEAN countries show that differences between internal and external factors can have a negative impact on trade efficiency (Doanh, Truong, & Heo, 2022). It has been established that the efficiency of foreign trade remains at a moderate level from 0.561 to 0.612, with a downward trend.

A positive connection between domestic trade, including wholesale and retail, was recorded with a number of factors, such as the spread of the Internet (Herman & Oliver, 2023) digital infrastructure development (Li, Zhang, & Zhang, 2023) improving trade regulation (Karanja, 2022) increased transport length railways, highways (Ningjie & Rui, 2020) increased domestic investment in trade (Bostan et al., 2023) development of finance, human capital and innovation (Rizhamadze & Ābeltina, 2021).

Inessa, Artem, and Wielki (2019) confirms that the effectiveness of trade development depends on a variety of external factors, including the macroeconomic environment, competition, and innovation. These external conditions set the framework for the functioning of trading enterprises and should be taken into account in the formation of industry development strategies.

However, to increase trade efficiency, it is especially important to take into account internal factors such as management structure, organization of financial and economic activities, optimization of business processes, supply chain management, level of digitalization, human resources, logistics infrastructure of enterprises, and personnel training that directly increases trade efficiency (Groznik & Trkman, 2012; Yu, Gu, & Yuan, 2024; Yu, Ramanathan, & Nath, 2014).

The identification of factors affecting the efficiency of trade involves a comprehensive analysis of commercial activities, which makes it possible to study in depth and in detail various aspects of this activity using a system of indicators for assessing the state of financial and economic trade activities: financial, economic, organizational, logistics, and competitiveness indicators (Kolodin & Bystritskaya, 2015; Yu et al., 2014).

A comprehensive analysis of factors affecting trade efficiency allows strategic planning in the industry and the development of systems of priority activities necessary to increase the sustainability and efficiency of domestic trade.

2.3. Selection of Indicators to Assess the Efficiency of Trade Enterprises

Assessing the performance of trade enterprises requires the use of a comprehensive system of indicators that reflect both internal processes and their contribution to the economy. These indicators serve not only as tools for control and analysis but also as a basis for strategic planning, management decision-making, and resource optimization.

In traditional retail, the most significant indicators for assessing a business are turnover, gross and operating margin, inventory turnover, gross return on investment in inventory, and gross profit per employee (Stoyanov, 2021), and profitability of sales (Dumanska, 2021).

In the literature, there are key performance indicators (KPIs) for both retail (sales volumes, finance and sales budget, salary, etc.), wholesale, and distribution (purchase and sales volume, inventory volume, warehouse costs, order fulfillment, inventory management, etc.) (Abryutina, 2015; Srivastava et al., 2023).

The main absolute indicator reflecting the size of the processed material flow based on its cost characteristics is the volume of turnover or sales (O). However, this is not sufficient to assess the actual economic contribution. In this context, the Domestic Value Added (DVA) indicator, which reflects the contribution of trade activities to the country's economy, becomes important. Xu and Liang (2017) emphasize that high DVA and low-cost goods can serve as a showcase for exports and the basis for the transformation of the trading model.

In terms of supply chains, trading efficiency can also be assessed using more specialized indicators, such as the connectivity ratio (Cr) reflecting the number of links in the distribution chain; the level of costs of individual participants; and the trade profitability ratio (Raimbekov et al., 2024). These indicators assess the performance and economic feasibility of each element's participation in the distribution system.

Thus, the system for assessing the efficiency of trade enterprises should be comprehensive and multilevel, based on the widespread use of economic and mathematical methods.

3. METHODS AND DATA

Before outlining the specific stages of the econometric procedure, it is important to first characterize the dataset and justify the methodological choices made. This study is based on official statistical data provided by the Bureau of National Statistics (BNS) of the Republic of Kazakhstan for the period from 2001 to 2023, covering 23 complete calendar years (https://stat.gov.kz/).

The selected time frame reflects both the availability and consistency of the data, and captures key phases in the country's economic development, including pre-crisis, crisis, and post-crisis periods, as well as stages of institutional and structural transformation. In this context, the data are considered analytically representative and appropriate for conducting trend, correlation, regression, and factor analyses. This provides the necessary analytical depth and scope for evaluating the dynamics of internal trade in emerging market economies.

Factor analysis was applied to reduce potential multicollinearity and to extract latent structures among variables. Additionally, the primary aim of the regression analysis was exploratory rather than predictive, focusing on identifying key determinants of trade efficiency rather than constructing forecasting models. High explanatory power (R^2 between 0.88 and 0.97) and consistency with theoretical expectations further validate the reliability of the findings within the existing data constraints.

Stage 1. Selection of key performance indicators and construction of trend models to assess the financial and economic activities of the trade sector.

A detailed list of selected indicators is provided in Table 1.

Table 1. Trade performance criteria.

№	Indicator name	Designation	Formula / Description	Preferred trend
1	Gross commodity turnover, billion KZT	Y1	Total volume of all sales: sum of wholesale and retail turnover	Growth
2	Commodity movement connectivity ratio	Y2	Ratio of gross turnover to retail turnover	Decrease
3	Profitability ratio	Y3	Ratio of turnover to circulation costs	Growth
4	Capital productivity of commodity turnover	Y4	Turnover divided by the value of owned and borrowed fixed assets.	Growth
5	Commodity turnover period (in days)	Y5	Inventory at period end / turnover during the period	Growth
6	Inventory turnover rate	Y6	Turnover / average inventory	Growth
7	Commodity turnover per 1 sq. m of area	Y7	Turnover per square meter of retail space	Growth
8	Overdue payables level	Y8	Overdue accounts payable / turnover	Decrease
9	Level of goods supply	Y9	Cost of finished products / turnover	Growth
10	Costs per 1 KZT of sold products	Y10	Cost of goods sold as a percentage of turnover	Decrease
11	Cost of commodity turnover	Y11	Circulation costs / turnover	Decrease
12	Stock intensity of commodity turnover	Y12	Fixed asset value / turnover	Decrease
13	Material intensity of commodity turnover	Y13	Material costs / turnover	Decrease
14	Long-term investment capacity of turnover	Y14	Investments / turnover	Growth
15	Trade efficiency	Y15	Turnover / cost of goods sold and services rendered	Growth
16	Stock coverage level	Y16	Value of finished products and resale stock / turnover	Growth
17	Load capacity per 1 sq. m of area	Y17	Freight volume / turnover	Growth

These indicators were used to construct trend equations that characterize the development trajectory of the trade industry over time. The objective of this stage was to assess the stability, volatility, and directionality of core financial and operational indicators and to lay the groundwork for subsequent modeling stages. The trend analysis provides initial empirical insights into whether the observed dynamics align with strategic development goals such as profitability, efficiency, and capital productivity.

Descriptive statistics Yi are presented in Table A1 of the Appendix.

Stage 2. Econometric analysis and factor assessment

In this stage, a multivariate correlation-regression model was constructed to examine the relationships between socio-economic, infrastructural, and institutional factors and trade efficiency indicators. The model was used to assess the impact of various variables on trade performance (see Table 2).

Table 2. List of independent variables for the evaluation of trading activity in the process of commodity movement.

№	**Factor Description**	**Variable Name**	**Notes**
1	Population of Kazakhstan (in people)	X1	Reflects the size of the domestic market and consumer base.
2	Average per capita household income (used for consumption), KZT	X2	Income level affects purchasing power and consumption patterns.
3	Average per capita household expenses, KZT	X3	Household spending behavior can influence demand for goods and services.
4	Living wage (KZT)	X4	Represents the minimum income needed for households to meet basic needs.
5	Cost of the food basket (KZT)	X5	Key indicator for understanding the cost of basic goods and the affordability of essential commodities.

№	Factor Description	Variable Name	Notes
6	Gross output of agricultural products (services), million KZT	X6	Reflects the agricultural output, which is a significant part of the trade sector in developing economies.
7	Volume of food production in the industry, million KZT	X7	Measures the output of food products, which is critical for domestic food security and retail trade.
8	Share of investment in trade in GDP, %	X8	Indicates the importance of trade sector investment in the broader economy.
9	Usable storage area (sq. m)	X9	Represents the storage capacity within the retail sector, which is critical for efficient inventory management.
10	Volume of inventory in the retail network, billion KZT	X10	Reflects the amount of stock available in the retail sector, influencing turnover and inventory efficiency.
11	Retail space of retail stores selling consumer goods, sq. m	X11	Provides insight into the physical capacity of retail stores and its impact on sales volume.
12	Total area of markets (sq. m)	X12	Reflects the size of markets, which can influence the variety and availability of goods for consumers.
13	Number of markets	X13	Indicates the spread and accessibility of markets across regions.
14	Number of refrigerators	X14	Reflects infrastructure necessary for the storage of perishable goods, influencing supply chain efficiency.
15	Share of legal entities in trade among all legal entities	X15	Provides an indicator of formal trade activity and its contribution to the regulated economy.
16	Food price index	X16	Reflects the change in prices of food products, affecting both trade margins and consumer purchasing power.
17	Share of employees in the service sector (%)	X17	Shows the importance of services in the economy, which is often linked to increased demand for trade services.
18	Share of employed in agriculture and agro-industrial complex (%)	X18	Indicates the dependence of trade on agricultural and agro-industrial production.
19	Length of public paved roads, km	X19	A key infrastructure factor that affects logistics efficiency and the distribution of goods.
20	Density of paved roads (km per 1000 sq. km)	X20	A measure of road infrastructure quality and accessibility across regions, influencing trade flow.
21	Operational length of public railway tracks, km	X21	A critical infrastructural element for the transportation of goods across longer distances.
22	Share of expenses for product sale and service provision per 1 KZT of turnover	X22	Efficiency metric to evaluate cost control in relation to sales volume.
23	Cargo handling per 1 sq. m of area	X23	Indicator of logistics capacity, showing how much goods are handled per unit of retail space, which can affect trade efficiency.

By analyzing these variables, we will determine the key drivers of trade efficiency, identify patterns and relationships, and assess their influence on strategic decision-making in Kazakhstan's domestic trade sector.

Descriptive statistics Xi are presented in Table A2 of the Appendix.

To mitigate multicollinearity issues, factor analysis was applied, using the methods of Rummel (1970) and Stevens (2002). The dataset included key indicators such as macroeconomic data, domestic value added (DVA), profitability, employment, and logistics infrastructure, which are relevant to the trade systems of emerging economies. Data suitability was confirmed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity.

Principal component extraction with Varimax rotation was applied, and the number of factors was determined based on the Kaiser criterion and scree plot analysis. Factor scores were used in regression modeling. All analyses were performed using SPSS software.

The entire algorithm of economic and mathematical analysis and assessment of the state of functioning, trends, and choice of development strategy for the trade sector of Kazakhstan consisted of the following steps.

Step 1: Develop a comprehensive industry development strategy.

Step 2: Formalize the strategy by determining key performance criteria for trade efficiency.

Step 3: Building time-series equations for key performance indicators of an industry involved in trading activities.

Step 4: Verify whether the observed trends align with the chosen strategic direction.

Step 5: If aligned, refine strategic objectives and return to Step 2. If not aligned, proceed to model operational processes to identify causes of inefficiency.

Step 6: If not, then model processes and operations to localize the causes of industry inefficiency.

Step 7: Development of a set of measures to enhance the efficiency of industry trade activities.

Step 8: Conduct predictive assessment to evaluate the impact of proposed improvements.

Step 9: Verify whether enterprises comply with the proposed efficiency improvement measures. If not, repeat Step 9. If yes, proceed to the next step.

Step 10: Implement the approved measures to rationalize industry trade activities. Return to Step 3 to continue the evaluation cycle.

Step 1: Development of the Trade Strategy

In accordance with the Development of Trade Concept in the Republic of Kazakhstan (Government of Kazakhstan, 2020) a strategy has been selected to create a conducive environment for both the population and business entities (producers of goods and trade organizations). This strategy is aimed at developing a multi-format trade infrastructure, building a system that simultaneously satisfies the needs of all trade participants: consumers, producers, and trade entities. This approach is particularly relevant for emerging markets, where balancing these interests is essential for sustainable economic development.

The main objectives of this strategy are: 1. The development of multi-format trade (including retail chains, small-scale trade formats, online trade, and other models); 2. The development of the wholesale food sector; 3. The expansion of street retail (street trading) in urban areas; 4. The promotion of self-regulation, self-organization, and cooperation in trade; 5. The deregulation of trade; 6. Enhancing the image of the trading industry.

This strategy is a long-term priority for Kazakhstan's trade sector, reflecting the growing demands and unique challenges of emerging markets.

Step 2: Formalization of the Strategy

To carry out a subsequent economic and mathematical analysis of trade performance, Step 2 involves formalizing a strategy. This step entails creating a mathematical description of the most desirable trends in the dynamics of industry performance, which is crucial for understanding the rapid changes typical in emerging markets.

Step 3: Determining Key Trade Trends

The main trends inherent in the trade industry are identified in Step 3 based on trend equations, constructed in accordance with the same list of indicators used for performance criteria. The implementation of Step 3 involves mathematical analysis aimed at identifying extremes and intervals where functions are increasing or decreasing. In emerging markets, identifying and understanding such trends is essential for responding to fast-evolving economic conditions.

Step 4: Analyzing Trends and Their Alignment with Performance Criteria

The goal of Step 4 is to assess the degree to which existing trade trends align with performance criteria. To do this, we use an aggregated indicator of the state of financial and economic activities in the trade industry (A), which quantifies how well the activities of the industry align with the selected strategy.

$$\mathrm{A} = \sum_{n=1}^{n=i} m_{yn} a(y_n) r_{yn}^2 \qquad (1)$$

m – trend weight of the dynamic series of the n studied indicator in the aggregate of all priority directions of the enterprise development.

a – the value of the logical function characterizing the compliance of the dynamic series of the n indicator of the enterprise with the set goal.

r^2 – coefficient or index of determination of the trend equation for the dynamic series of the n indicator;

I – number of studied dynamic series of indicators.

In emerging economies, where data is often less predictable, this method allows for a clearer understanding of trade dynamics and their strategic alignment.

Step 5: Adapting the Strategy and Setting New Goals

If the analysis shows that the trends align with the strategy, the strategy is adjusted with new goals and objectives (Step 5). If the results do not meet expectations, a reassessment of the strategy and its objectives is necessary. This cyclical approach is vital for industries in emerging markets, which are subject to rapid shifts in both domestic and global economic conditions.

Step 6: Assessing the Causes of Inefficiency

If inefficiency is detected based on the analysis of trends, multi-factorial mathematical models are constructed to identify the causes of inefficiency in the industry. These models help pinpoint problems at various levels of management and provide the foundation for addressing these issues in the context of a developing market.

Step 7: Developing and Implementing Measures to Improve Efficiency

Based on the analysis of these models, measures to address identified issues are developed. These measures can only be implemented after a predictive assessment of the changes that will occur within the system, ensuring they align with the established efficiency criteria (Steps 8-9).

Step 8: Forecasting Changes in the System

Step 8 involves forecasting changes in the system after implementing the proposed measures and verifying whether these changes meet the efficiency criteria. The predictability of outcomes is especially important in emerging markets, where economic uncertainty is higher.

Step 9: Verifying the Implementation of Measures

Once the forecast has been completed, the implementation of the proposed measures is checked for their alignment with efficiency standards. If full compliance is not achieved, the process is repeated until the required adjustments are made.

Step 10: Implementing Effective Measures

Finally, after performing the forecast and verifying the changes, measures to enhance the efficiency of the industry are implemented, and the process moves back to Step 3 for continuous monitoring and strategic adjustments.

The strategy for developing trade in Kazakhstan must be dynamic, adapting to the unique challenges and rapid changes of emerging markets. Continuous monitoring, assessment, and adjustment of trends based on performance criteria ensure that trade activities remain competitive and sustainable in the long term. By focusing on the specific needs of developing economies, this strategy provides a framework for improving trade efficiency and fostering economic growth.

4. RESULTS

This section presents the main empirical findings from trend modeling, regression analysis, and factor analysis of trade efficiency in Kazakhstan. The results are structured into four parts: (a) trend equation construction, (b) regression modeling, (c) factor analysis of trading activities, and (d) assessment of factor impacts on gross value added (GVA) and trade efficiency indicators.

A) Based on the results of trend equation construction, a set of statistically significant trend equations was obtained (Table 3).

Table 3. Trend equations for indicators of financial and economic activity of trade enterprises in Kazakhstan and information on their statistical significance.

Trend equation	R^2	F-test	SE
Y1=451208976+2522315044·t	0.974	408	0.095
Y2=−0.0487x+2.8233	0.80	44.2	0.098
Y4=0.0301·t−0.0219	0.78	38.9	0.096
Y5=49.68−0.96·t	0.21	2.83	7.63
Y7=766.4+e0.072·t	0.863	69.3	0.923
Y10=−0.0007·t2+0.0058·t+0.8071	0.48	52.3	0.08
Y11=0.0004·t2−0.0041·t+0.0523	0.70	11.4	0.09
Y14=1.3601·t2−16.327·t+66.685	0.67	31.2	0.11
Y15=25.791e−0.034·t	0.42	12.8	0.05
Y16=0.0008·t2−0.014·t+0.166	0.50	7.5	0.04
Y17=0.0021·t−0.431	0.59	6.4	0.01

The evaluation of the quality of the trend model using the coefficient of determination (R2), Fisher's F-test (F), Student's t-test, and standard error of the trend equation (SE) showed compliance with the requirements with 95% reliability.

The analysis of the equations showed that for such indicators as turnover, fund output, product turnover connectivity ratio, cost intensity, investment intensity, etc., stable statistically significant relationships (linear, quadratic, and exponential) are observed, while preference is given to non-linear models – as more adequately reflecting the economic nature of processes, namely, it assumes the absence of a constant increase in the value of the indicator. At the same time, no significant trends were identified for a number of indicators (for example, the speed of circulation, the level of overdue debt, material intensity), which may indicate a lack of a systematic approach to managing the relevant areas.

To further assess the compliance of current trends with strategic goals, an aggregated indicator was used, taking into account not only the direction and significance of trends but also their impact on overall effectiveness. Based on model 1 calculations, the aggregated indicator of the financial and economic activity of the trading industry amounted to 0.2485 (in the range from -1 to +1) (Table 4). This indicates a slight but positive compliance of current trends with the strategic goals of the industry.

Table 4. Calculation of the value of the aggregated indicator of the functioning status of the trading industry.

Criteria	a (Y)	m	R^2	A
Y1	1	0.1	0.93	0.093
Y2	-1	0.07	0.88	-0.0616
Y3	1	0.09	0.62	0.0558
Y4	1	0.04	0.88	0.0352
Y5	1	0.1	0.32	0.0320
Y6	1	0.03	0.45	0.0135
Y7	1	0.1	0.48	0.0480
Y8	-1	0.07	0.38	-0.0266
Y9	1	0.08	0.25	0.0200
Y10	-1	0.05	0.8	-0.0040
Y11	-1	0.1	0.79	-0.0790
Y12	1	0.03	0.97	0.0291
Y13	0	0.01	0.46	0
Y14	1	0.08	0.73	0.0584
Y15	1	0.11	0.75	0.0825
Y16	-1	0.02	0.59	-0.0118
Y17	0	0.03	0.68	
Total		1.00		0.2485

Thus, the aggregated indicator of 0.2485 indicates a moderately positive state of financial and economic activity in the trading industry. This value signals the presence of development potential but also reflects structural problems that require targeted management impacts. The A (+) sign is especially important, as it acts as an indicator of positive dynamics despite the presence of individual negative factors. In a strategic context, this value corresponds to the lower limit of the permissible positive interval, which requires stimulating measures to strengthen the positive trend.

B) Results of regression analysis. Details of the regression models are provided in Appendix Table A3. The analysis revealed a significant impact of factors on key indicators.

The results of the assessment of factors and trade efficiency are published in Raimbekov et al. (2022) and the current study focuses on a systematic analysis of the impact of factors according to 2001-2023 data, as well as an expert assessment to determine the weights of priority factors. Regression models demonstrate statistical significance (R^2 = 0.88-0.97), but multicollinearity limits their applicability. In this paper, we extend the analysis by ranking factors through a matrix approach.

As a result of regression analysis, a number of models were built that allow assessing the impact of various factors on the economic efficiency of the trading industry. The key results are as follows:

- The turnover volume model (Y1) indicates that turnover is most strongly influenced by commodity stocks in the network (X10), market area (X12), and the share of active legal entities (X15).
- The connectivity ratio of commodity movement (Y2) depends on the sales area of stores (X11) and the number of refrigeration chambers (X14).
- The profitability ratio (Y3) is positively associated with the number of markets (X13), road density (X20), and the share of sales-related costs (X22), while it is negatively influenced by the number of trading enterprises (X15) and the food price index (X16).
- The fund turnover (Y4) is significantly influenced by market area (X12), road density (X20), and volume of retail space per capita (X21).

The next step in the analysis is to rank these significant factors according to the strength of their influence on performance outcomes in the trading sector. This will help identify priority areas for managerial intervention aimed at improving the functional efficiency of product distribution.

To solve this problem, we construct a matrix N, with elements $\beta(y_n; x_n)$ which are the partial beta coefficients of the regression equations (Table A4 of the Appendix).

Let us multiply matrix N by the vector of priorities for the development of industry M, the modulo value of each element of which is a certain expertly normalized priority value for yn, and the sign indicates the preferred direction of growth yn (Table A5).

It is possible to obtain a matrix K (Table A6 of the Appendix), the elements of which reflect the degree of influence of the growth of the studied factor on the efficiency of the enterprise.

The activities of a trade enterprise and its functions are multifaceted, and the growth of the same factor in the context of various dependent variables can have different impacts on the state of the financial and economic activities of the industry as a whole. Therefore, to determine the overall impact of the factor under consideration on trade as a system, we sum the elements of matrix K by columns.

Table A7 shows the resulting normalized vector P(Xi), derived from factor weights, and represents the prioritization of management influences on the development of the trade sector. The values of the vector elements make it possible to rank the factors by their strength of influence on Kazakhstan's trading industry's financial and economic activities (Table 5).

Table 5. Ranking of factors (vector P (Xi)) by the strength of their impact on the state of efficiency of the trade industry in Kazakhstan*.

Rank	Factor	Factor priority in the total volume of management impacts	Priority direction of factor growth
1	X10 (inventory)	0.2688	minimum
2	X8 (investment in trade)	-0.1617	maximum
3	X15 (share of active legal entities)	-0.1524	maximum
4	X12 (area of trade markets)	-0.0974	minimum
5	X11 (shopping area)	-0.0808	maximum
6	X22 (sales costs)	0.0741	maximum
7	X2 (household income)	-0.0533	maximum
8	X13 (number of markets)	0.0353	minimum
9	X7 (volume of food production in industry)	-0.0216	maximum
10	X20 (paved roads density)	0.0153	maximum
11	X14 (number of refrigerators)	0.0100	maximum
12	X19 (length of public paved roads)	-0.0145	maximum
13	X6 (gross output of agricultural products)	-0.0111	maximum
14	X23 (cargo handling per 1 sq. m of area)	0.0099	minimum
15	X16 (food price index)	0.0035	minimum

This table highlights the key factors that must be considered for optimizing the operations of trade enterprises in Kazakhstan.

C) Results of factor analysis of trading activities. In accordance with Table A2 of the appendix lists 23 factors used, including socioeconomic, production, infrastructure, and behavioral factors, which affect the performance indicators of the trade sector. Table 6 lists the eigenvalues of the factors obtained from factor analysis.

Table 6. Eigenvalues of factor analysis and contribution of components to total variance.

Components	1	2	3	4	5	6	7	8	9
Eigenvalue	**14.300**	**3.123**	**1.892**	**1.627**	0.806	0.568	0.316	0.155	0.006
Dispersion %	62.174	13.577	8.226	7.072	3.506	2.471	1.373	0.924	0.156
Total %	62.174	75.751	83.976	91.049	94.555	97.026	98.399	99.323	99.479
Cronbach's alpha coefficient	0.911	0.724	0.514	0.351	0.117	0.091	0.053	0.031	0.013

Only four components with variance and eigenvalues greater than 1 were selected for further analysis. As can be seen from Table 6, the total percentage of dispersion explained by the first component is 62.174%, together with the second (75.751%), third (83.976%), and fourth (91.049%).

Verification of the internal consistency of the studied characteristics, according to Cronbach's alpha criterion (Goforth, 2015), showed high reliability of the indicators, with a coefficient of 0.813. The Kaiser-Meyer-Olkin (KMO) test value of 0.788 indicated a high sample adequacy score.

Table 7 presents the factor loadings of 23 variables after applying the Varimax rotation method. The variables are grouped into four main components (F1 to F4), each reflecting distinct underlying factor structures.

Table 7. Factor load matrix of main components after Varimax method application.

Variables	Group of factors			
	F1	F2	F3	F4
X1	**0.944**	0.299		
X2	**0.951**	0.249		
X3	**0.953**	0.235		0.102
X4	**0.967**			0.122
X5	**0.971**	0.158		
X6	-0.220	**0.710**		-0.256
X7		**0.927**	-0.248	
X8	-0.556	-0.624	-0.419	

Variables	Group of factors			
	F1	F2	F3	F4
X9	**0.922**	0.361		
X10	**0.974**			
X11	**0.829**	0.392		0.215
X12	**0.945**	0.247		0.145
X13	-0.738	-0.454	-0.174	0.276
X14	**-0.907**		0.222	
X15	-0.415	-0.733		0.353
X16	0.240			**0.851**
X17	**0.905**	0.391	-0.124	
X18	**-0.911**	-0.389		
X19	-0.213		0.497	
X20			**0.959**	
X21	**0.764**	0.333	-0.443	0.110
X22	0.398	-0.173	0.424	**-0.779**
X23		0.235	**-0.880**	0.242

The constituents presented in Table 7 are characterized as follows.

The first main component (F1), with the greatest contribution to the total dispersion (62.174%), is closely related to socioeconomic factors: X1, X2, X3, X4, X5, X9, X10, X11, X17, and X18.

Thus, component F1 is an aggregated measure of relative purchasing power, trade, and employment in the production of goods. The relative contribution of these components was 55.7%.

The second main component (F2) is closely related to production factors X6 and X7. The relative contribution of these components was 13.577%.

The third main component (F3), with a relative contribution of 11.2%, considers the influence of infrastructure factors such as X20 and X23. The relative contribution of these components was 8.226%.

The fourth principal component (F4), with a relative contribution of 7.07%, has a strong correlation with X16 and X22.

D) Results of the assessment of the impact of the main components on Gross Value Added (GVA) and on the efficiency of trade. After identifying the four main groups of factors, an analysis of the relationship between these groups of factors and GVA trade was carried out (Table 8).

Table 8. Trade regression model after factor analysis.

Dependent variable GVA	$GVA = \beta_0 + \beta_1 F1 + \beta_2 F2 + \beta_3 F3 + \beta_4 F4$			
Variable	**Coefficient**	**Std error**	**t-stat**	**Prob**
F1	253.127	20.245	9.252	0.000
F2	125.121	12.152	7.234	0.000
F3	15.254	5.234	5.623	0.002
F4	5.235	2.451	4.187	0.002
β_0	490.977	42.292	3.116	0.005
R-sq	0.857	Mean dependent var		20.254
Adj R-sq	0.914	S.D. dependent var		4.8091
S.E. of reg	135.2321	Akaike info criterion		11.0525
F-Stat	56.8825	Durbin-Watson statistic		2.6356
Prob F-stat	0.0005			

According to Table 8, the model is highly significant: the coefficient of determination $R^2 = 0.857$ (adjusted $R^2 = 0.914$), which indicates that about 91.4% of the variation in GVA is explained by the four main components (F1-F4). This confirms the high explanatory ability of the model. All p-values for F1-F4 factors are less than 0.01, which indicates their statistical significance. The greatest influence is F1 (β_1 = 253,127), followed by F2 (125,121), F3 (15,254) and F4 (5,235), which emphasizes the key role of the first group of factors. The model as a whole is

statistically significant (F-statistic = 56.88; p = 0.0005), and the Darbin-Watson test value (2.6356) indicates the absence of autocorrelation of residuals, which confirms the correctness of the model.

The resulting model confirms that the identified four groups of factors significantly and positively affect the formation of gross value added in trade. It is especially important to take into account the first and second groups of factors when developing strategic management decisions, since they have the greatest impact on the efficiency of the industry.

The following regression models were constructed for subsequent analysis of the impact of the obtained main components on the efficiency of trading activity using the algorithm for the sequential inclusion of variables (Table 9).

Table 9. Assessment of the impact of key components on trade efficiency.

	F0	F1	F2	F3	F4	R^2	SE	F-statistic	*DW*
Y1	2.1E+10	9381336775	2986004018	-	-	0.94	2980656401	27.7	1.65
Y2	2.47	-0.203	-0.045	0.021	-0.025	0.85	0.112	8.75	1.85
Y4	0.190	0.109	0.036	-0.020	0.023	0.91	0.047	15.6	1.89
Y7	1288.0	343.5	125.78	-32.2	-22.0	0.84	205.6	8.23	0.65
Y11	0.050	0.007	-0.002	-0.001	0.003	0.65	0.0078	7.98	1.52
Y14	38.08	16.238	-15.07	0.006	4.423	0.68	17.24	5.29	1.23

Table 9 presents the effective (Significant) performance criteria for the trading industry: Y1, Y2, Y4, Y7, Y11, and Y14.

The study showed that most regression equations meet the main criteria for significance, except for the Y8 indicator, the level of overdue payables.

Subsequently, the factors (Main components) were ranked by the strength of their impact on the effectiveness of the financial and economic activities of trade entities (Table 10), which shows that the main development priority is the growth of socioeconomic indicators (income, employment, etc.), as well as trade indicators such as inventory, retail space stores, and the availability of warehouse space.

Table 10. Ranking of factors (Main components) by the strength of their impact on the efficiency of financial and economic activities of trade entities.

Rank	Factor	Factor priority in the total volume of management impacts	Priority direction of factor growth
1	F1	0.8154	F1 ⟶ Max
2	F2	0.3541	F2 ⟶ Max
3	F3	0.1385	F3 ⟶ Max
4	F4	0.0138	F4 ⟶ Min

Comparing the results obtained with the results of correlation and regression analysis, it should be noted that despite the above difficulties in interpreting the models obtained for the main components, their application makes it possible to obtain a more complete and balanced assessment of the state and main priorities of trade development.

At the same time, it is impossible to draw a conclusion about the preference for the use of a particular method for analyzing the state of a trade enterprise, since regression models built on factor characteristics better reflect particular patterns in trade activities, and models built on the main components are system-wide. In this regard, it can be concluded that, in the context of the algorithm for analyzing trade efficiency, both methods complement each other.

5. DISCUSSION

The results of the regression and factor analyses identified the key determinants of trade efficiency in Kazakhstan. The most significant is the socioeconomic factor (F1), which encompasses variables such as purchasing power of the

population, employment rate, and inventory levels (X10). Among these, the X10 variable (inventory) demonstrated a consistent influence across seven models (Y1, Y5, Y8, Y11, Y12, Y14, Y17), confirming its critical role in shaping trade efficiency. However, it is important to note that excessive inventory accumulation can reduce turnover and increase costs, aligning with the findings of Stoyanov (2021) and Srivastava et al. (2023).

A significant role is also played by investments in trade (X8), included in the F2 component. Their influence is manifested in four models (Y5, Y7, Y13, Y14) and is especially important for infrastructure renewal and sector modernization (Bostan et al., 2023; Raimbekov et al., 2024). At the same time, the share of legal entities in trade (X15) has a dual effect. On the one hand, it indicates the development of entrepreneurship; on the other, it may signal market oversaturation, which reduces efficiency, as indicated in the works of Minten, Randrianarison, and Swinnen (2009) but differs from the results of Rizhamadze and Ābeltina (2021).

Infrastructure factors (F3), including market area (X12) and road density (X20), have a positive impact on trade activity, subject to the qualitative development of transport accessibility, as confirmed by models (Y1, Y3, Y14). This statement is confirmed in the studies of Ningjie and Rui (2020). However, their influence is limited by regional inconsistency of development, especially in remote and rural areas, which reduces the overall effect and explains deviations from global models (Bourlakis & Weightman, 2003).

The price and cost factor (F4: X16, X22) exerts the least influence. While its significance is limited in a stable macroeconomic environment, it becomes more relevant during inflationary periods and rising cost conditions, as supported by Gray (1985) and Kox and Lejour (2005), as well as recent work by Bostan et al. (2023).

According to the results of the comprehensive analysis (Table 8 and 10), the priority of the factors is distributed as follows: F1 has the highest weight (0.8154), followed by F2 (0.3541), F3 (0.1385), and F4. At the same time, an increase in F1 by 1% leads to an increase in gross value added in trade by 253.127 billion KZT, emphasizing its dominant value. Production factors (F2) show a moderate influence, especially in the context of dependence on the agricultural sector, while the contribution of F3 and F4 remains relatively low.

The influence of the F1 component is supported by the high explanatory power of the models, especially concerning the gross income measure. At that time, F3 and F4 exhibit either a weakly positive or even negative effect, which can be explained by infrastructure imbalances and the high volatility of cost components across different regions.

Based on the results obtained, a hierarchical strategy for trade development is proposed:

In the short term (1-3 years): priority should be given to measures aimed at increasing the purchasing power of the population, creating jobs, supporting small and medium-sized businesses, and developing online trading (F1);

Medium-term (3-5 years): increased investment in logistics, trade infrastructure, creation of partnerships between retailers and local manufacturers (F2, F3);

Long-term (more than 5 years): improvement of pricing policy and reduction of transaction costs through digitalization, tax, and rental benefits (F4).

The following measures are proposed to effectively manage the determinants of trade efficiency.

By F1: loyalty programs, employment support, investments in digital sales channels.

By F2: subsidies for agriculture and food industry, development of product storage and transportation systems (Reardon, Timmer, Barrett, & Berdegué, 2003).

By F3: construction of logistics centers, development of road infrastructure, implementation of digital solutions (GPS, automation).

By F4: Introduction of electronic document management, reducing administrative barriers and regulating the price burden on the business.

These findings are generally consistent with the existing body of research. However, regional contextual factors must be considered to account for certain deviations. Differences from global trends are primarily attributed to the resource-based orientation of Kazakhstan's economy and regional imbalances (Uskelenova & Nikiforova, 2024).

The most effective strategy for trade development in Kazakhstan is the integration of socio-economic and trade factors (F1) with the industrial and agricultural production base (F2), while ensuring the sustainable development of transport infrastructure (F3) and cost optimization (F4).

An integrated and hierarchical approach to managing these groups of factors within the framework of a hierarchical strategy will achieve sustainable growth of the trading industry and increase its contribution to the country's economic development.

The scientific novelty of this research lies in the development of a methodological approach that connects the prioritization of factors influencing trade efficiency with the formulation of a hierarchical strategy for trade development. Unlike existing studies that focus solely on identifying key factors, this study integrates factor prioritization into a strategic planning framework.

Specifically:

- A direct linkage is established between the results of factor analysis (F1–F4) and the levels of strategic intervention (short-, medium-, and long-term).
- A weighted factor ranking methodology is introduced, combining econometric analysis and expert judgment, tailored to Kazakhstan's socio-economic conditions.
- The practical application of prioritized factors for trade development planning, resource allocation, and demand management forecasting is demonstrated.
- A system for incorporating trade and supply chain indicators into strategic planning is proposed to enhance the resilience and adaptability of the internal market.

Thus, the research not only identifies critical determinants of trade efficiency but also offers a practical, scalable approach for their strategic application in emerging economies.

6. CONCLUDING REMARKS

6.1. Conclusion

This study is a comprehensive analysis of factors affecting the efficiency of internal trade in Kazakhstan, using methods of regression, factor analysis, and expert assessment. The results confirm the importance of socio-economic factors for improving trade efficiency and also emphasize the need to optimize inventories and improve logistics infrastructure. Key recommendations for management include reducing excess inventories, increasing investment in trade infrastructure, and boosting government support for agriculture and the food industry. Measures to improve transport accessibility and logistics conditions are also important, which helps to reduce costs and improve profitability. In addition, our analysis demonstrates that regional features of Kazakhstan, such as dependence on commodity exports, require a special approach in interpreting the results and making management decisions. In general, the results of the study are consistent with modern scientific work, confirming the importance of an integrated approach for sustainable trade growth in developing countries.

6.2. Implications for Domestic Trade Theory and Practice

This study contributes to the theory of domestic trade development by highlighting the critical importance of trade efficiency in supporting sustainable economic growth in emerging markets. The dominant influence of socio-economic factors, particularly purchasing power, employment, and trade infrastructure, underscores the need for demand-oriented trade strategies. Investments in production capacities and infrastructure further enhance sectoral integration and competitiveness.

For practitioners, the findings emphasize the strategic relevance of optimizing resource allocation, improving local infrastructure, and adapting trade policies to regional socio-economic dynamics. The differentiated impact of infrastructure and price-behavioral factors indicates the necessity of region-specific approaches. Comprehensive

monitoring systems, integrating key trade and economic indicators, are crucial for strengthening market stability, mitigating operational risks, and fostering long-term growth of the domestic trade sector.

6.3. Limitations and Future Research

Despite the significance of the results obtained, this study has several limitations that should be taken into account when interpreting the results. First, the data used on factors influencing the trade sector are limited to a particular region, which limits the generalizability of the findings to other economic contexts. Second, given the complexity of the impact of various factors on trade efficiency, it is necessary to consider possible relationships between them, which were not always fully covered in this analysis.

Future studies may focus on examining regional differences and their impact on factor analysis results in greater detail, as well as using longer time series to analyze long-term trends in trading activities. It is also important to consider the impact of external economic factors, such as global economic crises or changes in international trade, which can have a significant impact on the trade sector. In the future, the impact of digitalization and innovative technologies on trade should be investigated, as they are becoming increasingly important to improve the efficiency and competitiveness of enterprises in modern conditions.

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Appendix A

Table A1. Descriptive statistics of initial data of trade industry efficiency criteria in the Republic of Kazakhstan.

	Average	Standard error	Standard deviation	Minimum	Maximum
Y1	25419.4066	3277.3016	12692.9346	9406.20	50789.10
Y2	2.4637	0.0515	0.1993	2.16	2.85
Y3	0.2103	0.0101	0.0393	0.14	0.27
Y4	0.2128	0.0357	0.1383	0.01	0.37
Y5	42.7027	1.9720	7.6373	31.95	61.00
Y6	8.3673	0.4767	1.8463	3.95	11.27
Y7	1390.6367	101.6108	393.5371	802.59	1985.40
Y8	0.1541	0.0257	0.0996	0.02	0.42
Y9	0.1176	0.0103	0.0398	0.08	0.24
Y10	0.7988	0.0070	0.0272	0.75	0.84
Y11	0.0540	0.0037	0.0143	0.04	0.08

	Average	Standard error	Standard deviation	Minimum	Maximum
Y12	0.2782	0.0700	0.2711	0.03	0.73
Y13	0.0352	0.0027	0.0105	0.02	0.06
Y14	50.0693	10.1458	39.2945	7.41	135.70
Y15	19.6176	1.2370	4.7908	11.78	27.33
Y16	0.1270	0.0104	0.0404	0.09	0.25
Y17	0.0011	0.0001	0.0005	0.00	0.00

Table A2. Descriptive statistics of factors influencing the development of trade in the Republic of Kazakhstan.

	Average	Standard error	Standard deviation	Minimum	Maximum
X1	17434258.20	297197.35	1151040.4	15571506	19503159
X2	42906.34	3926.09	15205.7	20037	66634.5
X3	40941.66	3894.99	15085.2	18324	64460
X4	21837.39	1913.26	7410.0	12364	33231.3
X5	12634.10	992.81	3845.1	7419	18598.8
X6	3930958.58	544345.38	2108240.6	1404493	8407512
X7	1247911.71	122959.08	476218.5	623487.8	1986616
X8	0.00	0.00	0.0	0.003	0.006
X9	10493090.40	568692.61	2202537.0	6782345	14053840
X10	412.83	67.49	261.4	106.6	856
X11	9816223.53	765814.60	2965987.2	5023045	14256245
X12	7046697.80	233806.67	905529.3	5665465	8664645
X13	779.60	8.02	31.1	735	829
X14	1692.27	29.63	114.8	1452	1839
X15	26.65	0.42	1.6	24.36	29.4
X16	107.15	0.87	3.4	101.4	111.3
X17	60.47	1.58	6.1	51.58	68.9
X18	19.89	1.69	6.5	12.86	29.73
X19	85448.19	375.90	1455.9	81814.1	87140
X20	31.41	0.14	0.5	30.02	32
X21	15673.11	151.92	588.4	14892.4	16634.8
X22	19.44	0.49	1.9	15.4	21.96
X23	0.13	0.01	0.0	0.089	0.253

Table A3. Statistical significance of multivariable regression equations.

№	Regression equation	R^2	SE	Fp	*DW*	t_p*b0	t_pb1	t_pb2	β_1	β_2	β_3
1	Y1=51339457211.7+ 38809595.1X10 − 1629306301.1X15 - 69079982533 + 13396.3 *X12	0.936	2760784065	73.0	1.672	3.12	10.1	-2.69	0.866	-0.229	
2	Y2=1412488070-54.56X11+910100.2X14	0.881	80129241.2	36.9	2.08	1.83	-4.5	2.26	-0.679	0.335	
3	Y3 = -79.15X8+0.0018X13-0.0529X15- 0.0079X16 +0.28X20+0.051X22	0.621	3.68	5.68	2.04	1.92	-2.39	0.78	-2.19	0.35	-1.07
4	Y4=0.013+1.64E-07X12-1.11E-05X19+0.002*X21	0.88	50.2	36.7	1.21	0.022	7.49	-1.12	0.882	-0.132	
5	Y5=29.73744.2X8-0.0049X10	0.324	74.04	5.34	1.89	2.51	1.62	-0.44	0.49	-0.133	
6	Y6=30.96-0.279X16+0.392X22	0.456	3022246	4.9	1.45	0.76	2.85	-0.85	0.67	-0.20	
7	Y7=13909.8-351099.0X8	0.48	0.31	6.85	0.58	6.32	-2.62		-0.62		
8	Y8=0.975+0.00019X10-0.028X15	0.38	0.103	3.8	2.51	2.16	-0.92	-1.92	-0.26	-0.54	
9	Y9=-0.59-5.0E-09*X6+0.00672X16	0.25	0.004	4.6	1.98	1.3	1.61	-0.55	-0.124	0.09	
10	Y10=1.095+0.0033X16-6.729E-06*X19+0.0091X22	0.801	0.015	5.72	1.45	2.87	2.02	-1.88	-0.197	-0.198	0.210
11	Y11= -0.414 − 2.055E-06X + 0.000137*X10 + 0.000119X14	0.791	7.26	5.45	1.69	1.05	-0.59	1.49	-0.46	1.17	-0.162
12	Y12= -1.596 + 0.00106X10 + 0.00202*X13	0.972	0.565	84.6	1.29	-3.13	11.3	2.94	1.14	0.297	
13	Y13=-0.209+2.187X8+3.59E-09X11-0.00049X16	0.46	9.66	6.57	1.78	0.93	-0.59	1.69	-0.196	0.573	-0.107
14	Y14=-457.0+16715.3X8 +0.117X10+12.33X20	0.73	14.7	8.65	1.77	-1.79	3.48	5.01	0.722	1.04	0.289
15	Y15=64.34 -5.24E-06X12 - 0.6831X23	0.75	2.61	4.23	2.35	0.98	0.54	0.06	-0.922	0.42	0.13
16	Y16=0.0191 + 2.17E-07 X7-0.039X23	0.59	0.04	0.048	2.11	1.11	0.036	0.13	-0.114	-0.223	
17	Y17 = 3.74E-07X10-1.802E-10X11 + 5.26E-05X20	0.68	0.00	6.41	2.15	0.202	0.08	2.77	0.165	-0.93	0.056

Table A4. Matrix construction by N elements $(y_m x_m)$.

		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20	X21	X22	X23
	Y1	0	0	0	0	0	0	0	0	0	0.866	0				-0.229								
	Y2	0	0	0	0	0	0	0	0	0		-0.679			0.355									
	Y3	0	0	0	0	0	0	0	-2.19	0		0		0.35		-1.01								
	Y4	0	0	0	0	0	0	0	0	0		0	0.88							-0.13				
	Y5	0	0	0	0	0	0	0	0.49	0	-0.13	0												
	Y6	0	0	0	0	0	0	0	0	0		0					0.67						-0.2	
	Y7	0	0	0	0	0	0	0	-0.62	0		0												
N=	Y8	0	0	0	0	0	0	0	0	0	-0.26	0				-0.54								
	Y9	0	0	0	0	0	-0.12	0	0	0		0					0.09							
	Y10	0	0	0	0	0	0	0	0	0		0					-0.197			-0.198			0.21	
	Y11	0	-0.46	0	0	0	0	0	0	0	1.17	0			-0.162									
	Y12	0	0	0	0	0	0	0	0	0	1.14	0		0.297										
	Y13	0	0	0	0	0	0	0	-0.196	0		0.573					-0.107							
	Y14	0	0	0	0	0	0	0	0.72	0	1.04	0									0.289			
	Y15	0	0	0	0	0	0	0	0	0		0	-0.94				0.007						0.485	
	Y16	0	0	0	0	0	0	0		0		0	-0.922										0.42	0.13
	Y17	0	0	0	0	0	0	-0.93	0	0	0	0												-0.223
	Y18	0	0	0	0	0	0	0	0	0	-0.165	-0.93									0.056			

Table A5. Vector of industry development priorities (M).

									M=								
Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18
0.10	0.07	0.07	0.02	0.10	0.01	0.11	0.07	0.08	0.05	0.09	0.02	0.01	0.04	0.01	0.12	0.02	0.03

Table A6. K matrix indicating that the growth of the studied factor affects the efficiency of the trading industry.

		X1	X2	X3	X4	X5	X6	X 7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20	X21	X22	X23
	Y1	0									0.0866					-0.02								
	Y2	0										-0.0475			0.025	0								
	Y3	0							-0.1533					0.025	0	-0.07								
	Y4												0.018							-0.003				
	Y5	0							0.049		-0.013													
	Y6																0.007					0.000	-0.002	
	Y7	0							-0.062															
K=	Y8	0									-0.0182					-0.04								

	Y9	0					-0.010										0.0072							
	Y10	0															-0.0099			-0.0099			0.0105	
	Y11	0	-0.046								0.117				-0.02									
	Y12	0									0.0228			0.006										
	Y13	0							-0.002		0	0.00573					-0.0011							
	Y14	0							0.0288		0.0416						0				0.0116			
	Y15	0											-0.009				7E-05						0.0049	
	Y16	0											-0.092										0.042	0.013
	Y17	0						-0.019																-0.004
	Y18	0									-0.005	-0.028									0.0017			

Table A7. Column sum vector (Xi) from Table A5.

X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20	X21	X22	X23
0	-0.053	0	0	0	-0.01	-0.021	-0.161	0	0.268	-0.069	-0.097	0.035	0.01	-0.15	0.0035	0	0	-0.014	0.015	0	0.074	0.009