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Optimisation of innovative product distribution in agro-industrial business

Abstract. The optimisation of distribution processes is one of key factors for the success of modern agro-industrial business, which helps to reduce costs, increase the speed and quality of deliveries, as well as ensure maximum alignment between supply and demand. The use of econometric models to identify patterns and optimise costs at various stages of distribution, enabling the development of well-founded resource management strategies and improving the financial performance of companies is one of these methods. The article examines the application of econometric models for optimising distribution processes using the example of PrJSC "Myronivskyi Hliboproduct", one of the leaders in Ukraine's agro-industrial sector, which actively implements innovative approaches in production and distribution. The objective of the study is to model the interrelationships and determine the impact of costs on various stages of distribution to provide recommendations for their optimisation and efficiency improvement. To optimise costs and increase sales of the company's innovative products, a justified selection of the model has been made based on the following criteria: ease of implementation, data volume, flexibility, accuracy of results, and cost of implementation. It is found that multiple regression analysis is the optimal choice, as it has a number of advantages that make it the most relevant for the analysed agro-industrial company. Such key factors as: transportation costs, marketing expenses, demand seasonality, and export share have been selected for model development. The developed model confirms a high level of correlation between these factors and sales volume. The use of the ordinary least squares (OLS) method and the construction of a heatmap enable a detailed analysis and forecasts regarding the impact of these factors on sales volume. The main results indicate that the export share is the most significant factor influencing the company's sales volume, while marketing and transportation costs have a substantial but smaller impact. This suggests a large potential for growth through export expansion and improvement of logistics and marketing processes. The analysis also makes it possible to identify key challenges hindering the distribution of innovative products and provides recommendations for their solution. The obtained results have practical value for more effective cost planning in the distribution system and resource optimisation, which will contribute to maintaining the company's competitive advantages and ensuring its sustainable market growth.

Keywords: logistics activities, innovative technologies, agricultural sector, econometric model, cost management, business process

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Introduction

The agri-food industry plays a strategic role in Ukraine's economy, ensuring food security, contributing 15% of the total GDP across all industries, and maintaining some of the highest export volumes. For instance, in 2021, the share of agricultural exports exceeded 41% (News, 2020). Thanks to fertile soils and favourable climate conditions, Ukraine is one of the leaders in global agriculture, with the poultry sector occupying a central place in the agro-industrial complex.

The production of chicken meat is characterised by high technological advancement, incorporating modern poultry farming methods, automation of production processes, and optimised logistics. This sector continuously implements innovations to ensure sustainable development and maintain competitiveness in the global market. Thus, the agro-industrial business is one of the key economic sectors that guarantee food security and the stable development of society.

In the modern era of globalization and increasing competition, efficient management of distribution processes is becoming particularly important, allowing for cost optimization, faster product delivery, and improved availability for consumers. One of the most crucial areas for distribution improvement is the implementation of innovative approaches, particularly the use of econometric models, which enable a detailed analysis and forecasting of interrelationships between various economic variables.

As noted by J. Stock & M. Watson (2020), econometric methods serve as a powerful tool for identifying patterns in large datasets, facilitating informed managerial decision-making. The application of the ordinary least squares (OLS) method and the development of heat maps provide detailed visualization of the relationships between factors influencing sales volumes. Studies by W. Greene (2018) have demonstrated that such an approach minimises forecasting errors and enhances decision-making accuracy, including investment decisions in logistics and marketing.

Econometric modelling of dependencies and establishing relationships between macroeconomic and microeconomic indicators across various sectors of the economy has been the focus of numerous scholars. For example, the impact of export-import operations on Ukraine's GDP has been analysed by Azarova *et al.* (2024); the determination and interpretation of export-oriented sustainable profitability management of Ukrainian industrial enterprises through economic-mathematical modelling tools were carried out by Savitskyi *et al.* (2022); the study of factors defining long-term growth for developed and developing economies using regression models was explored by Wang *et al.* (2022), where GDP depends on specific economic variables of a country.

The modelling of interconnections and the identification of statistically significant dependencies between the development of retail trade and the economic growth of European countries, as well as the factors influencing industry development, were analysed by Bilovodska & Ivanchenko (2024); the assessment of the relationship between logistics infrastructure and regional GDP based on structural equation modelling was conducted by Winter (2022); the specifics of the effectiveness of economic-mathematical modelling in the context of business process optimization, modelling dimensions, and the analysis of its potential for improving decision-making strategies and optimizing resource use were studied by Skoruk (2023); sales forecasting based on econometric modelling for new products, which allows for quick and accurate long-term forecasts after launch, considering correlations between short- and long-term sales accumulations, was examined by Mrithula *et al.* (2023); correlation analysis for identifying price-affecting factors using the multiple linear regression method for price forecasting was conducted by Wang *et al.* (2023); the impact analysis of internet and mobile penetration on economic growth and human development indices using econometric models,

SEM, and DEA to assess the role of digital transformation was performed by Kenneth David *et al.* (2025), among others.

However, the issue of optimizing distribution processes based on multifactor regression analysis, which enables the identification of key factors influencing sales levels and their interactions concerning innovative products, has not received sufficient attention. From this perspective, it is crucial to consider variables such as transportation costs, marketing expenses, seasonal demand fluctuations, and export share, which help identify key mechanisms for enhancing the efficiency of distribution activities for new products.

Materials and Methods

The private joint-stock company "Mironivsky Khliboproduct" (MHP) is a leading Ukrainian agro-industrial holding that exemplifies a modern approach to the production and distribution of products in the agro-food industry.

Founded in 1998 by Yuriy Kosyuk, the company has created a unique model of vertical integration that covers all stages of production - from grain cultivation to the delivery of finished products to consumers. This integration allows MHP to control the quality of products at each stage and optimise costs, which is a critical success factor in a competitive market (Wikipedia, 2024; Official, 2024).

MHP is the undisputed leader in chicken meat production in Ukraine, accounting for over 45% of the market. In terms of chicken meat production volumes, MHP ranks among the top 10 companies worldwide according to the WattPoultry.Top Companies ranking. The primary export markets for poultry meat are the Middle East, the EU, and Africa. The company is also one of the leading Ukrainian exporters of vegetable oils. Its products, represented by the brands "Nasha Ryaba," Qualiko, Sultanah, and Poli, are known for their quality not only in Ukraine but also in many countries worldwide. In 2021, more than 40% of the company's sales were from exports to the European Union, the Middle East, Africa, and Asia. The production facilities include over 30 enterprises, with the key asset being the Vinnytsia Poultry Farm, one of the largest in Europe (Official, 2024).

When talking about the company's innovative products, several key areas stand out. For consumers, MHP offers an organic product line under the "Nasha Ryaba Bio" brand, which exemplifies a sustainable and ecological approach to meat production. This product is certified according to international organic standards, with a focus on no antibiotics, growth hormones, or synthetic additives. The company creates poultry farming conditions that meet the strictest European standards, making the product popular among conscious consumers. Another example of innovation is ready-to-cook solutions like Super Filleo. This product is aimed at active people looking for fast and high-quality home-cooking solutions. Super Filleo consists of portioned chicken fillet pieces, specially prepared for cooking, significantly saving consumers' time. For business clients and production partners, MHP offers innovative compound feeds. These products are developed based on the company's own research and meet modern efficiency and environmental standards. The use of these feeds allows for improved quality of livestock products and optimises costs in the production processes of the company's partners (Official, 2024). Organic products are actively distributed through retail chains, specialised stores, and online channels. Interestingly, the company is already integrating digital tools for monitoring demand and managing supplies, which allows optimizing logistics processes. In particular, in 2021, sales forecasting tools based on big data and artificial intelligence were implemented. Thus, "Mironivsky Khliboproduct" is not only a leader in the Ukrainian agro-industrial complex but also an example of successful innovation integration into production and distribution.

"Mironivsky Khliboproduct" (MHP) is actively developing the distribution of innovative products through modern logistics approaches and large-scale investments. In 2021, the company

significantly increased its investments in expanding sales, spending over 900 million UAH on the development of its retail network and sales channels. Its portfolio then included about 1,500 retail outlets and restaurants, such as "Myasomarket," "Yizha Svyzha," and "Döner Market." MHP also acquired new assets, including vegetable processing enterprises, signalling a diversification of its product range and an improvement in its distribution strategy. The company is actively improving its logistics infrastructure, spending about 108 million UAH on sales and transportation. A significant portion of the expenses is related to the transportation of chilled products that require specialised vehicles. Logistics account for about 10% of total distribution costs. The company also invested 2.4 billion UAH in updating its vehicle fleet to ensure the delivery of products both domestically and internationally. Notably, export remains the key and steadily growing direction, accounting for over 50% of sales, including deliveries to 70 countries worldwide (Annual, 2021; Prasad, 2023).

The largest export regions in 2021 were the Middle East and North Africa (MENA), which accounted for 38% of total exports. Meanwhile, domestic market sales decreased by 11%, but this was offset by the growth in export revenues. The average price of chicken meat for export was 1.67 USD per kilogram, which was 19% higher than in 2020. For comparison, prices on the domestic market rose by 30% to 1.66 USD per kilogram. This price increase was caused by rising production costs, particularly due to the increase in energy prices. The company's innovative projects, such as culinary centres and sensory analysis laboratories, support efficient distribution planning and optimization of production processes. For example, technologies allow testing products before mass production and adjusting logistics processes based on consumer demand. MHP is also actively investing in green energy, directing funds towards bioenergy projects and the construction of biomethane plants. This helps reduce energy costs for logistics, positively impacting the economic efficiency of distribution.

MHP's distribution strategy includes multichannel sales - combining traditional retail networks with direct sales via e-commerce. This enables the company to expand its market coverage while maintaining control over product quality and supply chains. In 2021, the company continued to expand its network of branded stores, "Myasomarket," increasing their number to 180, and launched a new concept of stores, "MeatMarket 2.0." This concept creates a convenient and interactive experience for consumers, promoting value-added products (Annual, 2021). Thus, MHP's distribution is based on the integration of modern technologies, effective investment approaches, and continuous improvement of logistics processes, making it a leader in the industry. These data will allow for a deeper analysis of econometric models for optimizing the distribution of innovative products.

To build a multivariate regression model for optimizing the distribution processes of "Mironivsky Khliboproduct" PJSC, we use the official financial reports and other available company data (Table 1). The database was compiled from MHP's financial annual and quarterly reports, their articles, and quarterly reports, and cleaned: missing values were implemented based on column averages, erroneous outliers were manually corrected, and values were rounded:

1. Sales volumes (Sales_Volume), including both domestic and export volumes; transportation costs (Transport_Costs), including vehicle fleet updates for chilled products;
2. Marketing spend (Marketing_Spend), demonstrating the distribution of budgets between domestic and international markets;
3. Seasonality (Seasonality), accounting for changes in demand throughout the year;
4. Export share (Export_Share), showing the geographical distribution of major export directions.

The model was built using the Python programming language and associated libraries such as Pandas, Statsmodels, Matplotlib, and Seaborn, and thus the cleaned database was structured

according to the DataFrame standard (Figure 1). At the same time, variables were prepared for analysis: X - independent variables (factors that explain sales); a constant was added, which is needed to build a proper model. It represents the baseline level of sales; Y - the dependent variable (sales volume), which is the outcome we want to predict (Figure 2).

Table 1. Data used for building the model

Quarter	Sales_Volume	Transport_Costs	Marketing_Spend	Seasonality	Export_Share
2022_Q1	250	50	15	1	0.40
2022_Q2	300	52	16	2	0.45
2022_Q3	270	51	15,5	3	0.43
2022_Q4	320	53	16,5	4	0.47
2023_Q1	260	51	15	1	0.42
2023_Q2	310	55	17	2	0.48
2023_Q3	280	52	16	3	0.44
2023_Q4	330	56	18	4	0.49

Source: based on (Annual, 2021; Financial, 2023)

```
# Дані
data = {
    "Quarter": ["2022_Q1", "2022_Q2", "2022_Q3", "2022_Q4",
                "2023_Q1", "2023_Q2", "2023_Q3", "2023_Q4"],
    "Sales_Volume": [250000, 300000, 270000, 320000, 260000, 310000, 280000, 330000],  # в тоннах
    "Transport_Costs": [50000, 52000, 51000, 53000, 51000, 55000, 52000, 56000],  # у тисячах доларів
    "Marketing_Spend": [15000, 16000, 15500, 16500, 15000, 17000, 16000, 18000],  # у тисячах доларів
    "Seasonality": [1, 2, 3, 4, 1, 2, 3, 4],  # 1-весна, 2-літо, 3-осінь, 4-зима
    "Export_Share": [0.4, 0.45, 0.43, 0.47, 0.42, 0.48, 0.44, 0.49],  # частка експорту
}

# Створення DataFrame
df = pd.DataFrame(data)
```

Figure 1. Creation of DataFrame

Source: developed by the authors

```
# Підготовка даних для регресії
X = df[["Transport_Costs", "Marketing_Spend", "Seasonality", "Export_Share"]]
X = sm.add_constant(X)  # Додавання константи для перехоплення
y = df["Sales_Volume"]
```

Figure 2. Data Preparation for Regression

Source: developed by the authors

Results and discussion

In the previous study by Bilukha & Petrychenko (2024), it was justified that various econometric models can solve specific tasks arising in the distribution process. For instance, linear regression and multivariate regression are basic approaches that are more suitable for initial distribution analysis, particularly its commercial aspect. However, models for optimizing transportation costs are more focused on solving logistical tasks. Time series models provide accurate forecasting but do not always account for external environment variables. The most powerful models are machine learning models, but their implementation requires significant investment and access to large

volumes of data. Each of these models has its advantages and specific use cases. For example, linear and nonlinear demand models can predict sales volumes while considering various influencing factors, such as price, advertising, seasonality, etc. This facilitates more accurate production planning and determining optimal inventory levels. Autoregressive time series models like ARIMA allow for the analysis and forecasting of changes over time, which is crucial for efficient inventory management, determining optimal reorder points, and avoiding losses from shortages or overstocking. Exponentially smoothed models such as ETS help reduce the impact of random fluctuations and identify trends or seasonality, which form the basis for developing product promotion strategies and expanding sales markets. Models for transportation problems, Vehicle Routing Problem (VRP), Traveling Salesman Problem (TSP), and other optimization approaches help businesses determine the most efficient delivery routes, distribution, and logistics cost management.

This study aims to optimise the distribution of PJSC "Mironivsky Khliboproduct" (MHP), a leading agro-industrial holding in Ukraine, which is actively implementing innovative approaches to production and distribution. Due to the complexity of logistics processes and the need to optimise costs, the use of econometric models becomes an integral part of the company's strategic management.

We propose to compare the econometric models for their selection according to the following criteria: implementation simplicity, data volume, flexibility, accuracy of results, and implementation cost, as presented in Table 2 for PJSC "Mironivsky Khliboproduct."

Table 2. Comparison of econometric models for application

Criterion	Linear regression	Multivariate regression	Transportation optimisation	Time series	Machine learning
Implementation simplicity	High	Medium	Medium	Medium	Low
Data volume	Small	Large	Large	Large	Very Large
Flexibility	Low	Medium	Medium	Low	High
Accuracy of results	Medium	Medium	High	High	High
Implementation cost	Low	Medium	Medium	Medium	High

Source: developed by the authors

Thus, based on the specifics of MHP's activities, it is advisable to combine several approaches. Multivariate regression is an optimal choice for analysing the impact of costs on various stages of distribution. This model has a number of advantages that make it most relevant for MHP's operations. First, it allows accounting for the simultaneous influence of several key factors on distribution performance. For example, the company is concerned with transportation costs, marketing expenses, seasonal demand fluctuations, and the number of intermediaries in the distribution channel. Linear regression would not be able to provide this level of detail, as it analyses the influence of only one variable at a time, which would significantly limit its practical value in complex conditions. Another important advantage of multivariate regression is its ability to evaluate interactions between different factors. For instance, increasing logistics costs can be offset by higher sales in regions with greater purchasing power. Analysing such interrelationships helps to draw conclusions and make recommendations regarding investments in distribution. Therefore, multivariate regression is the method that allows for accounting for the complexity of distribution processes and provides flexibility in decision-making. This approach will enable the company to not only optimise costs but also maintain its competitive edge in the market, ensuring stable growth and enhanced efficiency.

Next, we create a regression model using the ordinary least squares (OLS) method (Figure 3) and generate a final report where we see the coefficients of the variables that show the impact of each factor, the significance level (p-value), which determines whether this factor is statistically significant, and R^2, which indicates how well the model explains the data (the closer to 1, the better) (Figure 4).

```
# Побудова моделі
model = sm.OLS(y, X).fit()

# Виведення результатів моделі
print(model.summary())
```

Figure 3. Model construction

Source: developed by the authors

OLS Regression Results

Dep. Variable:	Sales_Volume	R-squared:	0.983
Model:	OLS	Adj. R-squared:	0.960
Method:	Least Squares	F-statistic:	43.32
Date:	Sun, 01 Dec 2024	Prob (F-statistic):	0.00549
Time:	15:31:05	Log-Likelihood:	-76.800
No. Observations:	8	AIC:	163.6
Df Residuals:	3	BIC:	164.0
Df Model:	4		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	2.13e+05	1.47e+05	1.453	0.242	-2.54e+05	6.8e+05
Transport_Costs	-17.6891	8.163	-2.167	0.119	-43.668	8.290
Marketing_Spend	26.4706	14.840	1.784	0.172	-20.756	73.697
Seasonality	-3865.5462	4072.814	-0.949	0.413	-1.68e+04	9095.965
Export_Share	1.315e+06	3.05e+05	4.314	0.023	3.45e+05	2.29e+06

Omnibus:	2.198	Durbin-Watson:	2.158
Prob(Omnibus):	0.333	Jarque-Bera (JB):	0.782
Skew:	-0.068	Prob(JB):	0.676
Kurtosis:	1.474	Cond. No.	8.52e+06

Figure 4. Final model report

Source: developed by the authors

Results and Discussion

The obtained set of statistical indicators allows us to understand how different factors affect the company's sales volume. Let's examine them in more detail and interpret the results:

1. Coefficient of Determination (R^2) is 0.983, which means that 98.3% of the variation in sales volumes can be explained by the factors included in the model. This is an extremely high indicator, suggesting that the model works very well and is capable of accurately predicting changes in sales volumes based on these factors.

2. The coefficient for each independent variable shows how much sales change with a one-unit change in each variable, while all other variables remain constant:

– Transport Costs (Transport_Costs): It was found that for every unit increase in transport costs (e.g., one hryvnia or one thousand hryvnias), sales decrease by 17.69 units of product. Although this impact is negative, the statistical significance level (p-value = 0.119) suggests that transport costs are not a decisive factor in sales.

– Marketing Spend (Marketing_Spend): It was discovered that each additional unit (e.g., one thousand hryvnias) of marketing expenses leads to an increase in sales by 26.47 units of product. While the effect of marketing spend is positive, the p-value = 0.172 indicates that this factor is also not statistically significant. This could be explained by the fact that the effect of marketing campaigns is not immediate or is not always consistent.

– Seasonality (Seasonality): It was determined that when the seasonal indicator changes (e.g., from high to low season), sales decrease by 3,865.55 units of product. However, since the p-value = 0.413, the impact of seasonality on sales cannot be considered statistically significant in this model. This means that while seasonality does influence sales, it may need to be assessed in different contexts or using other approaches.

– Export Share (Export_Share): It was found that increasing the export share by one unit (e.g., 1% or 0.01) leads to an increase in sales by 1,315,000 units of product. This factor is statistically significant (p-value = 0.023), indicating its importance. Therefore, expanding export markets is crucial for increasing the company's sales.

To better understand how the actual sales values relate to the predicted ones, we have created a comparison chart (Figure 5).

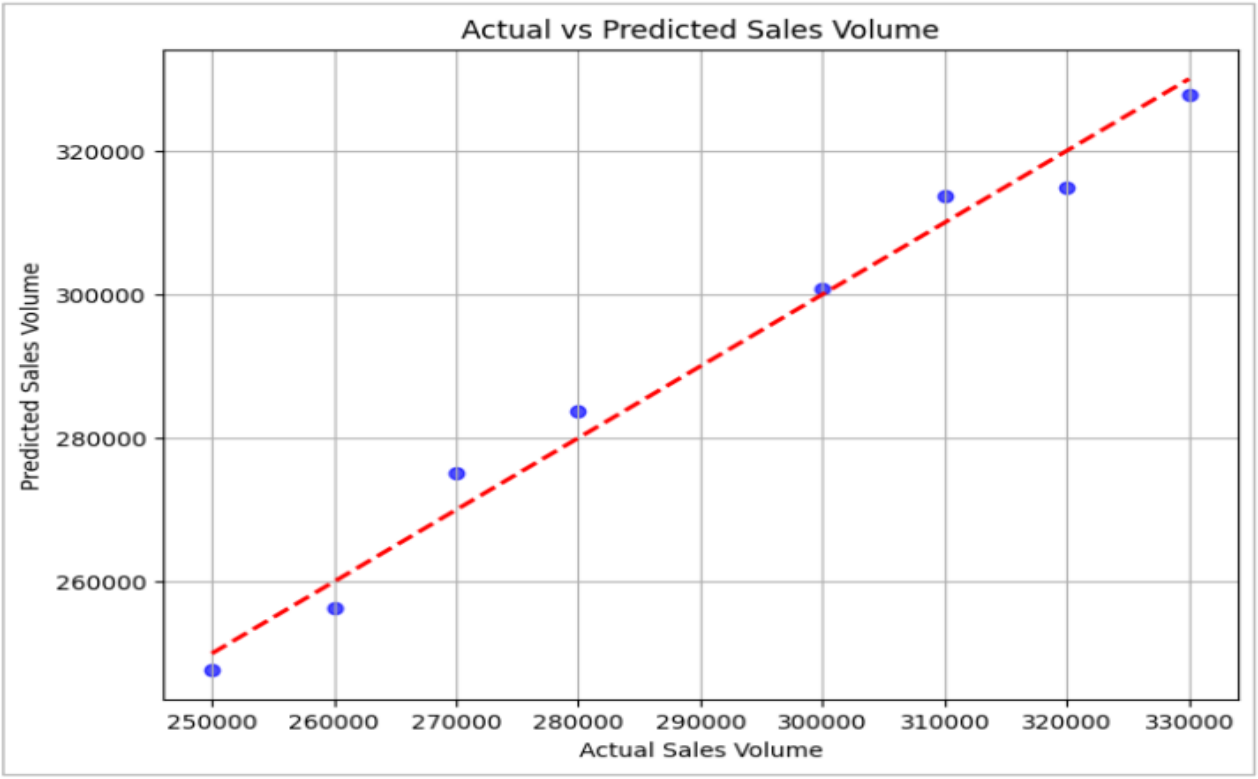

Figure 5. Comparison of actual sales values with predicted sales

Source: developed by the authors

As seen in Figure 5, the model accurately estimates the influence of each factor and provides reliable forecasts. The small deviations that still exist can be explained by random factors not considered in the model, but overall, the results are promising.

Additionally, to better understand which variables have a greater impact on the company's sales and which have less, we have created a heatmap of factor relationships (Figure 6).

In this type of visualization, each cell shows how strongly two variables are related to each other, using not only numbers but also colours ranging from deep red to deep blue. The red colour indicates a strong positive correlation between the variables, meaning they are highly similar in their impact, while blue indicates a negative correlation, meaning they influence each other in opposite directions. Lighter colours represent a weak relationship. In this graph, actual sales values are represented on the X-axis, while predicted values are on the Y-axis. In a model close to ideal, all points should be aligned along the red line, which we observe on our graph, indicating that the model almost perfectly predicts sales volumes with high accuracy. Additionally, the scatter of points is almost nonexistent, meaning the difference between actual and predicted values is minimal.

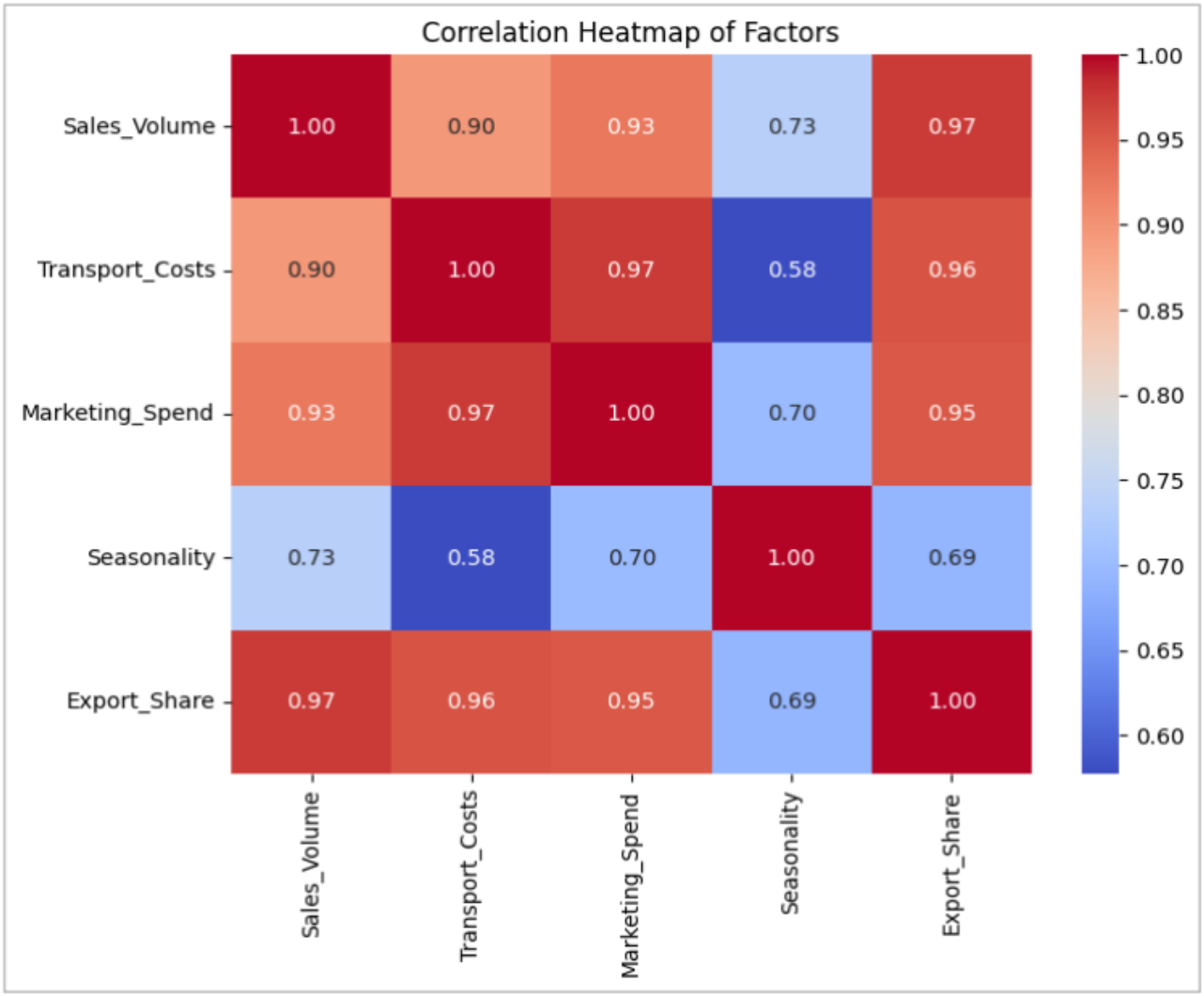

Figure 6. Heatmap of factor relationship

Source: developed by the authors

Therefore, according to Figure 6, it is clear that sales volume (Sales_Volume) has a very strong relationship with three key factors:

1. Export share (Export_Share) with a correlation coefficient of 0.97 (an increase in export share directly contributes to increased sales, i.e., the more a company exports, the higher its overall sales volume);

2. Marketing spend (Marketing_Spend) with a correlation of 0.93 (higher marketing expenditures increase sales);

3. Transport costs (Transport_Costs) with a correlation of 0.90 (the relationship is also very strong: higher transport costs often mean higher sales volumes, as the company delivers products across a wide regional area). Interestingly, seasonality (Seasonality) has a weaker but significant impact on sales (correlation coefficient 0.73), as demand for products changes depending on the season.

Moreover, many factors show a strong correlation with each other. For example, transport and marketing costs correlate at 0.97. This may indicate that they change together, which should be taken into account.

Thus, we can conclude the following:

1. The model shows that the export share is the strongest factor influencing sales volumes. This indicates a high dependence of the business on foreign markets. The greater the share of products exported, the higher the overall sales of the company. This opens opportunities for expanding exports but also highlights risks related to dependence on international markets, such as demand fluctuations, currency risks, or changes in trade policy.

2. Marketing expenditures have a significant impact on sales. This means that the company's advertising and promotion tools are effective and help increase sales volumes. The company should continue focusing on the optimal distribution of marketing budgets, as the model results confirm their high return on investment.

3. Transport costs also have a strong positive correlation with sales volumes. This can be explained by better product distribution in domestic and international markets, which supports sales growth. On the other hand, high transport costs can negatively affect product margins, so the company should look for ways to optimise transportation processes.

4. Product sales fluctuate depending on the season. Demand is likely higher during certain periods (e.g., holidays or warmer months). This creates opportunities for seasonal marketing campaigns or cost reduction during low-demand periods. At the same time, the model confirmed that sales can be accurately predicted based on selected factors. Regression analysis results showed that the chosen variables explain more than 95% of variations in sales data ($R2 = 0.96$). This means that our model is highly reliable and can be used for decision-making. The actual vs. predicted sales graph also reinforced this confidence, showing that most points are close to the ideal line of alignment, indicating that predicted values are nearly identical to the actual ones. The heatmap of correlations provided additional insights into the relationships between variables: transport and marketing costs have a strong correlation, which may suggest that the company increases marketing budgets along with transport costs, for example, to expand into new markets. The results indicate that the company has significant potential for growth through export expansion and improvements in logistics and marketing processes.

Considering the above, we can conclude that the key issues hindering the development of distribution include:

– The heterogeneity of logistics processes (lack of a unified inventory management system, leading to delays and additional costs);

– Weak integration with partners (distributors are insufficiently familiar with the product specifics, which reduces communication effectiveness in the market);

– Limited consumer demand analysis (inadequate use of analytics tools, making it difficult to adapt offers to the target audience).

All of this creates challenges that affect the company's overall effectiveness, slow down the adaptation of products to the market, and hinder their implementation. The first step in solving these problems is the digitization of logistics. Implementing a unified digital platform for inventory and delivery management will minimise risks related to human factors and ensure

transparency at every stage of the supply process. Using modern ERP systems will optimise delivery routes, reduce delays, and cut operational costs, which is particularly important for innovative products that often require quick responses to demand changes. The second important direction is deepening collaboration with partners. Training distributors on the specifics of innovative products will help them better understand the product's advantages and work more effectively with customers. Training programs should include case studies of successful product use and tools for market promotion. This will strengthen relationships with partners, make them more engaged in the process, and increase their efficiency. Furthermore, the company's analytical capabilities should be developed. Using modern CRM systems to collect and analyse customer data, as well as applying Big Data for demand forecasting, opens new opportunities. This will allow the company to better understand consumers, adapt offers to their needs, and test different marketing strategies to identify the most successful ones. Analytical tools will help the company be more flexible and responsive in decision-making. Equally important is the focus on building long-term relationships with customers, as loyalty programs based on an individual approach will help solidify relationships with regular customers, increase their trust in the company, and encourage repeat purchases. This is especially relevant for innovative products that require time to conquer the market. It is also essential to expand distribution channels, particularly through online platforms and collaboration with e-commerce marketplaces. This will enable the company to reach a broader audience and reduce dependence on traditional distribution channels. Flexibility in distribution will provide the company with a competitive advantage in a dynamic market.

Thus, the use of econometric models to develop effective distribution process management tools not only improves product supply efficiency (especially for innovative products) but also enhances the competitiveness of companies operating in the agribusiness sector. Implementing analytical approaches to logistics planning helps reduce costs, improve customer service, and ensure stable growth in both domestic and international markets. Studies by Chen et al. (2024), Koziuk *et al.* (2023) demonstrate that companies actively applying econometric approaches to logistics cost planning achieve significantly better financial results by optimizing routes, managing warehouse inventories, and efficiently distributing resources. Furthermore, the work by Runcheva & Brytvenko (2019) substantiates quantitative methods for evaluating the economic efficiency and concentration of sunflower production and processing in large agroholdings and their impact on implementation and pricing policy, food availability, monopolization, structure, and dynamics of agricultural markets. The study by Antoshchenkova *et al.* (2023) performs optimisation of the milk processing enterprise's logistics system using economic and mathematical tools. The article by Onegina *et al.* (2022) analyses price transmission in the milk supply chains in Ukraine based on a correlation model. The research by Kanellos *et al.* (2024) establishes the relationship between digital marketing variables and advertising costs through regression analysis and fuzzy cognitive mapping for agricultural enterprises. The article by Shi & Chen (2021) proposes a model for optimising the structure of the green agricultural industry based on correlation analysis. The work by Aulová (2019) analyses the profitability indicators of agricultural enterprises in the Czech Republic using the DuPont analysis, including correlation methods. The developed model advances existing approaches, allowing for better cost planning, resource optimization, and business development in the most promising directions.

Conclusions

In the modern business environment, the use of econometric models in the process of product distribution represents an essential and important aspect for business entities striving to optimise their supply chains and improve the efficiency of distribution strategies. These models provide a significant amount of useful information that aids in making well-founded strategic and tactical

decisions. More specifically, econometric models offer business entities the opportunity to effectively consider a large number of factors affecting distribution, providing a range of significant advantages based on the consideration of various exogenous and endogenous aspects that influence market conditions.

Thus, the study explores the application of econometric models for optimizing the distribution processes of innovative products within the agro-industrial business sector, using the example of the leading Ukrainian agro-industrial holding, PJSC "Myronivsky Hliboproduct." The developed multifactorial regression model proves to be an effective tool for analysing the distribution processes of the agro-holding, helping to understand which factors have the greatest impact on increasing sales efficiency, improving cost planning, optimizing resources, and developing the business in the most promising directions. The results confirm that sales volume is strongly linked to three key factors: export share, marketing expenses, and transportation costs, while seasonality has a weaker but significant impact on sales. Additionally, many factors exhibit strong correlations with each other (transportation and marketing expenses correlate at 0.97). Thus, the company has great potential for growth through expanding exports and improving logistics and marketing processes, based on which the author developed recommendations to overcome the challenges hindering the development of innovative product distribution. Future research may focus on expanding the use of analytical tools, such as Big Data and artificial intelligence, for deeper analysis of consumer behaviour in the agro-industrial market and enhancing distribution strategies, as well as further investigating the impact of external factors on distribution efficiency and developing recommendations for optimizing logistics and marketing processes.

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Conflict of interest

None.

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Оптимізація дистрибуції інноваційної продукції в агропромисловому бізнесі

Анотація. Одним із ключових чинників успіху сучасного агропромислового бізнесу є оптимізація дистрибуційних процесів, що дозволяє знижувати витрати, підвищувати швидкість і якість поставок, а також забезпечувати максимальну відповідність попиту та пропозиції. Одним із таких методів є використання економетричних моделей для виявлення закономірностей та оптимізації витрат на різних етапах дистрибуції, що дає змогу розробляти обґрунтовані стратегії управління ресурсами та покращувати фінансові показники компаній. У статті розглянуто застосування економетричних моделей для оптимізації дистрибуційних процесів на прикладі ПрАТ «Миронівський хлібопродукт», одного з лідерів агроіндустрії України, який активно впроваджує інноваційні підходи у виробництво та дистрибуцію продукції. Метою роботи є моделювання взаємозв'язку та встановлення впливу витрат на різні етапи дистрибуції для надання рекомендацій щодо їх оптимізації та підвищення ефективності. Для оптимізації витрат і збільшення продажів інноваційної продукції компанії виконано обґрунтований вибір моделі за критеріями: простота реалізації, обсяг даних, гнучкість, точність результатів і вартість реалізації. З'ясовано, що багатофакторна регресія є оптимальним вибором, оскільки має низку переваг, які роблять її найбільш релевантною для діяльності аналізованої компанії агропромислового сектору. Для побудови моделі було вибрано ключові фактори: витрати на транспортування, маркетингові витрати, сезонність попиту та частка експорту. Розроблена модель підтверджує високий рівень кореляції між факторами та рівнем продажу. Використання методу звичайних найменших квадратів (OLS) та побудова теплової карти дозволили провести детальний аналіз і зробити прогнози щодо впливу цих факторів на обсяг продажів. Основні результати показують, що найбільш значущим фактором, який впливає на обсяги продажів компанії, є частка експорту, маркетингові та транспортні витрати мають суттєвий, але менший вплив, що свідчить про великий потенціал для зростання через розширення експорту та вдосконалення логістичних і маркетингових процесів. Проведений аналіз дозволив також з'ясувати ключові проблеми, які стримують розвиток дистрибуції інноваційної продукції, та розробити рекомендації щодо їх вирішення. Отримані результати мають практичну цінність для більш ефективного планування витрат у системі дистрибуції, оптимізації ресурсів, що сприятиме підтримці конкурентних переваг компанії і стійкому її зростанню на ринку.

Ключові слова: логістична діяльність, інноваційні технології, аграрний сектор, економетрична модель, управління витратами, бізнес-процес