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New market entrance through transport companies' management: Kazakhstani transportation industry case

Abstract

Object: The main aim of the research is to analyze and investigate the performance management of companies in transportation industry in the context of the Republic of Kazakhstan. In terms of the research, the authors analyze such variables as oil prices, turnover of passenger rates, currency and its exchange rate, flow of investments in transportation industry, Gross domestic product and trends of export.

Methods: The authors apply quantitative analysis with the help of using the data from the official web-sites, as World Bank Data, etc., for the period from 2014 till 2023. The use of data allows the authors to analyze and assess the impact of different variables on PVI in transportation industry (physical volume index). There was constructed a multiple linear regression model in order to provide an in-depth analysis of this relation.

Findings: The results of the multiple regression model indicates a strong positive relation between PVI index and oil prices. This shows that oil price fluctuations have an impact on transportation's industry performance in general. Moreover, passenger turnover has a vice versa effect or negative association with the index PVI.

Conclusions: There should be settled certain strategies for addressing the impact of oil prices, passenger transportation systems optimiation, exploring export potentials, managing currency exchange risks. All of these measerues will be helpful and essential for sustainability insurance in terms of transportation industry.

Keywords: PVI, transportation industry, currency exchange rates, turnover of cargo, GDP, export trends, passenger turnover, oil prices.

Introduction

Transportation, for a long time, was considered as payable and non-payable service, which made the process of transporting people and cargo more easy from one place to another. There were also additional supporting services, as handling, loading, unloading and other services. In order to provde proper transportation services, the industry needs different components, such as infrastructure, staff, rules and reserves. Technological achievements have an impact on the development of modern transportation services nowadays. Time is one of the main source, and effective communication with a relevant contact person is efficient for timely manner operations.

Transport industry management is a very complex task with a process of creation of transport and logistic system that effectively helps to move goods from one location to another. Efficiency of process management mainly depends on the ability of making a forecast and allocate resources. However, in terms of a dynamic economic development and globalization, there is a variety of stakeholders and factors that introduce the complexity and uncertainty in the existing systematic processes.

Uncertainty of demand is one of the most basic problems in any industry, in particular in transport. Market demand and its dynamics may arise due to various factors, such as the economy and its conditions, consumer behavior and seasonality. Also, this includes other external systematic factors such as weather, infrastructure, transport landscape, as well as regulatory amendments.

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Literature review

As noted earlier, the management of the transport industry is influenced by many different factors, from demand to climatic and weather conditions. Unfortunately, these factors cannot always be predicted, which is why there was and will be a certain deviation between predicted and actual loading plans, namely loading schedules, grades, numbers of cars, congestion at arrival and departure stations. Taking into account all these complexities, optimal management of the transport industry becomes a more multifaceted task. Since each participant must make his own contribution to the development of the transport process, it will be possible to determine suitable options to meet the needs of all stakeholders. This point can be achieved using logistics process management methodology, which will help determine strategic goals and a favorable period for investment (Kotzab, 2003; Stjerne et al., 2019).

The main tools utilized in transport and logistics methodologies involve the planning, analysis, and synthesis of transportation service chains. The transport-logistics approach prioritizes the comprehensive management of transport-logistics processes and the optimization of overall expenses. It encompasses all phases and cycles of cargo flow coordination, promoting the integration of resource potential and logistics as pivotal elements of the primary transport and logistics procedure. This integration consequently adjusts the efficiency criteria for the entire transport system and for the optimal management of transport services, as outlined by Harvey and Evans (1995). Unlike conventional businesses, transport companies do not maintain stockpiles of transportation services, necessitating significant investments and lengthy construction times, which can affect long-term efficiency (Quinet & Vickerman, 2004). Globalization fosters economic and political interconnections, compelling transportation companies to pursue the highest industry benchmarks. This evolving market landscape and the rapid rate of external and internal changes within transport companies pose significant challenges to top management in terms of overseeing management processes (Hrášková & Bartošová, 2014).

Transportation companies primarily focus on purchasing and maintaining vehicles, along with insurance, distinguishing them from other businesses where care for rolling stock is secondary. Additionally, transportation companies incur higher costs for workshops, garages, and engineering facilities, while other companies typically face higher costs related to administrative offices or warehouses.

Risk is a prevalent factor in various business operations, viewed through different lenses such as strategy, finance, production, accounting, and marketing, leading to varied definitions. Lavastre et al. (2012) highlight three core aspects: the potential extent of loss, its significance, and the likelihood of occurrence.

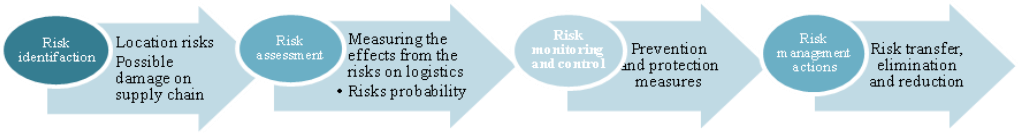

Figure 1. Risk management process in transportation companies

Note — compiled by the author based on (Lavastre et al., 2012)

Another perspective defines risk as the probability of experiencing loss and its impact on the organization or individual. In logistics, transport companies and supply chain management, risk is also a significant concern. It arises due to complexities in procurement markets, including supplier shortages, product replacements, and technological advancements. Entry barriers such as logistics costs, complexity, and market conditions further contribute to risk within logistics and supply chain operations (Lavastre et al., 2012).

Some authors suggest applying risk management framework in the transportation system. First, the company should understand the origin of the risk and only then apply necessary procedures with the help of API (application programming interface) (Fig. 4).

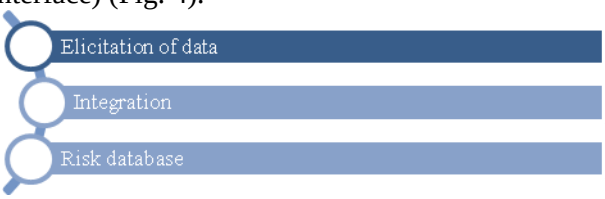

Figure 2. Risk implementation process

Note — compiled by the author based on (Nlenanya and Smadi, 2021)

The API refers to the translation from one process to another and it should be at the beginning of each process. The first one, elicitation, refers to the risk register. The company at this process should provide certain inputs in order to implement a successful risk management. This includes financial risks, decision and information risks, external risks and asset condition risks. In terms of the second process, data integration, the company needs to provide the whole risk analysis with the help of receiving relevant and timely risk data. The process is divided into spatial and non-spatial, where the first one is aimed at collecting and integrating the data, while the second one is at disparaging data entities. And, the final one is forming a risk database in order to track risk dependencies, provide a probability value of the arising risk and ranking them. Overall, such kind of framework (not only in transportation companies), can allow mitigate risks and be prepared to uncertainty (Nlenanya and Smadi, 2021).

Other scientists have found that delivery risk directly affects transportation quality and technological risks. Therefore, companies must manage distribution, delivery frequencies, packaging and storage. In addition, transport quality risks directly affect the company's activities and technological risks. For this reason, companies must improve the quality of transportation with additional seminars and training for employees, thereby improving service quality and solving routing problems through special software. The result of mediation shows that problems with the quality of transportation directly increase technological risks. Thus, improving your transportation quality can help companies improve your processes. Moderation effect demonstrates that information exchange during delivery process or increasing transparency between participants helps reduce the risks associated with the process (Ersoy & Tanyeri, 2021).

Methods

In this research, we employ quantitative analysis in order to identify the possible ways of good performance management in transportation companies of the Republic of Kazakhstan. Before analyzing transportation companies, it should be noted that there is a positive trend in the transport and warehousing sector, with both cargo and passenger segments experiencing significant growth and contributing to the overall economic activity of the Republic of Kazakhstan.

Some studies also look at GDP and transport's share of the mix. Disruptions in the transport networks of any country are inevitable. When road networks are unstable and cannot quickly recover from disruptions, unpredictable events can cause significant delays that are disproportionately larger than the magnitude of the disruptions themselves. Improving the resilience of the transport system can mitigate the impact of such disruptions, but justifying the necessary investment is difficult due to the low probability of such events. The authors assessed the economic consequences of random failures in US urban road systems and also made predictions about the impact of failures on GDP. Various disruption scenarios were simulated and the results were compared with a baseline scenario where the economic impact was proportional to the magnitude of the disruption. The results showed that GDP losses were significantly higher in this scenario compared to the baseline. Losses were higher in wealthier and more economically productive cities, and economic output recovered one to two years after the event (Kurth et al., 2020).

The GDP generated from the transport sector in Kazakhstan experienced a significant upturn, reaching 1421974.20 million tenge in the second quarter of 2023, compared to 1342075.80 million tenge in the preceding quarter of the same year. This surge indicates a positive trend in the transportation industry during this timeframe. Over the longer duration, spanning from 2007 to 2023, the average GDP derived from transport activities in Kazakhstan amounted to 1058300.13 million tenge, with fluctuations reflecting various economic conditions and policy alterations (statgov.kz).

Current trends include significant developments in communication and information technologies, as well as increased demands for flexibility in businesses that transport people, goods and materials. The attractiveness and success of enterprises is now assessed not only by price and quality, but also by their flexibility and ability to quickly respond to customer requests. One of the key distribution problems is the circular transport problem, also known as the traveling salesman problem. This task aims to serve predetermined places, after visiting which you need to return to the starting point, while minimizing the distance traveled. In such problems, there is no need to take into account the carrying capacity of the vehicle (Simanová and Stasiak-Betlejewska, 2019). Recently, there has been a tendency towards constant development and growth of customer needs, as well as restrictions and other requirements that cannot be ignored when searching for optimal solutions. This leads to an increase in the calculation time of distribution problems. Extended settlement times negatively impact a business's ability to quickly respond to new demands. In this regard, heuristic

or metaheuristic methods are used that allow one to work with certain estimates, providing results that are as close as possible to optimal solutions (Lakhmetkina et al., 2019).

During 12 month, from January till December 2023, PVI index increased to nearly 107%. This index is typically computed by considering the weighted average growth rate of revenue from the transportation of goods and passengers (statgov.kz).

During this period, the Republic's transport system efficiently handled a substantial volume of cargo, amounting to 980.7 million tons, marking a 4.4% increase from January-December 2022. Moreover, the cargo turnover reached 501.3 billion ton-kilometers, demonstrating a 3.1% rise compared to the previous year. In terms of passenger transportation, there was a notable increase as well. 1579.9 million passengers were transported, showing an 8.3% growth compared to January-December 2022. This surge in passenger traffic was accompanied by a corresponding increase in passenger turnover, which reached 72.8 billion passenger-kilometers, up by 10.3% from the previous year (Fig. 2).

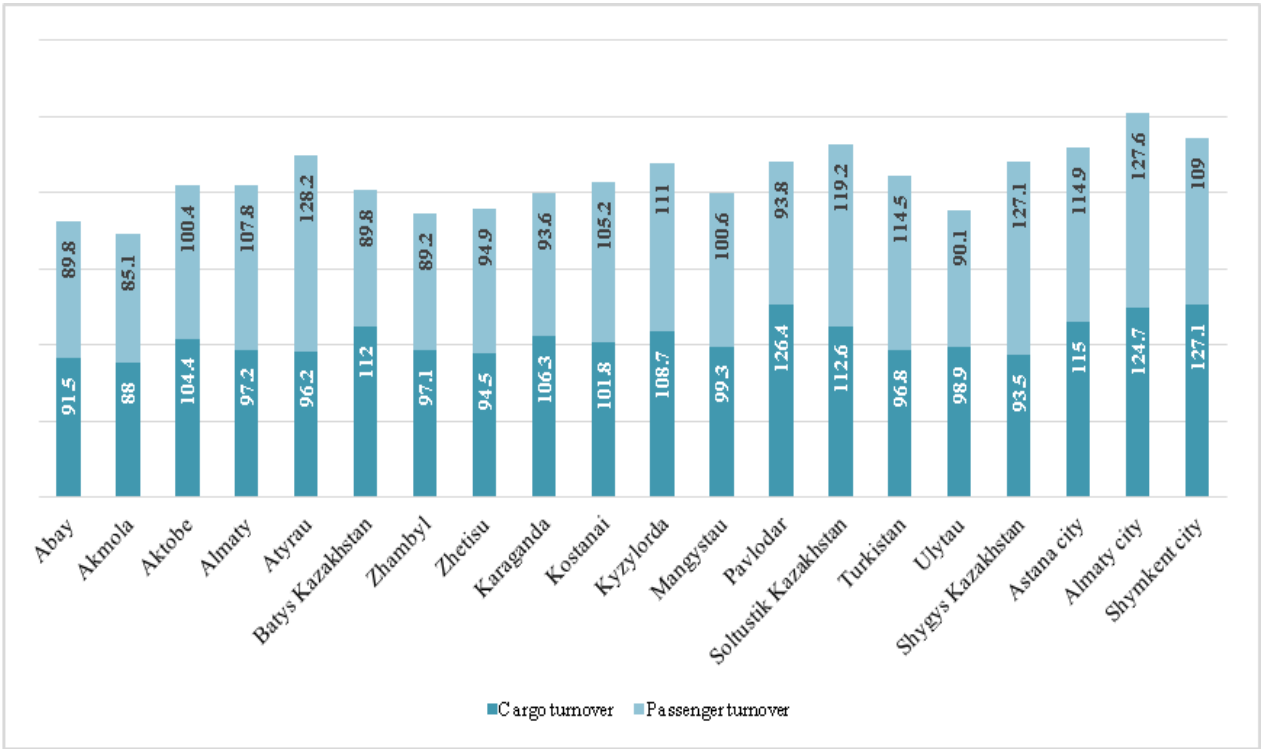

Figure 3. Transportation statistics: passengers and cargo turnover, 2023

Note — compiled by the author based on (statgov.kz, 2023)

The transportation sector data displays steady income streams across modes and operator categories (Figures 3–6). Railway transport, including government (10,318.3 million tenge), private (105,490.4 million tenge), and foreign (24,745.0 million tenge) entities, displayed consistent earnings. Electric cars, predominantly privately operated, generated significant revenue (818,647.6 million tenge), alongside foreign contributions (89,627.1 million tenge). This is due to the fact, that current emissions include not only greenhouse gases (GHGs), but also other pollutants. A future system with minimal GHG emissions may not solve all environmental problems if other pollutants are not taken into account (Fan et al. 2019). Therefore, the transition to electric vehicles is now gaining momentum, as they have significant potential to solve climate problems by reducing CO2 emissions. An alternative solution may be to use a different fuel for the transport system (Raymand et al., 2021). However, it is important to consider not only the environmental burden, but also the economic consequences (Kapeller et al., 2021).

Private maritime/coastal transport yielded 9,043.6 million tenge, with foreign entities contributing 624.4 million tenge. Government-controlled air transport earned 12,936.0 million tenge, while private operations amassed 283.6 million tenge.

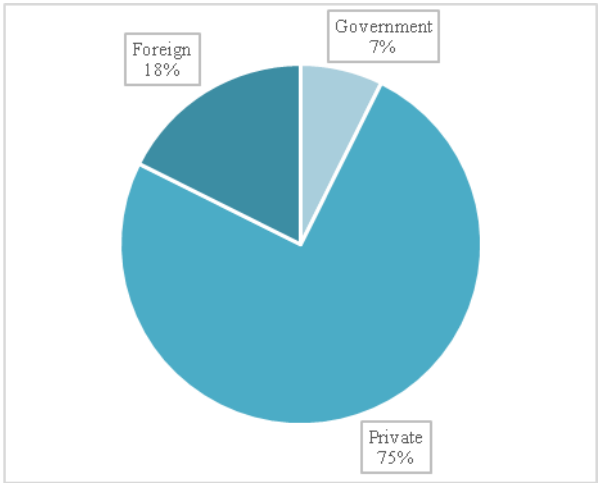

Figure 4. Railway transport, 2023
Note — compiled by the author based on (statgov.kz, 2023)

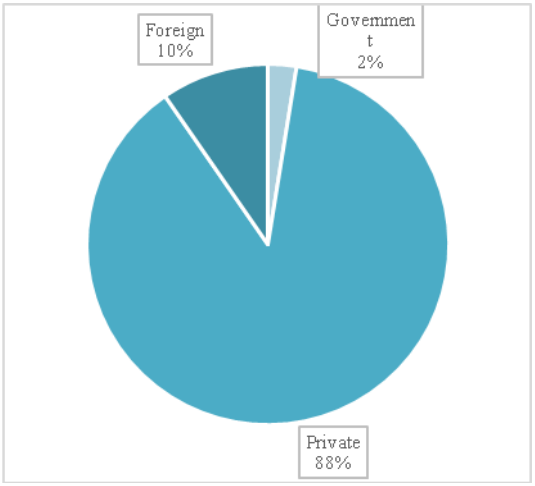

Figure 5. Electric cars, 2023
Note — compiled by the author based on (statgov.kz, 2023)

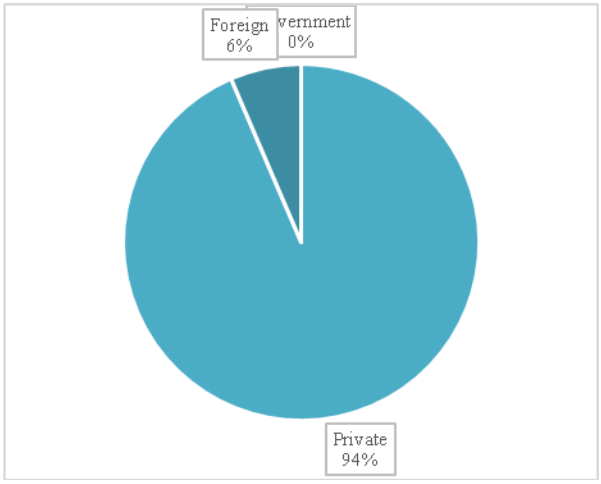

Figure 6. Marital and coastal transport, 2023
Note — compiled by the author based on (statgov.kz, 2023)

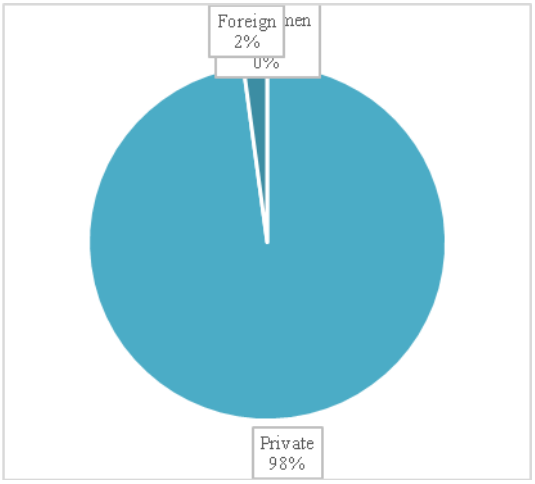

Figure 7. Air transport, 2023
Note — compiled by the author based on (statgov.kz, 2023)

The uniformity in earnings across sectors suggests stable revenue streams, potentially indicative of efficient management or steady demand, warranting further investigation for long-term sustainability.

The Physical Volume Index (PVI) is crucial in the transportation industry, serving to gauge the availability of passenger vehicles within a given market or region. Despite reaching its peak in 2020, the ongoing uptrend in the PVI index in 2023 highlights several positive industry trends (Fig. 7). The rising PVI index is indicative of increasing demand for passenger vehicles, often correlating with overall economic growth. As economies expand, consumers tend to have greater disposable income, leading to increased vehicle purchases. Moreover, a growing PVI reflects positive consumer sentiment regarding financial stability and future prospects. Confidence in economic conditions encourages significant purchases such as cars. Advancements in vehicle technology also contribute to the rise in PVI, making cars more desirable to consumers. Improved fuel efficiency, enhanced safety features, and connectivity options attract buyers to upgrade their vehicles (statgov.kz).

According to previous studies, the transport sector currently accounts for 23% of total emissions in the 27 EU member states due to its dependence on fossil fuels. If current trends continue, transport's share of total EU emissions is expected to reach 50% by 2050. Huang et al (2020) examined the negative impacts of transportation networks on Asian elephant populations, noting that the rapid growth of transportation networks threatens the existence of species with a wide range. Environmental concerns play a significant role in the shift towards cleaner, fuel-efficient vehicles, reflected in the rising PVI. Stricter emissions regulations, increased availability of electric and hybrid vehicles, and societal emphasis on eco-friendly transportation options contribute to this trend.

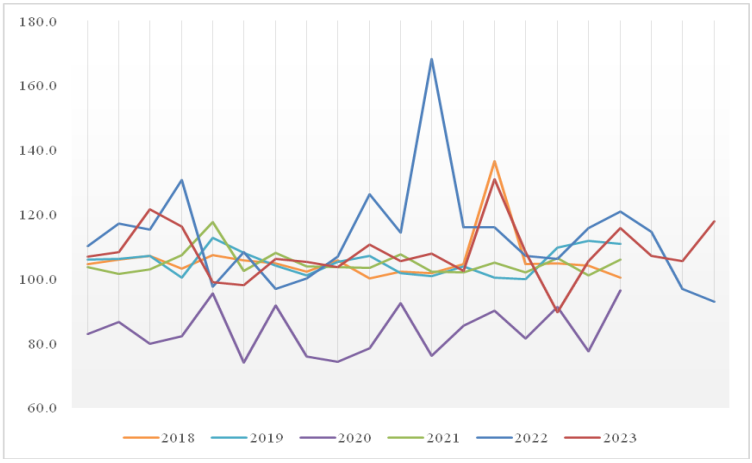

Figure 8. PVI index of transportation industry in percentage rate, 2018–2023

Note — compiled by the author based on (statgov.kz, 2023)

Additionally, investments in transportation infrastructure, including roads, highways, and public transit systems, contribute to the upward trajectory of the PVI index. Enhanced infrastructure makes car ownership more convenient and appealing, further driving demand for passenger vehicles. The sustained increase in the PVI index in 2023 underscores positive economic, technological, environmental, and societal factors propelling the demand for passenger vehicles. It reflects a robust and dynamic transportation industry poised for continued growth and development (Fig. 7).

In addition to the mentioned essential elements of transportation system effectiveness and sustainability factors, the Physical Volume Index (PVI) serves as another critical component in evaluating the overall performance and sustainability of transportation systems. As it was mentioned before, the Physical Volume Index, often referred to as PVI, provides insights into the volume and intensity of transportation activities within a given region or system. It encompasses factors such as passenger and freight movement, vehicle miles traveled, and utilization of transportation infrastructure. However, in foreign literature this index is conducted as a sustainability measurement.

In the context of sustainability, the PVI offers valuable data for assessing resource consumption, environmental impacts, and social equity considerations associated with transportation activities. It helps in understanding the usage patterns of different modes of transportation and their implications for resource preservation, air and noise pollution, and community livability. Furthermore, economic factors such as economic efficiency, financial affordability, and regional economic development are closely tied to the volume and efficiency of transportation activities, all of which can be gauged through the PVI. Social factors, including accessibility to services, public health, safety, and security, also intersect with transportation volume and intensity. The PVI aids in identifying areas where transportation services may be lacking or where accessibility barriers exist for certain demographic groups.

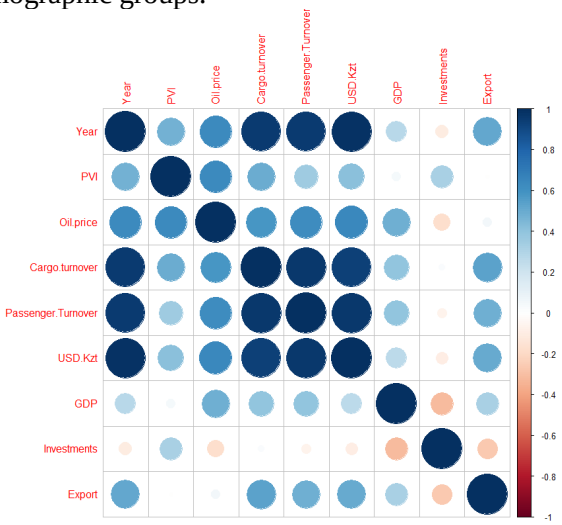

Figure 9. Correlation matrix

Note — compiled by the author based on (statgov.kz, world bank data, 2023)

The correlation matrix provided above reveals strong positive relationships between variables such as Cargo Turnover and Passenger Turnover with PVI, indicating their close association, while also highlighting significant positive correlations between Passenger Turnover and Oil Price, as well as USD/KZT with Cargo Turnover and Passenger Turnover.

We construct linear regression model with the same variables in order to assess the impact of the variables on PVI index. The model will be as follows:

$$PVI = Oil.price + Cargo.turnover + Passenger.Turnover + USD.Kzt + GDP + Investments + Export \quad (1),$$

where

PVI — index of the physical volume;

Oil price — Brent crude oil price for the period from 2014–2023;

Cargo and passenger turnover — key metrics used in transportation and logistics to measure the volume of goods and passengers moved within a specified period;

USD.KZT — currency value;

GDP — for the period from 2014–2023;

Investments to transportation companies of Kazakhstan;

Export from transportation industry.

Results

Using R studio program, we have the following data (Table):

Table. Multiple linear regression model, 2014–2023 (dependent variable — PVI index)

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	68.01245	56.57303	1.202	0.0352
Oil.price	0.84925	0.36496	2.327	0.0145**
Cargo.turnover	0.57467	0.81021	0.709	0.0552
Passenger.Turnover	-0.60697	0.28520	-2.128	0.0167*
USD.Kzt	-0.02962	0.06398	-0.463	0.0689
GDP	-0.02521	0.05061	-0.498	0.0668
Investments	0.01546	0.02337	0.662	0.0576
Export	-0.09493	1.43600	-0.066	0.0953
* p <.05, ** p <.01, *** p <.001 *Note — compiled by the author based on (statgov.kz)*				

According to the findings of our regression analysis, the intercept holds significance at the 0.05 level, implying its meaningful contribution to the model when all predictor variables are at zero. Furthermore, there exists a statistically significant positive relationship between oil price and the response variable. For every unit increase in oil price, the response variable increases by 0.84925 units on average. The coefficient is significant (p = 0.0145), suggesting that oil price has a statistically significant impact on the response variable. Conversely, the impact of cargo turnover does not reach statistical significance, while passenger turnover demonstrates a significant negative association. An increase in passenger turnover by one unit is associated with a decrease in the response variable by 0.60697 units on average. The coefficient is significant (p = 0.0167), indicating a statistically significant impact. The exchange rate between USD and KZT does not prove to be statistically significant, nor do GDP or investments. Similarly, the variable for exports also lacks statistical significance. In summary, while oil price and passenger turnover appear to be important predictors in our model, the significance of the other variables is less clear and warrants cautious interpretation, taking into account factors such as model fit and multicollinearity.

Conclusions

Based on the analysis, particularly focusing on the Physical Volume Index (PVI) and its associated factors, several key insights can be drawn regarding the management of transportation companies in Kazakhstan. First, the regression analysis highlights a statistically significant positive relationship between oil prices and the PVI index. This implies that fluctuations in oil prices can significantly influence the transportation sector's performance.

To adjust their activities, transport companies need to carefully monitor changes in oil prices, since fuel costs directly affect pricing in this industry. Effective management approaches include fuel management,

increased investment in more fuel-efficient vehicles, and the use of hedging strategies to mitigate external risks such as oil price volatility.

Our results showed that there is a certain negative relationship between indicators such as passenger turnover (over a certain period) and the PVI index. This relationship is due to the fact that the flow of passengers does not always lead to an increase in the physical volume index, although it can still indicate prosperity in the transport sector. Such problems can be solved by establishing route optimization strategies, improving and planning future investments in capacity, etc. However, according to the regression results, we also found weak statistical significance in the tenge-dollar exchange rate. We still believe that when applied to international trade (imports of goods and services), the exchange rate plays the most significant role. Moreover, there are related factors such as the purchase of equipment abroad, operating costs, which can also be affected by the exchange rate. Currency hedging is also one of the risk management strategies to subsequently mitigate the consequences of currency fluctuations.

Kazakhstan has a strategic geographical location as a transit hub between Asia and Europe. That is why the transport sector, namely international trade, has significant potential in this region and for our country. The transport sector requires a multifaceted approach, to consider internal operational strategies and to accommodate fluctuations in the external market. The PVI provides fundamental and valuable information on the volume and intensity of activity in the transport sector, leading to optimization of operations, identifying growth opportunities and reducing risks.

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Жаңа нарықтарға шығу үшін көлік компаниясын басқару: Қазақстандағы көлік саласының жағдайы

Аңдатпа:

Мақсаты: Зерттеудің мақсаты мұнай бағасы, жолаушылар тасымалы, жүк айналымы, валюта бағамы, ЖІӨ, инвестициялық және экспорттық үрдістер сияқты негізгі факторларды талдау арқылы Қазақстан Республикасындағы көлік компанияларының тиімділігін басқаруды зерделеу.

Әдісі: Сандық талдау 2014-2023 жылдар аралығындағы деректерді пайдалана отырып, осы айнымалы мәндердің көлік саласының көлем индексіне (PVI) әсерін бағалау үшін қолданылады. Көп сызықты регрессиялық модельдеу айнымалылар мен PVI арасындағы байланыстарды талдау үшін жүргізіледі.

Қорытынды: Регрессиялық талдау мұнай бағасының құбылуының көлік секторының көрсеткіштеріне әсерін көрсете отырып, мұнай бағасы мен PVI арасындағы айтарлықтай оң байланысты анықтады. Сонымен қатар, жолаушылар айналымы жолаушыларды тасымалдау жүйелерін оңтайландырудағы ықтимал қиындықтарды көрсете отырып, PVI-мен айтарлықтай теріс қатынасты айқындады.

Тұжырымдама: Мұнай бағасының ауытқуының әсерін жою, жолаушылар көлігі жүйелерін оңтайландыру, валюталық тәуекелдерді басқару, экономикалық өсу мүмкіндіктерін пайдалану және экспорттық әлеуетті зерттеу стратегиялары өнімділікті арттыру және көлік секторының тұрақтылығын қамтамасыз ету үшін маңызды.

Кілт сөздер: тасымалдау, PVI, мұнай бағасы, жолаушылар айналымы, жүк айналымы, валюта бағамы, ЖІӨ, инвестиция, экспорттық үрдістер.

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Управление транспортной компанией для выхода на новые рынки: кейс транспортной отрасли Казахстана

Аннотация:

Цель: Целью данного исследования является изучение управления эффективностью транспортных компаний в Республике Казахстан путем анализа ключевых факторов, таких как цены на нефть, пассажирооборот, грузооборот, курсы валют, ВВП, инвестиции и тенденции экспорта.

Методы: Количественный анализ используется с применением данных за период с 2014 по 2023 год для оценки влияния этих переменных на индекс физического объема (PVI) транспортной отрасли. Для анализа взаимосвязей между переменными и индексом PVI проводится множественное линейное регрессионное моделирование.

Результаты: Регрессионный анализ выявил значительную положительную связь между ценами на нефть и индексом PVI, что указывает на влияние колебаний цен на нефть на показатели транспортного сектора. Кроме того, пассажирооборот демонстрирует значительную отрицательную связь с индексом PVI, что подчеркивает потенциальные проблемы в оптимизации систем пассажирских перевозок.

Выводы: Стратегии по устранению последствий колебаний цен на нефть, оптимизации систем пассажирских перевозок, управлению валютными рисками, использованию возможностей экономического роста и изу-

чению экспортного потенциала имеют важное значение для повышения производительности и обеспечения устойчивости транспортного сектора.

Ключевые слова: транспорт, PVI, цены на нефть, пассажирооборот, грузооборот, курсы валют, ВВП, инвестиции, тенденции экспорта.