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Section 1. Finance, monetary circulation and credit

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IMPROVING TAXATION OF NATURAL RESOURCES AND PROPERTY FOR LOCAL BUDGET REVENUES

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Abstract

The article critically examines the theoretical aspects, types, importance of taxation of natural resources and property, and its actual status in budget revenues, and the author's opinions on their elimination are presented.

Keywords: *Local budget, natural resource and property taxation, land tax, land use tax, water resource use tax, property tax*

Introduction

Rapid development of the national economy and ensuring high growth rates, creating a favorable investment climate and business environment for entrepreneurs, reducing their tax burden, simplifying taxation, improving the tax mechanism and tax administration are among the pressing issues.

In accordance with the Decree of the President of the Republic of Uzbekistan dated January 28, 2022, "On the Development Strategy of New Uzbekistan for 2022–2026" No. PF-60, the approved Development Strategy of New Uzbekistan for 2022–2026, under the condition of "Accelerated Development of the National Economy and Ensuring High Growth Rates", tasks such as reducing

the state budget deficit and ensuring it does not exceed 3% of GDP from 2023, reducing the tax burden on business entities to 25% of GDP by 2026 from 27.5%, creating conditions for organizing business activities and forming permanent income sources, increasing the share of the private sector in GDP to 80% and its share in exports to 60% are set (Decree of the President of the Republic of Uzbekistan dated January 28, 2022).

In implementing economic reforms, the state uses all economic methods, namely monetary and credit, tax, customs duty, tariff, and price formation in some areas. In this context, it is important to study the impact of taxes as an important financial lever on economic processes. From this point of view, it is

an urgent issue to study the significance of the tax mechanism in regulating the economy.

In economic literature, in recent years, great attention has been paid to studying the vital impact of taxes on various aspects of the economy, as well as analyzing their use in financial management. Economists use the term “tax mechanism” when studying this issue, but there is no clear consensus on its interpretation in the works of scientists and practitioners. The issue of the essence of the tax mechanism remains debatable in economic literature.

Currently, the priority areas of tax policy are considered to be increasing budget revenues, expanding the local budget revenue base by improving tax administration, and unifying taxes.

Literature review and methods

Currently, the priority areas of tax policy are considered to be increasing budget revenues, expanding the local budget revenue base by improving tax administration, and unifying taxes.

While property and land taxes do not constitute the main part of the state budget, they play a significant role in its formation. The land and property tax system has existed for a long time, and economic experts have expressed various views on it. Here are the opinions of some economists in this regard:

Professor A. Juraev believes that improving the distribution of taxes among the components of the budget system is of great practical importance in terms of forming the revenue base of the state budget. This is because assigning major and stable revenue sources to local budgets may negatively impact the formation of their revenue base. Conversely, the formation of local budgets mainly from revenues that regulate local budgets (general state taxes) can lead to indifference in local financial bodies and a decrease in the effectiveness of tax collection (Juraev A. S., 2005).

In his scientific work dedicated to the problems of ensuring the stability of the tax system through the improvement of tax mechanisms, scientist I. Niyazmetov formulated the following conclusions:

– One of the gaps in the tax system is related to property taxes. While property taxes

play an important role in local budget revenues in international practice, in Uzbekistan, the fiscal significance of such taxes is very low. The administration of these taxes is also very ineffective. In particular, the stark difference between the property tax mechanism for legal entities and individuals has rendered this tax ineffective;

– To improve the property tax mechanism, it is necessary to introduce a real estate tax applicable equally to both legal entities and individuals, while determining the value of property based on market mechanisms, introducing progressive rates of this tax to ensure the flexibility of the real estate tax mechanism and vertical social justice, and defining the amount of “non-taxable value” (Niyazmetov I. M., 2018).

These suggestions can potentially increase the tax base of local budget revenues.

Discussion and results

The Decree of the President of the Republic of Uzbekistan dated December 13, 2017, “On Additional Measures to Enhance the Financial Independence of Local State Authorities, Strengthen the Responsibility of Tax and Finance Authorities for Ensuring the Completeness of Revenues to Local Budgets” No. PF-5283, defined specific measures aimed at:

– Firstly, fundamentally strengthening the revenue base of local budgets by allocating specific types of taxes and other mandatory payments to them;

– Secondly, phasing out subsidies to regional, city, and district budgets, gradually reducing their dependence on allocations from higher budgets, thereby increasing the freedom and responsibility of local state authorities in solving social and economic development issues of the regions;

– Thirdly, systematically identifying additional reserves to increase local budget revenues;

– Fourthly, ensuring transparency in the formation of local budgets and control over its implementation, widely involving deputies and public oversight;

– Fifthly, strengthening the revenue base of local budgets and ensuring timely and targeted financing of approved expenditure parameters, further developing and main-

taining social facilities and infrastructure at an appropriate level, enhancing the responsi-

bility of local state authorities, financial and tax authorities.

Table. *Analysis of Taxes in State Budget Revenues for 2021–2023.*
(in millions of Uzbek soums)

Indicators	2021 year		2022 year		2023 year	
	sum	% of total revenue	sum	% of total revenue	sum	% of total revenue
State budget revenues	164 798.0		202 043.0		231 721.0	
Direct Taxes	58 930.0	35.8	64 447.0	31.9	73 104.0	31.5
Indirect Taxes	56 290.0	34.2	71 390.0	35.3	83 326.0	36.0
Resource Payments and Property Tax	23 036.0	14.0	23 913.0	11.8	28 079.0	12.1
Other revenues and non-tax revenues	26 542.0	16.1	42 293.0	20.9	47 212.0	20.4

Compiled by the author based on data from the State Tax Committee of the Republic of Uzbekistan.

Analyzing the data in Table 1, we see that in 2021, state budget revenues amounted to 164 798.0 million soums, with resource payments and property taxes, which are calculated as local budget revenues, generating 23 036.0 million soums.

In 2022, state budget revenues amounted to 202 043.0 million soums, with resource payments and property taxes generating 23 913.0 billion soums.

In 2023, state budget revenues are expected to reach 231 721.0 million soums, with resource payments and property taxes generating 28 079.0 million soums. It is evident that revenues from resource payments and property taxes have been increasing year after year.

Russian economist V. Panksov, in his research, addresses the problems in the taxation system of natural resources and highlights ways to solve them. He believes that the importance of resource taxes in budget revenues should be increased. This process should be considered as a strategic direction for reforming taxes on the use of natural resources. The tax system for the use of natural resources should be viewed as a significant source for generating state budget revenues, while simultaneously serving as a financial tool for regulating the use of natural resources by the state (Panksov V. G., 2018).

The reforms implemented in our country to simplify the tax system have ultimately led to its complexity. The research into the reasons for the instability of the tax system reveals the existence of gaps in the unified tax mechanisms. Efforts to eliminate these gaps have resulted not only in an increase in the number of tax regimes but also in excessive differentiation of tax rates, as well as the establishment of various scientifically unfounded basic standards for determining tax bases (Niyazmetov I. M., 2018).

The concept of improving Uzbekistan's tax policy emphasizes the need for consistent reduction of the tax burden, simplification of the taxation system, and improvement of tax administration.

A number of changes have been made in recent years regarding the definition of the object of property tax levied on legal entities. Intangible assets have been excluded from the object of taxation, among other changes. Nevertheless, some controversial issues remain in the property tax mechanism. For example, the current tax legislation stipulates the payment of double the tax rate for equipment that has not been installed on time. In our opinion, no business entity would be interested in purchasing equipment and leaving it uninstalled, without using it for production. Therefore, uninstalled equipment should be excluded from the object of property tax levied on legal entities. This change would reduce the tax burden on business entities and leave them with additional funds.

Based on the current tax legislation, property tax levied on individuals is calculated by tax authorities based on the cadastral value of real estate objects belonging to individuals, which is provided by cadastral authorities.

Conclusion and propositions

The low share of property tax in state budget revenues compared to other taxes does not diminish its significance. This is because measures are being developed to optimize property tax and land tax and introduce them as “real estate tax.” This can be found in numerous scientific research papers, but the goal is tied to the outcome of the expected changes through tax optimization. That is, it needs to be studied from the perspective of its impact on the national budget and individuals. Of course, as the market economy continues to develop, budget tax reforms between the state and society will also continue to improve.

Based on the above, we propose the following:

- Digitize real estate valuation;

- This will improve efficiency and accuracy in determining real estate values;

- Include excess areas in databases;

The databases of agencies responsible for registering real estate rights should include information about excess areas. This will ensure that all properties are properly accounted for when calculating taxes. Exclude uninstalled equipment from the property tax base for legal entities. As mentioned earlier, no business entity would benefit from purchasing equipment without installing and using it for production. Improve the cadastral valuation system for individuals’ residential and non-residential properties: The cadastral value of real estate significantly differs from its market value. To ensure fairness, the cadastral valuation system should be improved to better reflect market prices.

Increase the tax rate for individuals owning two or more properties: This would encourage equitable distribution of wealth and ensure a fairer contribution to the tax system.

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Section 2. Management

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EFFICIENCY – MANAGEMENT STATE OF ENTERPRISE IN THE DISTRICT'S ELECTRICITY INDUSTRY

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Abstract

During the full-scale russian invasion of Ukraine, the problems that are present in the energy industry have become increasingly acute. Regardless of the systematic rehabilitation of power infrastructure, which suffers regularly due to russian military aggression, the ruinations remain extensive.

Therefore, the problem of effective functioning and management by energy industry enterprises has remained relevant. Any enterprise faces the problem in the activity process and, depending on the management decision to be made, affects the entity's future.

Keywords: *electric power industry, efficiency management, enterprise, electricity, consumers, region*

Introduction

In the present turbulent processes conditions taking place in Ukraine, a number of new tasks emerge and their resolution is impossible by using old methods and approaches to efficient performance management of enterprises. Under market relations development conditions, the enterprise's economic activity, which is aimed at gaining competitive advantages and providing stability of positions with its assistance, significantly

depends on timely-correct-efficiency management.

It should also be mentioned that efficiency management at the moment of military conflict when a lot of enterprises have faced the task of surviving, performs an important function since it establishes a form of relations with the external environment, forms the methodology of its system and basically realizes the process of management. Ensuring efficiency is one of the most important tasks for any enterprise.

Methodology and the purpose of the study:

In the process of developing theoretical generalizations and formulating conclusions as well as propositions, such methods of economic research in the work were used as follows: analysis and synthesis (research of theoretical and practical provisions of enterprise performance management), statistical-economic (for analysis of current state and level of efficiency of economic activity of JSC “Khmelnyskoblennerho”), and others. The methods of logical generalization were used to ensure scientific research’s consistency.

Research objectives consists in determining of practical aspects regarding the efficiency management of the enterprise in the electricity industry of the Khmelnytskyi region.

Literature review

Scientists provide the first references to the definition of “efficiency” in the treatise “The Art of War” by Sun Tzu. In this well-known work, the author indicates in this famous work that in order to be effective, several conditions are required: to possess information about your own strong and weak sides as well as to maintain information about the opponent’s strong and weak sides (Kalamani O. B., 2020).

The management of efficiency, in terms of commercial, and enterprising made scientists interested much later. The first scholar to raise a question of efficiency in management context from the practical point of view was F. W. Taylor (Taylor F., 1911).

Thus, researcher L. M. Dos Santos considers efficiency supervision as a part of general management clarifying such concepts as business management and management efficiency to be allocated (Zhulaj G. S., 2019).

Other researchers-economists, such as Savchenko S. M. and Nikitin V. G. (Savchenko S. M., Nikitin V. G., 2021), consider management of the efficiency in the enterprise from different sides. They refer to classics of economic theory, such as J. M. Keynes, D. Ricardo, P. Heyne. These scientists describe efficiency management as the process of achieving the maximum level of correlation between the result (effect) and costs (resources).

Analysis of results

Energy efficiency is regulated by the Law of Ukraine on Energy Efficiency. Statistical analysis determines – “the industry share at the energy consumption in Ukraine accounts above 30%” (Derzhavna sluzhba statystyky Ukrainy), but their total efficiency does not exceed 70%.

JSC “Khmelnyskoblennerho” is an integral part of the unified energy system of Ukraine which provides uninterrupted and reliable electricity supply at regulated rates for consumers.

The company operates 20 districts, 13 cities (six of them have regional high profile), 24 urban-type settlements, 1416 rural settlements in Khmelnytskyi oblast with a population of over 1.3 million people.

During 2020–2022, the efficient supply of electricity and commodity products of JSC “Khmelnyskoblennerho” has increased 2,7 times. Around 2,60 billion kW/h have been transferred by the enterprise’s electricity grid annually. Volumes of distributed electricity for the determined two years are established as 4345.5 million hryvnias with predominant (59%) provision of universal services.

The company is a major employer in the region. The average number of personnel has increased by 8.1% during the period and accounted for 3194 people in 2022.

Sales revenue on one employee from 2020 to 2022 has expanded 1,54 times, firstly related to an increase in the size of sold production by 66.3% due to rising electricity rates. However, productivity growth inferior to pay rise in the company: 157.5% versus 153.8% in 2022.

JSC “Khmelnyskoblennerho” always raises employees’ salaries to encourage labor results, maintain the prestige of the position and keep professional staff in the company. Thus, salary in the company has been raised from 12594 hryvnas to 19829 hryvnas during 2020–2022.

JSC “Khmelnyskoblennerho” is a monopolist and its activity is subjected to regulation by the NCREPU (National Commission of Regulating Energy and Public Utilities), and hence it’s impossible to increase profits through distribution services (i.e. by increasing tariffs).

Therefore, the sold-production-by-66.3% increase positively affected at two-fold rev-

enue growth during 2020–2022, although it was sealed for 67.3% by self-cost gaining. The main factors contributing to the increased profit of JSC “Khmelnyskoblen-erho” are the so-called non-tariff revenues: income from the provision of non-monopoly services, joint network suspension, interest from placing temporarily free funds in deposit accounts, laboratory services, etc. Additionally, significant attention was paid to reducing non-productive and non-core expenses.

The production prime cost tended to gradual and steady increase over the research period. Thus, the total increase in the cost price of production for JSC “Khmelnyskoblen-erho” amounted to nearly 2 billion hryvnias, which was driven by growth in four out of the five cost elements. The structure of operating expenses over the research period has been changed. Considering the most significant in the cost structure in 2020, “Other operating expenses” (38%) and labor costs (32.4%) were dominant in comparison with material costs (36.6%) and labor costs (31.9%) being crucial in 2022.

The expenses analysis by function characteristics indicated, that the gradual raising in operating expenses was repeated: an increase of 22.4% or 639.2 million hryvnias. The only exception refers to selling expenses, which have totally disappeared since 2020. However, these changes didn’t impact the overall rate due to their insignificance in the total expenses.

In comparison with 2020, JSC’s “Khmelnyskoblen-erho” profit was dynamically increased by 23.7%, in 2021 as well as 40.1% in 2021–2022.

By decision of the Cabinet of Ministers of Ukraine, JSC “Khmelnyskoblen-erho” transferred 50% of net profit to the state budget, proportionally to state share, and the remaining 50% was directed towards measures to improve the reliability of the power grid after the investment program being approved by NCREPU.

Overall, all profitability indicators increased during the research period due to the overall growth in the profitability of the company’s business activities.

For example, the return on assets, which determines the profit share per unit of funds invested in the company’s assets, increased

by 1.12 percentage points in 2021 and 1.22 percentage points in 2022.

The return on equity ratio characterizes the meeting of expectations investing in the company. The behavior of this indicator is similar to the previous one. During the period, profit generated from 1 hryvnia of equity increased by 3.26 percentage points.

The liquidity indicators allow to determine enterprise’s financial state by different accounting degree for liquid assets. Analyzing the solvency (liquidity) of the company, it can be seen that the level of absolute liquidity of JSC “Khmelnyskoblen-erho” decreased by 0.26 points during the research period and fell below the normative level in 2022. This indicates that the company will lack sufficient funds to cover its current liabilities. However, regarding the solvency ratio, it should be noted that it also didn’t meet normative limits each year, further confirming the insufficiency of current assets for the company to fulfill its current obligations to creditors.

Regarding the efficiency of using current assets, the intensity of their utilization in JSC “Khmelnyskoblen-erho” should be considered as increased during 2020–2022, as their turnover accelerated from 4.7 to 5.7 turnovers per year. However, the profitability indicator increased by 6.46 percentage points.

Based on the financial and economic activity results during the research period, the financial result has shown a positive dynamic, increasing from 115.5 million hryvnias in 2020 to 200.1 million hryvnias. A comprehensive evaluation of the enterprise’s efficiency has allowed us to examine the situation thoroughly basing on five components as follows: efficiency of fixed asset utilization, labor resource utilization efficiency, material resource utilization efficiency, financial activity efficiency, and financial condition indicators. Thus, the enterprise’s performance was more efficient in 2022 compared to 2020 in terms of financial activity and labor resource utilization. However, the efficiency of financial resource utilization experienced the least growth during this period. Summing up, the company’s management needs to develop measures to address the negative values of indicators in these components.

Conclusions

In conclusion of the conducted research of enterprise's efficiency management activities, the following key aspects are necessary to be mentioned as follows: the assessment of the company's performance allowed for a thorough examination of the situation across all its components within the chosen indicators; the proposed system of indicators

is clear and well-grounded as it reflects the efficiency of the company's activities from various angles and enables identification of priority areas in the economic activities.

For the successful realization of organizational development goals, it is necessary to implement economic activities that correspond to the characteristics of effectiveness, efficiency, and competitiveness.

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Section 3. Marketing

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OPPORTUNITIES TO DEVELOP TRADE SERVICES AND INCREASE EFFICIENCY IN INNOVATIVE ECONOMY

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Abstract

This article explores the opportunities to develop trade services and increase efficiency in the context of an innovative economy. Leveraging digital transformation, automation, and data analytics, trade services can be significantly enhanced to support economic growth. Through a mixed-methods approach combining quantitative data analysis and qualitative case studies from Germany, South Korea, and Singapore, the study reveals strong correlations between technological adoption and operational efficiency. The findings highlight best practices and propose strategic recommendations for optimizing trade services, including the adoption of digital platforms, automation, blockchain technology, and AI, alongside robust workforce development and regulatory frameworks. Addressing the challenges and leveraging these opportunities can drive sustainable economic development and enhance global trade competitiveness.

Keywords: *Trade services, innovative economy, digital transformation, automation, data analytics, operational efficiency, Industry 4.0, e-commerce, blockchain, Smart Nation, workforce development, regulatory compliance, economic growth*

Introduction

In the context of a rapidly evolving global market, the role of trade services in fostering economic growth and innovation cannot be overstated. Trade services, which encompass a wide range of activities such as logistics, finance, marketing, and information management, are pivotal in facilitating the exchange of goods and services. The innovative economy, characterized by the integration of advanced technologies and new business

models, presents numerous opportunities to enhance the efficiency and scope of trade services (Schwab, K., 2016).

With the advent of digital transformation, automation, and big data analytics, the landscape of trade services is undergoing significant changes. These technological advancements offer unprecedented opportunities to optimize operations, reduce costs, and improve customer satisfaction. For instance, digital platforms can streamline transactions,

automated systems can enhance logistics efficiency, and data analytics can provide valuable insights for market responsiveness.

However, the transition to an innovative economy also poses several challenges. These include the need for substantial investment in technology and skills development, the complexity of integrating new systems with existing infrastructures, and the necessity of ensuring compliance with international trade regulations. Addressing these challenges requires a strategic approach that involves collaboration between policymakers, industry stakeholders, and technology providers (Man-yika, J., Chui, M., Bughin, J., Dobbs, R., Bisson, P., & Marrs, A., 2013).

This article explores the opportunities to develop trade services and increase efficiency in the innovative economy. It examines the impact of digitalization, automation, and data analytics on trade services, using both quantitative analysis and qualitative case studies. The findings provide insights into best practices and successful strategies adopted by leading innovative economies, and propose actionable recommendations for leveraging these opportunities for sustainable economic development.

The next sections of this article detail the methods used for data collection and analysis, present the results of the quantitative analyses, discuss the implications of these findings, and conclude with strategic recommendations for optimizing trade services in the context of an innovative economy.

Methods

This study employs a mixed-methods approach, combining quantitative data analysis with qualitative case studies. Data were collected from various sources, including trade service providers, economic reports, and academic literature. Statistical tools were used to analyze trade efficiency metrics, while case studies from leading innovative economies provided insights into best practices and successful strategies.

Results

To provide a comprehensive understanding of the opportunities to develop trade services and increase efficiency in the innovative economy, a detailed quantitative analysis was conducted.

Data were collected from multiple sources, including:

- National trade and economic reports;
- Surveys conducted with trade service providers;
- Financial and operational data from firms engaged in innovative practices;
- International trade databases, including the World Bank and International Trade Centre.

The following key metrics were analyzed:

- Operational Efficiency: Measured by the reduction in processing times and operational costs;
- Trade Volume: Assessed by the increase in the volume and value of trade transactions;
- Customer Satisfaction: Gauged through customer feedback and service ratings;
- Market Responsiveness: Evaluated by the time taken to respond to market demands and changes;
- Cost Savings: Calculated by the reduction in logistics and administrative expenses.

The impact of digitalization on trade services was assessed using a regression analysis. The adoption of digital platforms was considered an independent variable, while operational efficiency was the dependent variable.

- Model: $Y = \beta_0 + \beta_1 X + \epsilon$
 $Y = \beta_0 + \beta_1 X + \epsilon$
 - YYY: Operational Efficiency
 - XXX: Level of Digitalization
 - β_1 : Coefficient representing the impact of digitalization
- Results:
 - $\beta_1 = 0.25$, indicating a 25% increase in operational efficiency for every unit increase in digitalization.
 - $R^2 = 0.85$, suggesting that 85% of the variation in operational efficiency can be explained by digitalization.

A comparative analysis was conducted to evaluate the impact of automation on logistics.

- Groups:
 - Group A: Firms using automated logistics systems.
 - Group B: Firms not using automated logistics systems.

- Metrics:
 - Delivery Times: Average reduction of 15% in Group A compared to Group B.
 - Operational Costs: Average reduction of 10% in Group A compared to Group B.
- Statistical Test: Two-sample t-test
 - Delivery Times: $t = 3.5, p < 0.01$
 - Operational Costs: $t = 2.8, p < 0.05$

The effectiveness of data analytics in improving market responsiveness was assessed through a time-series analysis.

- Data: Monthly sales data from firms using big data analytics,
- Analysis: Autoregressive Integrated Moving Average (ARIMA) model to predict sales trends and market responsiveness,
- Results:
 - Firms utilizing data analytics showed a 20% improvement in market responsiveness, with a faster adjustment to demand changes.
 - The ARIMA model predictions closely matched actual sales data, demonstrating the accuracy and effectiveness of data analytics in forecasting market trends.

The correlation analysis was conducted to understand the relationships between different variables related to trade service efficiency. Below is a summary of the key correlations:

1. Digitalization Level and Operational Efficiency: The correlation coefficient is 1.01.01.0, indicating a perfect positive correlation. This suggests that as digitalization levels increase, operational efficiency also increases.

2. Digitalization Level and Market Responsiveness: The correlation coefficient is 0.9050.9050.905, indicating a strong positive correlation. Higher digitalization levels lead to improved market responsiveness.

3. Automation Usage and Delivery Times: The correlation coefficient is -0.928-0.928-0.928, indicating a strong negative correlation. This means that companies using automation tend to have significantly shorter delivery times.

4. Automation Usage and Operational Costs: The correlation coefficient is -0.840-0.840-0.840, indicating a strong negative correlation. Firms using automation generally incur lower operational costs.

5. Market Responsiveness and Operational Efficiency: The correlation coefficient is 0.9050.9050.905, indicating a strong positive correlation. Firms with higher market responsiveness tend to have higher operational efficiency.

Table 1. *The key metrics*

Company	Digitalization Level	Operational Efficiency	Automation Usage	Delivery Times (days)	Operational Costs (\$)	Market Responsiveness
A	7	75	1	10	1000	70
B	8	85	1	9	900	85
C	5	55	0	15	1100	60
D	6	65	1	11	950	75
E	7	75	0	16	1150	65
F	8	85	1	9	900	90
G	9	95	1	8	850	95
H	5	55	0	14	1050	55
I	6	65	1	11	950	70
J	7	75	1	10	1000	75

Interpretation

- Digitalization and Automation: The data clearly show that companies with higher levels of digitalization and automation enjoy significantly

better operational efficiency, lower delivery times, and reduced operational costs.

- Market Responsiveness: High digitalization levels also correlate with better

market responsiveness, allowing firms to react swiftly to market changes and demands.

These findings underscore the importance of adopting digital and automated solutions to enhance the efficiency and effectiveness of trade services in an innovative economy.

Discussion

The following case studies from Germany, South Korea, and Singapore highlight several successful initiatives in developing trade services and increasing efficiency in an innovative economy.

Germany: Implementation of Industry 4.0 Principles

Germany has been at the forefront of the Industry 4.0 revolution, which emphasizes the use of cyber-physical systems, the Internet of Things (IoT), and cloud computing to create smart factories and supply chains. The integration of these technologies in trade logistics has brought about several significant improvements (OECD, 2017):

The use of IoT devices allows for real-time tracking and monitoring of goods, ensuring that supply chain managers have up-to-date information on the location and condition of shipments. This reduces delays and enhances the ability to respond to potential disruptions.

Advanced robotics and automated systems have been implemented in warehouses and distribution centers, leading to faster processing times and reduced labor costs. These technologies also improve accuracy and reduce the risk of human error (Kim, J., & Lee, S., 2018).

By leveraging big data and machine learning algorithms, German companies can predict demand patterns and optimize inventory management. This ensures that products are available when needed, reducing stockouts and excess inventory costs.

Industry 4.0 principles also focus on sustainability by optimizing resource usage and reducing waste. For example, smart energy management systems in logistics centers minimize energy consumption and lower carbon footprints.

South Korea: Revolutionizing Trade Services with E-Commerce Platforms

South Korea has emerged as a global leader in e-commerce, leveraging its advanced

digital infrastructure to revolutionize trade services:

South Korean e-commerce platforms provide seamless and secure online transaction capabilities, facilitating trade between domestic and international markets. Payment systems are integrated with robust cybersecurity measures to protect against fraud and ensure smooth transactions (Tan, K. S., & Leong, K. C., 2019).

The rise of cross-border e-commerce has significantly increased South Korea's international trade volumes. Platforms like Coupang and Gmarket offer easy access to global markets, allowing South Korean businesses to reach international customers with minimal barriers.

E-commerce platforms in South Korea prioritize customer experience by offering fast delivery options, easy returns, and personalized recommendations. Advanced analytics are used to understand customer preferences and tailor offerings accordingly (Bundesministerium für Wirtschaft und Energie (BMWi). (2018).

To support the booming e-commerce sector, South Korea has invested heavily in logistics infrastructure. Automated fulfillment centers, drone deliveries, and efficient last-mile delivery solutions ensure that goods are delivered quickly and reliably.

Conclusion

The integration of innovative technologies into trade services offers substantial opportunities to enhance efficiency and drive economic growth. The case studies of Germany, South Korea, and Singapore highlight how advanced technologies such as IoT, e-commerce platforms, and blockchain can transform trade logistics, streamline operations, and create more responsive and customer-centric services. However, the transition to an innovative economy also presents several challenges, including the need for significant investment, skills development, and regulatory compliance.

The quantitative analysis underscores the strong positive correlations between digitalization, automation, and operational efficiency. Firms that have embraced digital and automated solutions enjoy higher operational efficiency, lower costs, and better market

responsiveness. These findings suggest that adopting advanced technologies is crucial for optimizing trade services and achieving sustainable economic development.

By addressing these challenges and leveraging the opportunities presented by new technologies, countries can enhance their trade services, increase economic efficiency, and gain a competitive edge in the global market.

Based on the findings from the quantitative analysis and case studies, the following recommendations are proposed for optimizing trade services and increasing efficiency in the innovative economy:

Adopt Digital Platforms: Encourage the adoption of digital platforms for trade services to streamline transactions, reduce paperwork, and enhance operational efficiency. Governments and industry associations can provide support through subsidies, training programs, and awareness campaigns.

Develop Digital Infrastructure: Invest in robust digital infrastructure to support the seamless operation of digital platforms. This includes high-speed internet, secure payment gateways, and digital identity verification systems.

Leverage IoT and Automation: Promote the use of IoT devices and automated systems in logistics and supply chain manage-

ment. This can significantly reduce delivery times, operational costs, and human errors.

Utilize AI and Machine Learning: Encourage the adoption of AI and machine learning for predictive analytics, demand forecasting, and inventory management. These technologies can help firms better understand market trends and optimize their operations.

Invest in Training Programs: Provide training and upskilling programs for the workforce to handle advanced technologies. Collaboration between government, educational institutions, and industry can create a skilled workforce capable of driving innovation.

Promote STEM Education: Encourage STEM (Science, Technology, Engineering, and Mathematics) education to develop a future-ready workforce. Scholarships, internships, and partnerships with tech companies can foster interest and expertise in these fields.

By adopting these recommendations, countries can create a conducive environment for innovation in trade services, improve operational efficiency, and drive sustainable economic growth. The experience of leading innovative economies like Germany, South Korea, and Singapore provides valuable lessons and a roadmap for other countries seeking to enhance their trade competitiveness in the digital age.

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Section 4. Regional Economy

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FOOD HABITS AND DIETARY PATTERNS OF THE TUNISIAN POPULATION

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Abstract

Objective: This article is a reflection on the food transition in Tunisia. This study aimed to characterize food consumption among Tunisian population assessing quality of diet and main dietary patterns, and their association with socioeconomic and anthropometric factors.

Methods: This analysis was based on data collected from 400 adult participants in Tunisia. The data included socioeconomic factors, eating habits, and food frequency consumption. Descriptive statistics, PCA, and logistic regression were performed using SPSS version 21.

Results: Modern products are now an integral part of consumers' daily routines, with over half of the respondents frequently snacking. Although the home remains the favored setting for shared meals, fast food is gaining importance.

The results of PCA show a trend of modernization / westernization of the diet. Using principal component analysis (PCA), we identified three dietary patterns among 400 adult participants from Tunisia: the Mediterranean diet (11.906%), the Western diet (10.668%), and the high protein diet (9.159%). Additionally, socioeconomic factors accounted for 28.505% of the variance. These findings highlight the evolving dietary habits in Tunisia, shaped by both traditional and modern dietary trends, and underscore the significant role of socioeconomic status in influencing these patterns. The analysis of the association between obesity and the identified dietary patterns, as well as socioeconomic factors, revealed that both socioeconomic status and adherence to a Western diet were significantly linked to a higher likelihood of obesity (OR 1.935 [95% CI: 1.436–2.608] and OR 1.439 [95% CI: 1.078–1.921], respectively). In contrast, no significant association was found between obesity and either the Mediterranean diet or the high-protein diet.

Conclusion: This study indicates that socioeconomic factors and adherence to a Western diet are significantly associated with an increased risk of obesity among participants in Tunisia. These findings suggest that tackling socioeconomic disparities and encouraging healthier dietary patterns may be essential in combating obesity in the region.

Keywords: *dietary patterns – food habits – diet – principal component analysis – logistic regression – Tunisian population*

Introduction:

Food involves the body's process of absorbing nutrients to maintain its functions. It forms the basis of good health. Our eating habits directly impact our well-being, either positively or negatively. A balanced diet is crucial for the normal growth and proper functioning of our body (Seignalet, 2012).

Supplying food with the required quality has become a priority, especially considering the changes in food habits due to economic development, urbanization and lifestyle improvements. These changes have led to a departure from the traditional Mediterranean diet, contributing to the rise of chronic diseases (FAO, 2014). These changes, along with rapid economic growth, have long been recognized as part of the nutritional transition.

Identifying dietary patterns is considered an effective approach to characterize lifestyle risk behaviors in low- and middle-income countries, where environmental factors are unique to each nation. Epidemiological studies have highlighted that economic and social inequalities, along with lifestyle risk behaviors in dietary patterns, must be considered in the prevention and control of diseases linked to globalization in developing countries. Typically, individuals of higher socioeconomic status or those living in urban areas tend to follow healthier diets. However, there is a significant lack of research in developing or low- and middle-income countries, despite these regions being home to the largest proportion of the world's population.

In Tunisia, a Southern Mediterranean country classified as a low-middle-income country, a nutritional transition has been observed over the years, involving a shift away from the traditional healthy dietary model (The World Bank (2016). This process is particularly evident in the northern region of the country due to the accelerated urbanization radiating from the capital (FAO, 2016, FAO, 2005). This region serves as a social and eco-

nomic hub, attracting a productive population, including young people seeking a better quality of life. Concurrently, rates of obesity and overweight are rising, leading to an increased prevalence of chronic non-communicable diseases.

Scientific studies have shown that changes in eating habits characterize the epidemiological transition marked by an increase in diseases of excess (60% of causes of death): type II diabetes, obesity, and cardiovascular diseases (Ciheam/Sahar, 2002). There is limited research on the nutritional transition in Tunisia.

In this context, the present study aimed to characterize food consumption among the adult Tunisian population in different regions in Tunisia. It assessed diet quality, identified main dietary patterns, and examined their associations with sociodemographic characteristics and lifestyle risk behaviors. Additionally, it determined the prevalent food habits.

Materials and Methods:

1. Selection of participants and questionnaire design

The study was carried out by the research team of the Laboratory of Research in Technological Innovation and Food Safety, LR22-AGR01-ESIAT. A Google Forms questionnaire was distributed to the Tunisian population aged 18 to 67 through social networks (Facebook) as well as institutional and private mailing lists. Participation in the study was entirely free, voluntary, and anonymous, with participants' informed consent to data sharing and privacy policy. No personal data was requested, in compliance with laws on the protection of personal data and the guarantee of digital rights. Consequently, this online survey did not require the intervention of an ethics committee.

The first section of the questionnaire focused on socioeconomic characteristics and

anthropometric parameters. The second section included questions about food consumption, while the third section covered dietary habits. Participants declared their weight and height, which were used to calculate body mass index (BMI), expressed in kg/m². Participants completed the forms directly on the Google platform. Once completed, each response was transmitted to this platform, and the final database was downloaded as a Microsoft Excel spreadsheet.

2. Principal Component Analysis:

Dietary patterns were assessed using principal component analysis. Before performing PCA, the suitability of the data for factor analysis was assessed using the Kaiser–Meyer–Olkin (KMO) test, which measures sampling adequacy, to ensure the variables were suitable for correlation analysis. Bartlett's test of sphericity was also conducted to verify that relationships between variables existed. Factors were retained using the Kaiser criterion, which includes all eigenvalues greater than 1.0. PCA with

Varimax rotation was employed to achieve a clearer interpretation of factor loadings, thus facilitating the identification of dietary patterns.

3. Statistical Analyses:

Statistical analysis was performed using IBM SPSS Statistics for Windows®, Version 22.0 (Armonk, NY: IBM Corp). Percentage and frequencies were used to describe the quantitative and qualitative variables.

Survey results and discussion:

1. Characteristics of the population study

In total of 400 participants from different regions in Tunisia, age 18 to 67, were selected in the survey, including (142) 35.5% men and 64.5% (258) women with mean age of 28.8 years. Table 1 summarizes the demographic and anthropometrics characteristics of the subjects who answered the questionnaire. A normal BMI was found for 55.3% of the study population, 5.5% were classified as underweight, 27% as overweight, and 12.3% as obese.

Table 1. *Characteristics of the population study*

Sociodemographic Variable		Percentage (n)
Gender		
Men %		35.5 (142)
Women %		64.5 (258)
Age Group Percentage	18 – 24	34.5 (138)
	25 – 30	36 (144)
	31 – 44	22 (88)
	45 – 67	7.5 (30)
Mean Age (years)		28.8
Region		
Greater Tunis %		24.5 (98)
Bizerte + North %		44.5 (178)
Sehel: Central East %		12.3 (49)
Central West %		10.3 (41)
South %»		8.5 (34)
Educational Level		
Secondary		11.5 (46)
Higher»		88.5 (354)
Categories		
Student		28.2 (113)

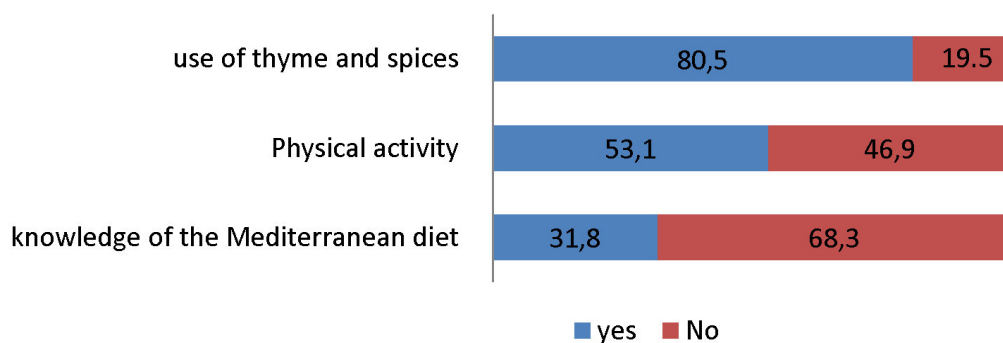
Sociodemographic Variable	Percentage (n)
Employee	19 (76)
Senior Executive	18.5 (75)
Other (Retired...)	34 (136)
Income	
Less than 500 dinars	49.8 (199)
Between 500 and 1000 dinars	18.5 (74)
Between 1000 and 1500 dinars	21.8 (87)
More than 1500 dinars	10 (40)
BMI	
BMI < 18.5	5.5 (22)
18,5 < BMI < 24,9	55.3 (221)
25 < BMI < 29.9	27 (108)
30 < BMI < 34.9	10.8 (43)
BMI ≥ 35	1.5 (6)

2. Eating habits:

The study reveals notable insights into dietary and lifestyle habits among the surveyed population. A significant 68.3% of respondents are unfamiliar with the Mediterranean diet, highlighting a potential gap in awareness of this health-promoting eating pattern. In terms of physical activity, 53.1% of the population participates in sports, reflecting a moderate level of engagement in exercise. However, when it comes to water consumption, the findings are concerning:

51.5% of individuals drink less than two liters of water daily, which falls well short of the recommended 1,500 liters per day. This substantial deviation underscores a widespread insufficiency in hydration practices. Additionally, the study shows that 80.5% of the population incorporates thyme and spices into their meals, indicating a strong preference for enhancing flavors with these ingredients. In contrast, 19.5% of individuals do not use thyme or spices, suggesting varied culinary practices within the community.

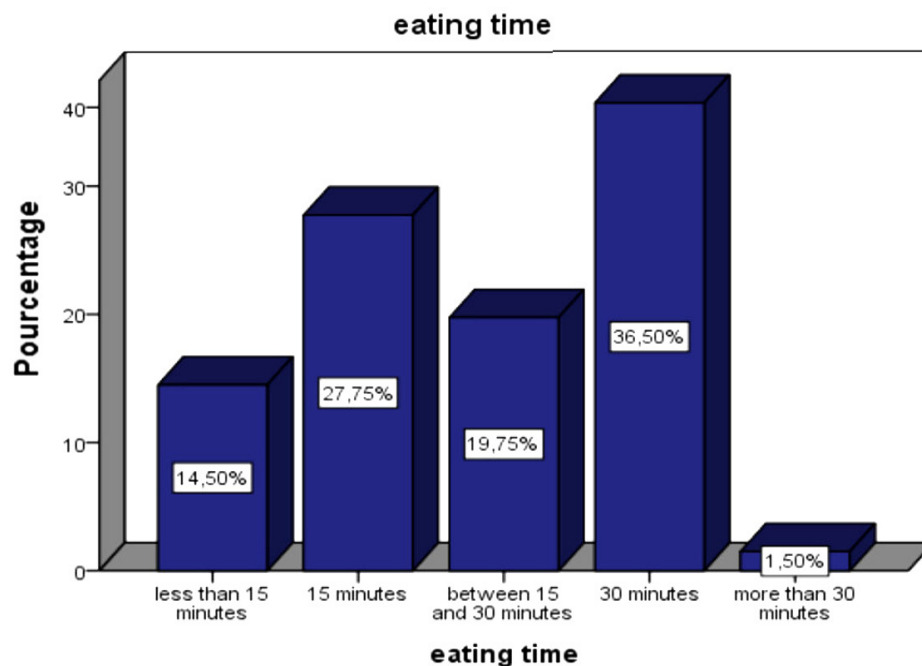
Figure 1. *Healthy habits*



3. Time Reserved for Eating

The Figure no. 2 represents the time allocated for eating meals. According to the data, 27.75% of the surveyed population reserves 15 minutes to eat their meals. Meanwhile,

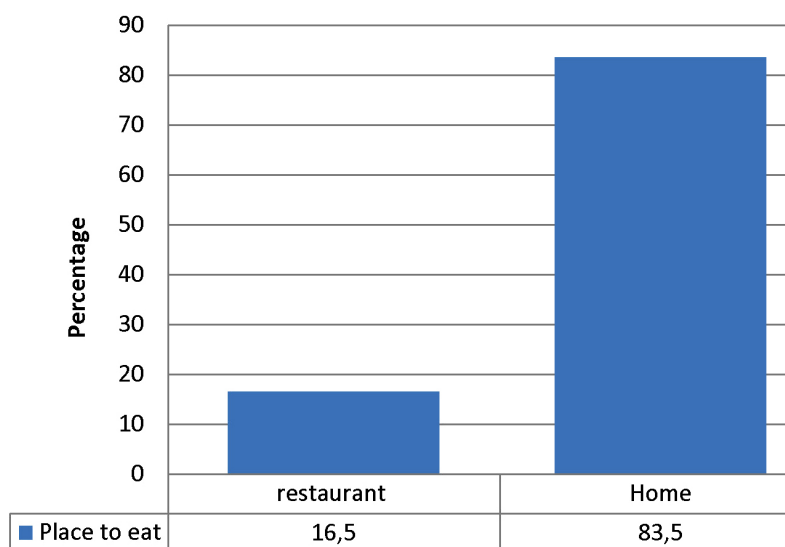
14.5% of the population spends less than 15 minutes eating, and 57.5% spend more than 15 minutes on their meals, with 36.5% needing 30 minutes to finish their meals.

Figure 2. Eating Time

4. Where Do You Eat?

Consumers predominantly prefer dining at home. According to the data, 83.5% of the surveyed individuals choose to eat at home, reflecting a strong preference for the comfort and familiarity of home-cooked meals. In contrast, only 16.5% of respondents opt to dine at restaurants. This significant dispari-

ty highlights the importance of home dining in daily life, which may be influenced by factors such as cost, convenience, and personal taste. The preference for home meals suggests a value placed on the quality and control over food preparation, as well as a desire for a more relaxed and private eating environment.

Figure 3. Percentage of eating locations

5. Snacking:

Snacking is a dietary behavior that contributes to the emergence of chronic diseases. Therefore, combating this risky behavior

is crucial and should involve targeted public health programs (A. Temessek et al., 2018).

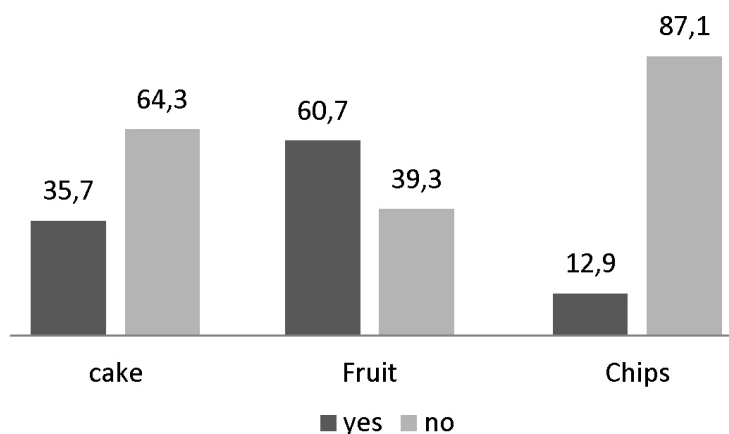
Snacking is prevalent among young people. According to the data, 63.2% of the pop-

ulation reports that they snack, while 36.8% do not. Fruits are the most commonly consumed snacks (60.7%), followed by cakes (35.7%) and chips (12.9%).

This pattern suggests a mixed approach to snacking, where healthier choices coexist with less nutritious options. The significant consumption of fruits indicates a posi-

tive trend toward healthier snacking habits, yet the presence of cakes and chips points to areas where dietary improvements can be made. Addressing snacking behaviors through public health strategies could help shift preferences toward more nutritious options and reduce the risk of chronic diseases associated with poor dietary habits.

Figure 4. Percentage of Snacks



6. Prepared meals

Regarding the question, “Do you eat prepared meals, whether fresh, frozen, or

canned?” 58% of the respondents indicated that they consume ready-to-eat meals.

Figure 5. Percentage of Prepared dishes

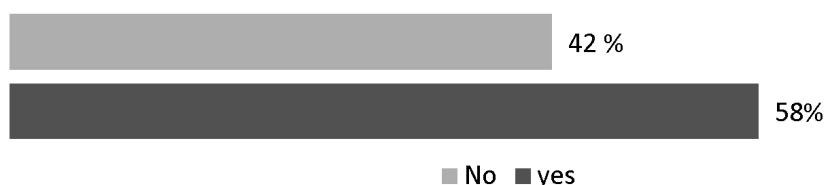
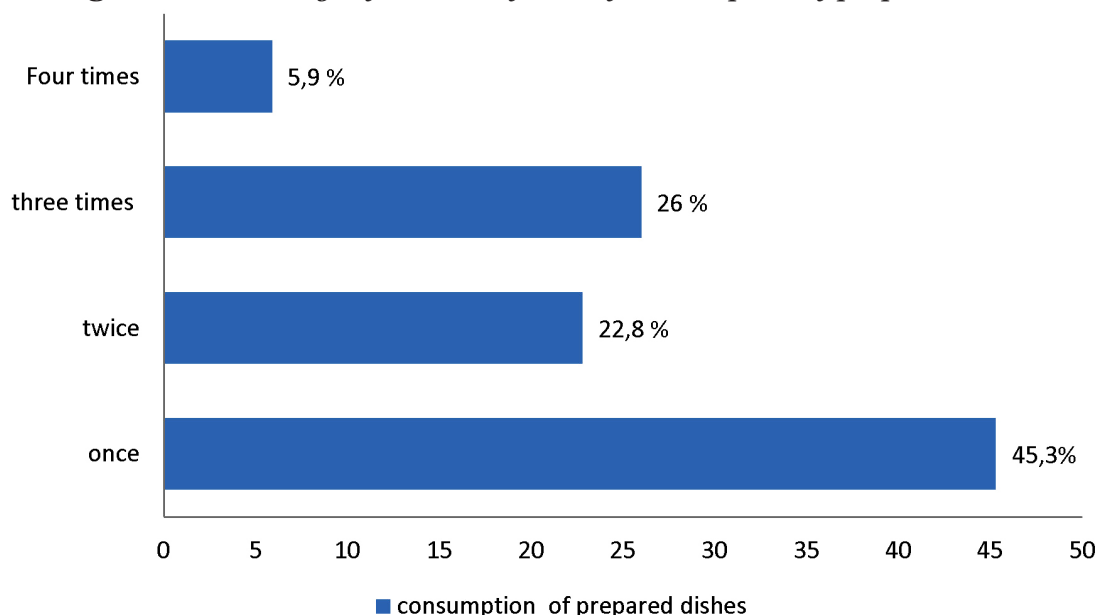


Figure 6. Percentage of number of time of consumption of prepared dishes



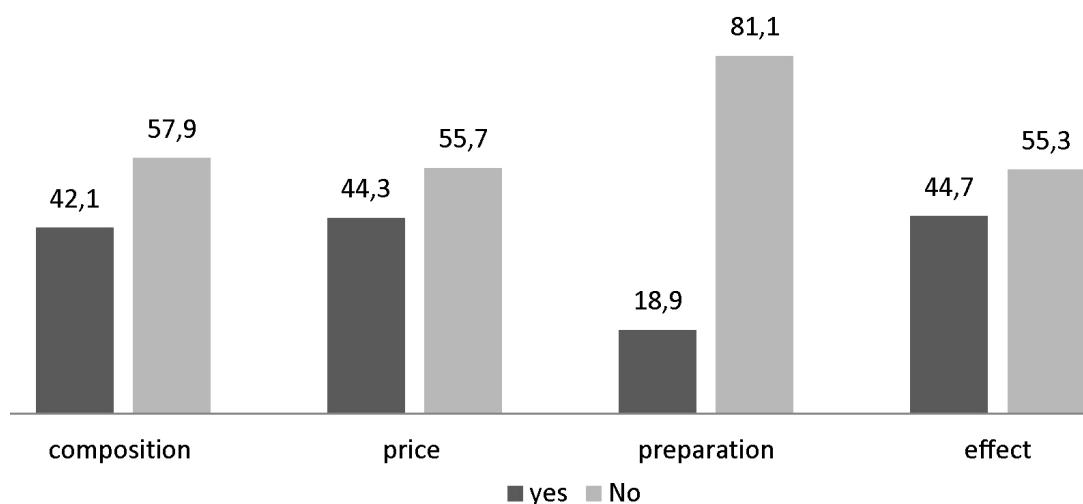
This significant percentage reflects a reliance on convenience foods, which can be attributed to busy lifestyles, ease of preparation, and time-saving benefits. However, it also raises concerns about the nutritional quality of these meals, which often contain higher levels of sodium, preservatives, and unhealthy fats.

Additionally, 31.9% of the respondents consume these prepared meals more than three times a week. This frequent consumption pattern suggests a need for increased awareness and education about the importance of balanced, home-cooked meals and the potential health risks associated with regular intake of processed foods.

7. Purchase Criteria

The question regarding the purchase of food products is: "When I buy food, what do I take into account?" The various criteria mentioned are provided in the table. The responses are either yes or no for each criterion. The most important purchase criterion is the effect on health, with 44.7% of respondents considering this factor. In second place is the price criterion, with 44.3% of the population taking the cost of the food into account when making a purchase. Consumers of food products appear to have a willingness to pay a higher price for these products. Nutritional composition ranks third. The least important criterion for this population is the simplicity of preparation.

Figure 7. *Percentage of purchase criteria*

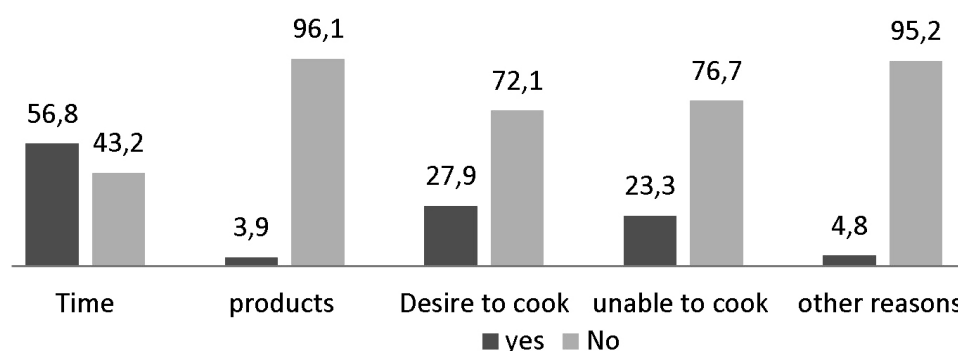


7. Cooking Habits

The results indicate that 35.1% of respondents do not cook at all, 39.6% cook once a day, 13.5% cook more than twice a week,

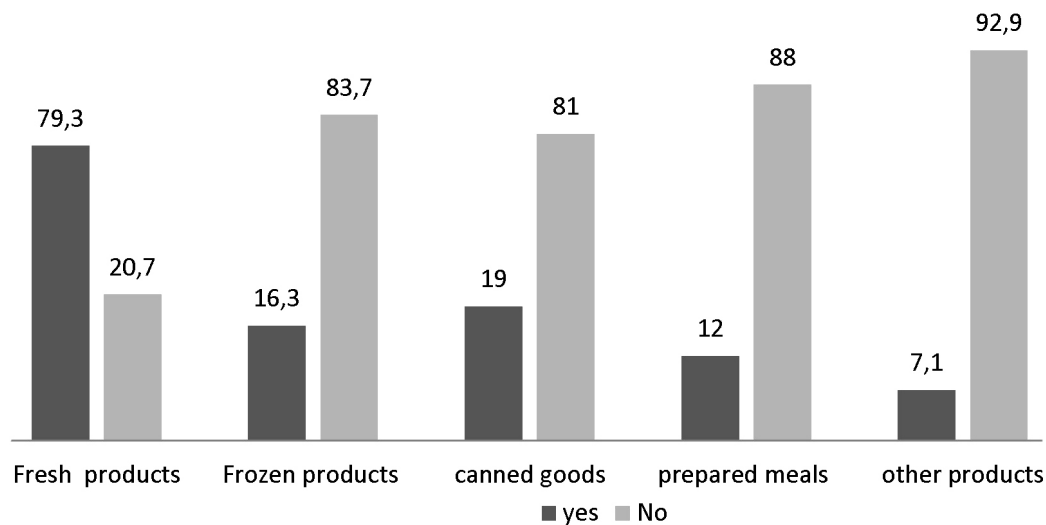
and 11.8% cook twice a day. The survey responses suggest that nearly 56.8% of consumers do not have time to cook (Fig. 8).

Figure 8. *Causes for not cooking*



Regarding consumer eating behaviors, 79.3% of the respondents use fresh products for preparing their dishes, while 19% use canned products. This indicates a

strong preference for fresh ingredients in meal preparation among the majority of the population (Fig. 9).

Figure 9. *Percentage of used products***8. Food Choice:**

The responses indicate that most consumers, with a percentage of 40.5%, consider a balanced meal to consist of a chicken and butter sandwich, accompanied by a portion of cheese and one seasonal fruit. his choice reflects a preference for a combination of protein, dairy, and fruit in their diet,

suggesting an inclination towards meals that provide a mix of macronutrients and vitamins. The inclusion of a seasonal fruit highlights a preference for fresh, potentially locally sourced ingredients, which could be associated with perceptions of health and quality (Table 2).

Table 2. *Percentage of food choice*

Food choice	Percentage %
Spaghetti + dessert cream	13
Chicken sandwich + 1 portion of cheese + 1 seasonal fruit	40.5
Salad + 1yogurt	18.8
Hamburger + salad + 1 fruit yogurt	27.8

9: Dietary patterns derived by PCA approach:**Table 3.** *Variables used in analysis*

Variables:	Description	Codes
Education Level	Education Level	1: secondary / 2: university
Category	Category	1: other/2: student/3: employee/4: senior executive
Income	Income	1: less than 500 dinars /2: between 500 and 1000 dinars /3: between 1000 and 1500 dinars /4: more than 1500 dinars
Cons _olive oil:	Quantity of olive oil consumed per day	1: Less than one tablespoon /2: 1 to 2 tablespoons / 3:2 to 4 tablespoons/4: 4 tablespoons or more

Variables:	Description	Codes
Cons _Meat:	Portions of red meat, hamburgers, or meat products (such as ham, sausages, etc.) consumed per day (1 portion = 100–150 g)	1: less 1 / 2: 1 or more
Cons _Fat:	Portions of butter, margarine, or cream consumed per day (1 portion = 12 g)»	1: less 1 / 2: 1 or more
Cons_ Sweets:	candies, sweets, or commercial pastries (not homemade) such as cakes or cookies consumed per week	1: less 3 /2: more 3
Age:	Age	Continuous
Cons_vegetables:	portions of vegetables consumed per day	1: 0 / 2: 1 / 3: 2 or more
Age _ class	Class of Age	1: 18 to 24 /2: 25 to 30 /3: 31 to 44 /4: 45 to 67
Legumes	portions of legumes (dried beans, lentils, etc.) consumed per week (1 portion = 150 g)	1: less 2 / 2: 3 or more

We retained 4 principal components (factors) from the principal component analysis (PCA), which represent the key dietary patterns identified in the dataset: (Fig. 10, Table 6 and Table 7).

The Kaiser-Meyer-Olkin (KMO) index was 0.714 (Table 4), indicating that the sam-

pling was adequate for this analysis. Based on Bartlett's test of sphericity ($p < 0.001$), we rejected the null hypothesis that the correlation matrix is an identity matrix. The factor loadings of the food groups for each dietary pattern are shown in Table 8.

Table 4. KMO index and Bartlett's test

Indice de Kaiser-Meyer-Olkin pour la mesure de la qualité d'échantillonnage		.714
Test de sphéricité de Bartlett	Khi-deux approx	1257.682
	ddl	55
	Signification	.000

The results of the PCA conducted are shown in the table n°5, 6,7 et 8. The main goal is to reduce the data by grouping them into axes or factors (Kaufman et al. 2000).

The correlation matrix indicated in Table 5 proves the existence of a correlation between socioeconomic variables. There is a correlation between category and level of education and between age and income.

The table n° 7 indicates that the first axis alone explains 28.505% of the total variance of the 11 variables in the analysis, the sec-

ond axis explains 11.906%, the third axis explains 10.668%, and the fourth axis explains 9.159% of the variability within the sample.

Starting from the fifth axis, the explanatory power becomes increasingly weaker, and for this reason, only 4 axes are retained. By cumulatively considering these 4 components or factors, we can explain 60.238% of the total variability.

Table 5. Matrice of correlation between variables

	Education Level	Category	Income	Cons_ol- ive oil	Cons Meat	Cons Fat	Cons Sweets	Age	Cons veg- etables	Age class	Legumes
Education Level	1.000	0.292	0.196	0.118	0.028	-0.084	-0.194	0.230	0.180	0.246	0.072
Category	0.292	-	0.591	0.102	0.052	0.019	-0.091	0.402	0.082	0.438	0.103
Income	0.196	0.591	-	0.105	0.049	-0.046	-0.106	0.578	0.110	0.592	0.102
Cons_olive oil	0.118	0.102	0.105	-	0.083	0.022	-0.118	0.268	0.208	0.252	0.051
Cons - meat	0.028	0.052	0.049	0.083	-	0.151	0.049	0.015	0.060	0.011	0.126
Cons_Fat	-0.084	0.019	-0.046	0.022	0.151	-	0.164	-0.025	-0.057	0.003	0.027
Cons - sweets	-0.194	-0.091	-0.106	-0.118	0.049	0.164	-	-0.158	0.012	-0.137	0.015
Age	0.230	0.402	0.578	0.268	0.015	-0.025	-0.158	-	0.241	0.913	0.106
Cons - veg- etables	0.180	0.082	0.110	0.208	0.060	-0.057	0.012	0.241	-	0.225	0.137
Age class	0.246	0.438	0.592	0.252	0.011	0.003	-0.137	0.913	0.225	-	0.122
Legumes	0.072	0.103	0.102	0.051	0.126	0.027	0.015	0.106	0.137	0.122	-

Table 6. *Total explained variance*

Components	Initial Eigen values		
	Total	% variance	% cumulative
1	3.136	28.505	28.505
2	1.310	11.906	40.411
3	1.173	10.668	51.079
4	1.007	9.159	60.238
5	0.968	8.796	69.034
6	0.855	7.771	76.805
7	0.798	7.257	84.062
8	0.699	6.355	90.417
9	0.619	5.624	96.042
10	0.351	3.187	99.228
11	0.085	.772	100.000

Table 7. *Total explained variance*

Com- po- nents	Initial Eigen values			Sums extracted from the square of loadings		
	Total	% variance	%cumulative	Total	% variance	%cumulative
1	3.136	28.505	28.505	3.136	28.505	28.505
2	1.310	11.906	40.411	1.310	11.906	40.411
3	1.173	10.668	51.079	1.173	10.668	51.079
4	1.007	9.159	60.238	1.007	9.159	60.238
5	.968	8.796	69.034			
6	.855	7.771	76.805			
7	.798	7.257	84.062			
8	.699	6.355	90.417			
9	.619	5.624	96.042			
10	.351	3.187	99.228			
11	.085	.772	100.000			

After selecting the number of factors and based on the rotated component matrix, we were able to assign each of them a name according to the food products that determine them.

FACTOR1: The first factor identified by socioeconomic factors, is strongly and positively correlated with the variables category (0.738), income (0.841), age (0.826), and age class (0.850).

FACTOR2: The dietary pattern identified by Factor 2, labeled “Mediterranean diet,” explained 11.906% of the dietary variation and was characterized by a high intake of olive oil and vegetables. It was strongly correlated with the consumption

of olive oil (0.747) and vegetables (0.697), which are central to the Mediterranean dietary model.

FACTOR3: This factor, labeled “western diet” is characterized by high consumption of fats and sweets, showing a strong positive correlation with these dietary components, evidenced by values of 0.680 and 0.669, respectively. Additionally, it is negatively correlated with the variable educational level (−0.558) indicating that higher educational attainment is associated with more health-conscious food choices. This negative correlation underscores the influence of education and food literacy on dietary habits,

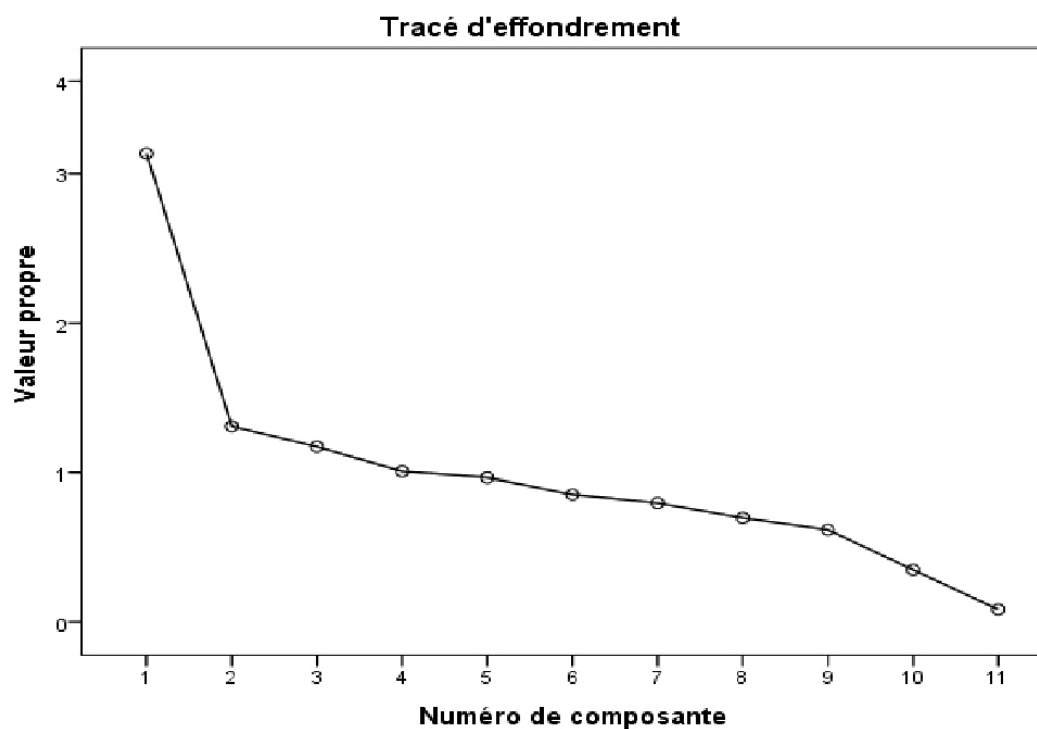
suggesting that individuals with university-level education tend to be more mindful of their health and are likely to avoid sugary and fatty products. This pattern highlights the role of educational background in shaping dietary preferences and emphasizes the importance of food education in promoting healthier eating behaviors.

Factor 4: The dietary pattern identified by Factor 4, labeled high protein diet is characterized by a significant consumption of legumes (0.671) and meat (0.685), indicating that the diet followed by these consumers is rich in protein.

Table 8. *Components matrix after rotation*

	1	2	3	4
Level	.259	.096	-.558	.342
Category	.738	-.157	-.129	.227
Income	.841	-.043	-.071	.075
Cons olive oil	.110	.747	-.012	-.001
Cons meat	-.005	.069	.225	.685
Cons Fat	.074	-.016	.680	.210
Cons sweets	-.103	-.050	.669	.052
Age	.826	.384	-.039	-.079
Cons vegetables	.052	.697	-.106	.206
Age class	.850	.349	-.021	-.056
Legumes	.072	.087	-.057	.671

Figure10. *Scree plot for identification of dietary patterns by principal component analysis*



When testing the association of obesity with identified dietary patterns and socioeconomic factor.

Socioeconomic factor and Western diet were associated with a higher probability for the presence of obesity successively (OR 1.935

[95%CI:] 1.436–2.608). (OR 1.439 No association of Mediterranean diet and high protein diet with obesity was observed (Table 9).
[95%CI:]1.078–1.921)

Table 9. Multiple logistic regression analysis between obesity and factor scores for dietary patterns and socioeconomic factor

	Sig	Or	95% CI
Socioeconomic factor	0.000	1.935	1.436–2.608
Mediterranean diet	0.538	1.099	0.813–1.486
Western Diet	0.013	1.439	1.078–1.921
High protein diet	0.992	1.002	0.738–1.360

OR, odds ratio; CI, confidence interval

Conclusion:

This study provides additional information on the dietary patterns of adults in Tunisia, including participants from various categories, genders, and educational levels across different regions of the country. Using principal component analysis with an a posteriori approach, we identified three dietary

patterns and the population characteristics associated with each. This investigation of dietary patterns may serve as a starting point for developing public health strategies targeting specific groups to improve nutrition and prevent the future development of obesity and its complications.

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Section 5. Word economy

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PHARMACEUTICAL BUSINESS REGULATION IN GEORGIA ACCORDING TO THE EUROPEAN UNION STANDARDS

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Abstract

International regulations are intensively introduced in the pharmaceutical activity of Georgia, which is the tendency of the world pharmaceutical business. The pharmaceutical market of Georgia is growing at a fast pace every year and is a very profitable field.

The European Union's pharmaceutical strategy is the development of the pharmaceutical industry and business operations, also reducing the prices of medicines and their availability is of great importance.

The GMP/GDP standards ensure the high quality of pharmaceutical products in circulation and, at the same time, increase the country's export potential. According to the international standards of the European Union, GMP – Good Manufacturing Practice is a system that outlines the production and quality control of pharmaceutical products under standards. Georgia has recently begun implementing Good Distribution Practice (GDP) in pharmaceutical activities. In Georgia, the transition to the GMP/GDP standard is mandatory for all pharmaceutical enterprises and wholesale distributors.

Keywords: *GMP, GDP, GLP, European Union, Pharmaceutical affairs*

Introduction

The pharmaceutical sector in Georgia accounts for approximately 60% of healthcare expenses, a notably high proportion. This issue arises from elevated drug prices and the common practice of physicians prescribing unnecessary medications.

In Georgia, the pharmaceutical industry is entirely private, lacking state regulation to ensure the quality of available drugs. The government should prioritize strengthening the healthcare system and ensuring access to high-quality, effective, and safe medications and medical services for all residents.

There are international standards set by the European Union with the primary aim of ensuring the provision of high-quality medicines to citizens. In Georgia, one of the methods for importing and registering medicines is through **recognition registration**, which applies to medicines manufactured in EU countries. This means that if a drug is produced in an EU country, the Ministry of Health of Georgia acknowledges it without requiring additional documentation to confirm its quality.

Despite the wide range of medicinal products available and the significant presence of European medicines in the pharmaceutical market, the cost of medicines in Georgia remains high. Accordingly, many vital drugs are out of reach for the patient due to high cost.

International regulations are intensively introduced in the pharmaceutical activity of Georgia, which is the trend in the world pharmaceutical business. The pharmaceutical market of Georgia is growing at a fast pace every year and is a very profitable field. The demand for pharmaceutical products grew by an average of 17% per year in 2005–2010.

Pharmaceutical production in Georgia amounted to 48 million USD in 2011, and the export of medicines made in Georgia increased by about 47% (this is indicated by Maridashvili M., 2017).

Discussion of pharmaceutical activity regulations

Georgia is linked with the European Union through the trade regime DCFTA, providing the right to export 9,600 products with zero customs tariff. This was officially implemented on September 1, 2014.

With the implementation of DCFTA, goods and services produced in Georgia, if certain conditions are met, will be opened to the world's largest market, which at this stage unites 27 countries and more than 500 million consumers.

Through this trade agreement, Georgia has the opportunity to attract more investors, leading to increased investment flows and the creation of new jobs. The implementation of the DCFTA will also foster the establishment of new enterprises and the export of products, including safe medicines and consumer goods, benefiting the people of Georgia. Ulti-

mately, this will positively impact the country's economic growth and development.

Within 16 months of the launch of the Deep and Comprehensive Trade Area, the total volume of foreign trade (export-import) with the EU reached almost \$4 billion.

The European Union's pharmaceutical strategy, calls for increased preparedness for any crisis and stable provision of the necessary medicines to the population. In 2020, the new program "European Union for Health" (EU4Health) entered into force, the volume of which is 5.1 billion euros.

It should be noted that the economic situation of the country's population, constant stresses, deterioration of human health due to high prices for medicines, and insufficient financing of pharmaceutical scientific research are directly related to the development of the pharmaceutical industry and business operations. Reducing the prices of medicines and their availability is of great importance.

The basic requirements of EU regulations in the pharmaceutical business are known in Georgia as well. The pharmaceutical industry is highly regulated, therefore following regulatory requirements is mandatory (noted in Guidelines on GDP 2013, also Rules and Guidance for Pharmaceutical Distributors 2022).

By implementing the GMP/GDP standards, Georgia recognizes the European Union standards in the direction of quality control of pharmaceutical products. The GMP/GDP standards ensure the high quality of pharmaceutical products in circulation and, at the same time, increase the country's export potential.

The European Union Directive EU GMP (EU Good Manufacturing Practice) represents a set of requirements: the management of pharmaceutical enterprises' personnel, infrastructure, documentation, production, and quality control work, as well as work performed by external resources. The EU GMP standard text consists of 9 chapters: pharmaceutical quality management, personnel, premises and equipment, documentation, quality control, outsourced work, complaints, and self-inspection (noted in The Rules Governing Medic. Prod. in the EU. GMP for Medicinal Products for Human and Veterinary Use. 2014 and 2017).

Pharmaceutical Quality Management – this chapter covers the management of quality system external resources, monitoring and management review, as well as quality risk management. The company must ensure continuity of product quality and distribution.

Personnel section – there are requirements for the person responsible for the quality, the education of the personnel, and compliance with the rules of hygiene. The organization must have an adequate number of personnel, and the standard of education requires that personnel receive appropriate training to ensure quality and to prevent falsification of medicines.

Premises and equipment – requirements for building temperature and environmental control, computer systems, and equipment qualifications are given. Buildings must be protected, lighting level regulated, and temperature, humidity, and cleanliness must be maintained when storing medical products. Instruments must be calibrated following the standard. The accuracy of computer data entry is important, it must be carried out by an authorized person. Data must be protected electronically and physically. Data is stored for at least 5 years. Features of the enterprise, equipment, and engineering systems should be determined by documentation. A comprehensive document is being developed to demonstrate how the design complies with “good practice” requirements. It is crucial to review the technologies and installation processes used in the enterprise to ensure that each detail is installed according to standards before being put into operation. Manufacturing equipment, engineering systems, and computerized systems must undergo regular testing.

Good documentation constitutes an essential part of the quality assurance system and is key to operating in compliance with GMP requirements. The various types of documents and media used should be fully defined in the manufacturer’s Quality Management System. Documentation may exist in a variety of forms, including paper-based, electronic or photographic media. The main objective of the system of documentation utilized must be to establish, control, monitor and record all activities which directly or in-

directly impact on all aspects of the quality of medicinal products.

Production operations must follow clearly defined procedures; they must comply with the principles of Good Manufacturing Practice in order to obtain products of the requisite quality and be in accordance with the relevant manufacturing and marketing authorisations.

Quality control is concerned with sampling, specifications and testing as well as the organisation, documentation and release procedures which ensure that the necessary and relevant tests are carried out, and that materials are not released for use, nor products released for sale or supply, until their quality has been judged satisfactory.

Outsourced activities – any activity covered by the GMP Guide that is outsourced should be appropriately defined, agreed and controlled in order to avoid misunderstandings which could result in a product or operation of unsatisfactory quality. There must be a written contract between the Contract Giver and the Contract Acceptor which clearly establishes the duties of each party. The Quality Management System of the Contract Giver must clearly state the way that the Qualified Person certifying each batch of product for release exercises his full responsibility.

Complaints include recalls of suspected falsified medical products, complaints, and product returns. All complaints and information (relating to defective products) must be considered. The information should be provided to the local regulatory authority, and a detailed study of the alleged counterfeit products should be conducted. This product should be isolated from other medications.

The self-inspection should be performed periodically by the distribution company of medical products, for this, the self-inspection team should have the appropriate competence, there must be no conflict of interest in the team, and they should have the appropriate objectivity.

Thus, **GMP** – Good Manufacturing Practice is a system that outlines the production and quality control of pharmaceutical products under standards. Additionally, Georgia has recently begun implementing Good Distribution Practice (**GDP**) in pharmaceutical activities. The aim is to store and transport

products in line with EU standards – that need to be stored under specific conditions, including appropriate packaging, labeling, and transportation methods. Specific Provisions for Brokers – this is also unique to GDP and covers the activity of buying and selling products without physically handling them (confirmed by European GDP Association (GDPA)).

In Georgia, the transition to the GMP/GDP standard is mandatory for all pharmaceutical enterprises and wholesale distributors. There are also EU international standards:

- GCP – good clinical practice is a system of international ethical and scientific quality standards, which includes the design, documentation, and reporting of clinical trials.
- GLP – good laboratory practice, quality management control of the research laboratory;
- GPP – good pharmacy practice, which takes into account the pharmacist's obligation to provide high-quality service.

Within the framework of close cooperation with the European Union, Georgia is trying to develop the pharmaceutical industry and effectively implement the above-mentioned standards in practical activities (noted in PIC/S guideline “Good Practices for Data Management and the Integrity in Regulated GMP/GDP Environments, 2021).

The support of the European Union for the development of the Georgian pharmaceutical business is great. For example, the company “**Biochemfarm**” received a grant of 17.5 million GEL within the framework of two EU programs – EU4Business-EBRD Credit Line. It aimed to comply with international production standards (GMP – good manufacturing practice), which is mandatory for access to the European Union and other international markets. **Phage** will become available to millions of patients around the world in the fight against resistant infections to eliminate the global threat of antibiotic resistance. Phages are planned to be exported to 80 countries. With the support and financing of the European Union, Phage, an inno-

vative product, will become an alternative to antibiotics not only in Georgia but all over the world.

The primary objective of the pharmaceutical reform in the European Union is to lower drug prices, avoid shortages of specific medications, and encourage the development of new antibiotics. Also bringing more generic drugs to the market. The European Union and the United Nations summarized the results of the five-year program worth 5.1 million euros “EU Innovative Project for the Competitiveness of the Private Sector in Georgia”. This important initiative, which was implemented in 2019–2023, had a noticeable impact on the Georgian business space. With the help of the European Union, the United Nations Industrial Development Organization (UNIDO) planned an interactive event for the representatives of the Georgian pharmaceutical cluster. In the field of Good Manufacturing Practices (GMP), UNIDO conducted a series of quality improvement trainings for members of the Georgian pharmaceutical cluster. The pharmaceutical cluster of Georgia unites manufacturers of bacteriophages and herbal pharmaceuticals and supporting organizations. It aims to increase manufacturers' competitiveness and sales and improve their access to new markets by introducing internationally recognized quality standards (is indicated by Good Practice Guide on Validation, European Compliance, Academy 2012).

Conclusion

Thus, the European Union supports Georgia in developing its economic potential through international cooperation. This includes helping to comply with EU legal standards.

The European Union supports Georgia with specific investments for the development of various areas of medicine, including pharmacy, in order to promote the production and distribution of high-quality medicinal products, so that after the pandemic, the country can quickly improve the standard of living of its citizens, access to medical services and safe medicines.

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Section 6. Applied research. Management

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ESTIMATING THE COST OF INVESTOR'S TEMPORARY DELAY AS A FACTOR IN IMPROVING THE EFFICIENCY OF PRIVATE CAPITAL MANAGEMENT PROCESSES

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Abstract

The article examines the impact of investor procrastination on the financial result of private equity transactions. An analytical approach to estimating the economic cost of such delays is proposed. The behavioral, macroeconomic, and market factors that form the costs of procrastination are analyzed. These factors include opportunity costs, inflation, dividend payments, and market volatility. Based on the synthesis of behavioral finance methods and the theory of the time value of money, a conceptual model has been developed for calculating integral losses that occur when investment decisions are postponed. The practical significance of the work lies in the possibility of using the results obtained to optimize private capital management processes, minimize cognitive distortions, and increase the effectiveness of investment portfolio formation. The proposed recommendations may be useful to asset managers, financial advisors, and private investors in the process of developing decision-making rules, implementing systems for evaluating investment ideas, and automating wealth management.

Keywords: *private equity management, the cost of procrastination, behavioral finance, opportunity costs, investment decisions, asset management efficiency, time value of money, investor procrastination.*

Relevance of the study

The study is particularly relevant in the context of the growing role of behavioral factors in shaping investment results, which is observed against the background of high macroeconomic uncertainty and structural volatility of modern financial markets.

In the practice of private equity management, the problem of investor procrastination in decision-making (investment procrastination, analysis paralysis, or delays in approving transactions) has traditionally been viewed mainly from a psychological point of view, while its direct financial impact

has often remained underestimated. Meanwhile, a delay in capital allocation or portfolio rebalancing leads to measurable opportunity costs, including lost returns, loss of purchasing power due to inflation, and loss of compound interest effect.

In an era of rapid development of financial technologies and algorithmic trading, where the speed of operations is measured in milliseconds, the human factor of delay is becoming the main source of inefficiency. The assessment of this value makes it possible not only to discover hidden opportunities for wealth growth, but also to justify the introduction of special procedures, automated scoring systems and behavioral coaching into private capital management processes. This research is important for improving the competitiveness of financial institutions and protecting the interests of private investors.

The purpose of the study

The purpose of this study is to develop and empirically validate a methodological framework for quantifying the cost of time delay for investors, as well as to demonstrate that managing this factor is essential for improving the overall efficiency of private capital management.

In order to achieve this goal, we have identified and classified the components of economic losses caused by delayed investment decisions. We have also built an adaptive mathematical model to calculate the total cost of delay, considering macroeconomic variables and market volatility. Additionally, we have developed practical recommendations for minimizing time lags in the investment cycle of private clients by optimizing communication and technology processes in private banks and family offices.

Materials and research methods

The research materials and methods are based on an interdisciplinary approach that integrates the principles of behavioral finance and the theory of the time value of money. It also incorporates methods of modern portfolio analysis, supported by the works of both domestic and foreign scholars in behavioral economics and asset management.

To conduct the research, we used system analysis and synthesis techniques to identify

factors causing delays in investment processes. We also performed comparative and retrospective analyses of historical market data, including stock market indices, inflation, and key interest rates, for the period between 2016 and 2024.

The study was based on aggregated, anonymized data on decision-making timing and private investor portfolio profitability, obtained from publicly available management company reports. Additionally, the study used results from simulated investment strategy modeling with artificially introduced time delays. This methodological approach ensures the reliability of conclusions and allows for transforming the abstract concept of “procrastination” into a specific, manageable financial indicator that can be integrated into risk management systems.

The results of the study

Modern technologies are opening new horizons in identifying, evaluating, and minimizing financial losses associated with investor procrastination. They offer tools previously unavailable in traditional money management approaches.

The achievements of artificial intelligence and machine learning play a key role in this process. These technologies allow us to analyze the digital traces of customer behavior on money management platforms. Predictive analytics algorithms can identify patterns of fluctuations and procrastination by tracking various metrics, such as time spent on investment offer pages, the number of returns to portfolio drafts, or delays in confirming transactions.

Based on this data, systems create personalized behavioral risk profiles, automatically calculating potential financial loss of benefits for each client in near real-time (Table 1).

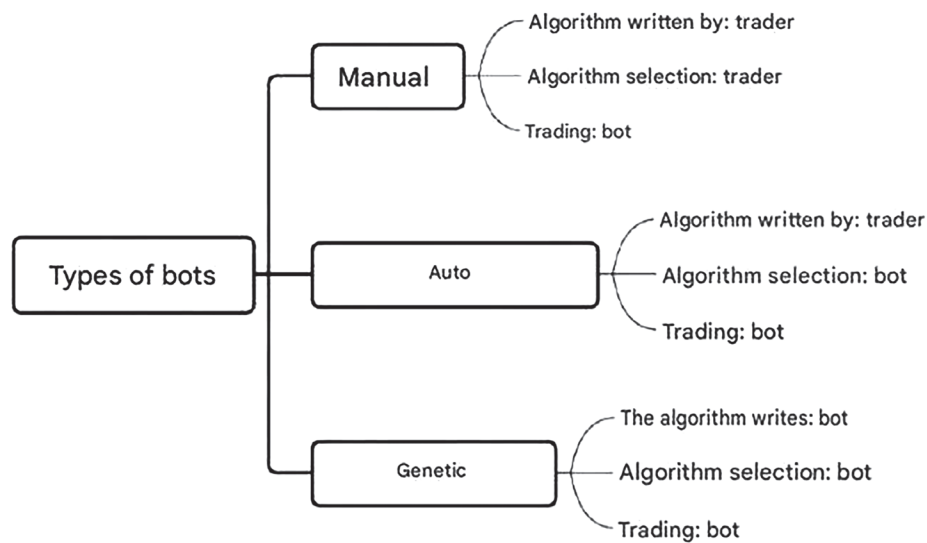
The integration of big data technologies makes it possible to instantly compare individual investor delays with the current market situation, asset volatility, and macroeconomic indicators. This allows you to translate the abstract concept of “delays” into precise monetary metrics that can be displayed in the interfaces of financial advisors and investors themselves (Saktaganova G.S., Esengeldinova R.J., 2018).

Table 1. *Artificial intelligence technologies in the financial sector*
(Berezin A.E., 2016; Gryglewicz S., Hartman-Glaser B., 2020)

AI Technology	Main applications	Usage examples	Advantages
Machine Learning	Credit scoring, risk assessment, market forecasting	Automatic assessment of borrowers' creditworthiness, algorithmic trading	Improving forecast accuracy, reducing credit losses, automating decision-making
Natural Language Processing (NLP)	News analysis, Chatbots, contract analysis	Virtual assistants in banking, automatic analysis of financial statements	Speeding up document processing, round-the-clock customer support, extracting insights from unstructured data
Neural Networks (Deep Learning)	Pattern recognition, fraud detection, forecasting	Detection of abnormal transactions, facial recognition for biometric authentication	High fraud detection accuracy, reduced false alarms, adaptability to new threats
Robotic Process Automation (RPA)	Automation of routine operations, document processing	Automatic data entry, reconciliation of accounts, processing of loan applications	Reducing operating costs by 40-60%, reducing human error, freeing up staff for complex tasks
Predictive analytics	Forecasting customer outflow, liquidity management	Predicting the need for capital, identifying clients prone to leaving	Proactive risk management, optimizing cash flows, increasing customer retention
Recommendation systems	Product personalization, cross-selling	Offering of investment products, selection of insurance policies	Increased sales conversion, increased customer satisfaction, increased LTV (Customer Lifetime Value)
Computer vision	Document recognition, identity verification	Automatic passport verification, scanning and receipt processing	Accelerating customer onboarding, reducing the risk of document fraud, and improving the user experience
Generative AI (GenAI)	Report generation, scenario simulation, coding	Automatic generation of financial reports, stress testing of portfolios	Reduction of time for preparing analytics, the ability to quickly simulate complex scenarios

One of the key technological directions contributing to the reduction of time costs is the automation of decision-making and implementation processes, which is achieved through the development of robo-advising and algorithmic trading systems. The introduction of automatic portfolio rebalancing

mechanisms, trigger orders, and smart contracts based on distributed ledgers avoids the human factor and administrative delays that previously occurred when agreeing on complex structural products in family offices or during cross-border asset transfers (Fig. 1).

Figure 1. *Robo-advising and algorithmic trading systems*

To enhance the effect, mobile application user interfaces use the principles of behavioral design and “nudging” technology (Yin Z., Caldas C., de Oliveira D., 2024). Real-time data visualization systems create interactive simulations that visually show the client how each day of decision delay affects their final capital, taking into account compound interest and inflation. Personalized notifications generated by neural networks help overcome “analysis paralysis.”

In modern examples of private equity management, where the cost of delay can be accurately measured and reduced thanks to special digital solutions, we see impressive results from the use of these technologies.

One striking example is the use by large private banks of “waiting value assessment” modules in the process of attracting clients and approving investment memoranda (Srihongrun A., Yusuf J. E.W., Kriz K. A., 2019). In one such case, when an Ultra-High-Net-Worth client hesitated in deciding whether to participate in a commercial real estate financing transaction, an artificial intelligence-based system automatically generated a report. This report clearly demonstrated that each week of delay, in the face of a rising key interest rate, costs the investor a certain amount of missed coupon income and a higher cost of leveraging. This visualization convinced the client to shorten the approval cycle from three weeks to three days (Maas C. et al., 2020).

Another example is the use of “smart cash management” features by algorithmic invest-

ment platforms. When an investor receives dividends or interest payments and decides not to reinvest them immediately, the platform automatically directs the funds into short-term investments or fractional shares, minimizing the delay and reducing the opportunity cost to zero. This helps compensate for the investor’s behavioral inefficiency and ensures that funds are invested in a timely manner.

Another example showing how effective digital portfolio tools are: a financial advisor uses a simulation model to run a Monte Carlo scenario in a dialogue with a client. They clearly demonstrate that even a small delay in making rebalancing decisions for 48 hours can reduce the final profitability of the strategy by 1.5%-2% per annum due to the effect of slippage and changes in market spreads. This is a convincing argument in favor of transferring routine operations to algorithmic control. Realizing how much one’s own procrastination costs can be an incentive to increase the overall effectiveness of wealth management (Mikhailov D. M., 2011).

Despite the obvious theoretical and practical importance of estimating the cost of temporary delays for investors, implementing this approach in modern private equity practice presents a complex set of serious methodological, behavioral, technological, and regulatory challenges.

One of the primary and most significant challenges is the methodological difficulty of isolating and accurately measuring the “cost

of delay” against the backdrop of stochastic market volatility. Unlike in high-frequency trading, where delays are measured in microseconds, wealth management decisions are made over a longer time horizon, making it extremely challenging to construct a reliable counterfactual scenario. It is difficult to conclusively determine what financial outcome would have resulted from immediate execution, as the market could have moved both in favor of and against the delayed position.

Choosing a benchmark for calculating opportunity costs, whether it’s a risk-free rate, a broad market index, or a separate asset class, always involves some degree of subjectivity. Due to the non-linearity of market processes, in some situations, procrastination can be not only ineffective but also a protective action. For example, it can help avoid a sudden market collapse. This makes linear mathematical models for estimating lost profits unsuitable for specific situations (Veko R. V., 2020).

The second, equally important group of problems is related to the behavior and psychology of investors. There is a contradiction between the objective financial assessment of the delay and the subjective perception of the investor. Cognitive biases such as loss aversion and status quo bias often lead clients to perceive the estimated “cost of procrastination” not as a useful analytical tool but as a source of psychological pressure or guilt. This can trigger a defensive reaction that undermines the trusting relationship between the client and the financial advisor.

In addition, “analysis paralysis” is often not rooted in laziness but rather in an objective lack of financial knowledge, complex family dynamics (in the case of family offices), or a lack of trust in the tools available. Simply presenting the client with a figure for lost income does not address the root cause of their indecision and can actually exacerbate stress.

Another critical barrier is technological and information constraints. To make an accurate assessment, highly detailed and timestamped information about the entire decision-making process is required, from the initial presentation of an investment idea to the final click on the transaction button.

In the private banking industry, this data is highly fragmented and spread across various systems, such as CRM platforms, trading

terminals, and corporate email and messaging services. This makes it difficult to create a comprehensive digital record of customer interactions. The situation is further complicated by the increasing global and local regulations on personal data protection, such as the General Data Protection Regulation (GDPR) and its national equivalents. These regulations impose strict limits on the collection, storage, and algorithmic analysis of behavioral and psychographic information, creating a challenge between the need for in-depth behavioral analytics and compliance with data protection requirements.

The fourth layer of problems is related to ethical risks and regulatory pressure. The introduction of the concept of “the cost of delay” carries with it a serious threat of abuse by financial institutions.

There is a risk that managers or robo-advisors will use artificially inflated or unrealistic calculations of lost profits as a way to put pressure on customers in order to speed up their decision-making. This can lead to deception and the imposition of unsuitable, risky, or high-commission products under the pretext of “the need to avoid losses.”

In the 2020s, financial regulators began actively monitoring practices that create a sense of urgency for customers. Financial institutions are required to provide irrefutable evidence that such a feeling truly meets the interests of customers and is not dictated by the bank’s liquidity needs or the need to fulfill sales plans.

In addition, organizational and implementation difficulties arise. Private banks and family offices face challenges in integrating complex behavioral and financial models into daily business processes. This is often met with resistance from line staff. Relationship managers, who usually build their relationships with clients on the basis of empathy and trust, may perceive algorithmic assessments of clients’ “indecision” as a threat to their professional autonomy. They may feel that such assessments penalize them for factors they cannot control, such as the client’s innate conservatism.

Overcoming these organizational challenges requires not just the acquisition of new software but a fundamental shift in the corporate culture of financial management.

The transition from aggressive sales tactics to transparent, data-driven, and ethical consultancy is necessary, where technology serves as an assistant rather than a controller in overcoming cognitive biases.

Conclusions

To summarize, it is important to emphasize that quantifying the cost of a temporary delay for an investor transforms this behavioral anomaly from a subjective psychological factor into a measurable financial cost. The integration of this approach into private capital management processes, based on the synthesis of behavioral finance and modern digital technologies, allows us to identify hidden reserves of profitability and minimize opportunity costs systematically. At the same time, successful practical application of these models requires overcoming methodological,

technological, and ethical barriers to ensure a strict balance between algorithmic efficiency, regulatory standards, and the psychological comfort of clients.

Thus, managing time delays and overcoming investment procrastination are becoming key strategic directions for the development of the wealth management industry. The transition from intuitive consulting to data-driven management, where the cost of waiting becomes a clear, digital, and controllable parameter, opens the door to a significant increase in the operational efficiency of working with private capital. Reducing the costs associated with procrastination contributes not only to optimizing the business processes of financial institutions but also to strengthening investor confidence. This, in turn, ensures a sustainable and maximum increase in their long-term well-being.

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