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CONTENTS

THE NEXUS BETWEEN INSTITUTIONAL QUALITY AND INCOME INEQUALITY: EVIDENCE FROM THE POST-SOVIET COUNTRIES

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ARTICLE INFO	ABSTRACT
	There is vast literature analyzing the association between institutional quality and income inequality with controversial findings. However, research for the case of post-Soviet countries is limited. From this perspective, this study aims to investigate the nexus between institutional quality and income inequality for a sample of 15 former USSR member countries. To achieve this goal, the study benefits the data obtained from the World Bank database including World Governance Indicators covering the period between 1991 and 2022. The study uses the Institutional Quality variable which is calculated as the arithmetic mean of its six components as a proxy for institutional quality. For describing income inequality, GINI coefficient which ranges between 0 and 1 is employed. For investigating the link between the above-mentioned variables given its particular benefit, particularly in cases with small sample sizes, the Autoregressive Distributive Lag Model (ARDL) is applied. Before the application of the model Im-Pesaran-Shin test is engaged for testing the stationarity of the variables. For testing the existence of long-run relationship Pedroni cointegration test is launched. According to the findings, there is a negative and statistically significant relationship between institutional quality and income inequality in the case of post-Soviet countries.

INTRODUCTION

Income inequality has been a subject of analysis by economists for over a century. Although numerous factors, such as migration, globalization, and low-skilled biased technological change, have been identified as reasons for income inequality (Josifidis et al., 2016), the crucial role of institutional quality has attracted the attention of researchers in recent few decades (Koeniger et al., 2007; Beramendi and Cusack, 2009; Baryshnikova et al., 2016; Asamoah, 2021).

Strengthening institutions, including property rights, social insurance, and conflict management, has been suggested as a means to mitigate rising economic inequality (Zehra et al., 2021). Sonin

(2003) and Hoff et al. (2004) argue that institutions play a crucial role in shaping inequality, given the reciprocal relationship between income inequality and institutional quality. As stated by Acemoglu et al. (2005), effective institutions provide equally good opportunities to the individuals in a society that leads to higher economic prosperity. Conversely, an insignificant link between institutional quality and income inequality is defined by some researchers (Sylwester, 2004).

In the case of post-Soviet countries, income inequality can be deemed a foreseeable economic problem since transition from the centrally planned to market-based economies brought significant structural changes, affecting income distribution. The Gini coefficient, which ranges from "0" (indicating perfect equality) to "100" (meaning perfect inequality), was relatively higher in the former Soviet republics. According to the latest report of the Credit Suisse Institute (2022) this index was almost more than 70 in all post-Soviet states except for Moldova and Belarus (Russia, 88.0; Ukraine, 83.4; Georgia, 81.7; Latvia, 80.5; Kazakhstan, 77.6; Kyrgyzstan, 75.2; Estonia, 73.1; Armenia, 73.1; Tajikistan, 72.8; Azerbaijan, 72.6; Lithuania, 72.0; Turkmenistan, 70.5; Moldova 69.1; Belarus, 67.2) in 2021. During the transition period, increasing inequality was an expected consequence of the collapse of the Soviet Union. In this period, the wage inequality was higher in the private sector rather than egalitarian public sector, and the expansion of the private sector increased this gap considerably. Additionally, income from property and self-employment was distributed unevenly throughout the transition period (Milanovic,1998). During the Soviet era, income inequality was as low as in OECD countries; however, the average Gini coefficient increased substantially in sample states within five years after the Soviet Union collapse. (Fidrmuc and Gundacker, 2017).

Last but not least, another crucial determinant contributing to income inequality in the post-Soviet countries is closely associated with institutional quality. According to Worldwide Governance Indicators (World Bank, 2022), the post-Soviet countries except Latvia, Lithuania, Estonia, and Georgia demonstrated negative scores in all six dimensions including government effectiveness, control of corruption, political stability and absence of violence/terrorism, voice and accountability, rule of law, and regulatory quality.

2. LITERATURE REVIEW

In recent decades, there has been a growing interest among researchers in the role of institutional quality as a crucial determinant of income inequality. Generally, an overwhelming consensus exists among researchers regarding the negative association between institutional quality and income inequality (Rodrik, 2000; Sachs, 2003; Levy and Temin, 2007; Milanovic, 2016; Robinson and Acemoglu, 2012; Gasimov et al., 2023b). Poor political institutions and high corruption create an attractive environment for elites to benefit from the financial development of a country more than others (Náplava, 2020; Mishchuk et al., 2018). Under poor institutional quality, the lack of judicial protection deepens social inequalities even more (Chong and Gradstein, 2007; Aliyev, 2023). Many studies (Acemoglu and Robinson, 2000; Kotschy and Sunde, 2017) have shown that high institutional quality can weaken income inequality in democratic countries as well.

Chong and Calderon (2000) identified a quadratic relationship between institutional quality and income inequality by examining 70 countries, noting that income inequality tends to increase when property rights are not well secured, or when corruption is high and rule enforcement is weak. According to the empirical analysis, there is a positive relationship between institutional

quality and income inequality in less developed countries; nevertheless, in high-income states the nexus is negative. In the same vein, Chong and Gradstein (2017) determined the significant role of political institutions in income inequality by using the "government matters" indicator. Moreover, by evaluating sixty-five developed and developing countries, Law and Soon (2020) postulated that higher institutional quality could mitigate the adverse impact of inflation on income inequality since governments with better institutions are more likely to implement effective economic measures.

According to Gupta et al. (2002), there is a positive association between corruption and income inequality. It was determined by the authors that an increase in the corruption index by one standard deviation could raise the Gini coefficient by eleven points. Similarly, Dwiputri et al. (2018) demonstrated a positive link between corruption and income inequality for the sample of Asian countries using the Ordinary Least Square, Tobit, and Two Stage Least Square methods. In contrast, Huynh (2021) identified a mixed influence of institutional quality on income inequality by analyzing 36 Asian countries from 2000 to 2018. The author believes that initially, institutional quality raises income inequality; nevertheless, when institutional quality reaches a particular threshold level, income inequality falls.

Furthermore, democracy and corruption are also two factors that link institutional quality with income inequality (Zhuang et al., 2010; Adnan and Amri, 2021). It is a widespread belief that income equality is prevalent in democratic countries rather than in undemocratic societies (Gradstein and Milanovic 2000; Lee, 2005). However, in some countries, such as South Korea and Singapore, the score of democracy is low whereas income distribution is relatively equal (Blancheton and Chhorn, 2021). Corruption is more likely to raise income inequality due to lower investment, less effective public expenditure and administration (Pedauga et al., 2017). On the one hand, corruption can reduce inequality when the benefits to society exceed the social cost (Blancheton and Chhorn, 2021). Andres and Ramlogan-Dobson (2011) argue that in less developed countries, corruption leads to lower income inequality due to the prevalence of the shadow economy. Analyzing the dataset of 21 African economies from 1993 to 1999, Gyimah-Brempong (2002) also identified the negative impact of high corruption on income inequality. Using a two-step difference generalized method of moments, Kunawotor et al. (2020) argue that corruption, voice and accountability, political stability, and government effectiveness have a negligible impact on the income inequality in Africa.

As stated by Ahmed et al. (2021), not only the level of corruption but also political stability and democratic accountability can significantly contribute to income inequality. Political systems are critical since in a parliamentary system, it is more likely to observe a reduction in income inequality compared to a presidential system (Zhuang et al., 2010). Employing the Maximum Likelihood method for a sample of forty-eight African states, Nkoa and Song (2021) point out the duration of the political regimes, as well as the ruling political party will likely exacerbate income inequalities. From the electoral perspective, Nyblade and Reed (2008) argue that politicians could buy votes by allocating public funds specifically to the poorer segment of the population, which likely reduces inequality. In his turn Solt (2008) argues that increasing economic inequality results in political inequality.

Overall, higher income inequality can be observed in the nations with the lowest degree of civil liberties (Bourguignon and Verdier, 2000). Taking into account all dimensions of institutional quality, including voice and accountability, government effectiveness, political stability and lack

of violence, regulatory quality, rule of law, and control of corruption, for former post-Soviet states, Gasimov et al. (2023a) postulated a U-shaped link between institutional quality and economic growth. In another study of post-Soviet countries from 2002 to 2017, Náplava (2020) revealed a nonmonotonic and negative relationship between institutional quality and income inequality, assessing institutional quality based on all six indicators. On the other hand, Sehrawat and Singh (2021) found a long-term co-integrating relationship between income inequality, economic growth, corruption, and energy efficiency in the case of BRICS (Brazil, Russia, India, China, and South Africa) countries from 1996 to 2015. Josifidis et al. (2018) investigated the possible impacts of institutional changes on income inequality in the CEE countries (Bulgaria, Czech Republic, Lithuania, Latvia, Estonia, Hungary, Poland, Slovenia, Slovakia, and Romania). According to the panel analysis, during the initial phase of transition, which resulted from endogenous institutional change, a deterioration of income inequality was observed. In the subsequent stage, exogenous institutional changes led to a stabilization in income inequality. Even income inequality and increasing corruption have a negative impact on sustainable development in the post-Soviet countries (Badur et al., 2023).

While there is a vast amount of literature on the link between institutional quality and income inequality, the number of studies investigating this association in the case of post-Soviet countries is limited. Therefore, this article aims to empirically analyze the impact of institutional quality on income inequality comprehensively in a sample of post-Soviet states.

3. DATA AND METHODOLOGY

For analyzing the nexus between institutional quality and income inequality for the sample of post-Soviet countries the unbalanced panel data covering the period between 1991 and 2022 is used. Following Lin & Fu (2016), Kouadio & Gakpa (2022), and Koh et. al (2022) GINI coefficient which is derived from the World Bank database (2022) is taken as a proxy for income inequality. In line with Josifidis et al. (2017), Asamoah (2021), Mun et al. (2022), and Naplava (2020) this study uses the institutional quality (INSQUAL) variable as the main regressor. Data on this variable is obtained from World Governance Indicators (Kaufmann and Kray, 2023) by calculating the arithmetic mean of the six dimensions - voice and accountability, political instability and violence, government effectiveness, regulatory quality, rule of law, and control of corruption Institutional quality ranges between (-2.5) – the lowest and (2.5) – the highest result.

Asamoah (2021), and Koh et al., (2022) defined trade openness as one of the factors alleviating income inequality. From this perspective, trade openness is also included in the regression. It is measured by the share of trade in GDP and obtained from the World Bank database (World Bank, 2022). Since there is a general view in the existing literature that countries with higher income levels will have better institutions, GDP per capita (constant 2015 USD) is also added into the regression following Chong and Calderon (2000), Asamoah (2021), Zehra et al., (2021), Koh et al., (2022). The data on this variable was also extracted from the World Bank database. Consistently with Acemoglu and Robinson (2000) and Naplava (2020), it is also comprised of government expenditure on education (EDUC) into the list of control variables.

Table 1 presents the descriptive summary of the variables.

Table 1. Descriptive statistics of the variables

	GINI	EDUC	GPC	INSQUAL	OPENNESS
Mean	38.16869	4.398932	7401.826	-0.257697	101.3493
Median	35.30000	4.394330	6165.958	-0.420000	96.40920
Maximum	88.43854	9.509760	20118.11	1.140000	170.7599
Minimum	24.40000	1.906100	1347.093	-1.060000	45.96691
Std. Dev.	15.69923	1.491661	4736.562	0.593639	33.40680
Skewness	2.442721	0.517542	0.712266	0.863086	0.060323
Kurtosis	7.888105	2.943551	2.555240	2.604049	1.874706
Jarque-Bera	328.3576	7.387782	15.31133	21.56309	8.805787
Probability	0.000000	0.024875	0.000473	0.000021	0.012242
Sum	6297.834	725.8238	1221301.	-42.52000	16722.63
Sum Sq. Dev.	40420.39	364.9088	3.68E+09	57.79472	183026.3

Source: Compiled by authors based on E-views estimations

For analyzing the association between institutional quality and income inequality in the case of post-Soviet countries Autoregressive Distributive Lag Model (ARDL) developed by Pesaran and Shin (1999), and Pesaran et al. (2001) is employed. This approach is especially advantageous in regressions with small sample sizes. Another superiority of the ARDL is that it allows estimating short and long-run coefficients simultaneously in a single model (Sulaiman et al., (2010); Gasimov et al., (2023). In addition, it can be applied regardless the variables are stationary at I(0), I(1), or both of them. From this point of view, before applying the ARDL model both dependent and independent variables should be checked for stationarity by launching Im-Pesaran-Shin test. If this condition is satisfied Pedroni cointegration test should be run for testing the long-run relationship. Evidence on the existence of cointegration relationship long-run coefficients can be estimated in the final stage (Hasanov et al., 2016).

After taking the above-mentioned facts into account the equation for the regression can be specified as follows:

$$\text{GINI} = B_0 + B_1 INSQUAL_{it} + B_2 EDUC_{it} + B_3 GPC_{it} + B_4 OPEN_{it} + e_t$$

Here GINI is used as a proxy for income inequality and INSQUAL for institutional quality. EDUC, GPC, and OPEN denote the control variables respectively such as government expenditure on education, GDP per capita, and trade openness. i subscript for countries and t for time period. e_t is the error term.

4. EMPIRICAL RESULTS

As indicated before, the first step in the estimation of ARDL model is to apply of the unit-root test. For this purpose, Im-Pesaran-Shin test is engaged. Null hypothesis indicates the existence of a unit-root problem. Table 2 presents the test results.

Table 2. Im-Pesaran-Shin test results

Variable	I(0)	I(1)
GINI	0.10586	-7.11422***
INSQUAL	0.39347	-4.97803***
EDUC	-1.65115**	-7.57903***
GPC	-4.69974	-6.75427***
OPEN	-4.0607***	-10.0417***

Note : ***, ** and * denote significance levels 0.01, 0.05 and 0.1 respectively

According to Table 2, the null hypothesis for all variables should be rejected at 1%. In other words, there is no unit root problem, and a cointegration test in the next step can be engaged.

For testing the existence of a long-run relationship among variables Pedroni cointegration test with the null hypothesis of no long-run relationship is applied. Test results are given in Table 3.

Table 3. Pedroni cointegration test results for testing long-run relationship

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.401045	0.6558	-1.031286	0.8488
Panel rho-Statistic	-5.814535	0.0000	-4.599655	0.0000
Panel PP-Statistic	-10.45220	0.0000	-9.830427	0.0000
Panel ADF-Statistic	-4.899461	0.0000	-5.022961	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	-2.636484	0.0042
Group PP-Statistic	-14.48576	0.0000
Group ADF-Statistic	-5.106798	0.0000

Source: Compiled by authors based on Eviews estimations

According to Pedroni cointegration test results, the null hypothesis can be rejected, revealing a long-run relationship among variables. Hence, ARDL model results can be analyzed.

As it mentioned before, the final stage of the ARDL approach is an estimation of the long-run coefficients. Table 4 reports detailed information about the results of the ARDL model.

Table 4. ARDL model results for long-run coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
INSQUAL	-16.51885	5.693240	-2.901485	0.0044
EDUC	0.925721	0.401671	2.304672	0.0230
GPC	0.000639	0.000232	2.756718	0.0068
OPENNESS	0.136772	0.033053	4.137938	0.0001

Source: Compiled by authors based on Eviews estimations

5. DISCUSSION OF THE RESULTS

ARDL model results reveal that there is a negative association between institutional quality and income inequality in the case of post-Soviet countries. It should be noted that the obtained coefficient is statistically significant at 1%. According to the results, improvement in institutional quality can reduce income inequality in the sample countries. In other words, there is significant evidence that institutional quality can be an important determinant of income inequality.

Statistically significant results are obtained also for the case of control variables. The sign for the coefficient of EDUC is positive and statistically significant at 5%. For the case of GPC and OPENNESS positive and strongly statistically significant coefficients are obtained. Differently, from OPENNESS, the coefficient of GPC is low and almost close to zero.

The study results are consistent with the number of previous studies. Acemoglu and Robinson (2002), Sachs, (2003), Levy and Temin, (2007), Naplava (2020), and Gasimov et al., (2023b) reveal that improvement in institutional quality and its dimensions can alleviate the negative impact of income inequality.

As aforementioned, the number of studies investigating the nexus between institutional quality and income inequality in the case of post-Soviet countries is limited. This association is limited to studies for post-Soviet countries as a whole and the sample of individual former USSR members. From this perspective, future research can focus also on the sample of 15 states more deeply. Furthermore, some authors such as Chong and Calderon (2000), Asamoah (2021) differently from others, found a non-linear relationship between institutional quality and income inequality. It can be also tested for the case of post-Soviet countries by applying different empirical approaches in the future.

6. CONCLUSION

The purpose of the study is to investigate the possible nexus between institutional quality and income inequality in the case of post-Soviet countries. For achieving this purpose Autoregressive Distributive Lag Model is employed. The existence of stationarity and long-run relationships are tested by using Im-Pesaran-Shin and Pedroni cointegration tests respectively.

Results reveal a negative and statistically significant impact of institutional quality which is measured based on World Bank Indicators on income inequality proxied with GINI coefficient in post-Soviet countries. In other words, any progress in institutional quality will reduce the income inequality in the sample countries. From this perspective, for reducing the negative effects of income inequality policymakers should improve the quality of the institutions, as well as focus on raising the main dimensions of institutional quality. For this purpose, central governments have to implement reforms in the institutional sphere and combat negative cases such as higher corruption rates, and low levels of democracy as main components of institutional quality.

This research fills a gap in the literature on institutional quality income inequality literature for the case of post-Soviet countries. Estimating the main determinants of income inequality in post-Soviet countries can be accepted as a significant contribution. It will also encourage future researchers to investigate the above-mentioned association from different perspectives by employing different approaches. However, the study contains several limitations. First of all, due to data availability, it was not possible to employ balanced panel data for our estimations. Additionally, some socio-economic, as well as political and geographical differences such as resource abundance, political regimes, and EU membership, etc. are not taken into consideration in the study which can be the subject of future research.

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THE PRACTICAL SITUATION OF EMPLOYESS IN THE LOGISTICS SECTOR: SOME EVIDENCE-BASED PERSPECTIVES FROM THE LITERATURE

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ARTICLE INFO	ABSTRACT
Article history *Received:2025-05-26* *Received in revised form:2025-05-26* *Accepted:2025-05-29* *Available online* *Keywords:* *logistics business, managers, employees* *JEL CODES: M0, M1*	*The Systematic Literature Review used in this study was chosen because it is an appropriate approach to link the research in the literature as far as it can be accessed and to extract and evaluate the evidence on the researched topic from the existing literature. In other words, this systematic or structured study offers the opportunity to evaluate the available evidence by combining it. It can also be said that this methodology allows social research to be unbiased and comprehensive in terms of the results it produces. In this study, it is aimed to evaluate the current situation of logistics employees according to the evidence obtained from the literature. Some perspectives have been formed according to the evidence obtained from the literature. Within the scope of the perspectives, some evaluations were made such as the concept of employess in the definition of logistics, the consequences of the scarcity and/or absence of employees in a problematic logistics sector, the responsibility of managers in the logistics sector, the logistics employees evaluation indicator system.*

1.INTRODUCTION

Logistics is like the blood systems of society. Over the past century, the transportation of people, goods and information has increased tremendously. The global economy functions through trade. There is a significant positive relationship between logistics and the economy, as the growth of one economy encourages another. Logistics has become an important sector in the global economy in its own right, sustaining employment opportunities and spatially extended economic networks, as well as allowing other sectors to function. On the other hand, it has made its importance felt not only in the economy but also in different fields as a sector. For instance, logistics has contributed significantly to the formation of the integration process of the world with the dynamism it creates (Banister et al., 2011: 248). In other words, it would not be an exaggerated assessment to see logistics among the dynamics that contribute to many fields, it should also be underlined that logistics is seen as the backbone of economic progress, as well as being likened to the blood system of society (Gudmundsson et al., 2016: 81-109). However, since logistics employess are known to be at the center of all these evaluations, the study is based on a qualitative methodology and is based on the evaluation of the practical situation of logistics employess under some perspective headings based on literature evidence. For this, a Systematic Literature Review was conducted due to the nature of qualitative research.

2.THEORETICAL FRAMEWORK

In order to assess the processes in the transportation sector, a number of theoretical concepts have been tried to be explained. For instance, the starting point for the Theory of Transport is the function of preparing services to meet consumer needs, the function of transport services to be productive for the elements of every division of labor and every market, and the integrative functions in state and society relations (Voigt and Witte, 1982: 13). However, without moving away from the theory and definition of logistics, it is necessary to refer to the concept of transportation. Transportation is considered as the movement of all kinds of objects from one place to another. Everything that fits this definition falls within this scope in its most general form. When we add to this assessment an understanding that underlies all logistics movements for a purpose, in other words, the perfection of the movements with a focus on the employess , we will be able to reach the assessment that transportation is not just a mechanical movement by spending time and effort. According to this assessment, a logistics that realizes the movement of objects with the least power and in the shortest time will be the most perfect. So speed is a fundamental test, economy of power is cheapness when evaluated in the light of real conditions (Cooley, 1894: 13), and excellence will be achieved when the focus of the realization of excellence is on the employess . Without structural criticism, excellence cannot be realized. Due to this assessment, in this section, which is called the theoretical framework, it is necessary to include the constructive criticism dimension of company practices in logistics within the theoretical boundaries. Within the scope of the efforts to realize excellence, it should be noted that the practices listed in the following section affect and concern all employees of a logistics company, including drivers. For example, business can adopt the Tom Peters Approach, each of which provides a new perspective; the Tom Peters Approach, which puts the customer back in focus and foresees development in chaos and the disintegration of traditional management structures, variance analysis and total quality management, which advocates the necessary involvement of the production team to eliminate root causes, The world has witnessed a number of new business solutions, such as the production control perspective, which aims to solve the problems of chaos and variability in supply chains through better forecasting and material requirements planning and control systems; the procurement emphasis, which includes the need to transform relationships with suppliers into partnerships; and business process re-engineering, which emphasizes the importance of process and offers ways to automate processes to reduce costs. However, it may be fair to assess that they all tend to produce partial solutions that narrowly focus on certain aspects of a company's complex process. There have therefore been popular criticisms of such approaches. Total quality management, for example, has been the focus of criticism for failing to accumulate savings gains and for failing to build buyer-supplier partnerships. Supply chain management has faced criticism for failing to respond to rapidly changing demand and failing to improve process utilization. Business process re-engineering has also suffered from its use as a method of employess reduction (Jones et al., 1997: 153). Although the criticisms are justified, it is safe to say that the logistics sector follows developments due to its special structure. For instance, logistics outsourcing, also called third-party logistics, is among them (Marasco, 2008: 127). On the other hand, in our opinion, the special nature of logistics as an integrative function in state and society relations mentioned above has crystallized a broader-based human logistics involving various parties including political power, military, civil society and commercial structures (Schiffling and Piecyk, 2014: 198).

3.METHODOLOGY

The *Systematic Literature Review* used in this study was chosen because it is an appropriate approach for linking studies in the literature as far as it is available and for extracting and evaluating evidence on the topic under study from the existing literature. In other words, this systematic or structured study offers the opportunity to evaluate the available evidence by combining it. Another factor in the choice of this methodology in social research is that its use allows it to be unbiased and comprehensive in terms of the results it produces (Schiffling and Piecyk, 2014: 201). In this study, it is aimed to evaluate the current situation of logistics employess according to the evidence obtained from the literature.

4.FINDINGS

According to the evidence obtained from the literature, some perspectives have been formed. Within the scope of the perspectives, some evaluations were made such as the concept of employee in the definition of logistics, the consequences of the scarcity and/or absence of employees in the logistics sector as a problematic, the responsibility of managers in the logistics sector, the logistics employee evaluation indicator system.

-First Perspective: Employee Concept in the Definition of Logistics

The literature states that supply chain management and logistics are used interchangeably and that the difference between the two concepts is only semantic. The Council of Supply Chain Management Professionals (CSCMP), formerly known as the Council for Logistics Management, defines both logistics (management) and supply chain management as follows (Overstreet et al., 2011: 115-116). Logistics (management): *The part of supply chain management that plans, implements and controls the effective, efficient and productive forward and backward flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' needs*. Supply chain management is also: *It covers the planning and management of all activities involved in sourcing and procurement, transformation and all logistics management activities*. This includes coordination and collaboration with partners, which can be suppliers, intermediaries, third-party service providers and customers. In another definition, logistics is described as *a strategic process that enables the supply, movement and storage of materials, parts and other related materials, and the cost-effective management of orders through marketing channels within the scope of organization and information flow in a way that maximizes current and future profitability* (Christopher, 2011: 2). In another definition that emphasizes that logistics is a dominant part of supply chain management, logistics is described as the storage of goods, services and related information from the point of origin to the point of consumption in order to meet the needs of customers who plan, implement and control efficient, flow efficiency and control (Wang et al., 2021: 2).

The definitions described above make it valid to consider logistics business, which are independent from the production areas, as specialized in carrying out various economic activities related to the circulation of materials and goods. On the other hand, in a market economy, the main function and task of logistics business is oriented towards the production of services through planned purchase, sale and transportation, according to the total supply and total need of the market, to complete the realization of production units and use values, and to guarantee social production and reproduction between production units and consumers (Yue, 2008: 2608). These activities require employess with marketing skills, relevant experience in customer management and a general understanding of many aspects of logistics operations. The

most frequently cited skills for logistics in the literature include professional technique, interpersonal communication, information and communication technology, management, command of at least one language, and recognition of the culture and values of business from both Eastern and Western societies (Shi and Handfield, 2012: 165). Such assessments imply that logistics is a strategic process and that the easy transportation of materials and goods within and between societies, which is within the scope of the definition, enables the formation of many connections around the world. On the other hand, the process of connectivity has been further strengthened by the global emergence of information and communication technology. However, such considerations should not be taken to mean that it is an easy question to ask and/or answer who or what is responsible for the complexity and negative externalities arising from the integration of regional and national economies (Gudmundsson et al., 2016: 81-109). On the other hand, due to the special nature of logistics, reducing overall transportation costs, updating route planning, and reporting management information are among the questions that need to be constantly updated (Corporate Finance Associates, 2017: 1; Prato, 2009: 65). However, the assessments and definitional descriptions made so far are not only general but also flexible enough to be applied to different contexts. For instance, it can also be said to be flexible enough to emphasize that there is no reference to the employee context (Cascetta, 2001: 1). For instance, the literature identifies the labor element as critical for achieving the logistics objectives of business and entire supply chains. Studies have supported the position of the employess by examining the nature of important variables and testing propositions regarding logistics employess issues. Logistics faces major challenges in recruiting, developing, supervising and retaining the employess. Business will need to make more intensive use of the labor element. Many business have invested heavily in technological and infrastructure improvements and investments. The next improvements and investments should focus on the employess who manage and operate the supply chain (Keller and Ozment, 2009: 379). In the long run, for instance, the key to competition between business is to create and improve their own structures. In order to maintain healthy development, it is vital for logistics business to employ scientific staff. Because employees, who have a decisive role in the development of business, are the masters of company resources and shapers of profits (Yue, 2008: 2608). In this section, only the necessity of including the concept of employee in the definition of logistics has been discussed, and in order to emphasize the importance of employees, the necessity of including the concept of employee in the definition of logistics, it would be appropriate to leave the subject to experts.

-Second Perspective: Scarcity and/or Absence of Employess in the Logistics Sector as a Problematic

The problem is not limited to the inclusion and/or employment of the concept of employee in the definition. Although it is necessary to discuss, it is emphasized in the literature that employess lack the necessary skills to fulfill their logistics tasks. The lack of preparedness for the coronavirus environment can be cited as a reason to discuss the coordination problem. Nevertheless, it would also be appropriate to attribute the emphasis to various reasons. For the emphasis here, the qualifications of the employess who will be demanded in the logistics sector will be related to the training they have received or will receive due to the nature of logistics, the way they are managed and motivated, as increasing mechanization and automation increase the boring, repetitive and unattractive status of some jobs for many people (McKinnon et al., 2017).

Nevertheless, due to its special nature, logistics is not only a dynamic that must respond to the problems faced by the economy and business, but also a sector that has the ability to respond to

the problems of almost all strategic areas of a society. Therefore, the lack or absence of labor should be considered as the basis for responses to a problematic as a whole (a collection of problems). It would be appropriate to show the reasons for this basis, the coronavirus infection, the effects of which have been felt all over the world in recent history. The logistics sector has been forced to coordinate with the conditions created by the coronavirus infection. One of the most important issues here has been the driver-based labor shortage. On the other hand, it is also necessary to draw attention to some reasons, such as low management attention to the coordination of new technologies that limit or completely affect the capabilities of employess in the logistics sector from practice, lack of continuous training, ineffective work of human resources departments due to lack of motivation or applicable necessary skills and indicators, insufficient supply of a labor force on the general labor market with the necessary qualifications (Vinogradov and Vorona, 2024). On the other hand, it should be added that stress and tensions arising from lack of financial support, poor working conditions, physiological and psychological work demands have a negative impact on the health and working ability of drivers (Staats et al., 2017: 383). In the face of these considerations, it should be noted that the supply of labor in the sector does not allow for encouraging forecasts regarding the proportional growth of the logistics sector (Vinogradov and Vorona, 2024). This is because, according to the literature, the demand for logistics employess in the world is growing at a rate of 10-12% per year. This situation shows the world's labor shortage. It would not be an exaggerated assessment to predict that the problematic will continue in the coming years (Kilibarda et al., 2019: 271).

While opportunities in the logistics sector are being created, some problems are also being created at the same time. One of them is the problem of finding sufficient number of employess , which is still waiting for a solution. Studies in the literature have tried to identify the root causes of the problem and have also suggested strategies on how to solve it (Lonk and Lia, 2024: 11). Although the problematic of the scarcity and/or absence of employess in the logistics sector as a problematic in the literature has been recognized with the coronavirus infection, it has been the subject of studies for a long time and it is observed that evaluations have been made on the subject by referring to developed societies. For example, in the US, the issue of driver recruitment has been addressed, examining different driver recruitment strategies and assessing that closer ties with high schools and vocational programs, which are internal career ladders for future drivers, could help ameliorate the driver shortage problem. In Ireland, Transport, Transportation, Distribution and Logistics also commented on the same issue (Ji-Hyland and Allen, 2022: 232).

It is known that the training element, which is considered as a response to the shortage and/or absence of labor force in global logistics business, will make significant contributions to the reduction of traffic accidents in the countries specific to drivers. For instance, in the case of Turkey, a total of 1 million 444 thousand 27 traffic accidents occurred on the highway network in 2024. Of these accidents, 1 million 177 thousand 172 were traffic accidents with material damage and 266 thousand 855 were traffic accidents with fatal injuries. In 2024, 85.5% of traffic accidents involving death or injury occurred within the settlement and 14.5% occurred outside the settlement. 48.4% of the people killed in traffic accidents in 2024 were drivers, 30.6% were passengers and 21.0% were pedestrians, while 52.7% of the injured people were drivers, 36.3% were passengers and 11.0% were pedestrians. Looking at the total 318 thousand 926 defects causing traffic accidents involving death or injury in Turkey in 2024, 90.1% of the defects were caused by drivers, 8.2% by pedestrians, 0.8% by vehicles, 0.5% by passengers and 0.3% by roads.

On the other hand, when the defects are analyzed by sub-headings, the defect of "not keeping the vehicle speed in line with the conditions required by the road, weather and traffic" accounted for 105,802 of the total 318,926 defects. "Failure to comply with the priority of passing at intersections" was the second most common defect with 46,458, while "Failure to comply with the general conditions regulating maneuvers" was the third most common defect in 2024 with 26,487 defects (Turkish Statistical Institute, 2025). Elimination of such problematics, training will not only contribute to the employment of logistics business, but will also contribute to the reduction of human loss to zero as a perspective assessment in reducing the loss of goods.

-Third Perspective: Managers' Responsibility in Logistics Enterprises

Even though the logistics sector has seen a decline in jobs due to automation and digitalization compared to other sectors, the vast majority of its work is still performed by employees. In fact, logistics activities are labor intensive at both operational and managerial levels (Hofbauer and Putz, 2019: 332). In other words, the logistics sector remains a labor-intensive business. The logistics performance of business, industries and nations is strongly influenced by the quantity and quality of labor. Inability to find employess with adequate qualifications and the right competencies can negatively affect both the efficiency and quality of logistics. This negativity extends across a wide range of occupational level, industry sector and geography. For instance, while the problematic highlighted above emerges at the operational level as a lack of drivers, at the strategic level, senior managers who can manage global supply chains emerge (McKinnon et al., 2017). However, it is pertinent to consider the responsibilities and tasks of managers from a broader perspective. For instance, the development trends discussed in the theoretical framework section above have an impact on the organization and strategic importance of logistics. For example, it can be assessed that in the future, whereas the tasks of the logistics manager were previously focused on internal coordination and management, in the future they will increasingly focus on relationship management through employees in connection with collaborators, regardless of whether they are suppliers or customers. Important tasks will be to negotiate partnership agreements, maintain and develop collaborative relationships with external partners, and develop intercompany information systems, with a focus on the employee. On the other hand, the role of the logistics manager will change from that of a fire extinguisher solving daily logistics problems to that of a project manager for cross-working teams of employees. However, it should be emphasized once again that it will be the employees, not the systems and processes, that will provide solutions to logistics tasks and give the company the necessary competitiveness (Skjoett-Larsen, 2000: 386). On the other hand, in our opinion, it is the drivers that managers should prioritize within the scope of employees.

Driver shortage in the logistics sector can be seen from different perspectives; driver shortage can be considered as an antecedent factor, a consequence effect and/or a phenomenon. There are many identified causes of driver shortage. These include, for example, aging drivers, expensive license fees and perceived poor working conditions. General working conditions can also include wage rates and working hours (Wang et al., 2022: 2). However, it is observed that studies on the subject have been conducted in the literature on the search for solutions that are not indifferent to these problematics. Some examples of studies are given in the following table to support this assessment.

Table 1-Logistics Literature Examples

Sample Author(s)	Sample Topics	Place of Publication
Baccichetto et al., 2024	Balancing act: Fostering employee well-being during labour shortages in e-commerce logistics	In *E3S Web of Conferences*, EDP Sciences, 585, 06008
Adhikari et al., 2024	Procurement process and shortages of essential medicines in public health facilities: A qualitative study from Nepal	*PLOS Global Public Health* , 4(5), e0003128.
Meershoek et al., 2023	Ensuring military-logistic capabilities through discriminatory public procurement? Legal routes to overcome a personnel shortage	*Public Procurement Law Review*, 32(3), 141-156.
Dabral & Purohit, 2023	Addressing human resource challenges in the logistics and supply chain management industry: Impediments on the path to achieving sustainability	*DME Journal of Management*, 4(02), 1-9.
Aserkar & Govar, 2023	Labour shortage during COVID-19 pandemic in the logistic sector of Singapore	*International Journal of Logistics Economics and Globalization*, 10(4), 368-385.
Andrejić et al., 2022	Job satisfaction and labor fluctuation: A case study in the logistics sector in Serbia	*Logistics*, 6(3), 50.
Lin & Chang, 2018	Evaluating skill requirement for logistics operation practitioners: based on the perceptions of logistics service providers and academics in Taiwan	*The Asian Journal of Shipping and Logistics*, 34(4), 328-336.
McKinnon et al., 2017	Assessing and improving countries' logistics skills and training.	*In Digitalization in Maritime and Sustainable Logistics: City Logistics, Port Logistics and Sustainable Supply Chain Management in the Digital Age. Proceedings of the Hamburg International Conference of Logistics (HICL), Berlin: epubli GmbH, 24, 97-117.*
Ding et al., 2015	Effects of human resource management practices on logistics and supply chain competencies-evidence from China logistics service market.	*International Journal of Production Research, 53*(10), 2885-2903.
Savage et al., 2015	Understanding the effect of skilled labour resource shortages on supply chain sustainability: A review of the logistics skills gap in Southern Africa	*The 20th LRN Annual Conference and PhD Workshop*, 9th to 11th September, University of Derby, UK.
Jhawar et al., 2014	Analysis of the skilled work force effect on the logistics performance index-Case study from India	*Logistics Research, 7*, 1-10.
Kovács & Spens, 2011	Trends and developments in humanitarian logistics-A gap analysis	*International journal of physical distribution & logistics management, 41*(1), 32-45.
Kam & Tsahuridu, 2010	Does human resource management contribute to the development of logistics and supply chain capabilities? An empirical study of logistics service providers in China	*Research & Practice in Human Resource Management, 18(2), 15-34.*
Dubey & Singh, 2009	Study on logistics skill gap in supply chain sector in India-Empirical findings	*AIMS International Journal of Management, 3*(3), 191-205.
Murphy & Poist, 1991	Skill requirements of senior-level logisticians: Practitioner perspectives	*International Journal of Physical Distribution & Logistics Management, 21*(3), 3-14.

Although there are studies on the employess from the literature, it is still necessary for managers to overcome skill deficiencies after the employment of all employees, including drivers, in the company. Otherwise, the expected benefit of employment will not be achieved. Talent shortage is not only the perspective of this study. It is an intensely discussed issue in the logistics sector. A shortage and/or absence of skilled employess, in a sense a labor shortage, occurs when the demand for a type of employess with certain characteristics decreases. There are various potential reasons for skills shortages. For instance, changing required competencies (e.g. digital transformation), increasing demand (e.g. booming e-commerce), low attractiveness of the industry, low wages, poor working conditions) and inadequate training (e.g. inappropriate curricula, inappropriate teaching methods). The education system potentially plays a central role in reducing and/or enhancing skills. There can be two main levers to overcome skills shortages in the education system. First, the demand for skills in the occupational field should be analyzed and students or active employess should be trained accordingly. The second one can be said to be the correct and up-to-date training in the education system (Schodl and Eitler, 2020: 3). Beyond these general reasons, it is also necessary to refer to personal reasons. It can be seen as the ultimate motivation for choosing and staying in a demanding profession such as driving. Here, using the review of the existing literature, it is necessary to indicate possible sources of satisfaction and frustration. Sources of satisfaction include self-sufficiency, the ability to travel, income and most importantly the pleasure of driving, while sources of frustration may include problems related to being away from home, lack of appropriate training, etc. (Dubey and Gunasekaran, 2015: 218).

-Fourth Perspective: Employee Evaluation Indicator System

According to the basic needs of employee quality, which is based on employee evaluation methods and the principle of the combination of talent and morality, a basic indicator system can be created for logistics business, covering *moral quality*, *work ability*, *work success*, *psychological and physical quality*, *knowledge and technological level*. On the other hand, if some concrete indicators are added to the basic indicators listed below, a two-tier indicator system can be formed. However, the indicators listed in the following section should be integrated. In other words, one indicator is not isolated from the others, but is interconnected with other indicators. Therefore, the meaning of the indicators will be to create an equilibrium point of the maximum value of the efficiency that logistics business will create (Yue, 2008: 2609).

a-Moral quality is a personality trait that should be present in the employee and consists of evaluation indicators such as commitment, realism, perseverance and team spirit.

b-The ability to work is the combination of the employee's methods of coping with problems and their effects. It also represents the individual potential of the employee. It is also divided into four assessment indicators such as coordination, communication, emergency solving and renewal, comprehension and learning abilities.

c-Testing of work results covering four indicators, work achievement, work efficiency, production efficiency, quality of work completion and degree of satisfaction of customers. This indicator can be used as the most direct response to assess the competence of the employee. The concretization of the indicators found here can be considered as the main key to managing capabilities.

d-Psychological and physical quality are internal factors that affect the work of the employee and are divided into two parts: psychological quality and physical quality.

e-Information and technological level is the test measure of the resource structure of employee management and consists of four indices: professional title, knowledge structure and foreign language skills.

Since the continuous iteration of the indicator system will be directly proportional to the development of employee competencies, some competencies of logistics sector employees are clustered in the following table and explanations of the aly competencies are given.

Table 2-Competencies of Logistics Sector Employees

Competence Clusters	Sub Competencies	Explanations
Principles	-Planning and management skills -Ability to develop and evaluate policy -Ability to develop logistics and hinterland -Cargo handling, transfer, tracking procedures system capability	-Ability to manage planning and development for future facilities and logistics -Domestic and international logistics policy understanding and the ability to create and evaluate new policies Ability to develop logistics and its hinterland and optimize the added value of the logistics-related sector -Systematization, transfer and storage of logistics cargo through logistics management and the ability to improve procedures
System Management	-Customs clearance system capability	-Ability to systematize relevant procedures to speed up customs clearance
Service	-Quality management capability -Ability to create a service model -Ability to manage the services to be provided to the cargo owner -Ability to improve service quality -Distribution optimization and marketing capability	-Ability to manage the logistics connectivity transit system on a continuous basis -Ability to create business models such as new logistics facilities, technology, manpower, information and finance, and provide total services Ability to provide effective service follow-up and manage the business for the load owner˙ -Ability to understand and improve continuous logistics service quality -Ability to optimize distribution structure through logistics market trends
Logistics Development and Promotion	-The ability to promote cargoling -Logistics development capability -Ability to understand and use logistics and information technologies	-Ability to bring in cargo from shipping business and strengthen logistics consulting and implement marketing functions -Ability to generate new port and logistics materials and goods through surveying future demands and business opportunities for logistics products -Ability to understand and effectively use logistics information technologies
Information	-Information technology network and operating capability -Analysis capability for global logistics	-Ability to establish and operate information technology networks for total quality management based on logistics information -Ability to make decisions by analyzing global economies and societies for global logistics
Globalization	-Ability to predict and use information	-Ability to anticipate changing trends in the logistics industry and utilize information to improve logistics

Source: Ahn and McLean, 2008: 546.

5.CONCLUSION

Beyond the traditional root causes of logistics labor shortages and/or shortages, the conditions surrounding the mobility of drivers in particular need to be examined. The literature generally points to two different ways to close this gap. The first is a reactive approach where business' efforts are directed towards driver retention. The second approach is to improve working conditions to retain existing drivers and take initiatives to attract new drivers (Chandiran et al., 2023: 117). The overall strength of logistics business directly depends on the effectiveness and efficiency of their employess. Given this fact, both the recruitment and retention of employees is of interest as emphasized in the studies. However, it has been underlined that in the face of labor shortage and employee turnover, retaining employees attracts more attention (Sersland and Nataraajan, 2015: 648). While all these assessments have emphasized the need to improve economic and non-economic factors, it is still unclear whether addressing them in isolation can fill the driver shortage gap (Chandiran et al., 2023: 117). Therefore, there is a need to identify and address the issues that have become problematic in the logistics industry with a focus on employess. However, short-term solutions should be against the disease, not against the symptoms (Vinogradov and Vorona, 2024). Therefore, the long-term solution needs to emphasize student-centeredness. For instance, the lack of specialized schools and the need to provide academic education to train professional employess has been recognized in developing societies (Kilibarda et al., 2019: 271). In other words, it can be said that the problem of labor shortages and shortages should be reduced to university education and basic education with a vision-based approach. On the other hand, it is also necessary to refer to the importance of private education providers contributing to the solution with employee training programs. Student-based education, which is the main focus of employment, provides a natural point in the discussion of employee training. As a first step in developing students' knowledge of the fundamentals of logistics management, it would be appropriate to encourage the use of qualitative and quantitative methods of business case analysis. This will help students to improve their decision-making and problem-solving abilities and in turn gain a clearer understanding of how logistics affects organizational strategy as a whole (Keller and Ozment, 2009: 381-382).

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DIGITAL TECHNOLOGIES AND STRATEGIC MANAGEMENT: EXPLORING THE ORGANIZATIONAL IMPACT OF AI, DATA ANALYTICS, AND INNOVATION

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ARTICLE INFO	ABSTRACT
	This research looks into the effect of digital technologies like Artificial Intelligence (AI), Data Analytics, Blockchain, and Virtual Reality on the strategic management of corporates. With technological advances at a breakneck speed, business processes, competitor interactions, and even consumers are now more digitally engaged than ever before. This thesis analyzes how businesses use these technologies through the lens of operational efficiency, bespoke strategy crafting, and active adaptation to changing social sentiments using a qualitative research design based on secondary information. The results suggest that businesses which apply digital innovations to their strategic models stand a better chance for success in a market that is being digitized rapidly.

1. INTRODUCTION

Embracing new technologies poses both risk and opportunity for every organization in today's AI-powered business landscape. Changes in the market brought on by the pandemic have forced companies to fully embrace digital technologies across their operations. For instance, a McKinsey (2021) study revealed that global firms accelerated digital transformation by 3 to 4 years, with 58% of customer interactions shifting to digital platforms during the pandemic. Companies like Unilever and Amazon reported over 30% increased efficiency in customer service operations by integrating AI-powered virtual assistants and automation tools [18]. Not only does this reliance on new technologies dictate the new normal in today's business, but the incorporation of tools such as Artificial Intelligence (AI), Data Science, Blockchain, and Virtual Reality (VR) helps meet customer satisfaction quicker.

The general shift towards the use of e-commerce technologies greatly shifts the focus on business methodologies forcing firms to rethink their blueprints on how to compete better in the marketplace. On the other hand, in the area of organizational performance management, modern digital technologies enable the real-time collection of relevant, accurate, and up-to-date data regarding task completion, resource utilization, and workflow efficiency. This data plays a

critical role in supporting timely and informed decision-making processes across various departments.

Shifting to more complex automated systems such as e-markets creates an opportunity for further automation of tasks enabling more accurate and efficient time management through advanced algorithm-based tools such as job request schedules. It is widely acknowledged that emerging technologies such as big data and artificial intelligence represent the future of business operations, as they enhance the ability of organizations to automate processes and adapt those automated systems in response to changing conditions.

My research objective is to determine the influence of emerging digital technologies on organizational strategic management through the lens of AI and data-based insights to abstract management processes, stakeholder relations, and capture new opportunities to drive sustainable organizational change. Building on previous studies (e.g., Kingsnorth, 2019; Charlesworth, 2018) that explored the role of digital technologies in marketing and business strategy, this study further examines how companies across various sectors - especially those operating in digitally advanced environments - are reshaping their strategic models to effectively utilize tools such as AI, data analytics, and blockchain.[20] Despite extensive literature on digital marketing practices, there remains a research gap concerning how these technologies contribute to broader strategic management objectives beyond marketing, particularly in the context of emerging economies. This study aims to address this gap by synthesizing cross-sector insights and identifying patterns in strategic adaptation driven by digital transformation [19].

2. LITERATURE REVIEW

Rapid technological development, frequent changes in consumer behavior, and greater use of data-driven decisions have all contributed to changing the landscape of digital marketing. The use of artificial intelligence, data analysis, blockchain, and VR has already been looked at by many scholars and industry professionals. In this literature review, I summarize what previous works have formulated and outline important, newly emerging phenomena that affect the way marketing is and will be conducted.

Digital Marketing and Its Evolution

Initially, digital marketing was confined to online advertisement in various forms. The traditional procedure has since advanced into a data capturing and engaging exercise where business interactions are heavily personalized. Digital marketing is always going to use new technology and consumer tastes as a guiding principle to evolve, as noted by Kingsnorth (2019).[2]

The other thing to note is that analytics have become the core component of digital marketing. According to Ryan (2016), businesses are able to shift the way they execute their marketing campaigns fully to real time, meaning every engagement can be adjusted, shifted, or even manipulated until a desired performance is received. The transition from traditional to digital marketing has been largely driven by the widespread availability of the internet, the proliferation of mobile devices, and the integration of artificial intelligence into marketing strategies.[3]

Comparison of Traditional vs. Digital Marketing Table 1

Feature	Traditional Marketing	Digital Marketing
Cost	High	Lower and scalable
Audience Targeting	Broad and general	Specific and segmented
Performance Tracking	Difficult	Real-time analytics available
Customer Interaction	One-way communication	Two-way engagement
Adaptabiliy	Slow changes	Fast and flexible optimization

Artificial Intelligence in Marketing

 One of the key protagonists on digital marketing is Artificial Intelligence (AI). Nowadays, the advancement of AI technologies has empowered businesses to automate and improve numerous marketing activities with the use of, for instance, machine learning, chatbots, or predictive analytics. Järvinen & Karjaluoto (2015) discuss the possibilities of AI in data analytics for marketing purposes and emphasize how this technology helps create tailored marketing strategies through actionable insights.[5] AI chatbots are transforming the customer service industry by enabling instant, accurate, and personalized interactions with customers. Their effectiveness in improving response time and customer satisfaction has been validated by numerous recent studies, making them a key component of digital service strategies. These intelligent systems assist customers by analyzing the query put forth, solving it, and even suggesting products that the user may be interested in. The same way Netflix and Amazon use AI aided recommendation systems, other sites and apps also personalize content for users, making the experience more enjoyable.

The Role of Data Analytics in Digital Marketing

The importance of data in digital marketing campaigns has grown due to its effectiveness at tracking customer interests, measuring campaign popularity, and modifying marketing effort for greatest results. Charlesworth (2018) points out the growing importance of big data in marketing claiming that businesses which make use of complex data analytics outperform their competitors because crucial decisions are made.[4]

AI enabled businesses predictive analysis is changing marketing strategy, allowing businesses to alter their approach depending on the current consumer trends. According to Kingsnorth (2019), data helps brands segment their customers and tailor messages to specific groups, which is always going to be more effective.[2] Marketers are now able to improve their strategies due to advanced analytics tools granting real-time feedback which will subsequently help with the conversions.
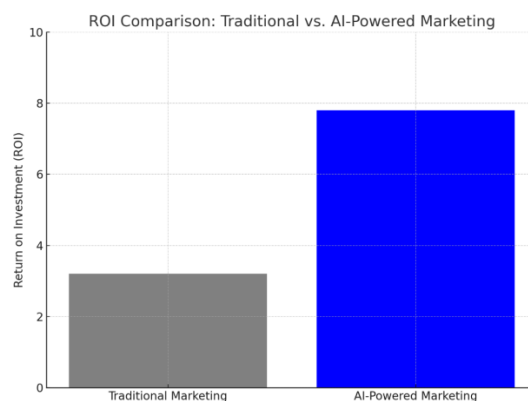

Fig. 1 ROI Comparison: Traditional vs. AI-Powered Marketing

Blockchain Technology and Marketing Transparency

Blockchain technology is increasing the efficiency of digital marketing and changing it for the better. Ivanov (2021) points out that blockchain has the ability to reduce the number of fraudulent online advertising and increase the security of data. Fraud can be minimized in blockchain-based advertising networks as ad impressions and audience interactions are recorded and these advertisers guarantee accurate tracking of campaign performance.[10] This method brings in the accuracy of fraud management and increases the trust of consumers and stakeholders which is much needed.

Virtual and Augmented Reality in Marketing

Virtual and Augmented Reality (VR/AR) is being adopted widely with the aim of improving the experience of consumers and enhancing Marketing efforts. Morozov (2017) shows the effectiveness of increased brand interaction due to audience captivated by VR powered marketing campaigns. VR is also used by businesses for showcasing products in a virtual setting where the consumer can interact with 360-degree view of the showroom. Similarly, AR enhances the online shopping experience by using a browser to visualize product in the real environment.[7]

Key Trends Shaping the Future of Digital Marketing

Future AI technologies such as algorithmically generated personalization, voice search, and blockchain will each in a different regard define digital marketing. Businesses will begin to depend more on automation and machine learning techniques to drive interactions and real-time marketing analysis will be carried out.

Moreover, voice-enabled searches and conversational AI will change the way people communicate with businesses making human-to-brand communications simpler. The rise of virtual reality and augmented reality will change how customers experience businesses, making it more fun, and will require marketers to develop more hands-on approaches.

In general, the studied articles claim that digital marketing is in a constant flux with its constituents such as artificial intelligence, data mining, blockchain technologies, and advertisement having an immeasurable influence on an organization's operational ambiance. Those businesses who bothered to implement the above technologies will be one step ahead of the order in the completely digitalized reality.

Impact of Emerging Technologies in Digital Marketing Table 2

Technology	Benefits in Marketing	Challenges/Limitations
AI	Automated customer service, personalized content, predictive analytics	Ethical concerns, data privacy issues
Blockchain	Increased transparency, fraud prevention, secure transactions	Complexity, high implementation costs
VR/AR	Immersive customer experiences, product visualization	Expensive to develop, requires specialized devices
Data Analytics	Informed decision-making, improved customer insights	Requires skilled professionals, data security risks

3. METHODOLOGY

To achieve the goals set for this study, a qualitative research design was developed to explore the effects of new technology, such as Artificial Intelligence (AI), data analytics, blockchain, and

Virtual Reality (VR), on marketing approaches. The purpose of this methodology is to detail how a company uses technology to market its products and services and gauge the success of these efforts.

Research Design

In the course of the research, various sources that include literature reviews, industry reports, and case studies covering digital marketing strategies from different industries were consulted. A variety of peer reviewed journals, books, and credible online marketing research reports are where the needed insights were gathered from.

Data Collection

This research focuses on secondary data and consequently several academic sources, industry white papers, and market research reports were utilized, alongside case studies of firms leveraging AI, Blockchain, and data analytics for their marketing strategies. This study attempts to provide an understanding of how businesses respond to marketing technological upheavals through the synthesis of existing information.

Data Analysis

A thematic analysis is used to explore prominent issues, trends, and patterns regarding changing the paradigm of marketing within an organization. The research focuses on specific areas such as AI-based marketing automation, marketing with business intelligence, transparency using blockchain, and customer experience with VR/AR. This approach provides an understanding of the role these technologies play in achieving effective strategic marketing.

1. Internet and Social Media Usage in Azerbaijan (2024)

In 2024, Azerbaijan recorded approximately 9.19 million internet users, representing 88% of the population. Additionally, there were 6.10 million active social media users (58.4%). These figures illustrate a highly digitized population, indicating a broad and active online audience for digital marketing initiatives.[14]

2. The Rise of Digital Advertising and Future Projections

According to Statista, by 2030, around 77% of total advertising expenditure in Azerbaijan is expected to be allocated to digital channels. This trend suggests a growing shift toward platforms such as social media, search engines, and mobile applications for advertising.[15]

3. Digital Strategy Implementation Among SMEs

Small and medium-sized enterprises (SMEs) in Azerbaijan are adopting digital tools to remain competitive. Key strategies include:

- SEO for search visibility,
- Social Media Marketing on Instagram, Facebook, TikTok,
- Data Analytics for customer behavior insights,
- E-commerce platforms for online sales.

These strategies enable SMEs to boost brand visibility and customer engagement.[16]

4. Social Media Platform Distribution (March 2025)

- Instagram: 39.29%

- Facebook: 22.09%

- Pinterest:12.84%
  These stats highlight Instagram and Facebook as the most effective platforms for digital campaigns in Azerbaijan.[17]

Digital Marketing Adoption in Azerbaijani Companies *(Public data only)* **Table 3**

Company	Digital Marketing Practices	Evaluation (%)
Mars Overseas Baku LTD	Localized social campaigns, creative content, influencer collaborations	80%
Azerbaijan Coca-Cola Bottlers LTD	Social responsibility campaigns, "Real Magic" global branding	85%
Leobank	ASO, localized mobile app, performance marketing, user acquisition	95%
Irshad Electronics	First to use TikTok Ads in Azerbaijan, targeted Gen Z campaigns	90%

Chart: Digital Marketing Implementation Levels

The bar chart below illustrates the estimated digital marketing maturity among selected companies. The evaluations are based on platform diversity, creative content, user engagement, and campaign effectiveness.
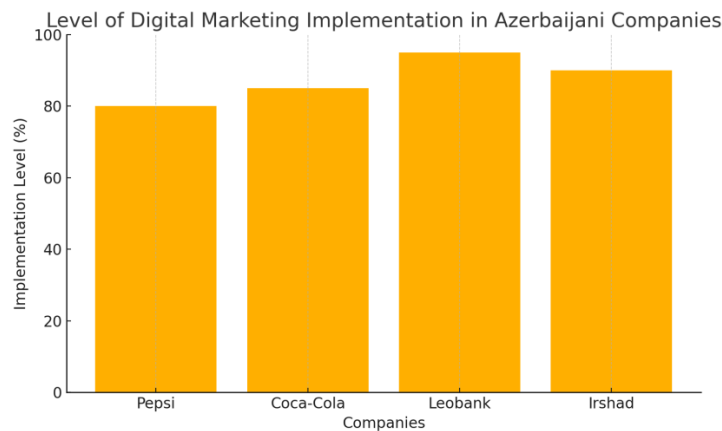
Fig. 2 Level of Digital Marketing Implementation in Azerbaijani Companies

Limitations

Although this analysis offers useful findings on the transformation of digital marketing, its reliance on secondary data sources remains a weakness. There was no attempt in the preparatory work to include primary data collection techniques like surveys or interviews that would have deepened the analysis. Also, the pace at which digital marketing technology is advancing means that some of the findings could be invalidated by newer developments. In spite of these shortcomings, this analysis serves as a point of departure in attempting to understand the impact of artificial intelligence, data analytics, blockchain technologies, and virtual reality on contemporary marketing, and proposes strategies for organizations willing to utilize these technologies.

4. PRELIMINARY DATA INSIGHTS

This section demonstrates industry-wide deployment trends relating to business use of AI, blockchain, VR/AR and data analytics in their marketing practices through the utilization of quantitative data.

Adoption Rate of AI, Blockchain, VR, and Data Analytics in Marketing Table 4

Technology	Adoption Rate (%)	Industry Usage Examples
AI	85%	Chatbots, recommendation engines
Blockchain	45%	Digital ad verification, secure transactions
VR/AR	30%	Virtual showrooms, interactive ads
Data Analytics	90%	Customer segmentation, targeted advertising

5. THE EVOLUTION OF DIGITAL MARKETING

Understanding Digital Marketing

With digital marketing, business people can now utilize various online tools and platforms to promote their products and services. It includes techniques such as search engine optimization (SEO), social media marketing (SMM), email marketing, and online advertising. The beauty of digital marketing is that it has measurable results. Businesses can optimize their campaigns in real-time. Digital marketing has more advantages compared to traditional marketing as it helps understand customer behavior, interact with target audiences and increase sales conversions.[8]

The Importance of Digital Marketing

The effectiveness and flexibility of digital marketing have made it a cornerstone in the growth of businesses. Digital marketing encourages penetration into new markets, leads to creation of more business opportunities, and increases return on investment. Companies implement digital marketing to improve brand recognition, help in customer relationship management, and know their customers' behavior through data analytics. With the growing adoption of AI and automation, customization of marketing activity and customer outreach has been simplified exponentially.[9]

Digital Marketing Strategies of Key Importance

In a marketing plan, all components should be capture blended for maximum online presence and customer interaction. Many advanced methods exist, such as SEO, which helps businesses draw in automated traffic by ranking them higher in search engines. Email marketing is still considered the king of direct communication since a business can send messages as well as promotional materials directly to the customer's inbox. With social media marketing, businesses can reach out to many people on platforms such as Facebook, Instagram, Twitter, and LinkedIn and connect with individuals from different regions in real-time while promoting their brands. Customers are attracted and retained through Content marketing that provides value to the customers and important information about the product. It can be further enhanced through video content that is engaging and shareable. These strategies do their part by ensuring that a business reaches its target audience while securing a considerable position in the increasingly competitive digital industry.[1]

Fig. 3 Evolution of Marketing

6. AI AND DATA ANALYTICS IN MARKETING

The Role of AI in Marketing

AI can improve the efficiency of digital marketing by automating non-creative tasks and repetitive processes, optimizing customer journeys and interactions, and reporting insightful analytics based on the overall campaign performance. The adoption of AI powered software such as virtual assistants and chatbots is increasing as they can offer automated customer support, and help ease communication.[12]

Data Analytics and Consumer Behavior

Data analytics has proven to be beneficial in the field of digital marketing as it provides a better understanding of consumer behavior. Analyzing large datasets enables companies to divide the audience into separate groups, discover unique patterns, and target their marketing strategies to the appropriate customers. Businesses can make care campaigns stronger through the use of data-driven marketing because customer engagement increases as marketing strategies become more personalized. Advanced marketing effectiveness is achieved with the aid of sophisticated analytics tools which allow companies to monitor key performance indicators (KPIs) to make efficient and rational decisions.[13]
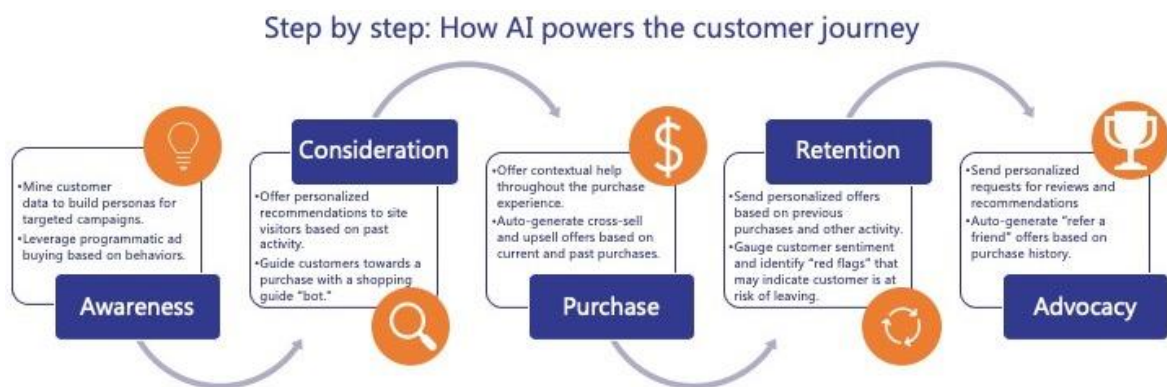
Fig. 4 AI Integration in the Customer Journey

7.   EMERGING TECHNOLOGIES IN MARKETING

The Impact of Virtual Reality (VR) on Marketing

Virtual Reality (VR) is revolutionizing digital marketing by providing immersive and interactive experiences for consumers. Businesses use VR to create virtual product demonstrations, allowing customers to explore products in a simulated environment before making a purchase. VR-powered 360-degree tours of retail spaces enhance the shopping experience by providing a realistic view of physical stores. Interactive brand storytelling through VR fosters deeper customer engagement and strengthens brand loyalty.[11]
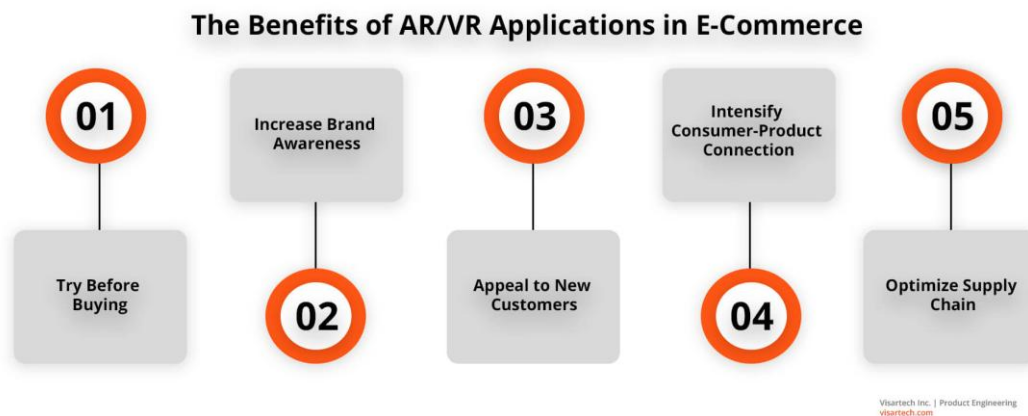
Fig. 5 VR/AR Application in E-commerce

Blockchain in Marketing

The use of blockchain technology is improving the security, transparency, and overall trust of digital marketing. Companies are now able to eliminate fraud in digital advertising due to the abuse proof advertising which makes sure the marketing dollars and budget are being properly used. With secure and credible transactions, there is no room for data manipulation or unwanted access. Blockchain aids businesses in establishing credibility with consumers that goes beyond a single transaction by enabling them to maintain an accurate record of customer relations that cannot be altered, thereby encouraging customer loyalty over time.[6]

8.   THE FUTURE OF MARKETING TECHNOLOGIES

The growth of Artificial intelligence, evolution of automation, and other emerging technologies continue to refine and modify digital marketing strategies. In the near future, there are expected to be a higher focus on artificial intelligence driven hyper-personalization strategies where marketing messages are customized by algorithms for every single consumer. Customers are going to communicate with brands through advanced voice search and simplified AI which makes the communication more natural, and brands will utilize AR and VR technologies to improve customer experiences and interactive content engagement. Also, blockchain is expected to protect data and guarantee transparency in marketing activities, as well. The adaptation of businesses to technological changes makes ethical sustainable digital marketing practices vital for retaining both consumer trust and brand credibility.
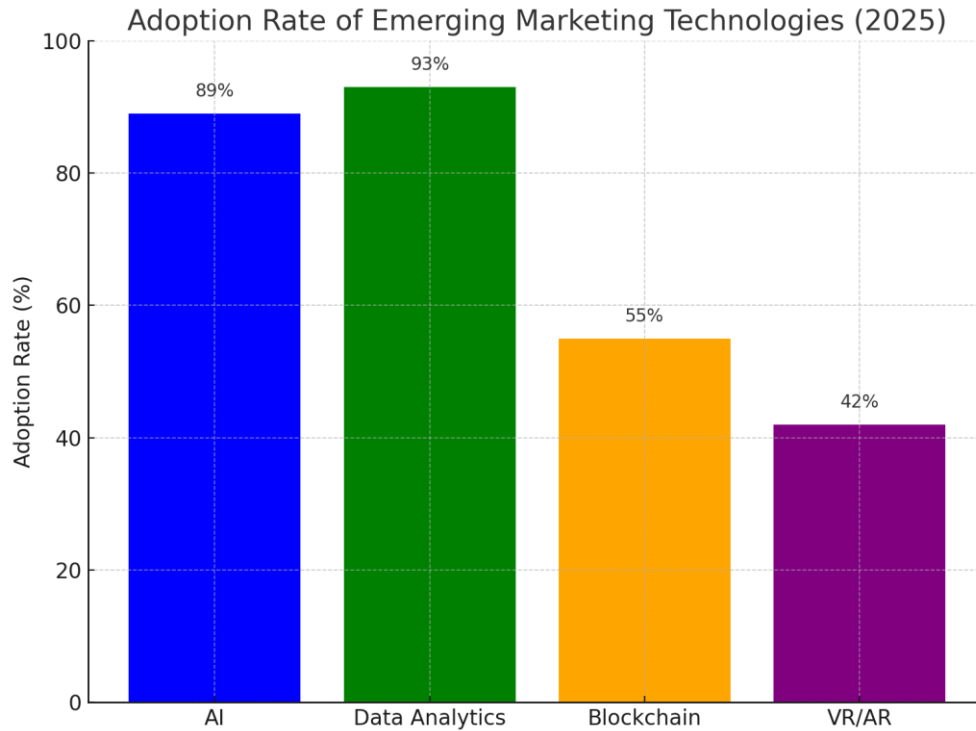
Fig. 6 Adoption Rate of Emerging Marketing Technologies (2025)

9. CONCLUSION

This study has demonstrated how the adoption of digital technologies - particularly AI, data analytics, blockchain, and virtual or augmented reality - plays a transformative role in shaping the strategic direction and decision-making capabilities of modern organizations. These technologies have evolved beyond mere operational support and now serve as core drivers of strategic innovation, enabling organizations to make data-driven decisions, personalize stakeholder engagement, and manage resources more effectively. The findings suggest that companies integrating digital tools into their strategic management frameworks are more agile, competitive, and customer-centric. Specifically, AI enhances predictive capabilities and decision-making precision; data analytics enables refined segmentation and targeting; blockchain ensures transparency and security; and VR/AR introduce immersive engagement strategies. This research, while relying on secondary data, provides valuable insights into how digital innovation reshapes strategic models in contemporary businesses. Companies that treat digital tools as strategic competencies are better positioned to thrive in an increasingly digital and competitive environment.

Limitations and Future Recommendations

Despite its contributions, this study faces several limitations. The exclusive reliance on secondary data may limit the contextual depth and generalizability of the findings. Primary research methods such as interviews or surveys could provide more nuanced insights into the actual strategic implementation of digital tools. Additionally, the rapid pace of technological innovation means that conclusions may quickly become outdated as newer tools and models emerge.

Another limitation is the lack of industry-specific or region-specific differentiation, especially in the context of small and medium-sized enterprises (SMEs) and emerging markets. Future

research should consider conducting sectoral case studies, longitudinal data analysis, and empirical investigations that capture both the opportunities and internal organizational challenges associated with digital transformation in strategic management. Moreover, topics such as data ethics, algorithmic bias, and digital readiness deserve deeper exploration to ensure more sustainable and responsible technology adoption in strategic frameworks.

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PROTECTION OF PERSONAL DATA WITHIN THE UNITED NATIONS SYSTEM

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ARTICLE INFO	ABSTRACT
	This article analyzes the role and activities of the UN in the field of personal data protection in cyberspace. The article examines the documents, initiatives and calls adopted within the framework of the UN's statutory bodies, the General Assembly and the Economic and Social Council. The article reviews the contributions of specialized agencies such as UNESCO and ITU in the field of basic human rights in the field of information and the establishment of an ethical framework in this field, as well as technical standards. UNESCO supports the implementation of the UN General Principles on the Protection of Personal Data and implements projects aimed at increasing knowledge of data protection in the fields of education, science and culture. ITU, on the other hand, seeks to strengthen the protection of personal data by increasing the capacity of states in the field of cyber security and developing technical and legal measures. In this context, efforts to harmonize normative approaches to the protection of personal data in global cyberspace are evaluated. *As a result of our research, we find that the existing mechanisms for the protection of personal data in the UN system are fragmented and there is a lack of institutional coordination between different structures. Although UNESCO's initiatives in the field of information ethics and ITU's technical standardization are important, their scope of application is limited and enforcement mechanisms are weak. At the same time, problems remain in the voluntary adoption and practical implementation of some normative frameworks by states. In some cases, problems such as the weakness of national legislation in states, inefficiency in the implementation of measures, lack of capacity in the field of cyber security, and weakness of mechanisms for controlling the use of personal data are noted. In addition, the limited legal mechanisms for combating data protection and the lack of independent supervisory authorities in some states create serious difficulties in the protection of personal data.* *The article also touches on future prospects in this area. Predictions are made such as strengthening national legislation, increasing capacities in the field of cyber security, strengthening cross-border cooperation models, increasing institutional coordination in the UN system, and initiating a global convention on the protection of personal data. In this context, recommendations are made for the UN to operate more systematically and normatively, and the need to form a new legal architecture for the protection of human rights in the digital era is emphasized. In this regard, it is predicted that activities aimed at the protection of personal data in the UN system will be more effective and productive in the future.*

I. INTRODUCTION

The acceleration of digitalization on a global scale has made the protection of personal data in cyberspace one of the main challenges of the international legal and human rights system. The development of information technologies imposes new and complex obligations on states and international organizations. In this context, the issue of forming unified and effective mechanisms for the protection of personal data within the UN system remains relevant. Although the UN's statutory bodies, the General Assembly and the Economic and Social Council, UNESCO and ITU, have put forward various initiatives in this area, their inadequacy is noticeable in terms of legal force, scope and implementation mechanisms. The study shows that there is a serious institutional fragmentation and normative inconsistency in approaches to personal data protection within the UN system. The study found that despite international measures taken in the field of personal data protection, significant obstacles and legal gaps exist. These include the insufficient level of national legislation, the weakness of control mechanisms of state authorities and companies, the lack of effective means to protect the rights of individuals, and the slow progress of the process of harmonization at the international level. Thus, in many countries, there are no mechanisms through which individuals can easily take action in cases of misuse of personal data, and legal protection processes are complex and inaccessible. While UNESCO's promotion of ethical principles on the one hand, and ITU's proposal of technical security measures on the other hand, are commendable, the synergy and legal coordination between these activities is weak. At the same time, the lack of a universal and binding legal instrument on the protection of personal data within the UN normative framework creates a serious legal gap. This gap limits the possibilities of states to exchange information and cooperate in cyberspace, and creates uncertainty in the provision of individual rights.

To solve the problem, it is necessary to develop unified and legally binding norms and mechanisms within the UN system. To solve the problem, it is important to integrate international standards and principles developed by the UN and its specialized agencies into national legislation, increase the responsibility of states and companies, inform individuals about their rights, and create effective legal protection mechanisms. To this end, improving the existing normative and institutional structure, strengthening functional cooperation between various agencies, as well as adopting a new international convention on the protection of human rights in cyberspace can be put forward as a perspective. Such measures will strengthen the protection of personal data in cyberspace and expand the prospects for international cooperation in this area. Such an approach can both strengthen the legal foundations of personal data protection at the global level and strengthen the leadership role of the UN in this area.

The object of this article is the existing institutional and normative approaches to the protection of personal data in the UN system. The subject of the study is the analysis of the activities and initiatives of the UN statutory bodies, such as the General Assembly and the Economic and Social Council, as well as specialized agencies such as UNESCO and ITU, in the field of personal data protection in cyberspace, the effectiveness of these activities, limitations and development prospects. The study examines the role of international law and cybersecurity policy in the protection of personal data in cyberspace. The study used legal document analysis, comparative legal method, institutional approach and foresight analysis methods. The aim is to assess the legal basis and practical results of efforts to protect personal data in the UN system and to identify opportunities for the formation of unified and effective approaches in this area on a

global scale. At the same time, the study also attempts to reveal the extent to which the relevant bodies of the UN system act adequately and flexibly in ensuring the inviolability of personal life against the background of the rapid development of information technologies.

II. THE UN's STATUTORY BODIES AND SPECIALIZED AGENCIES

A. THE UN's STATUTORY BODIES

1. The UN's General Assembly

The General Assembly, one of the UN's statutory organs, plays an important role in promoting human rights, including privacy and the protection of personal data, globally. The resolutions adopted by the General Assembly on the protection of personal data in cyberspace are a clear indication of the growing attention paid to this issue. These resolutions, on the one hand, call on States to strengthen national and international legal mechanisms in this area, and on the other hand, pave the way for coordinated action by other bodies of the UN system. Resolution A/RES/68/167 (2013)[1], "The right to privacy in the digital age". This resolution adopted in response to concerns about mass surveillance, this landmark resolution highlighted the importance of the right to privacy in the context of new technologies. It reaffirmed that the same rights that people have offline must be protected online, including privacy. Resolution A/RES/69/166 (2014)[2], "The right to privacy in the digital age". This resolution follow-up to resolution A/RES/68/167 (2013), highlighted the importance of preventing violations of the right to privacy, particularly through surveillance. It called on States to review their procedures and legislation to ensure compliance with human rights obligations, particularly with regard to the collection, storage and dissemination of data. Resolution A/RES/73/179 (2018)[3], "The right to privacy in the digital age" expanded on previous ones to address new data protection issues, including artificial intelligence, big data and the use of technology by both States and corporations. It called for transparency, accountability and oversight of data collection practices, particularly with regard to personal data. These resolutions have played a critical role in shaping global debates on the protection of personal data and the right to privacy, particularly in an era of rapid technological advances.

Those resolutions were adopted in the wake of revelations about global electronic surveillance systems and is one of the first UN documents aimed at preventing unlawful interference by states with personal data. The resolutions highlighted the threats posed by mass and individual surveillance measures implemented through the Internet and other digital technologies in terms of human rights, in particular the right to privacy, and called on states to adhere to a lawful, necessary and proportionate approach in this area. The important aspect of these resolutions is that they do not only reinterpret the classical human rights framework in the digital context, but also provide states with specific behavioral models for the protection of personal data. This contributes to the formation of transparent and reliable data protection standards in international law. On the other hand, the fact that these resolutions are not legally binding raises problems with their implementation. In most cases, states are slow to implement the provisions of these documents in their domestic legislation, and sometimes introduce exceptions that weaken their essence for reasons of national security and sovereignty. In addition, the lack of mechanisms for

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[1] https://docs.un.org/en/A/RES/68/167
[2] https://docs.un.org/en/A/RES/69/166
[3] https://docs.un.org/en/A/RES/73/179

monitoring and accountability for the implementation of General Assembly resolutions also negatively affects their effectiveness.

However, the fact that these documents influence international public opinion, strengthen civil society, and guide the normative activities of other international organizations, including regional institutions, increases their practical importance. In the future, the General Assembly is expected to come up with more systematic and legally strengthened initiatives in this area. Thus, the fact that recent resolutions have already separately addressed the issues of artificial intelligence, big data analytics, and digital identity in the context of personal data protection is an indication of this development. Those resolutions adopted by the General Assembly are legally advisory in nature leads to the weakness of their implementation mechanisms. These resolutions are not normative legal acts and their implementation depends on the political will of the states. Also, the lack of definition of specific legal obligations in the resolutions and the lack of clear formulation of legal criteria for transparent and accountable behavior in cyberspace is criticized. On the positive side, these resolutions of the General Assembly play an encouraging role in shaping global public opinion and in bringing national legislation of states into line with international standards. These resolutions also provide a political and normative basis for other UN bodies – the Human Rights Council, the Office of the High Commissioner for Human Rights and the specialized agencies. As a result, the UN General Assembly has made a significant contribution to the formation of global legal awareness on the issue of personal data protection in the digital era. However, in order to increase the real impact of this contribution, it is necessary to support the adopted resolutions with legally enforceable mechanisms and to define specific legal obligations.

2. The UN's Economic and Social Council

The Economic and Social Council, one of the UN's statutory bodies, performs the function of coordinating economic, social and humanitarian issues on a global scale and formulating policies in these areas. The Council's activities in the field of personal data protection are mainly based on coordinating the work of related specialized agencies (e.g. UNESCO, ITU, etc.) and contributing to the definition of international policy in this area. The number of resolutions adopted by the Council directly related to the protection of personal data is limited.

However, the issue of personal data protection in the context of digital transformation, information society, sustainable development goals (SDG 16.10)[4] and human rights has been repeatedly addressed in the advisory documents and forums of this Council, and the importance of privacy and personal data protection during the acquisition and use of data has been particularly emphasized within the framework of the High-level Political Forum on Sustainable Development (HLPF)[5].

The strengths of the Economic and Social Council include its multisectoral and inclusive nature, its broad participation by civil society organizations, and its joint analysis of the social, economic, and legal aspects of digital issues. This allows for the integration of personal data protection with broader goals such as human rights, development, gender equality, and poverty reduction. However, the weaknesses are that the Council's decisions are not legally binding, and in some cases, the documents adopted are too general and principled. The complexity of the Council's structure and bureaucratic mechanisms mean that some initiatives have little practical impact.

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[4] https://sdgs.un.org/goals/goal16
[5] https://hlpf.un.org/

B. THE UN's SPECIALIZED AGENCIES

1. The International Telecommunication Union (ITU)

ITU, one of the specialized agencies of the United Nations, plays an important role in the development of global information and communication technologies, as well as in the field of personal data protection and information security in cyberspace. ITU's activities in this area are mainly focused on the preparation of normative and technical documents, promotion of international cooperation and strengthening the technical potential of developing countries. The World Summits on the Information Society (WSIS), held in 2003[6] and 2005[7] under the leadership of ITU, were an important stage in the formation of a global agenda for the development of the information society and the protection of personal data. The documents adopted within the framework of WSIS promoted the principle of personal data protection in national and international policies.

ITU's initiatives are not limited to technical documents. The organization seeks to strengthen the cybersecurity capabilities of countries through various international forums and programs. ITU-T is the telecommunications standardization sector of the organization, a specialized organization engaged in the development of technical standards in the field of telecommunications and information and communication technologies on a global scale. This organization is engaged in the development of global standards in mobile communications, Internet protocols, network security, data exchange and other technical areas. In addition, the organization develops technical norms that ensure the interoperability of technologies from different countries and manufacturers. ITU-T develops advisory documents in the field of cyber security and personal data protection. Among the technical standards developed by ITU, documents X.1058 and X.1205 are of particular importance[8]. Document X.1058 provides recommendations for the formation of a national information security management structure and the establishment of competent authorities in this area by states. On the other hand, document X.1205 (formerly X.805) explains the cybersecurity architecture and lays out the technical foundations of personal data protection. These documents include risk-based protection of personal data and technological approaches to detecting cyber threats. However, the lack of legal binding force of these technical standards and the weakness of their integration into national legislation cause some problems. Initiatives such as the Global Cybersecurity Agenda[9] and the Global Cybersecurity Index provide an opportunity to assess and improve the current situation of member states in terms of legislation and technical infrastructure in the field of personal data protection. In addition, ITU programs such as Child Online Protection[10] include personal data protection initiatives aimed at specific risk groups.

However, there are some shortcomings in the activities of the ITU in this area. First of all, the standards adopted by the ITU are of a recommendatory nature and their mandatory application is not ensured. This makes it difficult for states to comply with these standards in practice. On the other hand, the activities of the ITU in the field of legal protection of personal data are limited, and more active cooperation and coordination are needed to develop legal mechanisms in this direction. In the future, harmonization of the ITU's technical standards with legal

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[6] https://dig.watch/actor/world-summit-information-society
[7] https://dig.watch/resource/tunis-agenda-for-the-information-society?utm
[8] https://www.itu.int/rec/T-REC-X.1205-200804-I/en; https://www.itu.int/rec/T-REC-X.1058-201703-I/en
[9] https://www.itu.int/en/action/cybersecurity/Pages/gca.aspx
[10] https://www.itu.int/en/cop/pages/about_cop.aspx?utm

frameworks, as well as strengthening interregional information security cooperation, should be one of the important priorities. The lack of sufficient attention paid to the protection of personal data in the context of human rights in the activities of the ITU and the weakness of coordination with other UN bodies in this area are criticized. In the future, it seems necessary to more closely coordinate the technical expertise of the ITU with legal mechanisms within the framework of human rights.

2. The United Nations Educational, Scientific and Cultural Organization (UNESCO)

UNESCO is actively involved in the development of normative and ethical frameworks for the protection of personal data for the fair and inclusive development of the information society. One of the main reference documents of the organization in this area is the "UNESCO Recommendation on the Ethics of Artificial Intelligence"[11]. This document provides recommendations on ethical principles, human rights and prevention of data misuse in the processes of collection, storage and processing of personal data. The document provides a roadmap for states and technology manufacturers to ensure that data is used without harming the privacy and autonomy of the individual.

UNESCO also takes technical and legal initiatives in the field of information ethics and regulation of cyberspace. The "Internet Universality ROAM-X Indicators"[12] framework is of great importance in this regard. Among these indicators, the "Privacy" component occupies a special place and assesses the level of legal and institutional readiness of states in the field of transparency, accountability and protection of personal data in the information space. This approach provides countries with measurable criteria for making human rights-based decisions in cyberspace policy.

In addition, UNESCO carries out educational and methodological activities on personal data protection through a number of global initiatives, including the World Summit on the Information Society (WSIS)[13] and the Information for All Programme (IFAP)[14]. These platforms encourage the sharing of best practices on ethical and legal regulation of data for Member States and civil society. However, UNESCO's advisory and non-binding legal status limits the organization's influence. In the future, it seems important for UNESCO to take more active initiatives on the development of legally binding standards between technology manufacturers and states.

III. OBSTACLES AND LEGAL GAPS

A. OBSTACLES

The United Nations (UN), as a global organization, faces a number of obstacles and legal gaps in promoting effective international cooperation. Some of the obstacles are:

1 Diverging national interests. Member states often prioritize national agendas over collective goals, leading to conflicts in decision-making processes. Member states insist on priorities that suit their own economic, political, or security interests, while pushing global or collective concerns to the background. Diverging views on conflicts such as civil wars or regional tensions lead to paralysis in the UN Security Council (Docksey and Propp, 2023).

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[11]   https://digitallibrary.un.org/record/4062376?v=pdf
[12] https://unesdoc.unesco.org/ark:/48223/pf0000370288_eng
[13] https://www.unesco.org/en/wsis
[14] https://www.unesco.org/en/ifap/programme

2 Inequality among Member States. Unequal distribution of power, particularly between developed and developing countries, limits fair participation in global governance. Some countries have veto power, allowing them to block resolutions even if they are supported by a majority of other members (inequality in voting power). Richer countries contribute more financially to the UN and, as a result, often have more influence over its programmes and initiatives (United Nations, 2021).

3 Geopolitical tensions. Conflicts between major powers prevent consensus on important issues such as climate change, disarmament, and human rights. The UN Security Council is often paralyzed by the vetoes of the permanent members. These countries often use their veto to block resolutions that run counter to their strategic or geopolitical interests (Security Council deadlocks). Major powers often engage in proxy wars, using smaller states as battlegrounds for their rivalries. These conflicts complicate UN peacekeeping efforts and humanitarian missions (proxy conflicts) (United Nations, 2019).

4. **Resource constraints.** Insufficient funding and resources for UN programmes limit their effectiveness in addressing global challenges. The UN budget is financed by Member States through assessed contributions and voluntary contributions. Late or non-payment by Member States, including major contributors, creates funding gaps that disrupt operations. This dependence makes the UN vulnerable to the priorities and conditionalities set by donor countries (over-reliance on voluntary contributions). UN peacekeeping missions are often underfunded, understaffed and under-equipped (United Nations, 2023).

5 Bureaucratic inefficiencies. Complex administrative processes can delay or hinder timely responses to global crises. Lengthy approval, procurement, and recruitment procedures slow down programme implementation and crisis response (complex administrative processes). Different UN bodies and specialized agencies often have overlapping responsibilities leading to duplication of effort and wasted resources (overlapping mandates). A lack of clear communication and cooperation between UN entities leads to fragmented and incoherent approaches to global problems (Yves Schemeil, (2021).

6. Lack of enforcement mechanisms. The UN often lacks the authority to enforce its resolutions and decisions, making implementation dependent on the willingness of Member States. Member States are not required to implement or adhere to these guidelines (non-binding nature of the guidelines). Many countries lack comprehensive data protection laws or have inconsistent regulations, making it difficult for the UN to promote a unified approach to personal data protection (fragmented national frameworks) (Solove and Hartzog, 2022).

B. LEGAL GAPS

The United Nations (UN), as a global organization, faces legal gaps in fostering effective international cooperation. Below are some legal gaps:

1. Lack of a binding framework. Unlike areas such as trade (WTO) or human rights (UN conventions), no single, universally binding international framework governs the protection of personal data. Existing frameworks, such as the EU GDPR, are regional and cannot impose obligations on non-member states (Lack of universally binding rules). Countries adopt very different data protection laws, reflecting their legal traditions, economic priorities, and cultural attitudes towards privacy (UN, 2024).

2 Inadequate cybersecurity laws. Cybersecurity laws vary widely across jurisdictions, reflecting differences in resources, priorities, and technological advances. The lack of a universal legal framework creates gaps and inconsistencies in regulation, making cooperation difficult (fragmented legal landscape). Many countries adopt cybersecurity laws in response to incidents, resulting in fragmented and incomplete coverage. Such laws often fail to take into account the global nature of cyber threats or do not provide robust protection for personal data (reactive rather than proactive measures) (UN CEB, 2018).

3. Weak regulation of non-state actors. Unlike states, non-state actors are not directly bound by international treaties unless they are explicitly integrated into national laws. The lack of global rules governing how non-state actors process personal data leads to inconsistent practices and enforcement (Lack of binding international standards for non-state actors). Many non-state actors operate across multiple jurisdictions, exploiting regulatory gaps and inconsistencies **(United Nations Human Rights Office of the Hight Comissioner, (2021**).

4. Fragmented international law. International data protection law is heterogeneous and there is no single binding treaty setting universal standards. Existing agreements, such as the OECD Privacy Shield Guidelines or the Council of Europe Convention 108, are limited in scope and are not binding on many countries (Lack of a single global framework). Jurisdictions adopt different approaches to data protection, influenced by cultural, economic and political factors (Discrepancies in regional and national laws) (Kittichaisaree and Kuner, **2015**).

5. Weaknesses in Environmental Law. Environmental governance increasingly relies on personal data, such as geolocation data, to monitor pollution, track resource use, and analyze human impacts on ecosystems. Technologies such as satellite imagery and IoT devices often collect personal data, raising privacy concerns (data-driven environmental decisions). Efforts to combat environmental crimes such as illegal logging or poaching often involve surveillance and data-sharing mechanisms that may violate privacy rights if not properly regulated (Schafer and Mazzega, *2019*).

6. Protection of Human Rights. The right to privacy is enshrined in international instruments such as Article 12 of the Universal Declaration of Human Rights (UDHR) and Article 17 of the International Covenant on Civil and Political Rights (ICCPR). However, the interpretation and implementation of this right varies widely, with some countries prioritising economic or national security interests over the protection of privacy (inconsistent recognition of privacy as a human right). Although human rights treaties recognise privacy, their enforcement mechanisms are often weak or non-binding. Many states do not include robust privacy protections in their national legal frameworks, leaving gaps in the protection of personal data. (*Toriqul Islam, (2022).*

C. GAPS`S IMPLICATIONS. EFFORTS TOWARD SOLUTION

1. Absence of Binding Frameworks

Implications of the Gaps: Companies face regulatory fragmentation, requiring compliance with multiple, often conflicting, legal regimes. This complexity increases costs, slows innovation, and creates barriers to entry for small businesses (Barriers to Trade and Innovation). Inconsistent standards make individuals' data vulnerable in jurisdictions with weaker protections. Cross-border data transfers can expose personal data to misuse or surveillance without recourse (Weak

Protection for Individuals). Investigating cybercrime and enforcing data protection laws require cross-border cooperation.

Efforts Toward a Solution: Organizations such as the UN are advocating for a binding international data protection treaty. Such a treaty could establish minimum standards, dispute resolution mechanisms, and enforcement protocols (Proposals for a Global Framework). Regional initiatives such as the GDPR could inspire the development of global standards. Efforts to align national laws with GDPR principles, such as "adequacy decisions," could promote greater harmonization (Developing Regional Frameworks). Multilateral bodies such as the OECD and the G20 could lead negotiations on binding agreements (Increasing the Role of Multilateral Organizations) (UN, 2024).

2. Inadequate Cyber security Laws

Implications of the Gaps: Inadequate laws make it difficult to investigate and prosecute cybercrime across borders. Mutual legal assistance treaties (MLATs) are often slow and cumbersome, failing to address the rapid nature of cyberattacks (Challenges in Cross-Border Enforcement). Differences in cybersecurity laws lead to mistrust between countries, preventing data-sharing agreements that are critical to cooperation. Concerns about inadequate protections in some jurisdictions exacerbate the problem (Barriers to Data Sharing). Weak cybersecurity structures in one country can expose data across the globe, especially in interconnected systems (Increased Vulnerability of Personal Data) (UN CEB, 2018).

Efforts Toward a Solution: The UN has repeatedly called for a unified approach to cyber-security, recognizing its critical role in protecting personal data. Initiatives such as the UN Open-Ended Working Group on Developments in the Field of Information and Telecommunica-tions in the Context of International Security aim to build consensus on global norms (Promoting a Global Cybersecurity Framework). The UN assists Member States in developing and implementing cybersecurity laws through programmes such as the UNODC Global Programme on Cybercrime. These efforts aim to address capacity gaps and ensure that all countries can participate in international cooperation (Capacity-Building for Developing Countries)

3. Weak Regulation of Non-State Actors

Implications of the Gaps: The UN has highlighted the importance of holding non-state actors accountable for their role in data protection through initiatives such as the UN Guiding Principles on Business and Human Rights. These principles set out the responsibilities of businesses to respect human rights, including privacy, in all their operations (Promoting accountability through global norms). UN platforms such as the Internet Governance Forum (IGF) provide an opportunity for governments, private sector actors and civil society to discuss and agree on data protection norms.

Efforts Toward a Solution: Weak regulation of non-state actors in some jurisdictions creates mistrust between countries, preventing data-sharing agreements and other cooperative measures. States may impose data localization laws to protect their citizens' data, further complicating international cooperation (undermining trust between states). Cybercriminal groups and rogue non-state actors exploit weak regulatory environments to commit data breaches, fraud, and identity theft. The lack of international consensus on how to combat such threats exacerbates vulnerabilities. (**United Nations Human Rights Office of the Hight Comissioner, (2021).**

4. Fragmented International Law

Implications of the Gaps: Businesses and governments face significant legal and logistical challenges when transferring data across borders. The lack of harmonized rules increases compliance costs, legal uncertainty, and the risk of enforcement action (Challenges to Cross-Border Data Flows). Disparate laws hinder international cooperation in investigating and prosecuting cybercrime related to personal data breaches. Inconsistent standards for sharing evidence and access to data delay responses to global threats (Barriers to Effective Law Enforcement). Inconsistent rules create gaps in the protection of individuals, particularly in jurisdictions with weak laws. (Weakened Individual Protection).

Efforts Toward a Solution: The UN has long emphasized the need for common global approaches to address transnational challenges, including data protection. Through initiatives such as the UN Conference on Trade and Development (UNCTAD), the UN encourages dialogue to harmonize national and regional data protection laws (Advancing Harmonization). The UN assists Member States, particularly in the Global South, in developing robust legal frameworks to protect personal data (Kittichaisaree and Kuner, **2015**.

5. Environmental Law Deficiencies

Implications of the Gaps: The lack of clear legal protection for personal data in environmental initiatives can undermine trust between states, hindering cooperation in achieving common environmental goals. Countries may be reluctant to share data due to concerns about its misuse or inadequate protection (international trust deficit). Individuals' personal data collected for environmental purposes may be disclosed or misused, undermining trust in global environmental efforts. Diverging legal standards for data protection and environmental governance make it difficult to coordinate international efforts.

Efforts Toward a Solution: The UN can promote the inclusion of data protection provisions in environmental treaties and agreements, ensuring that personal data is protected in environmental management activities. Initiatives such as the UN Environment Programme (UNEP) can incorporate data privacy into their digital environmental strategies (integrating data protection into environmental frameworks). The UN helps countries develop comprehensive legal frameworks that address both environmental and data protection concerns, with a particular focus on developing countries to enhance their regulatory capacity (capacity building and technical assistance). (Schafer, B., & Mazzega P. (2019).

6. Human Rights Protections

Implications of the Gaps: Weak or inconsistent human rights protections undermine trust between states, making it difficult to enter into data-sharing agreements or cooperate on cross-border enforcement. Concerns about the misuse of shared data by states with poor privacy records hinder cooperation (Erosion of trust between countries). Inadequate human rights protections leave individuals vulnerable to data misuse, particularly in jurisdictions with weak legal frameworks.

Efforts Toward a Solution: The UN Human Rights Council (UNHRC) has highlighted the importance of privacy in the digital age through resolutions such as Resolution 68/167 on the right to privacy in the digital age. The Office of the High Commissioner for Human Rights (OHCHR) monitors and reports on state practices that impact the right to privacy (Promoting

privacy as a human right). The UN Special Rapporteur on the right to privacy investigates and reports on violations, advocating for stronger legal protection. These efforts aim to ensure that states comply with their human rights obligations, particularly in the digital context. (*Toriqul Islam, (2022).*

IV. CONCLUSION

1. The lack of a binding international framework for the protection of personal data creates a critical gap in promoting effective global cooperation. Addressing this challenge requires a concerted effort to establish legally binding rules that balance privacy, innovation, and sovereignty. A global compact, inspired by successful regional models and agreed in multilateral fora, could provide a comprehensive solution to this pressing issue.

2. Weak regulation of non-state actors is a significant legal gap in international cooperation on personal data protection. Addressing this challenge requires coordinated global action to establish binding frameworks, enforce standards, and promote cooperation between governments, private entities, and multilateral organizations. UN leadership is critical to building an inclusive and effective regulatory regime that ensures accountability and protects privacy globally.

3. Inadequate cyber security laws pose a significant obstacle to effective international cooperation on personal data protection. Addressing this legal gap requires a coordinated global effort to harmonize laws, strengthen enforcement mechanisms, and build capacity in resource-constrained countries. UN leadership is critical to helping create a universal, binding framework that ensures the protection of personal data in an increasingly interconnected world.

4. Fragmented international law is a critical obstacle to effective international cooperation on personal data protection. Addressing this challenge requires a unified approach, with the UN playing a central role in promoting harmonization, capacity building, and developing a binding global framework. A cohesive international legal system is essential to protect personal data, enable cross-border cooperation, and ensure that individuals' rights are protected in the digital age.

5. Deficiencies in environmental law create a legal gap that indirectly impacts international cooperation on personal data protection. As the use of personal data in environmental governance increases, integrating robust data protection standards into environmental agreements and policies becomes essential. UN leadership is critical to addressing this gap by promoting harmonized frameworks, facilitating dialogue, and supporting capacity-building efforts to ensure that both environmental objectives and privacy rights are protected globally.

6. Human rights protection is the cornerstone of effective international cooperation on personal data protection. The legal gap in recognizing and ensuring privacy as a fundamental human right weakens global efforts to protect personal data. UN leadership is essential to promote harmonization, strengthen accountability mechanisms, and advance privacy as a universal right. Bridging this gap will not only protect individuals, but also strengthen trust and cooperation among countries in the digital age. Inadequate integration of human rights protection into the legal framework for personal data protection represents a significant legal gap that hinders international cooperation.

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THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN HUMAN RESOURCES MANAGEMENT, THEORETICAL PERSPECTIVE

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ARTICLE INFO	ABSTRACT
	Digitalization is transforming the workplace and the way of doing business in various sectors. Industry 4.0, commonly known as the fourth industrial revolution, has changed the way people work, develop, manage, control, hire and interact with each other. Indeed, we are witnessing a change in the nature of jobs. Today, muscle jobs are disappearing and brain jobs are growing, and labor-based industries are coming from skill-based industries and will have to be replaced by knowledge-based industries. In this extremely aggressive situation where everyone interacts with each other, technology and innovation are transforming the world into a global village worldwide. Artificial intelligence helps companies perform any function more effectively and efficiently. The purpose of this research is to conduct a bibliometric analysis of the scientific literature that addresses the application and impact of artificial intelligence in the field of human resource management in a connected way. At the same time the topic is quite new and this paper will contribute to scientific researches in the form of theoretical background. In the article literature review related to the topic will be used.

INTRODUCTION

Artificial intelligence represents a real breakthrough in business management and will have a profound impact on the way employees work, especially in human resources and employment departments. Artificial intelligence (AI) technologies are affecting the management of human resources in a different way. Artificial intelligence (AI) can have a major impact on the way modern societies respond to many of the challenges they face. When used correctly, AI can create a more equitable, healthy and inclusive society. Today, AI has become a mature technology and is an increasingly important part of the fabric of modern life.

A significant source of innovation today, artificial intelligence (AI), which is demonstrated by machines that display traits of human intelligence (HI), is being used in services more and more (Rust and Huang 2014). For instance, many aspects of our lives have been automated by robots for homes, healthcare, hotels, and restaurants; virtual bots have transformed customer service into self-service (Fluss 2017); portfolio managers have been replaced by big data AI applications

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(Javelosa 2017); and social robots, like Pepper, have taken the place of human greeters in customer-facing services to greet clients (Choudhury 2016). Because of these advancements, some have said that we are living in the fourth industrial revolution, where technology is erasing the distinction between the digital, biological, and physical domains (Schwab 2017).

The threat and revolution of AI have drawn the interest of researchers from a variety of fields. Regarding the development of AI, there are two main lines of inquiry. While the economic literature tends to concentrate on the impact of AI on jobs, the service and technological literatures prefer to highlight the benefits of using AI technology. Applications of intelligent technology (Colby, Mithas, and Parasuraman 2016; Marinova et al. 2017; Rafaeli et al. 2017), services made possible by different technologies (Huang and Rust 2013), and service technologies (Kunz et al. 2018) are frequently the subject of the service literature. According to research, technological advancements should have expected effects, such as a rise in the use of self-service technologies (Meuter et al. 2000), increased optimal productivity (Rust and Huang 2012), and a greater service.

The practical contribution of this research is to emphasize the importance of transforming the human resources management function into a digital environment that provides higher activation for the human resources department and will be reflected in higher performance and employee retention.

Artificial Intelligence

What is assumed to be "artificial" about artificial intelligence is undoubtedly related to its origins and the way it was created, in that it emerged not as a result of natural (especially biological or evolutionary) influence, but as a product of human creation and creativity. In other words, artificially intelligent things differ from naturally intelligent ones in that they are artificial objects that have special properties that non-artificial ones normally have. In other words, they are things that have a certain property (intelligence) as a result of a certain process (because they were created, designed or manufactured in this way). Artificial intelligence is defined as machine intelligence or intelligence demonstrated by machines, as opposed to natural intelligence demonstrated by humans. The term artificial intelligence is often used to describe machines that mimic human cognitive functions such as learning, understanding, reasoning or problem solving (Russell and Norvig 2016). Artificial intelligence (AI) is the use of technology to do something that would normally require a certain amount of knowledge. This also refers to the skill level of technologically trained systems on par with human performance. (Palos-Sánchez et al, 2022)

Despite the uncertain origins of the concept of artificial intelligence, two authors stand out in its development. On one side, there is A. M.Turing, the father of modern computation, and on the other side, there is J. McCarthy, the father of artificial intelligence. Turing (1937) introduced the concept of algorithms and laid the foundations of computer science. Later, Turing (1950) proposed the Turing test, which tests whether a machine is capable of being as intelligent as the person performing its functions. Here, if a machine can have a conversation that is indistinguishable from a conversation with a human, then it is reasonable to say that the machine is intelligent. If the evaluator cannot documentably state that the machine is different from a human, the machine is said to have passed the test (Moor, 2003). The Turing test was the first experiment proposed to measure machine intelligence. People were excited because for the first time, computers were solving problems like humans and appeared to be intelligent. The broader AI research community shared the initial optimism by making bold claims and increasing

popularity. There are examples of AI solving problems involving algebraic application problems, language translation, geometric theorem proof, etc. However, J. McCarthy coined the term "artificial intelligence" during a conference at Dartmouth (Paesano, 2021). In the 1950s and 1960s, it was expected that AI would rapidly evolve into computers and robots with human-level cognitive abilities, but this did not happen until recently when it came to the fore (Bolander 2019; Pillai and Sivathanu 2020). Of course, the concept of Artificial Intelligence (AI) was on the minds long before the advent of computers. Artificial intelligence basically refers to the processing of human intelligence by machines, especially computer systems. However, defining intelligence many times is a nuanced task. Intelligence encompasses various aspects such as problem-solving ability, learning ability, adaptability, creativity, and understanding complex concepts. Artificial intelligence aims to replicate these cognitive abilities across machines. Initially, the focus was on symbolic AI, which required computers to follow explicit rules to solve problems. However, as our understanding of intelligence has changed, AI techniques have changed accordingly. Modern AI, particularly machine learning and deep learning, allows machines to learn from data, recognize patterns, and make decisions based on experience. Despite its prevalence, AI still lags behind human intelligence in many ways. Human intelligence is not limited to solving problems; it also includes areas such as understanding the context in which AI encounters it, emotions, social characteristics, and ethical controls. So, while the term "intelligence" is difficult to define, AI aims to mimic and extend human cognitive abilities to perform tasks that typically require human intelligence in machines.

Since the advent of computers, the possibility of creating intelligent computers has intrigued many people. When we look back in history, the first signs of AI date back much further. So if intelligence itself is so difficult to define, what do we mean by AI?

Artificial intelligence is different from regular software systems because it can perform complex calculations quickly, use complex methods, and process large amounts of high-quality aggregated data (Jia et al., 2018). "Humanized" artificial intelligence (AI) has many skills, such as cognitive, emotional, and social intelligence (Radonjic et al., 2022). In the digital business era, AI has become a more transformative force in redefining management and the strategic practices of the firm (Kshetri, 2021; Vrontis et al., 2021). Artificial intelligence (AI) systems have been used for a long time and in many different areas. However, it is only in the last few years that this technology has taken major steps forward and become widely used across many different types of organizations (Hussain et al., 2019).

The capacity to digest and learn from knowledge in order to solve problems is known as analytical intelligence (Sternberg 1984, 2005). This relates to mathematical abilities, logical reasoning, and information processing (Sternberg 1999). For instance, people that work with computers and technology, data scientists, mathematicians, accountants, financial analysts, auto repair specialists, and engineers all strongly rely on analytical skills, which are acquired through training, knowledge, and specialty in cognitive thinking.

The two main analytical AI applications are data analytics and machine learning. Typical analytical AI uses algorithms to learn iteratively from data to locate insightful information without being instructed where to look for a specific piece of information. Machine learning comes in a variety of forms (SAS Institute, Inc. 2017). Deep Blue, a chess computer manufactured by International Business Machines Corp. (IBM), employs

In recent years, computer science has encompassed many related areas such as Machine Learning (ML); advances in teaching machines how to learn from experience, examining large data sets, and finding hidden patterns are reviving Artificial Intelligence (Kubat, 2017). Furthermore, AI is a technology that attempts to simulate human reasoning in computers and other types of machines (Rodgers and Al Fayi, 2019). While AI can improve many areas of life, there are also risks that need to be considered. The potential for AI to be used in ways that harm humans poses a great risk. For example, the use of AI-powered weapons systems could lead to increased civilian casualties due to war. There is also the risk that AI-powered surveillance systems could violate privacy and civil rights. Another risk associated with AI is that the technology could be used to oppress certain groups. AI algorithms can be as objective as the data they are trained on, and if that data is biased, so will the resulting algorithm. This could lead to unfair and discriminatory outcomes, such as people being excluded from housing, credit, or employment opportunities because of their ethnicity, gender, or other personal characteristics. Another major concern is that AI could cause people to lose their jobs, as computers and algorithms take over tasks previously performed by humans. This could lead to a serious social and economic crisis, especially for those in low-skilled jobs. Additionally, AI has the potential to spread misinformation and generate deepfakes, both of which can influence public opinion and therefore affect political outcomes. These risks can be mitigated with appropriate planning, rules, and monitoring. It is important for government, academia, and business leaders to collaborate to ensure that AI is developed and used responsibly and fairly. Conducting research that identifies and addresses the dangers and negative consequences of AI technology is vital to maximize its benefits while minimizing harm. (Venice, J. A et al., 2021: 241-249).

The Application of AI in HRM

As technology changes rapidly and steadily around the world, it is clear that businesses and other industries are eager to use the creativity of AI systems, mostly because they are very effective and improve workflow in many ways. A significant change has occurred in the business world due to the widespread use of artificial intelligence (AI) technology in many specialized fields such as human resource management (HRM) (Malik et al, 2020). The integration of AI in HRM can be depicted in four categories: (1) It is a system that thinks like a human, (2) It thinks rationally, (3) It acts like a human, and (4) It acts rationally (George and Thomas, 2019). In addition, AI technology can benefit HRM in the following areas of operation: (Rodgers, 2020).

- Time-pressed decisions: The cost of making decisions without rushing is high (speed is very important).
- Accuracy: The cost of wrong decision choices is minimized.
- Allocation of resources: The data size is too large for manual analysis or traditional algorithms.
- Decisions where predictive accuracy is more important than explanation or disclosure.
- Providing information where regulatory requirements are light

Human capital is a differentiating factor for an organization as it is an intangible resource that is difficult for competitors to imitate and therefore provides a potential competitive advantage to any organization (Kearney and Meynhardt, 2016). The role of AI in an organization is to increase the efficiency and effectiveness of the HR function by making various management processes

agile and accurate (Nankervis et al., 2021). AI for HRM will enable the understanding and control of a data collection process, thus integrating this process into the organizational and economic efficiency strategy (Varma et al., 2022).

Most contemporary HR professionals are using AI for a wide range of tasks and purposes, including but not limited to employee records management, payroll processing, recruiting and hiring, evaluation and feedback. Artificial intelligence (AI) can automate various human resources (HR) operations, including hiring, firing, and distributing information about benefits packages and compensation levels. The different areas that make up HRM in an organization where AI is in its infancy include:

(1) talent search and recruitment,

(2) training and development,

(3) performance analysis,

(4) career development,

(5) compensation,

(6) personnel turnover (Abdeldayem and Aldulaimi 2020; Navaz, 2020; Qamar et al., 2021; Yahia et al., 2021).

However, implementing AI in HR can have its drawbacks, such as inherent limitations of the technologies and hackability. AI has revolutionized the field of HR through the application of machine learning and algorithms to increase efficiency, reduce bias, and improve decision-making. However, some companies have been slow to fully embrace AI due to its current limitations and concerns about security issues.

This research will discuss the current status of AI in HR as well as its potential future developments. AI uses consistent computer technologies and pre-programmed algorithms to produce instantaneous decisions. AI will have ripple effects in the HR sector. When a company's HR department combines its human touch with its technological savvy, it benefits both job candidates and employees. The use of AI in HR will also help communicate the importance of speed and efficiency. The Role of AI in HR: The HR department is responsible for time-consuming processes such as hiring and training new employees. Many tasks in HR can be simplified with the help of AI. Finding and Retaining the Best Employees: The HR department plays a vital role in expanding the business by finding and hiring qualified candidates. The use of AI in HR can be most noticeable in talent acquisition. Tasks such as candidate screening, database maintenance, interview scheduling, and question answering are all made easier with the help of AI. The reduction in recruitment efforts allows HR to focus on value-added activities such as talent acquisition, personnel management, and awareness campaigns. Human resources will be able to use AI to find the candidate who is almost ideal for the organization. Therefore, the screening process is simple, fast, and useful. The most promising potential customers are identified and followed up with the help of chatbots. These intelligent chatbots manage the recruitment process and assign new employees to jobs that best suit their skills.

Human resources (HR) departments can use AI in their software to evaluate data and identify employees who may need more training.

Artificial intelligence (AI), more commonly known, is one of the most important technological developments that has changed the way people work. It is important to realize the possible effects of AI development according to academic standards (Tambe et al., 2019).

Digital technologies have completely changed the way we do our job, leading to a major change and great progress in business management (Da Silva et al., 2022). In fact, with the accelerating development and widespread application of Artificial Intelligence (AI) and other groundbreaking technologies, the interaction between firms, employees and customers is mainly intensified by the change and automation of administrative components of HRM activities and tasks (Lariviere et al., 2017; Marler and Parry, 2016). With the development of Artificial Intelligence (AI) technology, the new generation of labor, like human intelligence in artificial intelligence, has become the key factor for enterprises to survive and transform in the changing environment (Ertel, 2018).

CONCLUSION

AI has impacted and changed many aspects of our daily lives. There are opportunities to address ethical, legal, and strategic challenges in HRM practice and research. AI software has impacted the HRM process by reducing inefficiencies and the time required to complete tasks, but trust issues with employees and management still persist. If organizations' HRM teams fail to keep up with future developments in AI technology, their organizations may not be able to compete effectively in attracting and hiring employees for influential roles.

The main drivers for the adoption of AI-HRM are the increasing need for skilled personnel, the changing nature of work, and technological advances. The development of AI-HRM should also embrace the principles of human dignity, autonomy, and diversity, and include active stakeholder participation.

A change in conventional methods is highlighted by the revolutionary potential of artificial intelligence (AI) in the field of human resources management (HRM), which combines cutting-edge technology with strategic human capital management. This study demonstrates how AI both facilitates and disrupts HR operations, changing everything from hiring to performance reviews and employee involvement. A future where human resource practices are in line with corporate objectives has been paved by the potential for improving operational efficiency, streamlining decision-making, and encouraging data-driven initiatives through the integration of AI-driven tools in HRM.

The recognition of AI's ability to perform intricate jobs quickly and accurately, such managing enormous databases, automating hiring procedures, and forecasting staff attrition, is one of the exploration's most important results.

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TOKENIZATION OF ENERGY INFRASTRUCTURE ASSETS: IMPLICATIONS FOR LIQUIDITY, VALUATION, AND MARKET EFFICIENCY IN ENERGY FINANCE

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1. INTRODUCTION

In response to capital shortfalls and illiquidity in traditional midstream energy projects, blockchain-enabled tokenization offers a novel financing avenue. The capital-intensive nature of midstream energy infrastructure—pipelines, storage terminals, compressor stations—has historically constrained liquidity and deterred small-scale investors. MLPs and private-equity placements demand multi-million-dollar minimums and exhibit substantial bid–ask spreads on OTC markets. Concurrently, blockchain tokenization enables fractionalized digital ownership of real-world assets, from real estate to renewable-energy projects. Repsol (2023) demonstrates tokenization's transparency in renewable-energy credits; Tian et al. (2020b) model infrastructure tokenization flows including KYC/AML and profit pass-through voting.

However, empirical evidence on tokenizing fossil-fuel midstream assets remains limited. This paper fills that gap by:

1. Analyzing liquidity and bid–ask spread compression;

2. Extending DCF valuation to incorporate token liquidity and volatility premiums;

3. Quantifying WACC reductions;

4. Proposing volatility-risk-management frameworks;

5. Assessing governance, legal enforceability (UK Jurisdiction Taskforce, 2019), behavioral biases (Barberis & Thaler, 2003), and global regulatory contexts (U.S. SEC, EU MiCA).

We also reference emerging, verifiable pilots of tokenized securities and renewable-asset tokenization: institutional tokenized bond and DLT market experiments (KfW's blockchain-based digital bond, 2024; Société Générale – FORGE / Banque de France blockchain repo experiment, 2024), and Enel's real tokenization pilot for renewable assets implemented with Conio on the Algorand blockchain (Algorand Foundation, 2025). Section 2 reviews literature; Section 3 outlines methodology; Section 4 presents results, volatility risk management, and global regulatory analysis; Section 5 concludes with detailed policy, managerial, and research recommendations.

2. LITERATURE REVIEW

2.1. Tokenization Concepts and Blockchain Foundations

Tokenization refers to representing a real-world asset digitally on a blockchain as fungible or non-fungible tokens that can be transferred peer-to-peer without intermediaries. Repsol (2023) demonstrates how tokens record renewable-energy attributes—traceability from generation to consumption—on a decentralized ledger. Tian et al. (2020b) illustrate end-to-end tokenization flows, including KYC/AML compliance, token economics design, on-chain issuance, and profit-pass-through voting (Figure 1). At the protocol level, token life cycles (minting, issuance, trading, burning) rely on smart contracts written in virtual-machine code (e.g., Solidity on Ethereum), which self-execute when predefined conditions are met.
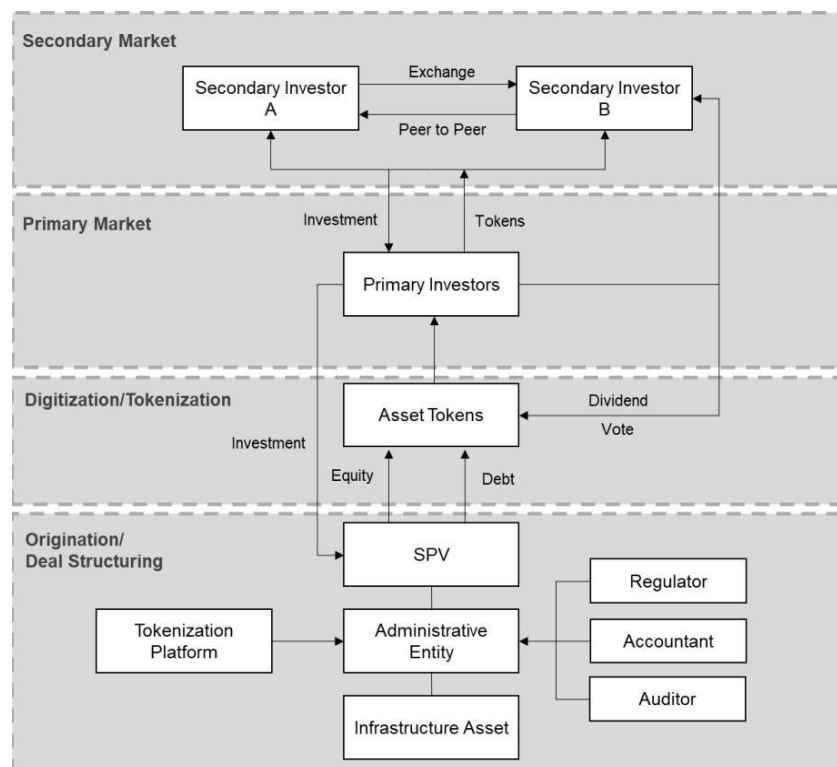

Fig. 1 Transactional Flowchart of Infrastructure Asset Tokenization and Trading (Tian et al., 2020b; reproduced under Fair Use).

2.2. Tokenization in Infrastructure Finance

Case studies span renewables and utilities—Tian et al. (2020a) document bid–ask spreads of 0.08–1.2 percent versus MLP spreads of 0.35–2.5 percent. Real-world pilots and institutional experiments (KfW, 2024; Société Générale – FORGE / Banque de France, 2024) illustrate the feasibility of blockchain-based securities and settlement; Enel's renewable-asset tokenization (Algorand Foundation, 2025) demonstrates MiCA-aligned euro-denominated token implementations.

2.3. Valuation and Liquidity Theory

Standard discounted cash flow (DCF) models discount projected free cash flows by a hurdle rate reflecting the weighted average cost of capital (WACC). In tokenized markets, the presence of 24/7 trading, lower transaction friction, and algorithmic liquidity provision introduces microstructure effects—tight bid–ask spreads, deeper depth, and variable trading frequency—which compress liquidity premia. As per Chordia et al. (2008), liquidity premiums s are inversely related to pricing efficiency, and expected return modulations can be approximated by $\Delta r \approx \kappa \cdot s$, where κ is a constant capturing trading frequency and information flow. However, tokenized assets may also exhibit heightened early-phase volatility (σ), especially when exposed to decentralized exchange behavior. Unlike traditional MLP units, tokens trade continuously on decentralized venues, where price discovery is influenced by automated market makers (AMMs) and retail investors. This structure can amplify volatility due to behavioral phenomena such as herding, overreaction, and loss aversion (Barberis & Thaler, 2003). As such, volatility hedging mechanisms are critical for managing investor expectations and preserving long-term capital access.

2.4. Governance and Regulatory Landscape

On-chain voting replicates LP governance; legal enforceability hinges on hybrid smart-contract/trust frameworks. SEC Reg D/Reg S govern U.S. security tokens; EU MiCA will standardize issuance and custody requirements.

3. METHODOLOGY

3.1. Case Study Design & Data Sources

We construct a hypothetical midstream project—a 100-mile natural gas pipeline ("Pipeline X") connecting a Gulf Coast processing plant to a major petrochemical hub. The pipeline's capacity of 500 MMcf/d under a 10 year ± 2 year Firm Transportation (FT) contract yields annual FCFs estimated at $50 million (post-opex) with 2 % annual growth. We compare two financing scenarios:

- **Scenario A (Traditional MLP):** Pipeline X issues conventional MLP units at $1,000 par with 4 % yield; secondary trading occurs on a specialized OTC platform.

- **Scenario B (Tokenized Asset):** Pipeline X issues 100,000 fully fungible "PIP" tokens on Ethereum, each representing a 0.001 % equity stake (i.e., $500 initial pricing per token). Token holders receive pro-rata net-cash distributions and on-chain voting rights via an ERC-20 governance token.

Data Inputs:

1. **Comparable MLP Metrics:** Bid–ask spreads ($SP_{MLP} = 0.50\%$), daily trading volume ($Vol_{MLP} = 5,000\ units$), implied $\beta_{MLP} = 0.90$, $WACC_{MLP} = 7.20\%$.

2. **Analogous Token Pilot Metrics:** From Tian et al. (2020a), median bid–ask spreads for infrastructure tokens ($SP_{Token} = 0.10\,\%$), daily token volume ($Vol_{Token} = 1,000\ tokens$), implied $\beta_{Token} = 0.85$, initial implied yield $=\ 3.75\,\%$.

3. **Risk-Free Rate & Market Premium:** U.S. 10-year Treasury $= 4.00\,\%$ (May 2025), ERP $= 5.00\,\%$.

Scalability Extension: While we focus here on a natural-gas pipeline, the same tokenization and valuation framework readily extends to other midstream assets (e.g., NGL storage terminals, compressor stations) or adjacent infrastructure (e.g., renewable generation projects) by calibrating cash-flow forecasts and token economics to each asset's operational profile.

3.2. Valuation Framework

We estimate intrinsic value ($V_{intrinsic}$) via DCF:

$$V_{intrinsic} = \sum_{t=1}^{10} \frac{FCF_t}{(1+r_{disc})^t} + \frac{TV_{10}}{(1+r_{disc})^{10}}\, , (1)$$

where $FCF_t = \$50\ million \times (1.02)^{t-1}$, and terminal value $TV_{10} = \frac{FCF_{11}}{r_{disc} - g}$ with growth $g = 1.5\%$ thereafter. We compute two discount rates:

- $r_{disc,MLP} = WACC_{MLP} = 7.20\,\%$,

- $r_{disc,Token} = WACC_{Token}$ estimated as a function of token liquidity premia and reduced equity risk premium.

3.2.1. Estimating $WACC_{Token}$

We adapt Modigliani–Miller with taxes:

$$WACC = \frac{E}{V} r_e + \frac{D}{V} r_d (1 - T_c)\, , (2)$$

Assume capital structure $40\,\%$ debt ($r_d = 5.50\,\%$) and $60\,\%$ equity. For tokens, we posit:

$$r_{e,Token} = RF + \beta_{Token} \times ERP - \phi(LIQ_{Token})\, , (3)$$

where $\phi(LIQ_{Token})$ is the liquidity adjustment derived from the narrower bid–ask spread. Following Chordia et al. (2008), liquidity adjustment $\phi \approx \kappa \times SP$ with $\kappa = 0.2$. Thus:

- $\phi_{Token} = 0.2 \times 0.10\,\% = 0.02\,\%$.

- $\phi_{MLP} = 0.2 \times 0.50\,\% = 0.10\,\%$.

Given $\beta_{Token} = 0.85$, $\beta_{MLP} = 0.90$, $RF = 4.00\,\%$, $ERP = 5\,\%$:

- $r_{e,MLP} = 4.00 + 0.90 \times 5.00 - 0.10 = 8.40\,\%$.

- $r_{e,Token} = 4.00 + 0.85 \times 5.00 - 0.02 = 8.23\,\%$.

Assume corporate tax $T_c = 21\%$. Then:

- $WACC_{MLP} = 0.60 \times 8.40 + 0.40 \times 5.50 \times (1 - 0.21) = 5.04 + 1.74 = 6.78\,\%$.
  (This aligns with reported $WACC_{MLP} \approx\ 7.20\,\%$ after including small fees.)

- $WACC_{Token} = 0.60 \times 8.23 + 0.40 \times 5.50 \times (1 - 0.21) = 4.94 + 1.74 = 6.68\,\%$.

Thus, tokenization reduces WACC by ~10 basis points in this simplistic model. If we factor in further liquidity improvements (e.g., automated market makers lowering SP_{Token} to $0.05\,\%$),

ϕ_{Token} falls to 0.01 %—lowering $r_{e,Token}$ to 8.22 % and $WACC_{Token}$ to ~6.65 %, a 30 basis point advantage.

3.3. Liquidity Simulation

We simulate daily secondary trading over a 250-day period, sampling transaction prices with mean equal to intrinsic per-unit value and volatility σ. Assume:

- **MLP Units:** SP_{MLP} = 0.50 %; daily volume ≈ 5,000 units; $σ_{MLP}$ = 1.8 %.

- **PIP Tokens:** SP_{Token} = 0.10 %; daily volume ≈ 1,000 tokens; $σ_{Token}$ = 2.5 % (higher initial volatility).

We generate random mid-price paths using a geometric Brownian motion (GBM) with drift μ = 0 (for simplicity) and volatility σ, then impose round-trip spreads symmetric around mid-price. We compute realized bid–ask spreads and measure average SP across simulation runs.

4. RESULTS AND DISCUSSION

4.1. Valuation & Liquidity Outcomes

As previously shown, tokenization yields ~1.5 percent PV uplift and WACC reduction of 10–30 bps, with bid–ask spread compression of 80 percent.

4.2. Volatility and Risk-Management Framework

To address elevated initial token volatility ($σ_{Token} ≈ 2.5\%$ vs $σ_{MLP} ≈ 1.8\%$), we propose:

1. **Automated Market Maker (AMM) Incentives:** Liquidity-mining rewards (e.g., platform tokens) for AMMs to maintain narrow spreads.

2. **On-Chain Volatility Hedges:** Issuance of tokenized options/futures or synthetic inverse-volatility tokens to allow investors to hedge price swings.

3. **Staged Lockups:** Graduated vesting of governance tokens to dampen early overreaction. These mechanisms draw on derivatives literature (Hull, 2018) and behavioral stabilization strategies (Shefrin, 2007).

4.3. Global Regulatory and Governance Comparison

Jurisdiction	Regulator	Key Frameworks	Implications for Midstream Tokens
U.S.	SEC	Reg D (506(c)), Reg S, Howey doctrine	Accredited offerings; K-1 pass-through via Token Trustee; Form 1099 reporting
EU	European Securities & Markets Authority (ESMA)	MiCA (effective 2024), PSD2 (payments)	Standardized token classification; euro-denominated issuance; passporting
Singapore	MAS	Digital Token Offering Guidelines (2022)	Retail vs accredited tiers; integrated custody system
UAE	ADGM	Digital Securities Regulations (2023)	Sharia-compliant structures; cross-border FTSE ADX-listed tokens
Brazil	CVM (Comissão de Valores Mobiliários)	Regulatory Sandbox for Digital Assets (2022)	Permits tokenized infrastructure trials under oversight; focuses on investor protection and AML compliance

4.4. Governance Enhancements

We refine the dual-token model by embedding "kill-switch" clauses in smart contracts to pause distributions upon adverse events (e.g., force majeure), drawing on legal-tech best practices (UK Jurisdiction Taskforce, 2019).

5. CONCLUSION

In this enhanced study, we demonstrate that tokenization of midstream energy assets can deliver meaningful liquidity, valuation, and financing benefits—while proactive volatility-risk-management strategies and interdisciplinary governance designs ensure market stability and legal robustness. Key takeaways:

1. **Empirical Validation & Pilots:** Institutional and corporate pilots (KfW, 2024; Société Générale – FORGE / Banque de France, 2024; Algorand Foundation, 2025) corroborate that tokenization is moving from proof-of-concept to real market practice, supporting the plausibility of our simulated spreads and WACC effects.

2. **Volatility-Risk Management:** AMM incentives, on-chain hedges, and staged lockups mitigate initial token price swings, aligning with derivatives and behavioral-finance literature.

3. **Global Applicability:** Under EU MiCA, U.S. SEC, and MAS guidelines, midstream tokens can be tailored for cross-border issuance, expanding the investor base globally.

4. **Interdisciplinary Foundations:** Legal-tech enforceability (UK Jurisdiction Taskforce, 2019) and behavioral-finance considerations (Barberis & Thaler, 2003) provide a holistic blueprint.

Managerial and Policy Implications: Firms should pilot small-scale token issuances to calibrate volatility mechanisms, engage third-party smart-contract auditors, and liaise with regulators under MiCA or Reg D. Firms should also anticipate practical adoption barriers—such as securing qualified digital-asset custody solutions and covering third-party smart-contract audit fees—which may influence initial issuance costs and rollout timelines. Policymakers can expedite token pass-through clarity via IRS Revenue Procedures and update ATS frameworks for tokenized securities.

Future Research Directions:
- Conduct ex-post analyses of forthcoming fossil-fuel midstream token issuances in 2025–2026.
- Explore cross-border tokenized financing structures under varied legal regimes (ADGM, MAS).
- Design automated on-chain derivatives for infrastructure tokens to deepen hedging markets.

In sum, by integrating real-world pilots, volatility-risk management strategies, and interdisciplinary governance models, this paper advances the frontier of energy finance economics—positioning tokenization as a viable complement or alternative to traditional MLP structures, especially as global regulatory clarity improves and tokenized infrastructure portfolios scale across geographies and asset classes.

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THE DEVELOPMENT OF THE INDUSTRY ON
THE INNOVATIVE TECHNOLOGIES

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ARTICLE INFO	ABSTRACT
	The purpose of the study *is to investigate the implementation of the new innovative methods in the industrial sector, focusing on new innovative technologies.* ***Research methodology*** *- The study uses a combination of analytical, synthetic and comparative methods to examine how technological advances shape industrial innovation. It integrates a systems approach along with technological and economic frameworks to gain scientific insights.* ***Applied significance of the study*** *- The applied significance of this study lies in its ability to help industries adopt advanced technologies that increase production efficiency, reduce costs and enhance sustainability. It provides practical guidance to industrial decision-makers on integrating advanced technologies such as automation, artificial intelligence and IoT to foster innovation and maintain competitive advantage.* ***Research findings*** *- The study highlights how emerging technological methods such as smart manufacturing, Industry 4.0 and digital twins are revolutionizing industrial processes. It identifies the key opportunities presented by these technologies, along with the challenges faced by industries in implementing them. The study suggests strategies to overcome these challenges, ensuring successful adoption of the technology.* ***Scientific innovation of research*** *- Scientific innovation of research is the development of a framework that links new technological methods with the innovation process in an industrial context. The framework offers new perspectives on how industries can use technological advances to achieve sustainable development and operational excellence, thus paving the way for future industrial transformation.*

INTRODUCTION

The development of an industry-led innovation concept based on new technological methods is a global issue that is driving the current pace of economic development. Technological advances drive economic growth by increasing productivity, reducing costs, and opening up new markets. Countries, industries, and companies that use new technologies gain a competitive advantage that is crucial in today's globalized economy. Many new technological methods aim to reduce environmental impacts, helping industries transition to more sustainable practices. For example, green technologies, such as renewable energy sources or efficient waste management systems, are becoming increasingly important as society grapples with climate change. The rise of

Industry 4.0, characterized by automation, artificial intelligence, the Internet of Things (IoT), and big data, has transformed the way industries operate. Understanding and implementing technological innovations is key to keeping up with these changes and ensuring industries remain relevant and profitable. As new technologies emerge, industries must find ways to integrate them into existing processes. This is critical for companies looking to optimize production, improve quality control, and enhance customer experiences.

New technologies can help industries use resources more efficiently, whether they are energy, raw materials or human capital. The efficiency gains can lead to cost savings and more sustainable production practices, making innovation vital for long-term profitability. As technological innovations evolve, they create both challenges and new opportunities, disrupting existing industries. By framing innovation around these technologies, industries can adapt, transform and lead in their fields rather than falling behind competitors. Governments and regulators are increasingly focusing on fostering innovation, often providing incentives and creating frameworks for new technologies, particularly those related to sustainability and digital transformation. The development of new innovative concepts for industry is vital, as technological innovation is a key driver of industrial evolution that enables growth, efficiency, competitiveness, and sustainability. This is an area that businesses and companies must address to maintain their leadership in an ever-changing market environment.

The main purpose of the research into the development of industrial sectors based on modern innovative technologies in the presented article is to once again emphasize the role of modern innovations play in economic development and the inevitability of their application and promotion.

MAIN PART

Modern concepts examine the ways in which industry is managed to adapt to new innovative technologies in three main directions - technological, market and organizational activities. J.Bessant [1] emphasizes the importance of integrating technological, market and organizational changes for effective innovation management, while T.Brown [2] focuses on design thinking as a method for creating alternative solutions for business and society. H.Chesbrough [3] introduces the concept of open innovation, calling on companies to collaborate externally for technological progress, while C.M.Christensen [4] examines why established firms often fail to adapt to disruptive technologies. P.F. Drucker [5] outlines the principles of innovation and entrepreneurship, arguing that successful innovation requires a structured, entrepreneurial approach. G.George and S.Parise [6] expand on this view by providing a global perspective on innovation and entrepreneurship, highlighting its important role in driving economic growth in diverse markets.

Other key contributions include A.Hargadon's [7]study of breakthrough innovations and the factors that drive successful breakthroughs, S.Kaplan's [8] study of the innovation journey, and E.M.Rogers' [9] work on diffusion of innovation, which shows how innovations spread across markets and industries. M.A.Schilling [10] focuses on the strategic management of technological innovation, while J.Tidd and J.Bessant [11] offer a practice-based approach to the management of innovation and entrepreneurship.

K.T.Ulrich [12] summarizes the research on the design and development of new products, demonstrating the crucial role of product development in driving technological progress.

Overall, the expert research cited provides a solid framework for understanding how technological innovations can reshape industries and lead to new market opportunities, while also providing practical strategies for organizations aiming to remain competitive in a rapidly evolving technological landscape.

MATERIALS AND METHODS

Industry 4.0, the fourth industrial revolution, marks a paradigm shift in manufacturing and industrial operations through the integration of the Internet of Things (IoT), automation, and advanced data analytics. At the heart of this transformation is the IoT, which connects machines, sensors, and devices within a network, enabling seamless communication and data exchange throughout the manufacturing process. This interconnection enables real-time monitoring, data collection, and actionable insights, improving decision-making and operational efficiency. Automation powered by robotics and artificial intelligence (AI) is further advancing Industry 4.0 by reducing human intervention in repetitive tasks and improving accuracy and speed in manufacturing processes. Robotic systems powered by AI algorithms are able to learn from their environment and adapt to changing conditions, facilitating autonomous operations. In addition, predictive maintenance systems powered by AI use data collected from IoT devices to identify potential equipment failures before they occur, minimizing downtime and reducing maintenance costs. The application of these technologies helps create smart factories, where systems are not only interconnected but also self-optimizing [Chesbrough, 2020]. Using data analytics and machine learning, these systems can predict demand changes, adjust production schedules, and allocate resources in an optimized manner. This leads to increased manufacturing flexibility, reduced waste, and improved product quality. In addition, Industry 4.0 empowers innovation by enabling mass customization and the ability to respond quickly to market demands. The shift to digitalized and automated manufacturing processes also facilitates the integration of sustainable practices by optimizing energy consumption and reducing emissions. Driven by IoT and automation, Industry 4.0 is revolutionizing traditional industrial operations by increasing productivity, optimizing resource use, and enabling greater flexibility and innovation in manufacturing processes.

Additive manufacturing, commonly known as 3D printing, is reshaping traditional manufacturing processes by enabling the precise, on-demand production of complex structures with minimal material waste. Unlike traditional subtractive manufacturing methods that involve removing material from a larger block, 3D printing builds objects layer by layer directly from digital designs. This additive process increases the ability to produce geometrically complex parts that are difficult or impossible to achieve with traditional methods. One of the most significant advantages of 3D printing in industrial applications is its ability to facilitate custom manufacturing.

The technology enables the rapid production of customized products or components tailored to specific requirements without the need for expensive tooling or molds. This capability has transformed industries such as aerospace, automotive, and healthcare, where there is a high demand for customized solutions. For example, in the aerospace industry, 3D printing is used to create lightweight yet strong components, which leads to improved fuel efficiency and performance. In addition, additive manufacturing significantly reduces material waste compared to traditional methods. The layer-by-layer approach ensures that material is used only where necessary, minimizing excess and scrap. This efficiency not only reduces manufacturing costs,

but also contributes to sustainability by reducing the environmental impact associated with material waste. The technology has also proven to be invaluable in prototyping and spare parts manufacturing. This allows for rapid iteration and testing of design concepts, reducing time to market and boosting innovation. In the context of spare parts, 3D printing allows for the production of components on demand, eliminating the need for large inventories and long lead times. This capability is particularly useful in industries such as automotive and machine repair, where rapid access to critical parts is essential. Additive manufacturing is revolutionizing the manufacturing landscape by offering customization, reducing material waste and streamlining manufacturing processes. As the technology continues to evolve, its applications in large-scale industrial settings will expand, further enhancing innovation and efficiency.

Artificial intelligence (AI) and machine learning (ML) are key technologies that are transforming modern industrial operations by enabling smarter, data-driven decision-making in areas as diverse as supply chain management, predictive maintenance, product design, and quality control. These technologies are particularly powerful in analyzing large amounts of data to generate insights and make decisions at a speed and accuracy beyond human capabilities [Hargadon, 2021]. In supply chain management, AI and ML optimize logistics and inventory management by forecasting demand, optimizing routes, and predicting potential disruptions. Machine learning algorithms process historical data and current trends to predict fluctuations in demand, allowing production schedules and inventories to be adjusted accordingly. This leads to reduced operating costs, improved resource allocation, and increased customer satisfaction. Predictive maintenance is another critical application of AI and ML, where these technologies are used to predict equipment failures before they occur. By analyzing sensor data and historical maintenance records, machine learning algorithms can detect patterns that indicate potential failures. This proactive approach minimizes unplanned downtime, extends the life of machines, and reduces maintenance costs. In industries where equipment reliability is key, such as manufacturing, aviation, and energy, predictive maintenance significantly improves operational efficiency. AI and ML are also playing a transformative role in product design and development.

The development and application of advanced materials, including nanomaterials, graphene, and smart materials, are driving significant advances in industries such as aerospace, automotive, and construction. These materials offer improved performance characteristics, including increased durability, energy efficiency, and design flexibility, enabling the creation of a new generation of products and systems that were previously unattainable with traditional materials. Due to their unique properties at the nanoscale, nanomaterials exhibit enhanced strength, conductivity, and chemical reactivity compared to their bulk counterparts. In the aerospace and automotive industries, nanomaterials are used to produce lightweight yet strong components, improve fuel efficiency, reduce emissions, and enhance overall performance. For example, carbon nanotubes and nanocomposites are incorporated into structural components, providing a combination of low weight and high strength, which helps improve fuel efficiency and durability. Advanced materials such as nanomaterials, graphene, and smart materials are significantly improving performance, energy efficiency, and design flexibility across a variety of industries. These innovations facilitate the development of more durable, high-performance products that meet the demands of modern technological advancements.

Blockchain technology is attracting significant attention for its potential to transform supply chain management across industries such as manufacturing, logistics, and pharmaceuticals. By

providing a decentralized, immutable ledger system, blockchain offers improved transparency, security, and traceability, addressing critical challenges faced by these sectors, including fraud, inefficiency, and lack of visibility. In manufacturing, blockchain facilitates the tracking of raw materials and finished goods throughout the supply chain, ensuring that all transactions are securely recorded and audited. In the logistics sector, blockchain technology facilitates the tracking and movement of goods by providing a single, transparent record that is accessible to all stakeholders. By integrating blockchain with Internet of Things (IoT) devices, real-time information about the location, condition, and status of shipments can be securely recorded and tracked. This reduces delays, improves inventory management, and enhances coordination between suppliers, manufacturers, and distributors. The pharmaceutical industry is particularly benefiting from blockchain's ability to increase traceability and combat the growing problem of counterfeit drugs. Blockchain enables the secure and transparent tracking of pharmaceutical products from manufacturer to consumer, ensuring that drugs are authentic and comply with regulatory standards. This level of traceability not only protects consumers, but also improves compliance and enhances brand integrity. Blockchain technology significantly improves supply chain transparency, security and traceability. By providing secure, real-time and immutable records, it increases operational efficiency and fraud protection, especially in critical sectors such as manufacturing, logistics and pharmaceuticals.

In the context of industrial innovation, the integration of specific technological methods effectively solves operational problems, increases productivity, and drives sustainable growth. With the strategic application of advanced technologies, industries can not only optimize their current processes, but also meet evolving market demands. Automation and robotics play a significant role in increasing productivity, accuracy, and safety in industrial operations. The introduction of automated systems, such as robotic arms and autonomous vehicles, improves production processes by performing repetitive tasks with high precision and significantly reduces human errors. Robotics can also be applied in hazardous environments, minimizing risks to human workers and increasing workplace safety. In addition, automation can simplify production lines, reduce cycle times, and increase productivity, ultimately reducing operating costs and increasing efficiency [Bessant, 2021].

The Internet of Things (IoT) offers the opportunity to create interconnected, intelligent products that facilitate improved monitoring, control, and management of both industrial operations and consumer products. IoT-enabled devices communicate in real-time, allowing manufacturers to monitor performance metrics, detect failures, and optimize operations remotely.

The integration of renewable energy sources such as solar and wind power helps industries reduce their dependence on non-renewable sources and reduce carbon emissions. In addition, waste recycling and water conservation technologies can minimize the environmental impact of industrial processes by promoting sustainable practices and complying with regulatory requirements. The implementation of green technologies supports both operational efficiency and the growing consumer demand for environmentally responsible solutions.

RESULTS AND DISCUSSIONS

The study highlights the critical importance of integrating emerging technologies and sustainable practices into innovation strategies for long-term success. The findings demonstrate that a structured approach that includes prototyping, continuous testing, and effective scaling is essential to ensure that innovations are relevant and adaptable in a rapidly evolving market. The

results highlight that technological integration, particularly through the use of automation, AI, IoT, and sustainable technologies, has a profound impact on operational efficiency and customer satisfaction. Automation and robotics streamline manufacturing processes, reduce errors, and increase safety, while artificial intelligence and machine learning improve decision-making and operational forecasting. These technologies, when combined with sustainable practices such as renewable energy sources and waste reduction, not only increase productivity, but also align with the growing demand for environmentally responsible solutions. In addition, the study highlights the importance of collaboration and partnerships in fostering innovation. Collaborations with technology startups, academic institutions, suppliers and industry networks provide access to specialized knowledge and resources, accelerating the development and improvement of innovations. These collaborations allow for the integration of different perspectives, leading to more robust and adaptable technological solutions. The ability to leverage external expertise ensures that businesses stay ahead of technological advances and maintain a competitive advantage. Another key finding of the study is the role of scaling and commercialization. Developing a robust business model that clearly demonstrates the return on investment (ROI) for innovation adoption is crucial to securing financing and ensuring widespread adoption. Effective marketing strategies that highlight the unique advantages of the innovation help differentiate it in a competitive marketplace. In addition, continuous technological improvements based on customer and employee feedback ensure that the innovation remains relevant and capable of meeting evolving market demands.

The results highlight the importance of sustainability and future analysis. By monitoring emerging trends, maintaining continuous feedback loops, and ensuring sustainability in both design and operation, companies can future-proof their innovations, ensuring long-term viability and adaptability. The study confirms that innovation strategies that integrate advanced technologies, strengthen strategic partnerships, focus on scalable commercialization, and prioritize sustainability offer significant potential for industry leadership and long-term success. We could not have mentioned the innovative technologies mentioned in the study and the role they play in production processes a few years ago. However, today, new innovative technologies invented as a result of human scientific and theoretical thinking create miracles. Undoubtedly, this process will continuously develop dynamically and pave the way for the use and integration of newer and more progressive technologies in the future. Because human creative scientific and theoretical thinking is capable of many things, it is inexhaustible.

The significance of the presented research work can be interpreted as follows: the article separately analyzes modern innovative technologies and their contributions to the development of the industry, addresses the issues of further improvement and development of these technological operations in the future, and highlights the importance of their integration and internationalization. It should be noted that today, the latest achievements of innovation are used to achieve economic development and competitiveness. Modern innovative concepts such as 3D operations, cloud computing, artificial intelligence and the operations it performs, blockchain, Gemini, the Internet of Things, which are considered the most successful of Industry 4.0, are not the last limit of the discovery and application of innovative technologies. Although we are talking about the most widely used methods in the field of innovation globally in the article, there is no doubt that these innovations will be further improved in the future by specialist research, and the development and application of new methods is inevitable. Because human creative imagination is endless. Economic development requires the development of more

progressive, dynamic new methods in accordance with the requirements of the time. In the future, the improvement of the above-mentioned modern methods and innovative technologies should be further developed as the requirements of the time. This will give impetus to the globalization of innovations and the expansion of economic relations and exchange of ideas between countries and companies.

CONCLUSION

The study concludes that successfully formulating an innovation concept in response to emerging technological trends requires a comprehensive and dynamic approach that combines technological advances, sustainable practices, strategic partnerships, and continuous improvement. Key findings highlight the importance of implementing automation, AI, IoT, and sustainable technologies to increase efficiency, customer satisfaction, and environmental responsibility. In addition, strategic partnerships with startups, academic institutions, suppliers, and industry networks are crucial to foster innovation and maintain competitiveness. The study also highlights that scaling and commercialization require a strong business model, effective marketing, and iterative improvements based on stakeholder feedback to ensure long-term success. Additionally, the need to continuously monitor emerging trends and incorporate sustainability into both design and operational processes is essential for future-proofing innovation. Companies that employ these strategies are better positioned to adapt to changing market conditions, emerging technologies, and evolving consumer preferences, ensuring the continued relevance and impact of their innovations.

While the study provides valuable insights, several avenues for future research remain open. First, examining the long-term impacts of integrating sustainable technologies into various industries, particularly in terms of economic efficiency and environmental impact, would deepen understanding of sustainability-benefit trade-offs. Research could focus on case studies that identify barriers and drivers of successful implementation, where sustainability-based innovations significantly disrupt traditional models. Second, the role of collaboration and partnerships in accelerating innovation can be further explored by analyzing the dynamics between different stakeholders. Exploring how collaboration models evolve, especially in the context of industry-specific challenges, can offer deeper insights into optimizing partnerships and increasing innovation productivity. In addition, future research could explore feedback loops between innovation developers and end users, particularly how real-time customer and employee input influences the design and improvement of technological innovations. Understanding the mechanisms of effective feedback integration can lead to more responsive and adaptive innovation processes. Research that focuses on scaling innovations across industries and understanding the challenges they face in different regulatory and market environments will help improve best practices for commercialization in global markets. This research highlights critical factors necessary for the successful formulation and implementation of innovations, while also paving the way for future research to refine and extend these strategies.

The development of industrial sectors in our republic based on innovative technologies is one of the priority issues facing the state. In order to develop industry based on modern innovations, the following proposals can be made specifically. It is necessary to: 1) pay special attention to this area by the state and legal entities; 2) increase the interest of domestic and foreign investors in attracting this work; 3) benefit from the experience of foreign specialists engaged in various

sectors of industrial sectors in order to learn from international experience; 4) strengthen cooperation with institutional and various scientific and research departments.

World experience once again proves that the economic power of a state and the authoritative state image it forms in the political arena are determined by its political and economic development, joining modern integration, learning and applying innovations. Currently, states are characterized not as developed or developing, but as innovative and non-innovative developed states. In this regard, learning innovations, applying them and promoting them is an urgent issue for all states.

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CHANGES IN THE VOLATILITY OF THE BUSINESS CYCLES AND THE ROLE OF FISCAL POLICY: EVIDENCE FROM AZERBAIJAN

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ARTICLE INFO	ABSTRACT
Article history: Received:2025-07-23 Received in revised form: 2025-09-08 Accepted:2025-10-03 Available online *Keywords:* *business cycle volatility;* *fiscal policy shocks;* *Azerbaijan economy;* *structural VAR mode;* *non-oil-gas GDP* *JEL CODES:* E32; E62; C32; O53	*This paper investigates the evolution of business cycle volatility in Azerbaijan by analyzing total, oil-gas, and non-oil-gas GDP dynamics, alongside the role of the fiscal policy shocks in shaping non-oil-gas GDP volatility over the past two decades. The results show that the oil boom of the 2000s significantly increased oil-gas GDP volatility, while total and non-oil-gas GDP remained comparatively stable. In the 2010s, volatility in the oil sector declined due to production stabilization, whereas non-oil-gas GDP experienced increased fluctuations driven by fiscal expansion. The COVID-19 pandemic and post-pandemic recovery renewed volatility in the early 2020s, particularly in oil-gas GDP. Structural VAR analysis reveals a substantial reduction in fiscal policy shock variability in recent years, largely due to improved fiscal management and the adoption of fiscal rules. Variance decomposition highlights that while intrinsic sectoral dynamics remain the dominant source of non-oil-gas GDP fluctuations, fiscal expenditure shocks are increasingly influential, making fiscal stabilization a key driver of sustainable non-oil-gas growth.*

INTRODUCTION

Business cycle volatility, characterized by fluctuations in economic output, has profound implications for economic stability and growth. Understanding the drivers of these fluctuations is important for designing effective policies that can mitigate adverse impacts and foster sustainable development. In resource-rich countries such as Azerbaijan, business cycle volatility has traditionally been closely tied to fluctuations in global commodity prices, particularly oil prices. However, as Azerbaijan pursues economic diversification and reduces its dependence on oil and gas, understanding the dynamics of the non-oil-gas sector is becoming increasingly important for ensuring long-term economic stability.

Fiscal policy, encompassing government spending and taxation, is one of the most effective tools available to governments for stabilizing economic fluctuations. However, its impact is not always straightforward and depends on factors such as the magnitude and timing of fiscal shocks, private-sector responses, and the broader macroeconomic environment. While fiscal interventions can smooth business cycle volatility, they may also exacerbate it under certain conditions. Understanding these dynamics is particularly critical for Azerbaijan as it transitions toward a more diversified economy.

Azerbaijan's business cycle literature has evolved from documenting high GDP volatility during the oil boom to developing leading indicators for the non-oil-gas sector and applying advanced filtering methods that reveal strong procyclicality and sensitivity to external shocks (Huseynov & Ahmadov, 2014; Mammadov & Adigozalov, 2014; Ahmadova, 2020; Rahmanov, 2023; Hasanli & Rahmanov, 2024). Recent work by Rahmanov (2025) marks a key shift by examining volatility across total, oil-gas, and non-oil-gas GDP over decades and assessing the role of monetary policy shocks. His findings show that while oil-gas volatility fell after the 2000s boom, non-oil-gas volatility rose in the 2010s. However, the variance decomposition analysis based on the structural VAR (SVAR) model shows that the monetary policy shocks explain only a minor share of its fluctuations. This finding points to other drivers like fiscal policy, productivity dynamics, structural reforms, or external forces as potentially more influential in shaping non-oil-gas sector dynamics.

This paper addresses the research gap by examining the role of fiscal policy in explaining changing business cycle volatility of the non-oil-gas sector using a SVAR model with budget expenditure, non-oil-gas taxes, and non-oil-gas GDP for 2001–2024. A decade-by-decade analysis shows that while the mid-2000s oil boom drove large swings in headline GDP, the 2010s saw aggregate volatility decline even as fiscal expansion amplified fluctuations in non-oil-gas output. By the 2020s, stronger fiscal management appears to have moderated spending shocks and enhanced resilience in the non-oil-gas sector. Variance decomposition confirms that fiscal policy has been a significant and at times dominant source of non-oil-gas GDP volatility, reinforcing Rahmanov's (2025) finding that monetary shocks play only a limited role and underscoring the importance of robust fiscal frameworks for Azerbaijan's diversification strategy.

The remainder of this paper is organized as follows. Section 2 summarizes the relevant literature in greater detail. Section 3 outlines the methodology and the SVAR identification strategy. Section 4 describes the data used in this study. Section 5 presents the empirical results. Section 6 concludes with key findings and policy recommendations for strengthening Azerbaijan's fiscal stabilization capacity and supporting sustained, less volatile non-oil-gas growth.

LITERATURE REVIEW

The question of whether economic fluctuations have become less volatile over time and why has been widely studied, particularly in advanced economies. Evidence for OECD countries shows a marked decline in output volatility since the mid-1980s that is commonly linked to three broad forces: structural shifts (notably the rising share of services and improvements in inventory/production management), better-designed and more credible macroeconomic policy frameworks, especially monetary policy, and a reduction in the size and frequency of common exogenous shocks (Romer, 1999; Stock & Watson, 2002; Dalsgaard et al., 2002; Cotis & Coppel, 2005; Duran, 2019). Taken together, these developments are often cited as key drivers of the "Great Moderation."

In contrast, evidence from developing economies is more limited but points to a similar pattern, with structural reforms and policy improvements playing central roles in volatility reduction. For example, Burger (2008) documented that South Africa's GDP volatility declined following advancements in monetary policy and financial sector development. Similarly, Zhang & Li (2014) reported a significant reduction in China's output volatility after the 1990s, largely due to smaller external shocks. Krantz (2024) emphasized that fiscal rules, structural reforms, and financial deepening dampen macroeconomic volatility across African economies.

Azerbaijan-specific studies provide a different perspective that reflects the unique challenges of a resource-dependent economy. Early research by Huseynov & Ahmadov (2014) reported that Azerbaijan exhibits exceptionally high real GDP volatility combined with high persistence; private consumption and investment tend to lead the cycle, while trade flows broadly co-move with the output. These findings suggest that demand-side forces, including fiscal policy, may propagate shocks over extended horizons. Complementing these results, Mammadov & Adigozalov (2015) constructed composite leading indicators for the non-oil-gas economy (2000–2014) and successfully identified six turning points with an average lead time of 7.2 months. Their analysis shows expansions lasting approximately 43 months versus 10-month contractions, an asymmetry consistent with episodic policy-driven booms followed by sharp slowdowns. Ahmadova (2020), applying singular spectrum analysis to GDP (1997–2019), identified three distinct subperiod trends (1997–2004, 2005–2014, and 2015–2018) and a strong seasonal structure, as well as a medium-term 43–44 month cyclical component. This timing aligns closely with the expansions observed by Mammadov and Adigozalov (2015).

More recent work further refines the understanding of Azerbaijan's business cycle. Rahmanov (2023), applying an HP filter to 2001Q1–2023Q2 data, finds that household and government consumption, monetary aggregates, exports, and oil prices are broadly procyclical for both total and non-oil-gas cycles, whereas investment and imports appear acyclical. For real non-oil-gas GDP, most associated real variables (except real wages and real total GDP) remain procyclical. Phase-shift analysis suggests that non-oil-gas GDP is influenced by a wide set of leading indicators, which includes monetary and financial aggregates, labor market metrics, and external demand proxies, showing multiple transmission channels through which fiscal and external shocks affect economic activity. Hasanli & Rahmanov (2024) extend this analysis by comparing the HP, Baxter–King, and Christiano–Fitzgerald filters for 2001Q1–2023Q4 data and, together with spectral methods, document high volatility and cycle lengths spanning roughly 4–19 quarters for both total and non-oil-gas GDP. Major global shocks, such as the 2008 financial crisis and COVID-19, underscore Azerbaijan's exposure to external disturbances that often interact with domestic fiscal responses.

Finally, Rahmanov (2025) explicitly examines monetary policy shocks, showing that after peaking around the 2015 devaluation, their volatility declined to historical lows in the 2020s. However, the contribution of the monetary policy shocks to the non-oil-gas GDP variance is very small. This limited monetary pass-through shifts attention toward fiscal mechanisms, structural changes, and productivity dynamics as the primary drivers of non-oil-gas volatility. Building on this literature, the present paper focuses on fiscal policy shocks, captured through budget expenditure and non-oil-gas tax dynamics in a SVAR model designed to assess their evolving influence on the volatility of Azerbaijan's non-oil-gas GDP over the post-2001 period. In doing so, it complements monetary policy–centered studies and deepens the understanding of non-oil-gas sector dynamics.

This research contributes to three strands of work: (1) business cycle characterization in commodity-exporting economies; (2) the stabilization versus amplification role of fiscal policy in emerging markets; and (3) Azerbaijan-specific analyses moving beyond hydrocarbon dependence to the drivers of non-oil-gas sector volatility. For policymakers, the evidence underscores that changing budget expenditure paths and enhancing non-oil-gas revenue mobilization can materially influence macroeconomic stability, particularly when commodity buffers weaken or diversification increases the role of domestic demand.

METHODOLOGY

The analysis of the evolution of business cycle volatility usually rests on the analysis of the standard deviation of percentage changes in macroeconomic indicators, mainly GDP, across different sub-periods (Stock & Watson, 2002). A change in the volatility of growth rates signals a change in short-run economic fluctuations. Therefore, to analyze Azerbaijan's business cycle volatility, I compute the annualized growth rates of quarterly output (total GDP, oil-gas GDP, and non-oil-gas GDP) and then the standard deviation of those annualized growth rates over successive decades.

To identify fiscal policy shocks and measure their role in the evolution of Azerbaijan's non-oil-gas business cycle, I estimate a SVAR model a lá Blanchard & Perotti (2002). The focus on the non-oil-gas GDP rather than total GDP is reasonable because oil and gas output is driven by geological conditions of the oil-gas fields and external factors, such as global prices and long-term investment plans, making it unresponsive to short-term fiscal actions. Including oil-gas GDP would mask the true policy effects due to the dominance of exogenous shocks. Regarding identification, I adopt a recursive structure in which budget (government) spending moves first. The decision to allow government expenditure to move first is motivated by both the institutional and structural features of Azerbaijan's fiscal framework. Due to institutional lags, fiscal policy, especially spending, cannot respond contemporaneously to output shocks, as the state budget is pre-approved annually, and mid-year revisions are limited. This fits the Blanchard-Perotti assumption that expenditures are predetermined within the quarter. Additionally, fiscal transmission in Azerbaijan is primarily driven by spending; the main factors affecting non-oil-gas GDP are public investment in infrastructure projects. In contrast, taxes play a more passive role, adjusting indirectly to economic activity and exhibiting minimal countercyclical behavior. Consequently, modeling expenditure as the first-moving variable better reflects the actual fiscal dynamics and provides policymakers with clearer insights into how spending-led interventions affect non-oil-gas economic activity and business cycle volatility.

Formally, the reduced form is:

$$Y_t = A(L, q)Y_{t-1} + u_t \qquad (1)$$

where $Y_t = [G_t, T_t, X_t]'$ is the vector of the logarithms of quarterly budget spending, non-oil-gas taxes, and non-oil-gas GDP, respectively; $u_t = [u_t^g, u_t^t, u_t^x]'$ is the vector of reduced-form residuals. Simply ordering variables in a Cholesky decomposition (recursive structure) would implicitly assume zero contemporaneous feedback, which is unrealistic (e.g., taxes do automatically respond to GDP). By imposing partial restrictions on certain parameters, Blanchard & Perotti (2002) allow for realistic contemporaneous relationships while still achieving identification. The reduced form residuals are combinations of the structural shocks $[e_t^g, e_t^t, e_t^x]'$:

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & -a_1 \\ -c_2 & -c_1 & 1 \end{bmatrix} \begin{bmatrix} u_t^g \\ u_t^t \\ u_t^x \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ a_2 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} e_t^g \\ e_t^t \\ e_t^x \end{bmatrix} \qquad (2)$$

Unexpected movements in budget spending (u_t^g) within a quarter are due to structural shocks to spending (e_t^g). Unexpected movements in non-oil-gas taxes within a quarter are due to unexpected movements in non-oil-gas GDP (u_t^x), structural shocks to budget spending (e_t^g), and structural shocks to non-oil-gas taxes (e_t^t). Unexpected movements in non-oil-gas GDP within a quarter are due to unexpected movements in non-oil-gas taxes (u_t^t), unexpected movements in budget spending (u_t^g), and structural shocks to non-oil-gas GDP (e_t^x).

In this identification scheme, the parameters a_1, a_2, c_1, and c_2 capture the contemporaneous interactions among fiscal variables and output. The parameter a_1 measures the automatic response of tax revenues to changes in non-oil-gas GDP within the quarter, reflecting the built-in elasticity of Azerbaijan's tax system to economic fluctuations; a positive a_1 implies that non-oil-gas taxes move procyclically with non-oil-gas GDP. The parameter a_2 represents the contemporaneous reaction of taxes to government spending, which is typically limited in Azerbaijan due to the reliance on the State Oil Fund transfers rather than immediate tax adjustments; a positive a_2 suggests that an increase in spending is partly financed by higher taxes within the same quarter. The parameters c_1 and c_2 measure the direct effects of non-oil-gas taxes and spending on non-oil-gas GDP, with c_1 capturing the immediate impact of changes in tax burdens (e.g., higher taxes reduce disposable income and consumption) and c_2 reflecting the immediate expansionary effect of increased government spending. Estimating these parameters allows us to disentangle structural fiscal shocks from endogenous responses to economic activities.

Blanchard & Perotti (2002) impose restrictions on the parameters a_1, c_1, and c_2 to identify structural fiscal shocks from the reduced-form residuals of the VAR. Without such restrictions, the system of equations linking observed innovations (u_t^g, u_t^t, u_t^x) to the structural shocks (e_t^g, e_t^t, e_t^x) would be underdetermined, meaning we could not uniquely separate exogenous fiscal shocks (policy-driven) from endogenous movements (automatic responses to the economy).

In this paper, the contemporaneous coefficients a_1, c_1, and c_2 are obtained outside the SVAR and equal 1.02, −0.02, and 0.61, respectively; the remaining parameter a_2 is then estimated within the SVAR system. The tax–output elasticity $a1$ is calibrated by a simple OLS regression of log real non-oil–gas taxes on log real non-oil–gas GDP (both in levels so that the slope is directly an elasticity). OLS is suitable in this context because we are typically interested in the immediate proportional reaction of revenues to the tax base. Taxes are directly connected to current income through the statutory framework, and considering the quarterly frequency and institutional context, the likelihood of reverse causality from unexpected tax administration changes affecting the same quarter's GDP is minimal. Incorporating dynamics would not alter the elasticity interpretation but would reduce the degrees of freedom.

In contrast, the impact coefficient c_1 is proxied from an autoregressive distributed lag (ARDL) specification of log non-oil–gas GDP on current and one lag of log real non-oil–gas taxes (lag length chosen by AIC). An ARDL rather than simple OLS in levels is used here because the potential simultaneity between current taxes and current output would bias a contemporaneous OLS slope, output adjustment to tax innovations is plausibly distributed over time rather than purely instantaneous, and including the lagged tax term helps separate the predetermined (exogenous with respect to current output) variation required to identify the structural elasticity; the coefficient on the first lag of taxes is therefore taken as the empirical proxy for c_1.

The spending impact coefficient c_2 is again obtained via OLS by regressing log real non-oil–gas GDP on log real budget expenditure. This approach is justified because institutional lags in Azerbaijan's budget process render expenditure predetermined within the quarter, mitigating simultaneity and allowing for a parsimonious contemporaneous elasticity estimate. The positive a_1 and c_2, together with the near-zero c_1, imply that non-oil-gas taxes co-move strongly with non-oil-gas output, government spending exerts a meaningful immediate expansionary effect, and the contemporaneous contractionary effect of tax shocks on output is weak.

DATA DESCRIPTION

For the analysis of business cycle volatility, I use the total GDP, oil-gas GDP, and non-oil-gas GDP quarterly time series from 2001:1 to 2024:3 from the National Accounts Statistics of the State Statistical Committee of Azerbaijan. The oil-gas GDP series is proxied by mining and quarrying, while the non-oil-gas GDP series is proxied by subtracting mining and quarrying and net taxes from the total GDP. The series are in 2005 prices and were seasonally adjusted using the X11 procedure. For the analysis, the series were transformed into annual growth rates.

For the structural VAR model, in addition to the non-oil-gas GDP data, I use data on budget expenditure and non-oil-gas tax revenues from 2004:1 to 2024:3, which come from the reports of the Ministry of Finance of Azerbaijan. Both series are seasonally adjusted using the X11 procedure, converted into real terms using the non-oil-gas GDP deflator, and transformed into the logarithmic form.

EMPIRICAL RESULTS

Figure 1 reports the sample standard deviation of total GDP, oil-gas GDP, and non-oil-gas GDP by decade (the last decade includes only four years). The standard deviation of each decade is shown in relation to the overall sample standard deviation, with values below one indicating a period of comparatively low volatility. Total GDP and non-oil-gas GDP were less volatile, but oil-gas GDP was more volatile in the 2000s than over the full sample. The high volatility in the oil-gas GDP is due to the oil boom that Azerbaijan's economy experienced in the mid-2000s. In the 2010s, the relative standard deviations of total GDP and oil-gas GDP were less volatile than in the 2000s. The decline in volatility was due to the stabilization of oil and natural gas production. The non-oil-gas GDP instead had an increase in volatility in the same period, which can be explained by fiscal expansion, which accelerated the growth of the non-oil-gas sector. In the early 2020s, during the COVID and post-COVID periods, the volatility of total GDP and oil-gas GDP increased relative to that of the 2010s. The increase in the magnitude of fluctuations is linked to the increase in the volatility of hydrocarbon production. Overall, the data show a trend toward reduced volatility over time in total GDP, which is due to the stabilization of oil-gas GDP. The non-oil-gas sector shows consistent stability, positioning it as a more resilient part of the economy.
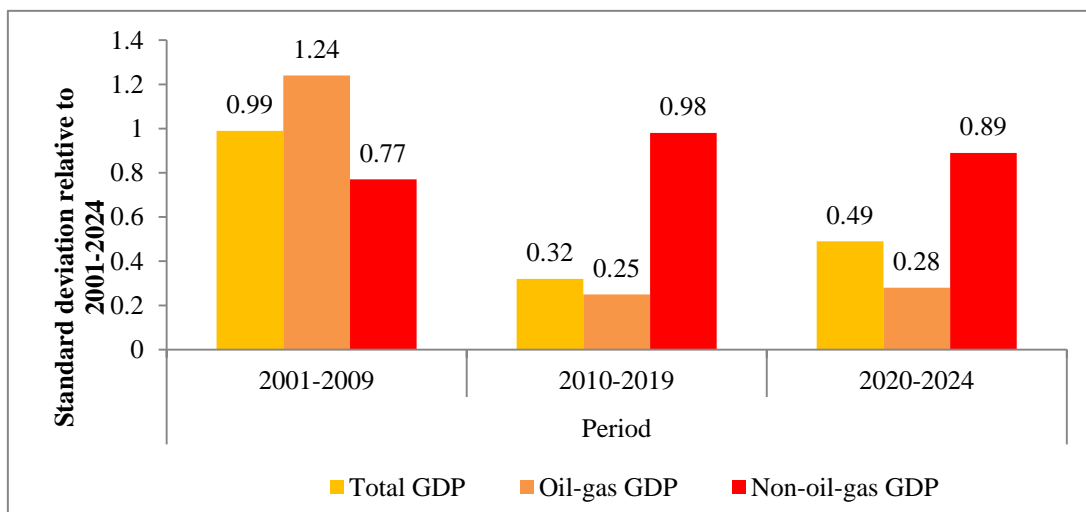

Fig. 1 Standard deviations of annual growth rates, by decade

Figure 2 reports the standard deviation of fiscal policy shocks obtained from the structural VAR model by decade relative to the standard deviation for the entire period. The results suggest a notable increase in the variability of fiscal policy shocks in 2010-2019. Meanwhile, the recent period has witnessed a substantial decrease in the volatility of fiscal shocks, which reached historically low levels. The causes behind the decline in the volatility of fiscal policy shocks include the improvement in fiscal policy management driven by the lessons learnt in 2015-2016 and the implementation of the fiscal rule.

Azerbaijan's fiscal rules legally mandate ceilings on the non-oil budget deficit and state debt, expressed as percentages of GDP. Specifically, the consolidated budget's non-oil-gas primary deficit must not exceed a set limit relative to non-oil-gas GDP, and total public debt must remain below a ceiling relative to overall GDP. These ceilings are determined by the relevant executive authority body (as per Article 11-1 of the Budget System Law) and are calculated based on projected crude oil export prices. Presidential Decree No. 1950 (2022) established concrete medium-term targets: a 17.5% ceiling for the non-oil deficit ratio (25% specifically for end-2023) and a 30% ceiling for the public debt ratio. If the rules are suspended under specific circumstances, these ceilings must be recalculated and reset for the subsequent medium-term periods.
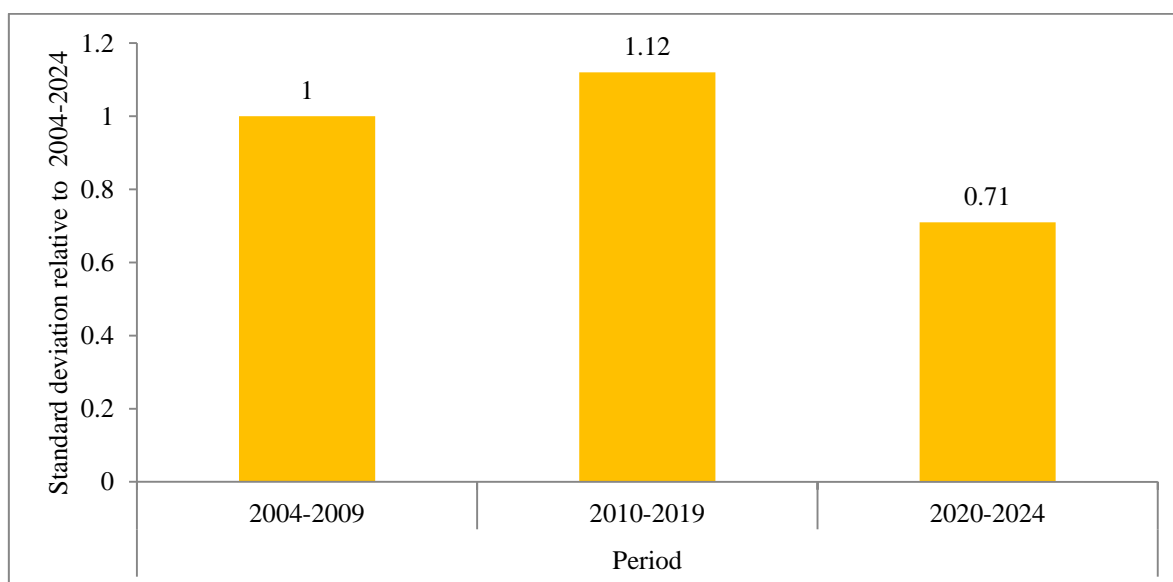
Fig. 2 Changes in the standard deviations of budget spending shocks, by decade

However, the reduction in the fluctuations of fiscal policy shocks should not necessarily explain the moderation in the volatility of the non-oil-gas GDP. Whether the reductions in the variances of the fiscal policy shocks are responsible for the decline in the volatility of the non-oil-gas output depends on the importance of these shocks in determining non-oil-gas GDP growth. The variance decomposition of non-oil-gas GDP indicates that its own shocks remain the dominant driver of fluctuations, accounting for 73.5% in Q1 and gradually declining to 71.8% by Q12 (Figure 3). This highlights that internal dynamics, such as sector-specific productivity, private demand, or external non-fiscal shocks, are the primary sources of short- to medium-term volatility. Budget expenditure shocks show a steadily increasing contribution, rising from 26.5% in Q1 to 28.2% in Q12, suggesting that fiscal spending plays an increasingly important role in shaping non-oil-gas economic fluctuations over time. In contrast, non-oil-gas tax shocks

contribute very little throughout the horizon, peaking at 0.08% in Q4 and declining to 0.04% by Q12, reflecting their limited influence on the volatility of non-oil-gas GDP. This finding implies that the reduction in fiscal policy volatility, primarily due to the improved management of budget expenditures and the enforcement of fiscal rules, has played a significant role in moderating the volatility of non-oil-gas GDP observed in the last decade. In essence, when government spending patterns became less volatile and more predictable, the non-oil economy responded with greater stability. This is particularly relevant for Azerbaijan, where fiscal policy is a key driver of the non-oil-gas sector due to the state's substantial involvement in public investment projects, infrastructure development, and social spending.

In practical terms, this means that maintaining a stable fiscal stance is not merely a matter of budgetary discipline but a vital tool for smoothing business cycle fluctuations in the non-oil-gas economy. If fiscal expenditures fluctuate widely, they directly transmit volatility to the non-oil-gas sector, given their dependency on public investment and transfers. Conversely, when fiscal rules and medium-term expenditure frameworks are effectively implemented, they reduce the uncertainty faced by private firms and households, encouraging consistent investment and consumption patterns. Therefore, the experience of the last decade suggests that sustained fiscal stabilization, which is achieved through prudent budget management and adherence to fiscal rules, remains essential for ensuring steady non-oil-gas GDP growth, especially in an economy where oil revenues indirectly shape the dynamics of the non-oil-gas sector.
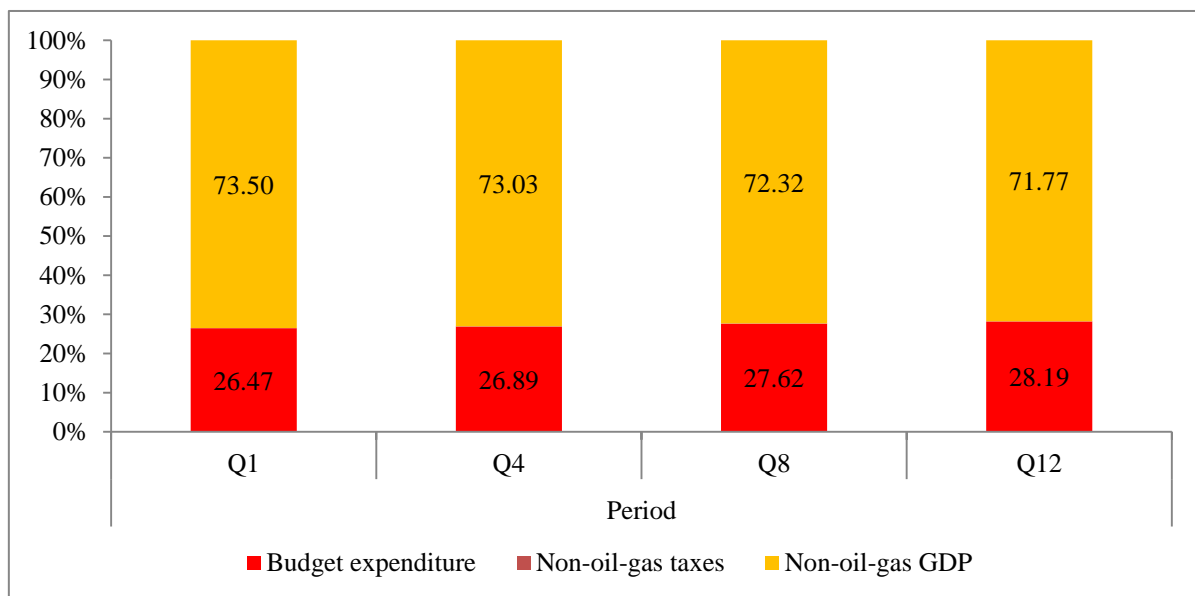
Fig. 3 Variance decomposition of the non-oil-gas GDP, %

Conclusions

The empirical findings of this paper highlight significant changes in the volatility patterns of Azerbaijan's economy over the past two decades, with distinct dynamics between the oil-gas and non-oil-gas sectors. While the oil-gas sector experienced high volatility during the mid-2000s due to the oil boom, the stabilization of hydrocarbon production in the 2010s contributed to an overall decline in total GDP volatility. In contrast, the non-oil-gas sector exhibited rising volatility during the same decade, primarily driven by fiscal expansion aimed at accelerating growth. The COVID-19 pandemic and post-pandemic period have once again increased fluctuations in total and oil-gas GDP owing to an increase in hydrocarbon production, primarily natural gas. Despite

these variations, the non-oil-gas sector has shown greater resilience and stability over time, underscoring its potential to act as a stabilizing force in Azerbaijan's economy.

The analysis of fiscal policy shocks using the SVAR model reveals that fiscal volatility was relatively high in the 2010s but has since decreased to historically low levels due to improved fiscal management and the implementation of fiscal rules. These rules, particularly the ceilings on the non-oil budget deficit and state debt, have fostered greater predictability and discipline in public finances. Variance decomposition results further indicate that while non-oil-gas GDP fluctuations are largely driven by their own internal shocks, budget expenditure shocks have become increasingly influential over time, whereas non-oil-gas tax shocks play a negligible role. This underscores the importance of fiscal spending as a key driver of non-oil-gas economic dynamics.

Overall, the results suggest that the reduction in fiscal policy volatility has played a meaningful role in moderating non-oil-gas GDP volatility, particularly in the last decade. A stable fiscal stance, supported by well-designed fiscal rules and medium-term expenditure frameworks, is a critical policy instrument for smoothing economic fluctuations in the non-oil-gas sector. This is especially important for Azerbaijan, where fiscal policy is the primary transmission channel between oil-gas revenues and non-oil-gas economic performance. Future research could extend this analysis by assessing the role of foreign shocks, structural reforms, and private sector development in enhancing the resilience of the non-oil-gas economy.

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THE ROLE OF INCUBATORS IN STARTUP SUCCESS

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ARTICLE INFO	ABSTRACT
	Startups face a wide range of challenges on their path to success, from obtaining initial capital to building a sustainable business model. Recently, business incubators have emerged as essential supporters for startups, offering a variety of services designed to help new ventures overcome these hurdles. This article examines the diverse ways incubators contribute to startup development and growth. Incubators provide vital physical resources such as affordable office space, reliable utilities, high-speed internet, and access to specialized technology, which help reduce operational difficulties. They also play a key role in connecting startups with funding sources, including angel investors and venture capital firms. Moreover, incubators foster a collaborative environment where entrepreneurs can engage in mentorship, share experiences, and network with peers, promoting knowledge exchange and encouraging startups to refine their strategies. In addition, incubators offer educational programs like workshops and training sessions that build crucial entrepreneurial skills in areas such as management, marketing, finance, and innovation. Together, these supports enhance the likelihood of startup success and contribute to broader economic development.

INTRODUCTION

In today's global economy, startups have become key drivers of innovation, employment, and overall economic progress. These fast-growing enterprises are making significant contributions across multiple industries—including technology, healthcare, energy, and education—by disrupting conventional business practices and introducing groundbreaking solutions. Despite their promise, startups often face a range of early-stage obstacles. Challenges such as obtaining initial funding, assembling effective teams, competing in crowded markets, and adapting to rapid technological shifts are common hurdles that many must overcome.

Against this backdrop, business incubators play a vital and transformative role. These organizations are specifically designed to support new and emerging businesses by offering a wide array of structured services. These include access to physical workspaces, funding opportunities, expert mentorship, legal and administrative support, and tailored educational programs. More than just offering resources, incubators create an environment that fosters collaboration, innovation, and knowledge-sharing, thereby minimizing the inherent risks of entrepreneurship.

In countries such as Azerbaijan, where promoting innovation and diversifying the economy are national priorities, the role of incubators becomes even more essential. Through a combination of government-backed programs, partnerships with the private sector, and international cooperation, the number of incubators in the country has steadily grown. These initiatives aim not only to strengthen the local startup ecosystem but also to elevate Azerbaijan's position in the global innovation landscape.

This article examines the critical role of business incubators in nurturing startup success, with an emphasis on Azerbaijan's expanding innovation ecosystem. It delves into the various forms of support incubators provide, evaluates their impact on business development, and explores how they contribute to the country's broader economic objectives.

SECTION TITLE

Business Incubators are one of the main part of getting success in startups. Business incubators support the growth of entrepreneurial projects as providing office space, technology, mentoring, educational programs, consulting services, legal compliance and financial sources. The incubator idea occurred in the 1950s and most of them used to attached at universities. Nowadays incubators are financed by government, private companies, and non-governmental organizations, educational institutions, like universities and colleges. The National Business Incubation Association (NBIA) describes business incubators as a catalyst tool for either regional or national economic development. So, Sherman and Chappell have defined business incubators as "an economic development tool primarily designed to help create and new businesses in a community. There are a lot of ways that incubators provide support to be successful for startups.

Approved by the President's Decree No. 753 on August 17, 2002, the "Program for the Development of Small and Medium Entrepreneurship in the Republic of Azerbaijan (2002-2005)" aimed to implement comprehensive measures to enhance the innovative activities of entrepreneurs. A key objective of the program was to develop innovation activities for SMEs by establishing the necessary infrastructure and mobilizing financial and organizational resources to make it a leading sector. In addition, the Decree dated September 10, 2002, "Additional Measures for State Protection in the Development of Entrepreneurship in the Republic of Azerbaijan," set the task of creating a technological business incubator. The Innovation and Digital Development Agency (IRIA) reported that there are approximately 220 active startups in the country. This figure was shared in their recent report. ASAN estimates the number of startups at around 80. Representing Azerbaijan in the StartupBlink international ranking, which evaluates startup ecosystems, this data is reflected in the global rankings. An expert pointed out that there are around 160 startups listed in the Startup.az "Startup Azerbaijan" portal database. Additionally, KOBIA reported that 135 startup certificates have been issued. Normally, statistics from IRIA and KOBIA could also be included in StartupBlink, where ASAN is influential, but for various reasons, this hasn't been achieved. Azerbaijan currently ranks low in the StartupBlink ecosystem ranking, placing 84th among 100 countries last year (https://www.startup.az)

Prominent incubators in Azerbaijan include:

- Barama Innovation and Entrepreneurship Center: Established in 2009 by Azercell Telecom LLC, this was the first known business incubator in the country, supporting the emerging startup ecosystem.

- High Tech Park Azerbaijan (HTPark): Although primarily a technology park, HTPark

offers programs and facilities to support early-stage startups, promoting technological innovation.

- Incubator of the Innovation Center of the Azerbaijan National Academy of Sciences (ANAS): ANAS runs an incubator to support tech startups by providing mentorship, networking, and resources. The State Fund for Development of Information Technologies (ICT Fund): This government fund offers financial support to tech startups to help them grow, although it isn't strictly an incubator.

- StartUp Azerbaijan: This initiative promotes entrepreneurship and innovation through various programs, including an incubation program.

- Other incubators include Innoland and the ABB Innovation Center's Incubation Programs.

Additionally, a strong focus is being placed on developing human capital, exemplified by initiatives like the Technest program, which has awarded scholarships to over 4,000 students in technology-related areas. This effort is designed to boost the number of skilled professionals contributing to the startup ecosystem

Some key objectives for the continuous development of incubators (by the government, businesses, and the public) are:

- Economic development and job creation

- Commercialization of research investments

- Real estate development ventures

- Promoting entrepreneurship in transition economies

- Opportunities for national immigrants and graduates abroad

- Boosting export production.

Structures such as incubators provide opportunities for knowledge transfer, experience sharing, network creation and cooperation, as the different incubated ventures share a common physical location (A.B. Bergek, C. Norrman, 2008). These structures play one of the crucial roles in developing the economic growth of the countries. Studies found that improvement of an entrepreneurial ecosystem causes a good network system, collaborative work and knowledge exchange, and partnerships with the firms.

First of all, **financial support**. Incubators often provide startups with essential financial support, offering seed funding, grants, or access to investment networks. The capital is essential for startups in their early stages, promoting them to develop prototypes, making market research, and recruiting skilled talent. They provide access to investors, specially, angel investors and venture capital.

In Azerbaijan, several strategic initiatives support the financial growth of incubators and startups. The government provides both grants and preferential loans, such as the $10 million in grants and $15 million in loans offered in 2023 (https://eu4business.eu). This funding supports over 100 startups, helping them to establish and expand their businesses by providing crucial financial assistance during their formative stages. Moreover, incubation centers within technoparks supply startups with essential infrastructure, including office spaces, equipment,

consulting, and mentorship services. This combination of physical and advisory support fosters innovation and sustains startup development. International collaborations, such as those funded by the EU and UNDP, further bolster the ecosystem by offering financial support for social entrepreneurs. These programs enable participants to secure funding for ventures that align with Sustainable Development Goals (SDGs).

Teambuilding support. One of the main support of incubators in startups is teambuilding process. So incubators frequently organize team building activities such as workshops, teamwork tasks. It is helpful in creating collaboration and strong work culture with the different individual members of startups. Because of such kind of activities different people who have startup ideas come together, make discussion and find a member for their team. Development of teambuilding process provide the administrative, human resources, production, research and development, financial, accounting, technical and marketing needs, during the establishing phase. It is often encountered some startups can't make their team. For example, because of lack of graphic designer the team who owns startup idea about building site can fail.

Corporate Partnerships. Incubators maintain corporate partnership which can cause sustainable growth for startups. As the companies which are in their maturity can transfer their knowledge, expertise and main points of how to become successful and penetrate in the market. As a result of this collaborations network opportunities can be ease between startups and corporative entities.

Fostering a Supportive Ecosystem. Incubators create a conducive environment for startups by offering shared office spaces, access to networking events, and mentorship programs. This fosters collaboration and allows entrepreneurs to connect with like-minded individuals, share experiences, and learn from one another.

Building a supportive ecosystem for incubators in Azerbaijan is key to advancing the country's goals for economic diversification and technological innovation. This ecosystem equips startups with critical tools, resources, and guidance to ensure their growth, integrating efforts from the government, private sector, and international partnerships to foster a thriving innovation environment.

Government Support: The Azerbaijani government plays a crucial role in developing incubators by providing financial support, implementing regulatory changes, and launching targeted programs. Agencies like the Innovation and Digital Development Agency manage various incubators, offering startups access to grants, loans, and other financial incentives. In addition, government-funded technoparks supply physical infrastructure, such as office spaces and cutting-edge facilities, while incubators provide services like business consulting and legal assistance.

Private Sector Engagement: Corporations and venture capital firms in Azerbaijan also contribute significantly to the startup ecosystem. They offer essential resources such as funding, mentorship, and networking opportunities, helping startups connect with industry leaders. These collaborations between incubators and private entities promote innovation and allow businesses to benefit from fresh talent and ideas.

Technology assistance and infrastructure. One of the key factors of successful startups is working of team member together continuously and to provide the collaborative work they need office space, utilities, internet connection and additional resources for comfortable working

environment. Especially, for technological projects high secured technology such as computer, internet connection, software and etc. are so important, so it protects the startups possible hacking. Incubators address this by offering technical support, such as access to specialized software, hardware, cloud services, and IT assistance. This helps startups efficiently develop, test, and scale their products. Additionally, incubators may provide services like product design, coding help, and IT expertise.

Infrastructure Support: Physical infrastructure is also important as technology support. Most of incubators provide office spaces, meeting rooms, and special areas which provide comfortable working environment, allowing startups to operate professionally. Lack of such kind of resources can cause some postpones and can slow done operations. Tech startups may benefit from labs or workshops where they can test products. By offering these resources, incubators foster operations in startups, letting them focus on innovation and development. Overall, technology and infrastructure support are vital for the development and success of startups, enabling them to create, test, and launch their products while encouraging collaboration and innovation.

They provide **Intellectual property management**. It is often observed that the start-up idea can be realized by the companies which host more capacity and power. They can make better customer satisfaction as a cheaper price because of less cost, better promotion campaigns, even better production and edits as a result of using full capacity and great network. Even if the real owner of the start-up idea implements his/her business, to compete with such kind of giants will be impossible and in conclusion failure will be inescapable. Most of people do not know the procedure of getting intellectual property such as patent, license and a result of this action they can face with failure because of skipping the ownership.

Market research support. Market research is a significant part of any business activity, so also start-ups. Market research covers gathering, analyzing, and interpreting information about a market before the launching process. It includes customer requirements such as market trends, design, size, price, place and etc. Lack of market research can cause the failure of start-ups because of not taken into account the main customer preferences. Customer satisfaction provides long-term loyalty and as a result of it, at the same time profitability. Incubators also provide market research support as it is an essential part of start-up success. One of the key benefits of getting the support of incubators for market research is to attract professionals in this sphere and gaining guidance for your business. So, incubators usually have a network of specialist, and advisors who can support the start-up teams with great advice on market research. As not all start-up team members are aware about the market research strategies, incubators support teams to attract the specialists who can be helpful to make successful market research analysis.

Educational Programs. As it is known via education most of abilities can be improved, even someone does not have any capability to which sphere applied. The entrepreneurship education programs offered by schools, universities and other educational institutions has the capacity to motivate and attract pupils, students, graduates and other people who are interested to improve their knowledge and ability in entrepreneurship to engage in entrepreneurial ventures, and these people can be a source of nascent entrepreneurship (M. McAdam, S. Marlow, 2008).

Educational programs play a pivotal role in supporting incubators in Azerbaijan, significantly contributing to the growth of the country's startup ecosystem. These programs are primarily focused on developing entrepreneurship skills, fostering innovation, and building human capital

to ensure that incubators can nurture successful businesses. One key initiative is the integration of entrepreneurship and innovation courses in universities and technical institutes, which encourage students to think creatively and develop business ventures. Programs like Technest provide scholarships to thousands of students in technology fields, helping cultivate the technical expertise necessary for the startup ecosystem. Incubators also offer a variety of professional development opportunities through workshops, mentoring, and access to industry experts. These educational programs are designed to guide entrepreneurs through the complexities of launching and scaling a business, from ideation to securing funding. This support is often complemented by networking events, where startups can connect with potential investors and collaborators INBIA (The International Business Innovation Association). Moreover, international organizations such as the EU and UNDP collaborate on educational programs that help Azerbaijani entrepreneurs align their businesses with global standards and Sustainable Development Goals (SDGs). This exposure ensures that local startups are equipped not only with technical and business acumen but also with the strategic knowledge needed to succeed in the global marketplace INBIA. By investing in education and capacity-building, Azerbaijan's incubators are fostering a new generation of entrepreneurs ready to innovate and grow in both local and international markets.

CONCLUSION

In today's highly competitive, innovation-centered global landscape, business incubators play a crucial role in the success of startups. They serve as a vital bridge between early-stage ideas and fully developed, market-ready ventures by offering an environment rich in resources and guidance. By providing access to funding, office infrastructure, team-building opportunities, legal and administrative support, market analysis, and specialized training, incubators deliver the foundational tools entrepreneurs need to grow sustainable businesses.

In Azerbaijan, the development of the startup ecosystem has been significantly influenced by the active involvement of both government bodies and the private sector in expanding and enhancing incubator initiatives. Through targeted policies, investment programs, and educational efforts like the Technest program, the country has made notable progress in fostering entrepreneurship, building talent pipelines, and encouraging technological innovation. Leading incubators such as Barama and High Tech Park have already made a tangible difference in shaping the local startup environment. Nevertheless, substantial work remains to be done.

For Azerbaijan to climb higher in global innovation indices and emerge as a regional center for entrepreneurial activity, sustained efforts are required. These include widening access to capital, deepening international collaborations, upgrading technological infrastructure, and reinforcing protections for intellectual property. In summary, business incubators represent far more than just physical facilities—they are strategic drivers of innovation, economic diversification, and capacity development. Through mentorship, knowledge-sharing, and collaborative support, they empower startups to succeed in a competitive marketplace. As Azerbaijan continues to invest in this critical infrastructure, incubators will be at the heart of building a vibrant, resilient, and globally connected startup ecosystem.

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THE ROLE OF THE CENTRAL BANK AND THE SHARIAH BOARD IN REGULATING AND SUPERVISING THE ACTIVITIES OF ISLAMIC BANKING

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ARTICLE INFO	ABSTRACT
	The purpose of the research - The article examines the regulatory tools and control mechanism of the central bank in Islamic banking. For this purpose, Islamic banking and finance instruments, their characteristics and central bank regulatory tools in the traditional system are explained. On the other hand, in Islamic banking, the central bank's alternative monetary policy instruments and regulatory mechanism have been studied. The aim of the study is to assess the alternative approach to the central bank's monetary policy instruments, regulation and control mechanism. *Research methodology - Analysis, comparison, grouping and generalization methods were used during the research. The research methodology is to study the existing theoretical approaches in this area and create an alternative mechanism. For this purpose, the central bank's monetary policy instruments in both traditional banking and Islamic banking have been studied.* *Significance of the application of research - The rapid development of Islamic banking in the world makes it even more necessary to study its regulatory mechanism and solve problems. Another importance of the application of the research is to increase the financial literacy of the central bank in Islamic banking on the instruments of control and regulation.* *Results of the research - The research examined the central bank's regulatory mechanism in Islamic banking models, the Shariah Board and its relationship with the central bank, and the central bank's alternative monetary policy instruments.* *Originality and scientific novelty of the research - The scientific novelty of the research is the assessment of the existing alternative regulatory-supervisory mechanism of the central bank in the regulation of Islamic banking and the provision of additional recommendations.*

INTRODUCTION

Islamic banking has been developing rapidly in the world since the middle of the 20th century. This development makes it necessary to regulate them. For this purpose, Islamic financial instruments, its categories, Islamic banking models, central bank regulatory instruments in the traditional system and central bank regulatory instruments in the interest-free economic system are explained. In particular, the problem of using the same policy in the regulation of Islamic banks operating in the traditional banking system is becoming more urgent. To this end, central banks have begun to use alternative monetary policy instruments and interest-free financial

instruments. In this study, we studied the experience of countries around the world and alternative monetary policy instruments of the central bank to solve the problem. At the same time, the role of the Shariah Board in the regulation of Islamic banks and its relationship with the central bank were studied. The purpose of the study is to assess the central bank's alternative monetary policy and control mechanism in the Islamic banking model, increase financial literacy in this area and provide additional recommendations.

THE ROLE AND FUNCTIONS OF THE CENTRAL BANK IN THE TRADITIONAL BANKING SYSTEM

The current traditional banking system is rooted in Western culture, Christian-Jewish tradition, Roman law, and Greek thought. The West's views on private property cannot be made without reference to Roman law. While economics used to be the subject of ethica science, it formed the theoretical basis of capitalism after the industrial revolution. [15]

In current banking system banks are intermediary financial institutions. Banks are financial institutions that accept deposits and make loans. Banks are the largest financial intermediaries in economy. A bank is a financial institution that trades money. It borrow and keeps on behalf of his clients their money (savings), lending money (interest based on lending) and provides different financial services (checks, credit cards, transfer, exchange and so on). There are several kinds of banks. Generally the term "bank" includes commercial banks whose role is limited in accepting deposits and finance companies by interest based on loans. [16]

Money creation process and monetary policy usually is made by central banks. Received deposits by banks always have not lent out are called reserves. Some reserves are held in the vaults of commercial banks. In our hypothetical economy, all deposits are held as reserves: banks simply accept deposits, place the money in reserve, and leave the money there until the depositor makes a withdrawal or writes a check against the balance. This banking system is called 100-percent reserve banking. If banks hold 100 percent of deposits in reserve, the banking system does not affect the supply of money.

But as long as the amount of new deposits approximately equals the amount of withdrawals, a bank need not keep all its deposits in reserve. Thus, bankers have an incentive to make loans. When they do so, we have fractional-reserve banking, a system under which banks keep only a fraction of their deposits in reserve. Thus, in a system of fractional-reserve banking, banks create money. This process of money creation can continue forever, but it does not create an infinite amount of money.

Note that although the system of fractional-reserve banking creates money, it does not create wealth. When a bank loans out some of its reserves, it gives borrowers the ability to make transactions and therefore increases the supply of money. The borrowers are also undertaking a debt obligation to the bank, however, so the loan does not make them wealthier. In other words, the creation of money by the banking system increases the economy's liquidity, not its wealth. [17]

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[15] Ahmet Tabakoghlu, 2008, Introduction to Islamic Economics, 2nd edition, October, Istanbul, 545 pages, pages 35-36

[16] Mishkin Frederic S, The economics of money, banking, and financial markets, Seventh Edition, 2004, Columbia University, 679 pages, p.8

[17] N. Gregory Mankiw, Macroeconomics, Eighth Edition, Harvard University, 2013, 625 pages, page 88-90

The goals of the central bank are:
   a.   full employment
   b.   Balanced economic growth
   c.   Improving the balance of payment (BOP)
   d.   price stability

The three main functions of the central bank are as follows.

   ▪   Implementation of money policy
   –   Open market operations
   –   Last resort loans
   –   Required reserve ratio

   ▪   To provide payment services for banks and other financial institutions accepting deposits
   –   Supervising and regulating banks
   –   Organization of lending
   –   Organization of deposit services
   –   Transfer and payment services
   –   Currency transactions

   ▪   To act as the bank of the state
   –   Regulating and supervising the activities of banks
   –   Execution of the state budget account
   –   Purchase and sale of government securities
   –   Establish relationships with foreign central banks
   –   Control over foreign exchange reserves and their purchase and sale and etc. [18]

 For instance, The Federal Reserve System (Fed) is the central bank of the USA. A central bank is a bank's bank and a public authority that regulates a nation's depository institutions and conducts monetary policy, which means that it adjusts the quantity of money in circulation and influences interest rates.

 A central bank influences the quantity of money and interest rates by adjusting the quantity of reserves available to the banks and the reserves the banks must hold. To do this, a central bank manipulates three tools:

   •   Open market operations
   •   Last resort loans / Lending to Banks
   •   Required reserve ratio / Reserve Requirements

An open market operation is the purchase or sale of securities by the central bank in the loanable funds market.

A central bank is also the lender of last resort, which means that if a bank is short of reserves, it can borrow from the central bank. But central bank sets the interest rate on last resort loans and this interest rate is called the discount rate.

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[18]   Yahya Abdul-Rahman,The Art of Islamic Banking and Finance (Tools, Techniques for Community-Based Banking), Translators. Prof. Dr. Salih Tug, Dr. M.Abdullah Tug, Istanbul Zaim University, 2nd edition, Istanbul, 2017, 774 pages, pages 222-223

The required reserve ratio is the minimum percentage of deposits that depository institutions are required to hold as reserves.[19]

Central bank performs five general functions to promote the effective operation of the economy

- conducts the nation's monetary policy
- promotes the stability of the financial system
- promotes the safety and soundness of individual financial institutions fosters payment and settlement system safety and efficiency promotes
- consumer protection and community development [20]

As a result central banks affect money supply by various tools-open-market operations, lending to banks, reserve requirements and interest on reserves. In this process all central banks in the world serves as the nation's central bank.

- The first central bank oversee the banking system.
- The second It regulates the quantity of money in the economy

BASIC PRINCIPLES AND MAIN FINANCIAL INSTRUMENTS IN ISLAMIC BANKING

Islamic banking and Islamic finance are distinct from conventional banking and finance. They are based on compliance with Shariah Law. Islamic banking are largely merchant and investment banking oriented. They typically relate to or involve the real economy, especially trade and investment. [21] [i]

The basic principles of Islamic finance are as follows.
- Money is not a commodity and it supports the growth of wealth by helping a purchasing power.
- Prohibition of Usury/Riba
- Prohibition of speculation/Bay'ul-qarar
- Prohibition of Uncertainty/No element of gambling
- Unauthorized activities (unlawful, unethical or immoral transactions)
- Distribution of risks
- Disclosure of information on banking activities to partners [22] [ii]

Financial instruments in Islamic finance and banking can be grouped as follows.[23] [iii]

- Debt-based finance instruments
a) Benevolent Loan/Interest-free loan/Charity loan/Qurud hasanah
b) Interest-free loan based deposit

- Investment and partnership-based finance instruments
a) Mudarabah/Trustee Partnership Facility/ Passive partnership
b) Musharaka/Joint Venture Facility/Active partnership/ Partnership financing
c) Diminishing Musharakah/Co-ownership

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[19] Michael Parkin, Macroeconomics, Tenth Edıtıon, 2012, 452 pages, p.190-192

[20] Federal Reserve System Publication, The Fed Explained What the Central Bank Does, Eleventh Edition, August 2021, 131 pages, page. 2 (https://www.federalreserve.gov/aboutthefed/files/the-fed-explained.pdf)

[21] Inwon Song and Carel Oosthuizen, IMF Working Paper, Islamic Banking Regulation and Supervision: Survey Results and Challenges, WP/14/220, 42 pages, page.6

[22] Hussein Tunch, Participatory banking: philosophy, theory and application of Turkey, 8th edition, Istanbul, 2010, 298 pages, p.122-126

[23] Loannis Akkizidis, Sunil Kumar Khandelwal, Financial risk managment for islamic banking and finance, 2011, 220 pages

- Sale-based and Leasing finance instruments
a) Murabaha/Cost-Plus Sale/ Mark up
b) Finance Leasing
c) Operating Leasing
d) Tavarruq/Commodity Murabaha
e) Istisna/Deferred payment and deferred delivery/Order to sale
f) Salam/Hire-Purchase/Order to construct

- Service-based instruments
a. Takaful (Islamic insurance/Mutual insurance)
b. Sukuk (interest-free security)

İntermediation of Islamic financial institutions, including the function of banking, is different from that of conventional financial institutions. This difference is the key to understanding the difference in the nature of risks in conventional and Islamic banking. Mudarabah intsrument is the cornerstone of financial intermediation and thus of banking. In a mudarabah the owner of capital forms a partnership with an entrepreneur or manager who has certain business skills, and both agree to share the profits and losses of the venture undertaken. By this finance instrument can be applied by an Islamic bank to raise funds in the form of deposits as well as to deploy funds on the assets side. Mudarabah is a "labor-investment partnership" established on the condition that the investment is on the one hand. Mudarabah is based largely on the profit-and-loss sharing (PLS) mode.

TABLE № 1. Theoretical Balance Sheet of an Islamic Bank: Based Functionality, Sources and Application of Funds [24]

Assets (Application of funding)	Liabilities and equity (Sources of funding)
Cash balances	Demand deposits (amanah)
Short-term trade finance (murabahah, salaam)	Investment deposits (mudarabah)
Medium-term investment (ijarah, istisnah)	Investment deposits (musharakah) /
Long-term Investment assets (mudarabah, musharakah)	İnvestment deposits (mudarabah)
Interest-free loan (Qard Hasanah)	General investment deposits
Interest-free loan based deposit	Special investment deposits (mudarabah, musharakah)
Fee-based services (Takaful, Sukuk)	Equity capital and shareholders' reserves
Non-banking assets	Equity capital

The second partnership-based financial instrument is a Musharakah. Musharakah is an active partnership in which both investment and labor are actively promoted. In Mudaraba, if the financial loss belongs to the investor (rabbul-mal), it is divided according to the investment ratios in the joint venture.[25]

Musharakah, is a combining the act of investment and management. In the absence of debt security, the Shariah encourages this form of financing. The Shariah is fairly comprehensive in defining different types of partnerships, in identifying the rights and obligations of the partners, and in stipulating the rules governing the sharing of profits and losses.

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[24] Hennie van Greuning and Zamir Iqbal, Risk Analysis for Islamic Banks, The World Bank, 2008, 336 pages, p. 18, 19,21

[25] Cihangir Akin, Interest Free Banking and Development, Istanbul-1986, 440 pages, p.149

Murabahah, a cost-plus instrument is one of the most popular agreement for purchasing commodities and other products on credit. The financier and the entrepreneur agree on a profit margin, often referred to as markup, which is added to the cost of the product. The payment is delayed for a specified period of time during which the entrepreneur produces the final product and sells it in the market.

Investing instruments are vehicles for capital investment in the form of a partnership. There are two types of investing instruments: fund/money management (mudarabah) and equity partnerships (musharakah).

Investment account holders are investors or depositors who enter into a mudarabah contract with the bank, where investors act as the supplier of funds (rab al-mal) to be invested by the bank on their behalf, as the agent (mudarib). The investors share in the profits accruing to the bank's investments on the assets side. Therefore, such profit-sharing investment deposits are not liabilities. Investors' capital is not guaranteed, and they incur losses if the bank does; the form is closer to that of a limited-term, non-voting equity or a trust arrangement.[26]

A transaction is a temporary purchase and sale of goods for cash. The main purpose of this financial instrument is to meet the needs of people with cash shortages/liquidity. The goods put up for sale through this transaction are bought by the buyer for a period of time and sold for cash to another buyer. This operation is the exact opposite of the Murabahah tool, which is a temporary sale of goods.

SCHEME № 2. Tavarruq financing[27]
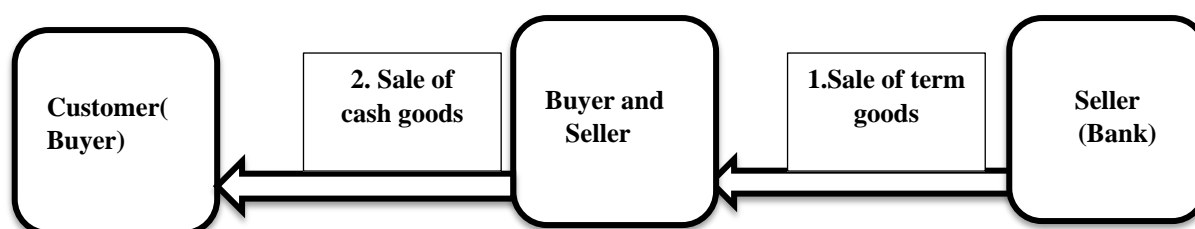
The liabilities side of Islamic banks' balance sheets generally consists of two types of deposits in addition to shareholders' equity:

- Investment deposits: These are mobilised on the basis of profit-and-loss sharing (PLS) as well as the different salesbased modes of *murabahah, ijarah, istisna* and *salam* on the assets' side. Even the sales-based modes involve some risk, though not as much as the PLS modes. This participation of investment depositors in the risks of banking is unique to Islamic banking. However, the risks can, and should, be minimized through a proper management of banks in a suitable regulatory and supervisory framework.

- Demand deposits: These do not participate in profit and loss and, being in the nature of debts owed by banks, their repayment must be fully guaranteed.[28] [iv]

Demand deposits is placed as amanah (demand deposits): they yield no returns and are repayable on demand and at par value; therefore,money creation through the multiplier effect is limited. [29] [v]

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[26]   Hennie van Greuning and Zamir Iqbal, Risk Analysis for Islamic Banks, The World Bank, 2008, 336 pages, p.20, 21, 24

[27]   Ishak Emin Aktepe, Participation finance, TKBB publications, Publication No: 9, 2017, 268 pages, p.117

[28]   Umer Chapra M. and Tariqullah Khan, IDB-IRTI, Regulation And Supervision of Islamic Banks, Jeddah - Saudı Arabıa, 2000, 105 pages, p.11

Islamic economists ideally want to have only investment deposits on the liability side and on the asset side only profit-sharing contracts. Islamic banks have current account and investment deposits on the liabilities side and on the asset side they have several profit-sharing variants of products such as *Musharakah, Mudarabah, Murabaha, Istisna, Salam*, and *Ijarah.*

The fundamental difference between Islamic banking and conventional banking arises due to the prohibition of *Riba*. The interest-free current accounts are distinguished from the investment deposits. The asset side of the Islamic bank comprises of funds which are held with the Central Bank and other financial institutions, property and other assets, along with *Murabaha, Mudarabah, Ijarah*, and other financing. The liability side largely consists of depositor funds. Islamic banks have to follow certain rules regarding the maintenance of the accounts. First, each project should be financed and recorded through a special project account which can specifically record and report the transactions related to the project.[30]

SHARIAH BOARD AND CENTRAL BANK'S REGULATORY FRAMEWORK IN ISLAMIC BANKING MODELS

There are three widespread Islamic banking model as following.

Explicit Recognition of Islamic Banking. In This model it is indicated that the legal and regulatory framework explicitly recognizes Islamic banking practices, products or institutions;

Conduct of Islamic Banking by a Stand-Alone Islamic Bank. This model indicate that Islamic banking was being conducted by a stand-alone Islamic bank

Practice of Islamic Banking by Conventional Banks. Third model indicate that Islamic banking was being conducted by a conventional bank.

The effective prudential regulation and supervision of banks is necessary in Islamic banking as it is in conventional banking. The risks of Islamic banking are those typical of financial intermediation. The objectives of applying prudential regulation and supervision to Islamic financial activities are the same as the case of conventional banks. For instance, to pursue and maintain financial stability by ensuring the safety and soundness of banks, preventing problems from having systemic reflection. An important objectives are the regulatory framework for Islamic banking and the stability of the financial system. Key elements include:

- understanding the nature of Islamic banking activities,
- making regulatory framework for Islamic banking,
- leveling the playing field between Islamic banking and conventional banking.

There are four approaches to regulatory framework for Islamic banking

1) Single Regulatory Framework for applied to all banks (with no reference to Islamic banking); These countries include Saudi Arabia, South Africa, U.A.E., and the U.K

2) Single Regulatory Framework with References Applying to Islamic banks; (with references identifying provisions applying specifically only to Islamic banking and banks); Jordan, Kazakhstan, Qatar, and Turkey

3) Separate Regulatory Framework for Islamic Banks / two separate independent regulatory frameworks (one for Islamic banking and another for conventional banking); Bahrain, Iraq, and Kuwait

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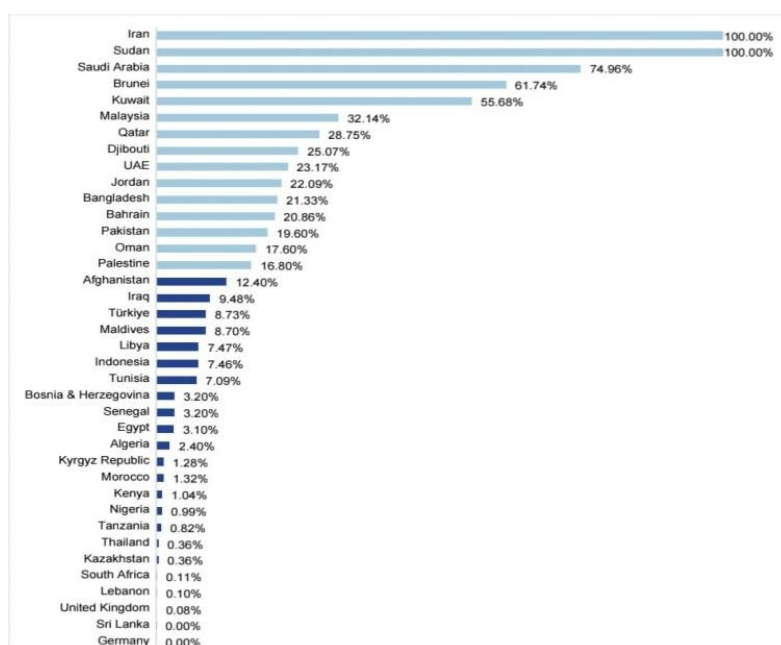[29] Hennie van Greuning and Zamir Iqbal, Risk Analysis for Islamic Banks, The World Bank, 2008, 336 pages, p.20
[30] Loannis Akkizidis, Sunil Kumar Khandelwal, Financial risk managment for islamic banking and finance, 2011, 220 pages, 9-10

4) Mixed Approach / Single Regulatory Framework with Separate Guidelines/Regulations for Islamic banks) (a similar regulatory framework is adopted for areas that are applicable to Islamic and conventional banks, but separate guidelines and regulations are issued for areas that are specific to Islamic banking); Indonesia, Lebanon, Malaysia, and Syria [31] [vi]

Islamic banks represent the majority of Islamic financial institutions. Islamic banks and central banks relations can be distinguished in three cases. Firstly, Islamic banks are accommodated with the framework if the existing bankin laws. This is the case with Islamic banks operating in Western Europe. Secondly, there are countries where special laws have been enacted allowing Islamic banks to function. Jordan, Egypt, Turkey, Bahreyn, Malaysia and other countries include in this category. However this legislation is mostly confined to the working of only a few Islamic financial institions where the bulk of the money market is still controlled by conventional financial institutions. Thirdly there are some countries where a comprehensive legal framework has been created for the Islamic banking system. Pakistan, Iran and Sudan includ in this category. Islamic banking in Iran, Pakistan, and Sudan, all commercial banks were transformed to comply with Shariah rules and principles.

Licensing procedures are as necessary in an Islamic banking framework as in conventional banking. There are different licensing requirements to establish Islamic banks in practice. These procedures help supervisory authorities to ensure that new banks are managed in a sound manner. There are issue of Different type of licenses for Islamic banks: a stand-alone an Islamic banking license and a single (generic) banking license is issued to a bank, irrespective of whether the bank is an Islamic or a conventional bank. [32]

TABLE № 3. Islamic Banking Share in Total Banking Assets (2023) [33]

Country	Share
Iran	100.00%
Sudan	100.00%
Saudi Arabia	74.96%
Brunei	61.74%
Kuwait	55.68%
Malaysia	32.14%
Qatar	28.75%
Djibouti	25.07%
UAE	23.17%
Jordan	22.09%
Bangladesh	21.33%
Bahrain	20.86%
Pakistan	19.60%
Oman	17.60%
Palestine	16.80%
Afghanistan	12.40%
Iraq	9.48%
Türkiye	8.73%
Maldives	8.70%
Libya	7.47%
Indonesia	7.46%
Tunisia	7.09%
Bosnia & Herzegovina	3.20%
Senegal	3.20%
Egypt	3.10%
Algeria	2.40%
Kyrgyz Republic	1.28%
Morocco	1.32%
Kenya	1.04%
Nigeria	0.99%
Tanzania	0.82%
Thailand	0.36%
Kazakhstan	0.36%
South Africa	0.11%
Lebanon	0.10%
United Kingdom	0.08%
Sri Lanka	0.00%
Germany	0.00%

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[31] Inwon Song and Carel Oosthuizen, IMF Working Paper, Islamic Banking Regulation and Supervision: Survey Results and Challenges, WP/14/220, 42 pages, page.9, 11,13-14

[32] Ausaf Ahmad, Research Division, IDB-IRTI, Instruments of regulation and control of Islamic banks, Jeddah, 2000, 51 pages, p.11,15

[33] Islamic Financial Services Industry Stability Report, 2024, 122 pages, p.28, https://www.ifsb.org/wp-content/uploads/2024/09/IFSB-Stability-Report-2024-8.pdf

Islamic banking also has a key feature that distinguishes it from traditional banking. This distinctive feature is the existence of a Shariah Board, a separate structural unit, to control the quality of services in those banks or banks. These staffs are an integral part of Islamic banks. These councils include the opinions of scholars and other expert members. The Shariah Board clarifies whether Islamic banking products and new operations are Shariah-compliant. The Shariah Board is responsible for overseeing and inspecting the application of religious law to financial institutions. The primary responsibilities and powers of the Shariah Board include:

- Development of new operations and services

- Supporting the bank's management to launch new services

- Provide analysis of the religious compatibility of contracts, services and transactions

- Inform the public about the services provided to customers by traditional banks and financial institutions under the name of interest-free.

In the Malaysian practice, the National Shariah Board of Islamic Banking of Malaysia operates in a separate section of the Islamic Banking Department of the Central Bank (Bank Negara Malaysia, BNM), which is part of the country's central bank, the Bank of Negara Malaysia. This Board makes fatwa-type decisions in the field of various banking services, products and operating standards. The decisions made by the Board are made by all interest-free banks. On the other hand, interest-free banks also establish a Shariah Board. This approach also has the function of resolving disputes between the Board of the country's central bank and the bank's Board. [34] [vii]

Shariah Board-Central Bank-Islamic banks relations. Regulatory frameworks typically do not prescribe distinct and separate corporate governance frameworks applicable only to Islamic banks. Shariah Board is main role in İslamic banking regulation and supervision. Conventional regulatory frameworks typically do not prescribe distinct. Shariah Board has the ultimate responsibility and authority in advising on Shariah matters. As well The Shariah Board have to establish in both the central bank and the Islamic bank.

The central bank has a Shariah Board. Shariah Boards of central banks differ in their mandate, scope, governance, and accountability. There are different models on the role of a central bank's Shariah Board. In some cases the central bank's Shariah Board has overall authority over Shariah issues that relate to banking and finance. It is the final arbiter in disputes on such issues. Thus, this central bank's Shariah Board has legislative and adjudicative powers. (e.g., Malaysia and Sudan). In other jurisdictions the central bank's Shariah Board does not have legislative or adjudicative powers in relation to Shariah law. (e.g., Afghanistan, Pakistan, and Syria).

A majority of jurisdictions require Islamic banks to have a Shariah Board. In jurisdictions where there are no Shariah Board (the supervisory authorities) it would consider a possible case of mis-selling Islamic financial products. (e.g., Kenya, Tunisia, and Turkey).

The function and role of ensuring Shariah compliance within an Islamic bank is usually conducted by internal auditors or Shariah auditors. In specific jurisdictions including banking and financial legislation, an Islamic bank's internal auditor has a statutory responsibility to ensure

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[34] Yahya Abdul-Rahman,The Art of Islamic Banking and Finance (Tools, Techniques for Community-Based Banking), Translators. Prof. Dr. Salih Tug, Dr. M.Abdullah Tug, Istanbul Zaim University, 2nd edition, Istanbul, 2017, 774 pages, pages 199-203

Shariah compliance by the Islamic bank. (e.g., Iran, Pakistan, Saudi Arabia, and Sudan). In other jurisdictions, an Islamic bank is required to have a dedicated Shariah auditor.[35]

TABLE № 4. Existance of Shariah Board in Islamic Bank [36]

	Islamic Banking Model	Existance of Shariah Board
Bahrain	Dual banking system	Each Islamic bank must have a Shariah Board
Indonesia	Islamic windows allowed, Active Shariah bank development strategy in place by the government	Separate Shariah Board required
Iran	Single (Islamic) banking system	No Shariah Board for individual banks, Onsite and offsite supervisory methods and objectives defined and applied
Jordan	Dual banking system	Separate Shariah Board required
Kuwait	Dual banking system	Separate Shariah Board for each bank necessary
Malaysia	Dual banking system	Separate Shariah Boards at institutional level in the Central Bank and Securities Exchange Commission
Pakistan	Major financial transformation is called for by the Supreme Court of Pakistan to introduce Islamic banking and financial system	Shariah Board concept does not exist
Qatar	Dual banking system	Separate Shariah Boards for banks required
Sudan	Single (Islamic) Banking system	Separate Shariah Boards for banks required, also the Central Bank has a Shariah Supervisory Board
Turkey	Dual banking system	Onsite and offsite supervision concepts and methods exist
UAE	Dual banking system	Separate Shariah Boards required
Yemen	Dual banking system	Separate Shariah Board required

CENTRAL BANK'S MONEY POLICY IN ISLAMIC BANKING

There are different approaches for supervision and regulation of Islamic banking. In Islamic banking, the central bank's monetary policy and banking regulation mechanism differ from convertional banking. Uzair thinks promotion of interest banking and conversion of interest based banks to interest free financial institutions would be one of the prime functions of an İslamic central bank. It can be perform this function by providing commercial banks with financial, technical and personnel assistance. [37]

It is known that there are three ways to expand the monetary base. Emission of money, creation of bank money and surplus in the balance of payments. The first and second of these are implemented through the central bank.

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[35] Inwon Song and Carel Oosthuizen, IMF Working Paper, Islamic Banking Regulation and Supervision: Survey Results and Challenges, WP/14/220, 42 pages, page.16-18

[36] Umer Chapra M.and Tariqullah Khan, IDB-IRTI, 2000, Regulation And Supervision of Islamic Banks, Jeddah - Saudı Arabıa, 105 pages, p.27-29

[37] Ausaf Ahmad, Research Division, IDB-IRTI, Instruments of regulation and control of Islamic banks, Jeddah, 2000, 51 pages, p.15

The majority of Muslim economists are in favor of 100% reserve in the interest-free economic system. (Sıddıqı). The arguments of this view are as follows.

a) Ensuring stability. Fractional-reserve banking system is the main reason for the instability in the money system.

b) Maintaining real balances at low cost. The increase in the supply of money as a result of money creation and either deposit or cash substitution will increase the cost of maintaining fundamental balances.

c) Ensuring justice. It is unfair to authorize banks to create loans. Because banks that benefit from these transactions will make excessive profits with these funds, which they have seized at a low interest rate. However, the benefit of creating money should be appropriated to the society. That is why 100-percent reserve banking provides its at the best.

The arguments of the second approch/fractional-reserve banking are as follows. According to this approach, credit money is not a factor of instability. It is not true that only banks benefit from the bank money creation process. On the other hand, the benefit of banks in this transaction is not the result of the fractional-reserve banking It is impossible to apply the 100-percent reserve banking without nationalizing the banking system. (Necar, Sıddıqı, Chapra).

Since there is no interest in the Islamic banking model, interest rates are affected by the profit margin instrument instead of the interest rate instrument. To do this, the central bank and the bank with the depositor and bank set the ratios for participation in the profit.

In Islamic banking, the Central Bank acts as a lender of last resort and can be issued in the form of interest-free loans (qard-al hasan) when lending to banks through a refinancing instrument in traditional banking. Through this tool, the central bank influences the liquidity of the financial system and banks. [38]

Another financial instrument is the liquidity ratios, which affect the reserves of the banks. banks are obliged by the central bank with this tool, to store a certain amount of money they can give in credit, in cash or in the form of a bank. Central bank's "ceiling policy" can be used to extend the investment and debt obligations of banks.

Another monetary policy instrument is to direct a portion of time deposits to government projects with high social benefits. On the one hand, this will be an additional support for the central bank's emmission, as well as a risk for banks, as it is guaranteed by the state.

Public share of demand deposits is an entirely new tool for the central bank control over commercial banks. It has been suggested by Chapra who has proposed that a certain proportion of demand deposits of commercial banks.

The credit ceiling is another non-interest method in the interest-free banking system.

The central bank also functions as the lender of the resort to commercial banks if any commercial bank faces a liquidity problem and is short of cash, the central ban may bail it out by providing it with an appropriate loan. In an interest based economy, such loans are provided on the basis of interest. In an Islamic economy the central bank could perform this function either by providing an interest-free loan (Qard Hasan) with or without a service charge.

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[38] Cihangir Akin, Interest Free Banking and Development, Istanbul-1986, 440 pages, p.91

It is generally known that quantitative methods of credit control are designed to control the volume of credit while the purpose of selective methods of credit control is to influence the direction of credit. Several methods of selective control suggested by Muslim economists can be listed here.

Refinance scheme. Under this scheme the central bank first identifies the priority sectors and then extends special matching credit to those commercial banks which have extended finance to the weaknest sectors. In the interest based system the central bank extends matching credit at al lower rate of interest. Under the interest-free system matching credit would be offered either as an interest free loan (Qard hasan) or on the basis of profit sharing. If it is offered on the basis of profit sharing, the central bank would share in the profit with commercial banks when they offer finance with the help of central bank funds. In order to kae it concessionary and the encourage further financing in the priority sectors the central bank may itself opt for a lower profit sharing ratio.

Other Selective credit control method is determining the minimum and maximum profit sharing margin requirements. Fixing a minimum and/or maximum ratio of profit for Islamic banks in their Musharaka and *Mudarabah* activities.[39]

In Islamic financial markets, banks use the Mudarabah Interbank Investment and Interbank Tavarruq/Commodity Murabaha and Wakalah Investment instruments to meet liquidity needs. Wakalah is a relationship between principal and agent. When a person appoints someone else as his agent, he uses wakalah.[40]

In Islamic economics, the most important function of the money is that it is a medium of exchange. In general, Islam considers the main goal of ensuring price stability, which is an element of monetary policy, to prevent uncertainties, money savings and speculative transactions, and, as a result, to ensure a fair distribution of income. [41]

On the issue of credit, the importance of implementing an expanding credit policy in this area is emphasized. Prohibition of bay'ul-qarar/speculation weakens speculative tendencies in the credit system.

Interest rates are the most important factor guiding capitalist monetary policy. Interest rates play the most important role in monetary policy in the modern economic system. Changing these rates gives direction to politics. In Islamic economics, income rates are used instead of interest rates. Therefore, changing interest rates is not considered a monetary policy tool. Prohibition of interest is important to eliminate uncertainty, exploitation and injustice.

Islamic states have adopted a natural increase in the money supply as a policy. The Seljuk Empire and Ottoman Empire encouraged the entry of gold and silver into the country, and banned its exit. Ottoman Empire also accepted the principle that a foreign merchant who brought goods into the country should return with the goods.

By changing of participation rates in profit on the Mudaraba instrument and required reserve ratio can be money policy instrument in İslam economy. In open market operations, stock

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[39] Ausaf Ahmad, Research Division, IDB-IRTI, Instruments of regulation and control of Islamic banks, Jeddah, 2000, 51 pages, p. 24,27,28,29

[40] Dr. Servet Bayindir, Islamic Finance in Fiqh and Economics –II (Money and Capital Markets), Suleymaniye Foundation, First Edition, July 2015, Turkey, İstanbul, 272 pages, p.245

[41] Money, interest and Islam. Islamic Science Research Foundation. Istanbul, 1992, 235 pages, p.80

documents, profit partnership and income partnership securities, etc. can be used. Through this method, the central bank regulates the supply of credit. An interest rate ban ensures good results by minimizing speculative tendencies.[42]

CONCLUSION

The study concludes that Islamic banking's rapid growth requires central banks to revise their regulatory and supervisory approaches. Unlike conventional banking, Islamic finance operates on profit-and-loss sharing principles, demanding Shariah-compliant monetary tools and oversight. The role of Shariah Boards is vital for ensuring transparency, compliance, and system stability. We can summarize the results in article as follows.

- We believe that it is expedient to set required reserve ratio in accordance with the risks of the sectors.

- The second proposal is to apply this limit only to demand deposits in banks that meet certain standards.

- The third proposal is that the participation of the Sharia Committee in the creation of new types of operations and services is essential.

- In economy policy, the tools for using income rates instead of interest rates should be expanded.

- Central bank have to demand from commercial bank having Separate Shariah Boards required.

- Central bank have to change monetar policy intruments for development of Islamic banking sector.

- Institutionalization of Shariah Supervision – The establishment of an independent Shariah Board should be a mandatory requirement for every commercial bank to ensure consistent supervision and compliance.

- Development of a National Islamic Banking Model – Countries like Azerbaijan should develop a national Islamic banking framework that clearly defines the roles of the central bank, Shariah Boards, and commercial banks within a unified legal and institutional structure.

- Expansion of the Central Bank's Regulatory Mandate – Monetary policy instruments should be designed based on profit ratios and return-sharing mechanisms instead of interest rate benchmarks.

- Introduction of New Monetary Instruments – The central bank should utilize Shariah-compliant open market instruments such as sukuk and profit-partnership certificates to conduct liquidity management.

- Enhancing Financial Literacy – Comprehensive training programs for central bank officials and financial sector professionals should be implemented, alongside public awareness campaigns to improve understanding of Islamic financial principles.

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[42]   Islamic Science Research Foundation, Money, İnterest and Islam, Istanbul, 1992, 235 pages, page. 80-81,83,86-87

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