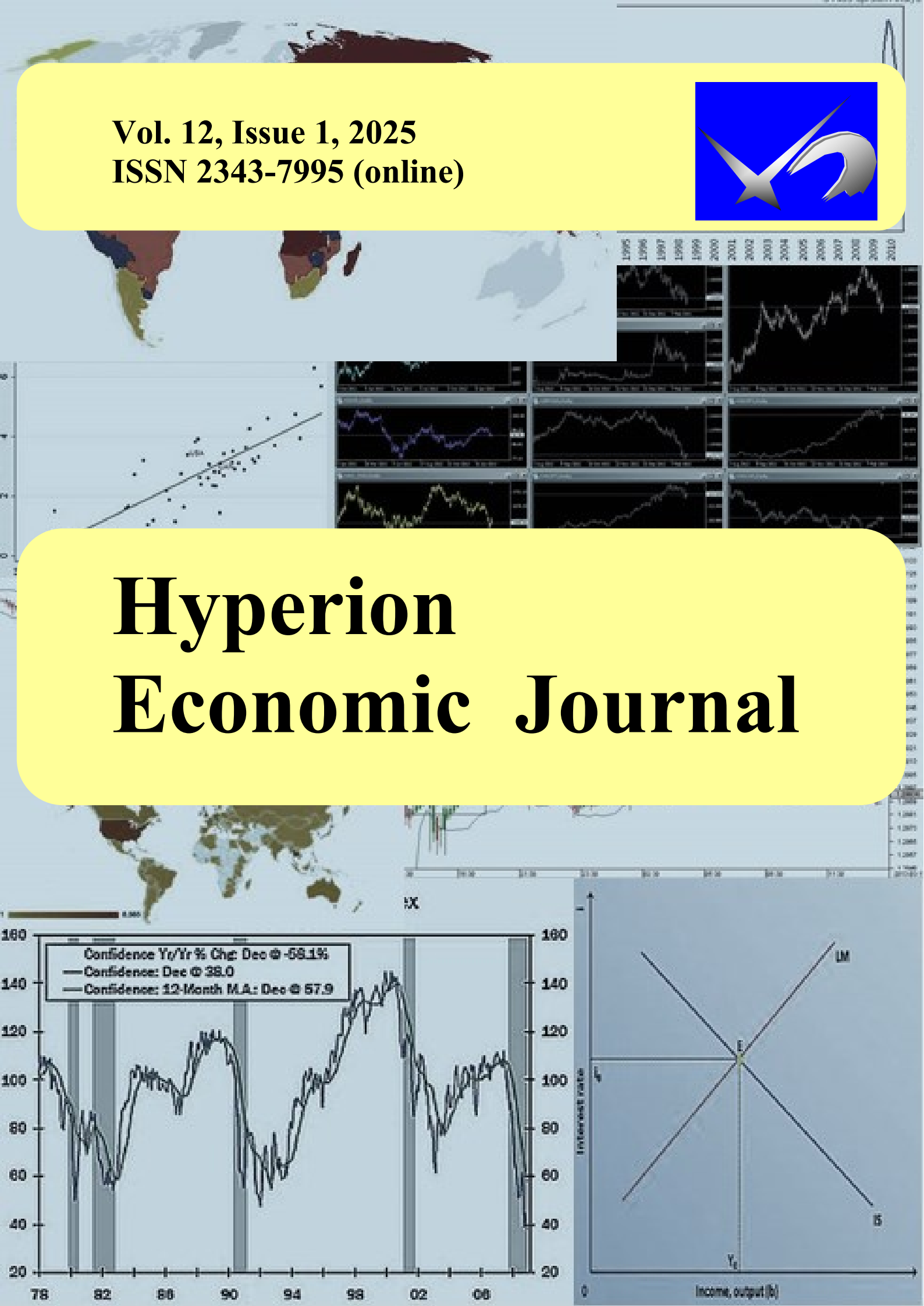
Vol. 12, Issue 1, 2025
ISSN 2343-7995 (online)

Hyperion Economic Journal



HYPERION ECONOMIC JOURNAL

Semiannual journal published by
Faculty of Economic Sciences
Hyperion University of Bucharest
Romania

YEAR XII, ISSUE 1, MARCH 2025
ISSN 2343-7995 (online)

Editorial Office: Hyperion University, Faculty of Economic Sciences,
Calea Calarașilor no. 169, district 3, Bucharest, 030615
http://www.hej.hyperion.ro hej@hyperion.ro

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THE STATE OF THE MODERN LABOUR MARKET IN CONDITIONS OF DEMOGRAPHIC AGEING IN THE REPUBLIC OF MOLDOVA

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ABSTRACT: *This article presents the results of a research of the state of the modern labour market and the employment level of the population in the Republic of Moldova. The labour market has been influenced by demographic factors, inflation, low standard of living, the presence social differentiation in society, economic stagnation and other changes in the international arena. The processes of differentiation of regional labour markets, the presence of informal employment, the imbalance of supply and demand for labour, regional unemployment, labour migration, as well as insufficient adaptation of legislation to the new conditions of labour market have become more obvious as a result of changes in the conjuncture in the system of international relations and external economic relations, the process of globalization, the introduction of Information Technology (IT) and New Technologies. The purpose of research is to analyze and assess changes in quantitative and qualitative indicators characterizing the employment of working age population, to determine the main problems of labour market in the conditions of population decline and ageing. The research is performed on the basis of statistical data on the main macroeconomic indicators, the number of the population with a usual place of residence, including elder age groups, employment indicators, income and poverty rates of population. When evaluation the state of labour market, complex and systemic approaches were applied, including the methods of monographs, comparative analysis, graphical, synthesis. The results of research revealed that an important factor affecting the labour market is the decline and ageing of the population, migration, which caused the deterioration of the quality of the modern labour market and is an obstacle to ensure a stable socio-economic development of the Republic of Moldova. Decrease in living standards due to low wages and increase in the risk of poverty of employed population are the factors that maintain labour migration, which has become irreversible. In order to improve the state of labour market, recommendations were developed to perfect public policies to ensure the fullest employment potential of labour force. The article was developed within the framework of the Subprogramme: Demographic transition in the Republic of Moldova: particularities, socio-economic implications and consolidation of demographic resilience (2024-2027).*

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Keywords: *demographic situation, income, labour force, labour market, demographic ageing, standard of living*

JEL Classification: *E24; J11; J21*

1. INTRODUCTION

In the modern conditions, the changes on labour market in the EU countries, including the Republic of Moldova, are more evident of socio-economic development of the world community. The given situation is related to both changes in the economy and, as a result, redistribution of labour force, increased competition and reduced employment opportunities, deficit of material resources and changes in business models, as well as the impact of demographic factors - decline and ageing of the population, irreversible nature of labour migration. The labour market was also affected by the Covid-19 pandemic, which was declared by the World Health Organization on 11 March 2020. The Republic of Moldova is not an exception in this context and in the analysed period the development of the given segment was also influenced both by the Covid-19 pandemic and the subsequent recession. According to the data of National Bureau of Statistics of the Republic of Moldova (NBS RM) Special Study "The impact of the Covid-19 pandemic on the labor market situation", conducted in the Republic of Moldova in the Q1 and Q2 2020 [NBS, 2020], in the second quarter of 2020 more than 217 thousand persons reported an impact on employment in labour market, and 121.7 thousand of employed population suspended their normal regime of work activity, including about 22% of employed were forced to stop labour employment.

The state of labour market and employment of working age population is determined by the influence of such factors as the evolution of the Gross Domestic Product, restructuring of economic activities types and territorial socio-economic infrastructure, indicators of public labour productivity, poverty rate and demographic processes (population decline, ageing, migration), as well as access to health and education services. An important role in the policies to ensure the development of national labour market is the adoption of the National Programme European Moldova - 2030, the Strategy Education Moldova-2030, the implementation of the goals of the Sustainable Development Agenda 2030 [United National, 2015], which provides for the implementation of 17 Global Development Goals, including in the field of labour market dysfunctionality (difference in the ratio of supply and demand), increasing the competitiveness of labour force, eliminating any form of inequality and discrimination in labour market. One of the key concepts and instruments of public policies, which are fixed in the conventions of the International Labour Organization and implemented since 1999, is "decent work for all", "decent labour", which also implies a fair remuneration, which will provide an opportunity to ensure professional development and social integration of worker, access to basic necessities. However, in the Republic of Moldova the level of wages remains one of the lowest compared to EU member states, according to the data of the National Bank of Moldova and Eurostat the gap between the wages, for example, in the sphere of information and communication (34030.8 lei gross wage) and accommodation and catering (9518,1 lei gross wage) is 3.5 times, in September 2023, 3.6% of employees had a wage of 4000.0 lei, from 20000.01-250000.0 lei - 5.0%, from 25000.01-300000.0 lei - 2.3% and from 30000.01 lei and over - 3.8% of employees, i.e. 11.1% of employees received a wage of more than 20.0 thousand lei and the wage gap is evident [NBS, 2024d]. This factor has a direct impact on the motivation for employment, on the stability of occupied working places and on the level of labour mobility (labour migration).

The research of labour market and the study of aspects of its functioning is reflected in the works of such representatives of economic theory as D. Ricardo, A. Smith, A. Marshall, J.

Keynes and others. The works of foreign authors of the neoclassical approach in the designated research area, including P. Deringer, A. Laffer, R. Layard, J. Kornai, G. Standing, R. Hall, R. Ehrenberg are also reflected the theory of transformational economics, flexible market and segmentation. The criteria of market economy elaborated by the above-mentioned authors are also the basis for the research of labour market and the concept of its functioning in the conditions of transformational transition of the national economy and the development of demographic processes such as decline population, depopulation, ageing and migration.

In the context of the above mentioned, it should be noted that in the Republic of Moldova, only for one year or as of 01.01.2024, as compared to 01.01.2023, the population with the usual residence declined by 2,8%, including rural - by 3.6% and urban - by 1.6% (according to the updated data уточненным данным, the population decline as of 01.01.2023 as compared to 01.01.2022 also constituted 2.8%), and as compared to 01.01.2019 - by 9.7%. In 2023, the negative value of natural increase (-9.7 thousand persons) increased compared to 2022 (-9.2 thousand persons). International migration, which has a negative value, also influenced the decline number of population, including if in 2022 it was -63.6 thousand persons, in 2023 its value despite the decline was negative and amounted to -59.6 thousand persons. The decline in number of population and, as a result, the change in the age structure caused an increase in the average age by 0.6 years: as of 01.01.2024, the average age was 41.1 years compared to 40.5 years as of 01.01.2023 (42.8 years for females and 39.1 years for males). As of 01.01.2024, the ageing population coefficient was 25.2%, which characterises a high level of demographic ageing (21.5% for males and 28.4% for females), compared to 01.01.2020, it increased by 3.5 p.p. (21.7% as of 01.01.2020). In 2023, the share of employed population aged 60 and over in labour market is 10.7% of the total employed population. [NBS, 2024b; NBS, 2024c].

In the domestic literature отечественной литературе, theoretical and methodological approaches, as well as the research of labour market are reflected in the works of a number of authors: Savelieva G. & Zaharov S. Analysis of principal tendencies of labour market in the Republic of Moldova [Savelieva G., Zaharov S., 2022b], Factors determining the inequity of regional development in the Republic of Moldova [Savelieva G., Zaharov S., 2022a], Impact of demographic factors on labour market in the Republic of Moldova [Savelieva G., Zaharov S., 2024a], Impact of population structure on GDP in the Republic of Moldova [Savelieva G., Zaharov S., 2024b]. The impact of population ageing processes on labour market is reflected in the monograph Savelieva G., Cesnocova N., Taragan R. et al Evaluation of the effects of ageing on socio-economic development [Savelieva G. et al, 2014], in the works of Bîrcă A. Elder people and labour market [Bârcă A. et al, 2012], Bîrcă A., Vaculovschi D., Sainsus B. et al Development of labour market policy in the Republic of Moldova [Bârcă A. et al, 2023], Vaculovchi D., Gîlca V. A demographic approach to the sustainability of the pension system (from the Republic of Moldova) [Vaculovchi D., Gîlca V., 2012].

The labour market is one of the important components of sustainable socio-economic development of the country. In order to ensure the sustainable development of this segment, the research of its quantitative and qualitative components, as well as the evaluation of the impact of socio-demographic and economic factors on its development, should be a necessary stage in the process of elaboration and implementation of state socio-economic policies.

2. PRINCIPAL PURPOSE

The principal purpose of present research is to identify and assess tendencies in change of the main indicators characterizing the state of the modern labour market, as well as to analyse and evaluate the impact of socio-demographic factors on labour market, including its competitiveness and balance.

One of the most important factors of existence, natural reproduction and distribution of labour force in space and time is *demographic*, which determines the quantitative composition and age structure of working age population, gender and territorial distribution. Population decline as a result of natural demographic (births, deaths) and migration processes, including a decrease in the share of youth aged 15-34 and a growth in the share of elder age groups contributes to the deformation of labour market, including in terms of sex and age composition and ageing of labour force in conditions of increasing life expectancy at birth. As a consequence of the demographic factor, there is also an imbalance between the economically active and inactive population in favour of the latter. Based on the above, the problem of replenishing the labour force emerges, at the expense of what reserves and opportunities can be used to ensure a balanced labour market and a deficit of labour force, i.e., a balance between demand and supply of labour force. At the same time, attention should be paid to the decrease in economic activity and employment rate of working age population, as well as the necessity to increase the duration of active economic activity of the population in elder age groups in conditions of increasing life expectancy and to cover the existing deficit of labour force. In addition to demographic factors, the labour market was influenced by the ongoing structural reforms of the socio-economic infrastructure, low wages and the risk of poverty of working-age population employed in labour market, the Covid-19 pandemic, the quality of labour force depending on the education level and others.

As a result of the influence of the above factors, the labour market is uncompetitive both at the internal and external levels. Consequently, the purpose of the given research is to identify the principal tendencies that affect the development of labour market, the character, specificity and consequences of their influence and, based on the results obtained, to form conclusions and proposals to improve the sustainability of national labour market development and its competitiveness.

The realization of the given purpose is carried out on the basis of research and implementation of the following tasks:

Analysis of the dynamics of changes in the population structure by main age groups, as well as life expectancy indicators, ageing coefficient, including by gender, place of residence, participation in economic activity of the population aged 60 and over. Characteristics of economically active and inactive population by main age groups and evaluation of the possibility of labour force reproduction;

Analysis of economically active and employed population by main age groups, including by gender, as well as assessment of changes in the distribution of employed population by types of economic activity and by main age groups in dynamics for 2019-2023;

Analysis of the quality of labour force by education level and professional training, as well as characterization of changes in employed population by occupation, including the ratio between the productive and non-productive potential of labour force, the balance of labour market in the supply and demand of workers in various occupations;

Analysis of labour migration by main age groups and education level;

Analysis of the dynamics of changes in wage levels, including by sectors of national economy, by gender, by type of economic activity, in territorial aspect, in comparison with the EU countries (in US dollars). Poverty risk evaluation of employed population depending on the main source of income.

Elaboration of conclusions based on the research results and proposals for improving the situation on labour force market, increasing the balance, sustainable development and competitiveness of national labour market at the internal and external levels.

The research of the state of labour market was performed on the basis of application of complex and systemic methodological approaches, methods of synthesis, analysis (including

comparative, quantitative and qualitative, in time and space), generalizations, calculations of secondary and tertiary indicators by the authors.

To research the state of the modern labour market, official statistical data of the National Bureau of Statistics of the Republic of Moldova, materials of non-governmental organizations, Eurostat data on wages of EU countries, scientific articles in the field of labour market, indicators calculated by the authors were used. The research used the number of population with usual residence, i.e. the population that lived in this place mainly during the last 12 months, independently of temporary absences (for rest, leisure, visits to relatives and friends, business, medical treatment, religious pilgrimages, etc.).

The research of the state in labour market, including the dynamics of indicators of labour force employment, average wages, disposable income and poverty is performed for the period from 2019 onwards, which is due to changes in the methodology of calculation of indicators and the sample size of surveys conducted by the National Bureau of Statistics.

3. RESEARCH RESULTS

In the modern conditions of socio-economic development of the Republic of Moldova, changes in labour market are evident as a result of changes in the economy related to the implementation of structural reforms and, as a consequence, regional infrastructure, opportunities to use innovations, new technologies and business models, as well as deficit of resource. The quarantine restrictions during the pandemic had a negative impact on economic activity in the country and changes in regional infrastructure, which also negatively affected on dynamics and trends in labour market, including employment among male, female, youth and elder workers. At the same time, despite the nature and impact of economic and regional policies on the situation in labour market, one important factor is demographic, including population decline and ageing. It is this factor that determines the reproduction of human capital, its distribution and employment by economic types of activities and regional aspect, including the presence of barriers to job placement, critical differences in employment of different social groups, the structure of unemployment, gender inequality in labour remuneration and others.

Table 1. presents data on change in number of population and its ageing, including by main age groups and gender for the last five years. Over the five-year period, the population with usual residence decreased, including by 7.7% decrease in 2023 compared to 2019, and by 2.8% from the previous year. With tendency to reduce the share of the population in the age group 0-15 years and the population of working age, a tendency of constant increase in the share of non-working age population in the elder ages (pre-pension and pension age and older) is clearly indicated and is characterised by the indicator of the ageing coefficient, which has already become irreversible.

Table 1. Dynamics of the main indicators of population by main age groups and demographic ageing, Republic of Moldova

Indicators	Number, thousand persons					Share of age group in total, %				
Age group	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Average headcount of population with the usual residence										
Total, persons	2664224	2635130	2595809	2528654	2457783	100.0	100.0	100.0	100.0	100.0
Including: - under working age (0-15 years)	523175	513952	504066	487209	464805	19.6	19.5	19.4	19.3	18.9
- working age	1582501	1552258	1537155	1489576	1438441	59.4	58.9	59.2	58.9	58.5

Indicators	Number, thousand persons					Share of age group in total, %				
Age group	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
(16-56/61 years)										
- over working age (57/62 years)	558548	568921	554589	551870	554537	21.0	21.6	21.4	21.8	22.6
Life expectancy at birth, years	70.9	69.9	69.0	71.4	71.9	males				
						66.8	66.0	65.1	67.1	67.5
						females				
						75.2	73.9	72.9	75.7	76.4
Characteristics of the population aged 60 years and over by participation in economic activity, %										
- economically inactive population	85.3	86.0	86.2	85.3	83.8	-	-	-	-	-
- employed population	14.5	13.8	13.6	14.4	15.9	-	-	-	-	-
- unemployed population	0.2	0.2	0.2	0.3	0.3	-	-	-	-	-
Population ageing coefficient, at the end of the year, %	21.7 (at the beginning of year – 20.8)	22.4	23.0	24.1	25.2	-	-	-	-	-
-males	17.5 (at the beginning of year – 18.3)	18.8	19.4	20.4	21.5	Urban				
						20.6 (at the beginning of year 20.0)	21.0	21.2	21.9	22.7
-females	23.9 (at the beginning of year – 24.9)	25.6	26.3	27.3	28.4	Rural				
						21.5 (at the beginning of year 22.5)	23.3	24.3	25.7	27.1

Source: NBS data and authors' calculations

Analysing the structure of the population by main age categories makes it possible to identify the formed tendency of both population decline and ageing. According to the data of the National Bureau of Statistics (hereinafter referred to as the NBS), in the Republic of Moldova, at the beginning of 2024, the number of population aged over 60 years constituted 610.7 thousand persons or 25.4% of total population with usual residence, of which the majority of given category of population are females (or 60.2%), with every third person being in the age category 60-64 years (31.0%), and 9.8% exceeding the age of 80 years. In this context, it is necessary to note the fact that for the 5-year period under review 2019-2023, there is a tendency of increase in the life expectancy of population aged 60 years and over, including, according to estimations, for females aged 60 years and over more 20.4 years, and 4.9 years less for males, or 15.7 years. [NBS, 2024c].

At the same time, the estimation of the possibility of economic activity of population 60 years and over, according to the data of the Labour Force Survey for 2023, the share of economically active population in the above age group was only 10.4% (97.0 thousand persons) of total economically active population and 16.2% of total population of the given age. The structure of changes in economically active and inactive population by main age categories for

the period 2019-2023 is shown in Table 2. The data on economically inactive population also reflects the category of economic inactivity.

Table 2. Dynamics of changes in the structure of economically active and inactive population by main age groups, Republic of Moldova, 2019-2023

Indicators/ Age group	Number, thousand persons					Share of age group in total, %				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Economically active population, 15 years and over (15+)										
Total, thous. persons	**919.3**	**867.3**	**871.6**	**890.0**	**929.5**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
15-24 years	62.8	51.2	48.5	47.3	52.4	6.8	5.9	5.6	5.3	5.6
25-34 years	230.8	209.9	205.6	199.8	188.8	25.1	24.2	23.6	22.4	20.3
35-44 years	225.2	222.2	230.3	238.4	259.7	24.5	25.6	26.4	26.8	27.9
45-54 years	207.5	198.2	201.7	213.2	223.0	22.6	22.9	23.1	24.0	24.0
55-64 years	165.0	160.9	164.9	168.6	176.3	17.9	18.5	18.9	18.9	19.0
65 years and over	27.9	25.0	20.6	22.7	29.3	3.1	2.9	2.4	2.6	3.2
15-29 years	166.1	145.9	135.1	130.7	130.6	18,2	16.8	15.5	14.7	14.0
15-34 years	293.6	261.1	254.1	247.1	241.2	31.9	30.1	29.2	27.8	25.9
15-64 years	891,3	842.3	851.0	867.3	900.2	96,9	97.1	97.6	97.4	96.8
20-64 years	881.7	833.6	844.0	859.5	888.6	95.9	96.1	96.8	96.6	95.6
25-64 years	828.6	791.1	802.5	820.0	847.8	90.1	91.2	92.1	92.1	91.2
Economically inactive population, thous. persons	**1 255.9**	**1 283.6**	**1 248.9**	**1 240.1**	**1 129.9**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
15-24 years	232.8	228.3	219.7	219.6	195,4	18.5	17.8	17.6	17.7	17.3
25-34 years	187.0	192.6	178.4	173.5	148.8	15.0	15.0	14.3	14.0	13.2
35-44 years	142.5	149.0	144.6	150.3	125.3	11.3	11.6	11.6	12.1	11.1
45-54 years	125.8	132.3	127.9	121.4	101.9	10.0	10.3	10.2	9.8	9.0
55-64 years	226.5	225.0	212.1	204.4	184.5	18.0	17.5	17.0	16.5	16.3
65 years and over	341.2	356.4	366.3	370.9	374.1	27.2	27.8	29.3	29.9	33.1
Including by category of economic inactivity										
- pupil, student	164.4	172.1	169.0	165.8	156.9	13.1	13.4	13.5	13.4	13.9
- pensioner	566.3	580.1	583.5	580.1	562.7	45.1	45.2	46.7	46.8	49.8
- housewife (householder)	163.4	167.6	166.3	163.9	143.9	13.0	13.1	13.3	13.2	12.7
- other situation	255.9	273.4	251.0	237.4	183.4	20.4	21.3	20.1	19.1	16.2
- went outside the country	105.9	90.4	79.0	93.0	82.9	8.4	7.0	6.4	7.5	7.4
Share of inactive population % of total population, 15 years and over (15+)	Economically active and inactive population, total, thousands persons					57.7	59.7	58.9	58.2	54.9
	175.2	150.9	120.5	130.1	059.4					

Source: NBS data NBS data and authors' calculations

Analysis of data on the structure of economically active and inactive population allows to conclude that the principal tendencies are connected with a decrease in both the number and share of economically active population in the youth groups 15-24 years and 25-34 years, including in 2023 compared to 2019 the number of population of the youth group 15-24 years decreased by 16.6% and 25-34 years by 18.2%. At the same time, there is an increase in more elder age groups, including 45-54 year by 7.5% and 55-64 year by 6.8%. In economically inactive population, the main share belongs to the category "pensioner", which increased by 4.7 p.p. in 2023 compared to 2019, while the population in the age category 65 years and over constitutes the largest share or 33.1% of economically inactive population. In the Republic of Moldova as a whole, economically inactive population is predominant in the population structure 15 years and over (55.0% in 2023), which highlights the difficulty in the quantitative reproduction of labour force of working age. Considering the issue of replenishment of labour force market at the expense of the above-mentioned category, this option is possible due to the entry into the population market of their category "pupil, student" and possibly due to the return of labour migrants to the country.

As a consequence of the demographic factor, the age structure of employed population tends to age, which is characterised by the data in Table 3.

Table 3. Characteristics of the structure of employed population by main age groups, Republic of Moldova, 15 and over

Indicators	Number, thousand persons					Share of age group in total, %				
Age group	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Total, thous. persons	**872.4**	**834.2**	**843.4**	**862.3**	**886.9**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
15-24 years	56.2	45.6	44.1	42.3	46.4	6.4	5.5	5.2	4.9	5.2
25-34 years	217.5	202.1	199.5	194.7	180.3	24.9	24.2	23.7	22.6	20.3
35-44 years	213.2	213.7	223.2	231.5	245.8	24.4	25.6	26.5	26.8	27.7
45-54 years	199.0	191.6	195.7	206,8	215.3	22.8	23.0	23.2	24.0	24.3
55-64 years	158.6	156.2	160.4	164.5	170.0	18.2	18.7	19.0	19.1	19.2
65 years and over	27.9	24.9	20.6	22.6	29.1	3.3	3.0	2.4	2.6	3.3
15-29 years	152.0	136.8	127.4	123.4	120.8	17.4	16.4	15.0	14.3	13.6
15-34 years	273.7	247.7	243.6	237.0	226.7	31.4	29.7	28.9	27.5	25.6
15-64 years	844.5	809.3	822.8	839.8	857.8	96.7	97.0	97.6	97.4	96.7
20-64 years	836.5	801.8	816.8	833.2	847.9	95.9	96.1	96.8	96.6	95.6
25-64 years	788.3	763.6	778.8	797.5	811.4	90.4	91.5	92.3	92.5	91.5

Source: NBS data and NBS data and authors' calculations

In the age structure of employed population in 2023, the principal share is the age category 35-44 years (27.7% or by 3.3 p.p. more as compared to 2019), with the established tendency of reduction of the youth age group 15-24 years by 1.2 p.p., as well as the tendency of growth of age categories 45-54 years (by 1.5 p.p.) 55-64 years (by 1.0 p.p.) for the analysed period, as well as it should be noted the stable tendency of maintaining the share of employed population in the age group 20-64 years at the level of 96% and its growth in 2023 compared to 2019 by 1.4%. Number of employed population in the age category of 65 years and over also increased by 4.3% in 2023 compared to 2019. There is an ageing of employed labour force, which leaves its mark on the puts an imprint on the necessity to create conditions and opportunities for the use of flexible working schedule for the above-mentioned category of workers, taking into account their physical and psycho-emotional state. Based on the

characteristics of the age composition of labour market, the comparative characteristic of economic activity and employment rate by main age groups is presented in Table 4.

Table 4. Economic activity and employment rate by main age groups, Republic of Moldova, 2019-2023

Age group	Economic activity rate, %					Employment rate, %				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Total, RM	**42.3**	**40.3**	**41.1**	**41.8**	**45.1**	**40.1**	**38.8**	**39.8**	**40.5**	**43.1**
15-24 years	21.2	18.3	18.1	17.7	21.2	19.0	16.3	16.4	15.8	18.7
25-34 years	55.2	52.1	53.5	53.5	55.9	52.1	50.2	52.0	52.2	53.4
35-44 years	61.2	59.9	61.4	61.3	67.5	58.0	57.6	59.5	59.6	63.8
45-54 years	62.2	60.0	61.2	63.7	68.6	59.7	58.0	59.4	61.8	66.3
55-64 years	42.2	41.7	43.8	45.2	48.9	40.5	40.5	42.6	44.1	47.1
65 years and over	7.6	6.6	5.3	5.8	7.3	7.6	6.5	5.3	5.7	7.2
15-29 years	33.7	31.4	30.6	30.0	33.0	30.9	29.4	28.9	28.3	30.6
15-34 years	41.2	38.3	39.0	38.6	41.2	38.4	36.3	37.3	37.0	38.7
15-64 years	49.4	47.6	49.1	49.9	54.4	46.8	45.7	47.5	48.4	51.8
20-64 years	52.9	51.1	52.8	53.7	58.4	50.2	49.1	51.1	52.1	55.7
25-64 years	54.9	53.1	54.8	55.8	60.2	52.2	51.3	53.1	54.3	57.6
Males	**47.0**	**45.1**	**46.5**	**46.3**	**49.5**	**44.2**	**43.1**	**44.7**	**44.7**	**47.1**
15-24 years	24.1	21.1	22.4	20.9	24.1	21.4	19.0	20.3	19.0	21.3
25-34 years	63.5	60.5	64.1	62.7	62.4	60.3	58.1	61.6	60.7	60.0
35-44 years	61.2	61.9	64.0	61.9	68.1	57.0	59.2	62.0	59.9	63.6
45-54 years	61.0	56.9	57.9	60.6	66.4	58.0	54.7	55.8	58.3	64.0
55-64 years	50.5	50.1	51.8	53.4	57.1	47.9	48.1	50.0	51.8	54.7
65 years and over	10.1	8.5	6.9	7.7	10.3	10.1	8.4	6.9	7.7	10.3
20-64 years	57.3	55.5	57.8	57.8	61.9	53.9	53.1	55.6	55.8	58.8
Females	**38.2**	**36.1**	**36.4**	**37.8**	**41.4**	**36.5**	**35.0**	**35.4**	**36.8**	**39.7**
15-24 years	18.2	15.4	13.6	14.6	18.3	16.5	13.5	12.3	12.7	16.2
25-34 years	47.6	44.4	44.0	45.2	50.3	44.4	42.9	43.2	44.4	47.7
35-44 years	61.3	57.9	59.0	60.8	66.9	58.9	56.1	57.2	59.2	64.0
45-54 years	63.4	62.9	64.4	66.8	70.8	61.3	61.1	62.8	65.3	68.6
55-64 years	35.2	34.2	36.6	38.3	42.1	34.3	33.7	36.0	37.6	40.9
65 years and over	6.0	5.4	4.3	4.5	5.3	6.0	5.4	4.3	4.4	5.2
20-64 years	48.9	47.0	48.1	50.0	55.3	46.8	45.5	46.9	48.7	53.0

Source: NBS data and NBS data

The coefficients of economic activity and employment both in the country as a whole and in the gender aspect during the analysed five-year period registered an upward tendency. However, for assessing by age categories, the low economic activity of the youth age category 15-24 years (below the national average by 23.9 p.p.), 15-29 years (below the national average by 12.1 p.p.) and 15-34 years (below the national average by 3.9 p.p.) is evident in this context, which, as a consequence, was the reason for the low employment rate or the employment rate in 2023 for the youth age category 15-24 years was below the national average by 24.7 p.p., respectively, 15-29 years old - by 12.5 p.p. and 15-34 years old - by 4.4 p.p. An upward tendency in economic activity and employment rate in the period 2019-2023 was registered in the 45-54 age category by 6.4 p.p. and 6.6 p.p., respectively, which exceeded the national average in 2023 by 23.5 p.p. and 21.2 p.p. Economic activity and employment in the 65 and

over age category had a downward tendency, but in 2023 it reached the level of 2029 or slightly more than 7%.In the gender aspect, the economic activity and employment rate registered an upward tendency, but males have higher rates than females, including the average rate of participation in economic activity for males is 8.1 p.p. higher than for female, and the employment rate is 7.4 p.p. higher. The highest economic activity and employment rates for males are registered in the 35-44 age category (68.1% or 18.6 p.p. higher than the average for males), and for females are registered in the 45-54 age category (70.8% or 29.4 p.p. higher than the average for females). In the 15-24 age category, both males and females have relatively low rates of participation in economic activities and employment (24.1% and 21.3% for males and 18.3% and 16.2% for females), and in the 65 and over age group, males also have higher rates than females (10.3% and 10.3% for males and 5.3% and 5.2% for females).

As a result of the influence of demographic factors and the process of implementing structural reforms, there was a change in employed population by type of economic activity (Table 5.).

Table 5. Structure of employed population by main types of economic activity, 2019-2023

Type of economic activity	Number, thous. persons					Share in total, %				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Total	**872.4**	**834.2**	**843.4**	**862.3**	**886.9**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Agriculture, forestry and fisheries	182.8	175.9	181.2	179.3	185.3	21.0	21.0	21.5	20.8	20.9
Industry	128.0	121.4	121.6	127.6	127.8	14.8	14.5	14.4	14.8	14.4
Construction	61.4	60.4	65.1	66.5	63.3	6.9	7.2	7.7	7.7	7.1
Wholesale and retail trade, Accommodation and public catering activities	163.8	148.4	147.5	152.7	156.9	18.8	17.8	17.5	17.7	17.7
Transport and storage; Information and communication	59.9	61.5	60.2	63.8	63.2	6.9	7.4	7.1	7.4	7.1
Public administration, Education, Health and social assistance	197.5	193.1	193.5	197.4	203.5	22.6	23.1	22.9	22.9	22.9
Other activities	78.9	73.5	74.3	75.1	86.9	9.0	9.0	8.9	8.7	9.9
Males	447.4	434.5	443.0	443.7	445.1	51.3	52.1	52.5	51.5	50.2
Females	425.0	399.7	400.4	418.6	441.7	48.7	47.9	47.5	48.5	49.8
Urban	404.7	377.6	379.1	393.6	412.1	46.4	45.3	44.9	45.6	46.5
Rural	467.7	456.6	464.3	468.8	474.8	53.6	54.7	55.1	54.4	53.5

Source: NBS data and NBS data and authors' calculations

The reduction in the number of employed population, as a consequence of the Covid-19 pandemic in 2020-2021, influenced the redistribution of employed population in favour of real sector of the economy, and subsequently the recovery of employment rate in the service

sector. The tendency of stability in the share of employed population is observed in real sector (approximately 42-43%, and in public administration, education, health and social assistance (about 23%). In transport, storage and especially, information and communication, the number of employed population in 2023 compared to 2019 increased by 5.5% and the share of employed by 0.2 p.p. From the point of view of the gender aspect, the share of employed males is predominant, as well as in the number of employed population the principal share is employed population in rural. The structure of employed population by main types of economic activity and by age groups is reflected in Table 6.

Table 6. Structure of employed population by main age groups and by type of economic activity

Type of economic activity, age group	Number, thousand persons					Share of age group in total number of employed in the sector, %				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Agriculture, forestry and fisheries	**182.8**	**175.9**	**181.2**	**179.3**	**185.3**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
15-24 years	8.4	8.0	9.2	7.9	7.0	4.6	4.6	5.0	4.3	3.9
25-34 years	33.7	31.2	29.3	27.2	26.8	18.4	17.7	16.2	15.2	14.5
35-44 years	35.9	39.4	42.9	41.2	42.9	19.6	22.4	23.7	23.0	23.1
45-54 years	49.3	45.9	51.1	51.7	55.1	27.0	26.1	28.2	28.8	29.7
55-64 years	44.7	44.1	42.4	43.7	44.7	24.5	25.1	23.4	24.4	24.1
65 years and over	10.8	7.3	6.4	7.7	8.8	5.9	4.1	3.5	4.3	4.7
Industry	**128.0**	**121.4**	**121.6**	**127.6**	**127.8**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
15-24 years	10.8	8.4	7.7	6.4	6.3	8.4	6.9	6.3	5.0	4.9
25-34 years	29.8	31.8	29.1	30.0	28.5	23.3	26.2	23.9	23.5	22.3
35-44 years	33.5	32.7	34.9	39.7	41.1	26.2	26.9	28.7	31.1	32.2
45-54 years	30.0	27.1	27.9	28.2	28.2	23.4	22.3	22.9	22.1	22.1
55-64 years	21.1	18.8	20.5	21.6	21.6	16.5	15.5	16.9	16.9	16.9
65 years and over	2.7	2.5	1.4	1.7	2.0	2.2	2.2	1.3	1.4	1.6
Construction	**61.4**	**60.4**	**65.1**	**66.5**	**63.3**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
15-24 years	4.2	3.3	4.3	3.7	2.1	6.8	5.5	6.6	5.6	3.3
25-34 years	21.3	17.0	17.3	17.1	14.1	34.7	28.1	26.6	25.7	22.3
35-44 years	16.5	20.7	21.1	18.1	21.6	26.9	34.3	32.4	27.2	34.1
45-54 years	12.0	11.1	13.3	18.0	16.0	19.5	18.4	20.4	27.1	25.3
55-64 years	6.7	7.9	8.8	8.8	8.8	10.9	13.1	13.5	13.5	13.9
65 years and over	0.8	0.5	0.4	0.7	0.8	1.2	0.6	0.5	0.9	1.1
Wholesale and retail trade; Accommodation and public catering activities	**163.8**	**148.4**	**147.5**	**152.7**	**156.9**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
15-24 years	17.5	13.5	12.2	11.4	15.8	10.7	9.1	8.3	7.5	10.1
25-34 years	49.7	42.3	41.1	37.3	35.1	30.3	28.5	27.9	24.4	22.4
35-44 years	44.8	43.1	41.1	46.3	45.6	27.3	29.0	27.9	30.3	29.1
45-54 years	28.8	29.2	31.5	35.2	34.2	17.6	19.7	21.3	23.1	21.8
55-64 years	20.3	17.8	19.6	19.9	22.5	12.4	12.0	13.3	13.0	14.3
65 years and over	2.7	2.5	2.1	2.6	3.2	1.7	1.7	1.3	1.7	2.3
Transport and storage; Information and communication	**59.9**	**61.5**	**60.2**	**63.8**	**63.2**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
15-24 years	3,6	3,0	1,9	3,1	3,2	6,0	4,9	3,1	4,9	5,1

Type of economic activity, age group	Number, thousand persons					Share of age group in total number of employed in the sector, %				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
25-34 years	19,4	18,7	19,9	19,7	17,5	32,4	30,4	33,1	30,9	27,7
35-44 years	14,5	15,7	15,4	16,8	17,4	24,2	25,5	25,6	26,3	27,5
45-54 years	12,0	11,4	10,9	13,6	13,9	20,0	18,5	18,1	21,3	22,0
55-64 years	9,0	11,1	10,9	9,5	9,8	15,0	18,0	18,1	14,9	15,5
65 years and over	1,3	1,7	1,2	1,0	1,3	2,4	2,7	2,0	1,7	2,2
Public administration, Education, Health and social assistance	**197.5**	**193.1**	**193.5**	**197.4**	**203.5**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
15-24 years	7.1	6.5	4.6	3.7	5.6	3.6	3.4	2.4	1.9	2.8
25-34 years	40.6	38.4	39.8	41.6	36.5	20.6	19.9	20.6	21.1	17.9
35-44 years	48.7	41.7	47.1	48.3	51.3	24.7	21.6	24.3	24.5	25.2
45-54 years	50.9	52.7	46.2	47.4	52.5	25.8	27.3	23.9	24.0	25.8
55-64 years	43.4	45.8	49.0	50.2	48.2	22.0	23.7	25.3	25.4	23.7
65 years and over	6.9	8.1	6.8	6.1	9.4	3.3	4.1	3.5	3.1	4.6
Other activities	**78.9**	**73.5**	**74.3**	**75.1**	**86.9**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
15-24 years	4.6	2.9	4.2	6.0	6.4	5.8	3.9	5.7	8.0	7.4
25-34 years	23.1	22.7	23.1	21.8	21.7	29.3	30.9	31.1	29.0	25.0
35-44 years	19.4	20.5	20.6	21.1	25.8	24.6	27.9	27.7	28.1	29.7
45-54 years	15.9	14.2	14.9	12.7	15.0	20.2	19.3	20.1	16.9	17.3
55-64 years	13.3	10.8	9.2	10.8	14.4	16.9	14.7	12.4	14.4	16.6
65 years and over	2.6	2.4	2.3	2.8	3.5	3.2	3.3	3.0	3.6	4.0

Source: NBS data and NBS data and authors' calculations

Analysis of employment data by main age groups indicated a downward tendency for youth aged 15-24 practically all types of economic activity, including in 2023 compared to 2019, a 2-times reduction of the given group in construction and in public administration, education, health and social assistance, as well as a 42% reduction in industry. A analogous downward tendency takes place in 25-34 age group, including a 34% reduction in construction, a 29.4% reduction in wholesale and retail trade, hospitality and catering, a 20% reduction in agriculture, forestry and fisheries and public administration, education, health and social assistance. Against the backdrop of the tendency of reduction of youth employment, the share of employed population of more elder ages, including the pre- and pension age groups, is growing both in real sector of the economy and in the sphere of services (in 2023, the highest share was in the age groups 55-64 years and 65 years and over in agriculture, forestry and fisheries - 28.8%, in public administration, education, health and social assistance - 28.3%), as well as the main share in employed population belongs to the 35-54 age group, including in construction - 59.4%, in industry - 54.3%, in agriculture, forestry and fisheries - 52.8%, in wholesale and retail trade, hotel complex, public catering, as well as in public administration, education, health and social assistance - 51%, in transport and storage, information and communication - 49.5%.

The analysis of the age structure of labour market leads to the conclusion that there is an irreversible tendency of its ageing, as well as the necessity to increase its competitiveness. In this context, it is necessary to evaluate the quality of labour force market depending on the educational level of labour force in labour market.

Table 7. Structure of employed population by education level

Education level	Number, thousand persons					Share in total, %				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Total	**872.4**	**834.2**	**843.4**	**862.3**	**886.9**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Higher	243.2	236.1	235.4	244.0	245.2	27.9	28.3	27.9	28.3	27.6
Secondary special	127.6	119.1	119.2	120.9	126.7	14.6	14.3	14.1	14.0	14.3
Primary vocational education	198.2	188.5	191.3	199.2	200.7	22.7	22.6	22.7	23.1	22.6
Lyceum, general secondary	154.8	146.5	139.6	138.1	139.3	17.7	17.6	16.6	16.0	15.7
Gymnasium	145.4	142.0	155.9	158.2	171.9	16.7	17.0	18.5	18.3	19.4
Primary school or without	3.3	2.0	2.0	1.8	3.0	0.1	0.2	0.2	0.3	0.4

Source: NBS data and NBS data and authors' calculations

During the period 2019-2023, the main share of labour force market is occupied by workers with higher education (27-28%), while the labour market has a deficit of mid-level workers, workers of different specialties. In 2023 compared to 2019, the number of employed population with gymnasium education increased by 18.2%, and there is also an increase in labour force with primary school or without. Characteristics of employed population by occupation reflected a more real situation on labour market.

Table 8. Characteristics of employed population by occupation

Occupation groups	Number, thousand persons					Share in total, %				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Total	**872.4**	**834.2**	**843.4**	**862.3**	**886.9**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Legislators, members of the executive branch, other high-ranking persons	60.9	60.0	63.8	71.4	67.0	7.0	7.2	7.6	8.3	7.6
Specialists in various spheres of activity	150.2	145.6	140.5	137.3	143.9	17.2	17.5	16.7	15.9	16.2
Technicians and other specialists with mid-level of qualification	61.1	53.7	60.0	62.5	61.9	7.0	6.4	7.1	7.2	7.0
Administrative employees (workers)	26.2	25.6	25.8	29.8	27.7	3.0	3.1	3.1	3.5	3.1
Workers in the sphere of services and trade	123.4	115.5	120.0	122.1	133.0	14.1	13,8	14.2	14.2	15.0
Qualified workers in agriculture, forestry, aquaculture, fishing and fisheries	118.8	114.7	114.3	115.5	116.8	13.6	13.7	13.6	13.4	13.2
Qualified and assimilated (equivalent to them) workers	133.7	125.8	127.4	127.9	123.1	15.3	15.1	15.1	14.8	13.9
Other professions	198.0	193.3	191.6	195.8	213.5	22.8	23.2	22.6	22.7	24.0
Of which: non-qualified workers	120.7	117.8	114.0	119.0	132.9	61.0	61.0	9.5	61.0	62.2

Note:
Occupation groups are indicated according to the Classifier of Occupations of the Republic of Moldova:
Group 1 - legislators, members of the executive branch, other high-ranking persons and heads of public administration, heads and senior officials of units;
Group 2 - specialists with the highest level of qualification;
Group 3 - specialists with medium level of qualification;
Group 4 - Administrative employees;
Group 5 - Workers in the sphere of services and trade;
Group 6 - Skilled workers in agriculture, forestry, hunting, fishing and fishery;
Group 7 - Skilled workers in large and small industrial enterprises, crafts, construction, transport, communications, geology and geological prospecting;
Group 8 - Operators, apparatus operators, plant and machine operators, fitters and assemblers;
Group 9 - Unskilled labourers

Source: NBS data and NBS data and authors' calculations

From the analysis of the employed population by occupation, it can be concluded that with an increase in the number of employed in administrative, legislative and executive authorities (by 10%) and administrative workers (by 5.7%) in 2023 compared to 2019 there is a tendency to decrease in the number of qualified workers (by 8 %), including in agriculture, forestry and fisheries (by 2 %), specialists in various spheres of activity (by 4.2 %), non-qualified workers (by 10.1 %), i.e. there is an imbalance in the demand for middle and lower level workers with professional and technical training or non-qualified workers. The analysis indicated, that the change in total number of management and legislative structures or *group 1 and group 4* (in 2019 - 87.1 thousand persons and in 2023 - 97.7 thousand persons), its growth was 12.2%, and the number of workers for this period or *group 7 and group 8* without *group 9* (in 2019 - 211.0 thousand persons and in 2023 - 203.7 thousand persons), the total number of qualified workers and workers with professional decreased by 3.5%. The above-mentioned situation, i.e. the growth of unproductive personnel with reducing the potential of productive workers, contributes to the reduction of both the possibility of stable balanced development of labour market and its competitiveness.

One of the factors in changing the age structure and reducing the quality of labour market is labour migration, which results in an outflow of labour force at the most productive age and the maintenance of a higher share of migrants with professional training (Table 9.).

Table 9. Structure of labour migrants by main age categories and education level

Education level	Number, thousand persons					Share in total, %				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Total	**140.6**	**151.1**	**129.0**	**126.0**	**99.7**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
15-24 years	16.7	16.0	14.4	12.9	7.0	11.9	10.6	11.2	10.2	7.0
25-34 years	36.8	43.3	35.3	34.0	28.7	26.2	28.7	27.4	27.0	28.8
35-44 years	40.5	40.2	35.4	39.0	29.2	28.8	26.6	27.4	31.0	29.3
45-54 years	33.0	36.1	32.1	27.5	24.8	23.5	23.9	24.9	21.8	24.9
55-64 years	13.6	15.5	11.7	12.6	10.0	9.6	10.2	9.1	10.0	10.0
65 years and over	-	-	0.0	-	-	-	-	-	-	-
Total	**140.6**	**151.1**	**129.0**	**126.0**	**99.7**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Higher	16.3	18.3	16.1	16.6	17.8	11.6	12.1	12.5	13.2	17.9
Secondary special	20.4	20.8	18.2	17.4	14,3	14.5	13.8	14.1	13.8	14.3
Primary vocational education (professional)	38.5	41.1	36.0	31.9	25.7	27.4	27.2	27.9	25.3	25.8

Education level	Number, thousand persons					Share in total, %				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Lyceum, general secondary	27.9	30.7	26.2	26.9	17.1	19.8	20.3	20.3	21.3	17.2
Gymnasium	36.7	39.3	31.0	32.0	24.5	26.1	26.0	24.0	25.4	24.6
Primary school or without	0.8	1.0	1.4	1.2	0.4	0.6	0.6	1.2	1.0	0.2

Source: NBS data and NBS data and authors' calculations

As follows from the analysis of data on labour migration, for the period 2019-2023 there is a evident tendency of reduction in the number of labour migrants, including by 29.1% at the end of the period compared to 2019. The given situation is typical for all age categories, especially for youth aged 15-24 years, the number of migrants from which decreased by practically 2.4 times, respectively, age categories 25-34 years - by 22% and elder age categories 35-44 years - by 28%. However, considering labour migrants by education level, it can note a tendency to increase the share of migrants with higher education (by 6.3 p.p.), as well as a tendency to maintain in 2023 the highest share of migrants with professional education (25.8%).

One of the motives for maintaining migration flows to work outside the country is the *absence of stability of economic development* due to the dependence on energy and other primary material resources necessary for economic development and *low wages*.

The dependence of wages and employment of population, including its economic activity, is one of the key characteristics of the modern labour market. In general, during the analyzed period, the tendency of growth of average monthly nominal wages is characteristic both on average for the country and by types of economic activity, by regions and in the gender aspect. At the same time, under the influence of the growth of the Consumer Price Index (CPI) the index of real wages is significantly lower than the index of growth of nominal wages, and in 2022 with the growth of nominal wages (116.3%), the index of real wages registered its fall to 90.4% compared to the previous year due to a sharp increase in the Consumer Price Index. The differentiation of average monthly wages between the budget and real sectors (on average 17-18%), as well as between males and females (on average 15%) remains.

Table 10. Comparative characteristics of changes in main indicators of average monthly wages

	2019	2020	2021	2022	2023	2023/ 2022, %	2023/ 2019, %
Average monthly wage, total							
- EURO	367.7	402.3	429.1	525.0	621.6	118.4	169.1
- MDL	**7 233.7**	**7 943.0**	**8 979.8**	**10 447.3**	**12 209.2**	**116.9**	**168.8**
Including:							
- budgetary	6 664.4	7 381.6	7 828.6	8 891.1	10 484.3	117.9	157.3
- real	7 420.4	8 135.7	9 360.3	10 954.7	12 758.3	116.5	171.9
Budgetary/real, %	89.8	90.7	83.6	81.2	82.2	+ 1.0 p.p.	-7.6 p.p.
- males	7 808.0	8 558.5	9 672.6	11 380.7	13 308.7	116.9	170.4
- females	6 709.8	7 387.2	8 353.1	9 618.4	11 237.2	116.8	167.5

	2019	**2020**	**2021**	**2022**	**2023**	2023/ 2022, %	2023/ 2019, %
Differentiation in remuneration of females and males, %	14.1	13.7	13.6	15.5	15.6	+0.1 p.p.	+1.5 p.p.
Consumer price index, %	104.8	103.8	105.1	128.7	113.4	-15.4 p.p.	+8.6 p.p.
Real wage index, %	110.1	105.8	107.6	90.4	103.1	+12.7p.p.	-7.0 p.p.
Wage growth index, % to the previous year	115.4	109.8	113.1	116.3	116.9	+0.6 p.p.	+1.5 p.p.
Average monthly wage by main types of economic activity, MDL							
Agriculture and forestry, fisheries	4 768.7	5 022.9	5 691.1	6 700.7	7 952.0	118.7	166.8
Industry and construction	7 151.8	7 572.4	8 221.4	9 507.7	10 983.5	115.5	153.6
Public administration and defense; obligatory social insurance	9 118.6	9 985м4	10 501.3	12 054.3	13 985.8	116.0	153.4
Education	6 327.6	7 016.8	7 462.3	8 445.5	10 073.5	119.3	159.2
Other service activities	7 541.8	8 398.1	9 871.9	11 551.4	13 441.4	116.4	178.2
Average monthly wage by territories, MDL							
mun. Chișinău	8 686.4	9 561.3	10 965.0	12 825.4	14 884.3	116.1	171.4
Northern zone	5 916.1	6 501.2	7 162.9	8 160.0	9 486.5	116.3	160.4
Central zone	5 910.6	6 429.9	7 131.3	8 231.3	9 692.0	117.7	164.0
Southern zone	5 572.2	6 151.3	6 841.3	7 928.2	9 490.7	119.7	170.3
ATU Gagauzia	5 554.9	6 150.7	6 999.6	7 714.0	8 771.5	113.7	157.9

Source: NBS data and NBS data and authors' calculations

The analysis of average monthly wages by main types of economic activity indicated, that the smallest amount is characteristic of workers in agriculture, forestry and fisheries, which is only 65.1% of its national average. With a 1.6-times growth the average monthly wage in the education sector in 2023 compared to 2019, its amount is 82.5% of the national average. Despite the increase in the nominal amount of the average monthly wage in all territorial zones of the country, an excess of its average value for the whole analysed period was recorded only in Chisinau municipality, including in 2023 by 14,6%, and in the remaining territorial units it is below the national average, respectively in the Northern zone - by 22,3%, in the Central zone - by 20,6%, in the Southern zone - by 22,3% and in ATU Gagauzia - by 28,2%.

The wages in the Republic of Moldova are lower than in the EU countries (Table 11.).

Table 11. Average monthly wage, RM, EU countries, USD

	2019	2020	2021	2022	2023	2023/2022, %	2023/2019, %
Republic of Moldova	**411.6**	**458.6**	**507.9**	**552.7**	**672.3**	**121.6**	**163.3**
Bulgaria	725.4	810.3	944.2	951.8	1112.6	116.9	153.4
Romania	…	1228.2	1330.4	1306.4	1609.9	123.2	...
Croatia	1301.9	1393.8	1507.0	1451.2	1713.0	118.0	131.6
Czech Republic	1582.5	1585.6	1781.7	1770.4	…	…	…
Italy	2 787.6	2 705.8	2 962.0	2763.1	…	…	…
Greece	1498.3	1516.8	1585.7	1417.4	…	…	…
Serbia	720.3	804.4	913.4	925.3	1094.1	118.2	151.9
France	3652.4	3571.3	3909.8	3654.9	…	…	…
Germany	3953.1	4020.0	4300.7	3983.7	…	…	…
Latvia	1204.5	1302.6	1510.6	1443.9	1662.2	115.1	138.0
Lithuania	1451.2	1627.9	1867.0	1882.8	2173.4	115.4	149.8
Estonia	1575.1	1650.2	1743.6	1729.9	1981.2	114.5	125,8

Source: NBS data, www.statistica.gov.md, Statistical Yearbook of the Republic of Moldova, 2024, section 23. International statistics, Table 23.11 Average monthly nominal wage per employee, p. 560, and authors' calculations

In the Republic of Moldova, the average monthly wage increased by 260.7 USD or 1.6 times in 2019-2023, but its level remains the lowest compared to EU member states. Thus, in 2023, the average monthly wage in USD was only 61.4% of the average wage in Serbia, respectively 60.4% in Bulgaria, 41.8% in Romania, 39.2% in Croatia, 40.4% in Latvia, 33.9% in Estonia and 30.9% in Lithuania. The risk of poverty and unemployment is increasing in the conditions of prices and tariffs growth and rising cost of living, as well as the realization of structural reforms and the globalisation process, which is a stimulus for the working-age population to look for opportunities to obtain new or additional sources of income and improve living standards, including through labour migration, i.e. it can be supposed that the given tendency is irreversible and will continue in the future. The structure of income, including transfers from labour migrants, as well as the characteristics of poverty indicators are reflected in Table 12.

Table 12. Dynamics of poverty indicators and structure of monetary incomes

	2019	2020	2021	2022	2023	2023/2019, %/p.p.
Absolute poverty threshold, MDL	**2 095.1**	**2 174.1**	**2 285,2**	**2 942.0**	**3 336.8**	**159.3**
Absolute poverty rate, %	**25.2**	**26.8**	**24.5**	**31.1**	**31.6**	**+6.4 p.p.**
- Urban	11.2	14.0	11.9	17.1	17.7	+6.5 p.p.
- Rural	34.5	35.3	32.8	40.3	42.0	+7.5 p.p.
mun. Chișinău	4.4	7.6	8.6	10.0	10.9	+6.5 p.p.
Northern zone	27.7	28.1	25.2	30.5	32.2	+4.5 p.p.
Central zone	29.8	30.6	26.8	37.0	39.3	+9.5 p.p.

	2019	2020	2021	2022	2023	2023/2019, %/p.p.
Southern zone	40.4	42.9	39.6	49.0	49.3	+8.9 p.p.
Extreme poverty threshold, MDL	**1 689.7**	**1 753.4**	**1 843.0**	**2 372.7**	**2 691.2**	**159.3**
Extreme poverty rate, %	**10.7**	**10.8**	**9.5**	**13.5**	**13.8**	**+3.1 p.p.**
- Urban	3.6	5.1	4.6	6.5	6.7	+3.1 p.p.
- Rural	15.4	14.6	12.7	18.1	19.2	+3.8 p.p.
mun. Chișinău	1.4	2.9	2.5	4.1	4.1	+2.7 p.p.
Northern zone	10.4	11.1	10.1	11.5	12.5	+2.1 p.p.
Central zone	12.9	12.0	10.3	16.2	17.9	+5.0 p.p.
Southern zone	19.2	18.5	16.0	23.7	23.9	+4.7 p.p.
Absolute poverty rate, by the main source of income, %						
- wages in the agricultural sector	43.2	37.9	35.1	39.2	41.3	-1.9 p.p.
- wages in the non-agricultural sector	11.9	14.5	12.9	19.1	19.2	+7.3 p.p.
- income from individual agricultural activity	38.4	35.4	36,5	42.5	50.9	+12.5 p.p.
- income from individual non-agricultural activity	22.0	25.1	17,1	30.4	26.8	+4.0 p.p.
- transfers of labour migrants from abroad	16.1	25.3	18.2	20.8	21.1	+5.0 p.p.
Average monthly disposable income per person, MDL	**2880.6**	**3096.6**	**3510.1**	**4252.6**	**4915.6**	**170.6**
Disposable income, total, %	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**-**
- wage	50.2	50.2	58.0	50.7	52.5	+2.3 p.p.
- individual agricultural activity	8.9	8.3	8.1	7.8	6.4	-2.5 p.p.
- income from individual non-agricultural activity	6.3	6.3	7.4	6.2	6.3	0.0
- property income	0.3	0.2	0.2	0.2	0.4	+0.1 p.p.
- social benefits	18.7	19.4	18.5	20.3	20.7	+2.0 p.p.
including pensions	14.4	14.5	14.0	15.8	16.5	
- other incomes	15.7	15.6	15.0	14.8	13.8	-1.9 p.p.
including remittances	12.4	12.9	12.5	12.0	11.1	-1.3 p.p.

Source: NBS data and authors' calculations

In 2023, the absolute and extreme poverty threshold increased by 1.6 times compared to 2019, as well as the absolute (by 6.4 p.p.) and extreme poverty rates (by 3.1 p.p.). In 2023, the absolute poverty rate in rural exceeded the given indicator in urban by 24.3 p.p., and in the regional aspect the highest rates registered in the Southern zone (49.3%) and in the Central zone (39.3%). The indicator of extreme poverty had an upward tendency by 2023 (by 3.1 p.p.),

including in urban by 3.1 p.p. and in rural by 3.8 p.p. In this context, it should be noted that the deterioration of the situation registered not only in the Central zone (by 5.0 p.p.) and the Southern zone (by 4.0 p.p.), but also in the capital or in mun. Chișinău - the extreme poverty rate increased from 1.4% in 2019 to 4.1% in 2023, or by 2.7 p.p. Depending on the main source of income, the highest rate of absolute poverty (50.9%) is registered among the population whose main source of income is income from individual agricultural labour activity and from the wages of workers occupied in the agricultural sector (41.3%). According to the statistical data on the distribution of wages in September 2023, on average, 3,6% of employees in the economy received an average monthly wage at the level of 4000,0 lei, including 7,8% of employees in agriculture, forestry and fisheries, 7,2% of employees in extractive industry, 9,9% in real estate transactions, 5,4% in administrative and support services, 5,8% in education, 6,9% in arts, recreation and leisure, as well as 3,0% of real and 5,1% of budgetary sectors. Also in September 2023, 11,0% of employees received a small amount of average monthly wage in the amount from 4000,01 to 5000,00 lei, and 10,5% of employees in the amount from 5000,01 to 6000,00 lei, i.e., on average up to 6000,0 lei was the average monthly nominal wage of 25% of employees. [NBS, 2023].

In 2023, the inflation rate was 4.2%, the Consumer Price Index was 104.0% in September, in October - 104.48% and in November - 104.66% in November [Legis.md, 01.18.2024].

In this context, considering the situation of labour remuneration in the country as a whole, for example Q4 of 2023 compared to the analogical period of 2022, then with the growth of the nominal wage index by 116.1%, the real wage index was 110.3%, with the consumer price index grew by 105.3% (the average monthly wage in Q4 of 2023 was 13401.1 lei, and in Q4 of 2022 it was 11539.1 lei) [NBS, 2024a].

Thus, the low level of wages in the above-mentioned areas of economic activity (practically 2.5-3.0 times lower than the national average for the fourth quarter of 2023) shows that not only the unemployed or low-income categories of the population are at risk of poverty in the country, but also the working population of working age, and this situation is characterised by the already established trend of poverty growth over the five-year period 2029-2023. At the same time, wages (52.5%), social assistance in the form of pensions, compensations, payments or benefits (20.7%), income from self-employment (12.7%), and transfers received from labour migrants (11.1%) remain the main stable sources of income.

The level of wages is one of the principal factors in the mobility of workers, including the availability of vacant work places on labour market.

Table 13. Vacant work places, in territorial aspect, 2021-2023*

	2021	2022	2023
Total, % of total work places	**3.9**	**3.9**	**3.8**
mun. Chișinău	4.5	4.6	4.5
Northern zone	2.9	2.8	2.8
mun. Bălți	3.6	3.4	4.0
Central zone	3.5	3.4	3.2
Southern zone	4.1	4.1	3.9
ATU Gagauzia	3.3	2.4	1.6

* NBS data for 2019-2020 are not available

Source: NBS data

From the analysis of the data in Table 13. it follows that the presence of vacant work places in mun. Chișinău and mun. Bălți, as well as in the Southern zone exceeds the national

average, while in mun. Chișinău it is stable during the 3-year period, in mun. Bălți it registered an increase in 2023, while in the Southern zone it tends to decrease. In ATU Gagauzia the presence of vacant work places tends to decrease, including by 1.7 p.p. in 2023 compared to 2021.

4. CONCLUSIONS

In modern conditions, the labour market is an integral part of the market economy, the basis of which is represented by public relations on supply and hiring of labour force. In this case, the price of labour force or its sale (seller or labour force) and purchase (buyer or employer) is regulated by means of wages, and the final result of mutual interests is a labour agreement, contract.

According to research, the labour force market largely depends on demographic factors, i.e., the number of working age population, including the structure of age and sex groups, gender and other indicators that characterize the dynamics of changes in the quantitative and qualitative composition of the population. Thus, in 2019-2023, a tendency of decline in the number of the population with a usual residence was registered, as a result of which its number decreased by 206.4 thousand persons or by 7.7%, including the share of the population aged 0-15 years decreased by 0.7 p.p., and the share of the working age population by 0.9 p.p., with an increase in the share of the elderly population aged over the working age by 1.6 p.p. As a consequence of the above-mentioned changes at the beginning of 2024, the number of population aged over 60 years was 25.4%, and every third person or 31% is in the age category of 60-64 years. The given tendencies are a consequence of the demographic crisis, including a decrease in the birth rate and migration of the working age population, and have a direct impact on the ageing of the labour force market. Analysis of the structure of the economically active population also indicated tendencies of a decrease in both the number and share of youth groups aged 15-24 and 25-34 by 16.6% and 18.2%, respectively, and the growth of age groups 45-54 by 7.5% and 55-64 by 6.8%, as well as the economically inactive population remains at 55% compared to the economically active population.

According to statistical data, the share of the population 60 years and over in employed population on labour market increased by 1.4 p.p. In 2023, compared to 2019, the tendency to reduce the number of youth groups 15-24 years by 17.4% and 25-34 years by 17.1%, respectively, remains with an increase in the number of employed in the age groups 45-54 years by 8.2%, in the group 55-64 years by 7.2% and 65 years and over by 4.3%. In this context, it should be noted that the highest rates of economic activity and employment are registered in the elder age groups compared to those of the youth groups (in 2023, the employment rate of 15-24 year was 24.7 p.p. below the national average, that of 15-29 year by 12.5 p.p. and that of 15-34 year by 4.4 p.p.), with the highest employment rates registered in the age groups 45-54 years (66.3%) and 35-44 years (63.8%).

The reduction in the number of employed population and its redistribution between economic activities took place as a result of the Covid-19 pandemic in 2020-2021. However, it can be noted that the stable tendency of the ratio the share of employed population in the sectoral structure in real sector and in public administration, education, health and social assistance maintained. At the same time, there was a tendency to reduce the employment of youth in almost all types of economic activities with an increase in the share of employed at elder ages, including pre- and pension ages, both in the real sector of the economy and in service sector (in 2023, the highest share of age groups 55-64 years and 65 years and over was registered in agriculture, forestry and fisheries - 28.8%, in public administration, education, health and social assistance - 28.3%).

Taking into account the irreversible tendency of demographic ageing of the population and, as a consequence, the ageing of labour market, an important problem is the *quality of labour market*.

In this context, it can be noted that the main share (27.6%) of the labour force with higher education and 22.6% with professional education (primary vocational education) or approximately half of labour force, while the rest of workers have a Gymnasium (19.4%), lyceum, general secondary (15.7%), secondary special (14.3%) and an insignificant share (0.4%) of workers with primary school or without. At the same time, in 2023 compared to 2019, there is a 10% increase in the number of legislators, members of the executive branch and other high-ranking persons and administrative employees by 5.7%, with a decline in the number of qualified workers (by 8%), including in agriculture, forestry and fisheries (by 2%), specialists in various spheres of activity (by 4.2%), and non-qualified workers (by 10.1%). Consequently, there is an imbalance in the demand for middle and lower level workers with professional-technical training or non-qualified workers, with a predominance the workers in unproductive sphere. The analysis concludes that labour migration is a factor influencing the changes in the age structure and reducing the quality of labour force market, as a result of which there is a tendency of outflow of migrants in the most productive age of 25-44 years (58%) and with professional education (25.8%). The main motive for labour migration is the low level of wages in the country. Thus, due to a sharp growth in the Consumer Price Index in 2022, with growth of nominal wages by 116.3%, the Real Wage Index sharply decreased and amounted to 90.4% compared to the previous year. The differentiation of average monthly wages between the budget and real sectors (at the level of 17-18%) and between males and females (at the level of 15%) maintains.

Despite the tendency of growth in the average monthly wage in the Republic of Moldova by 260.7 USD or 1.6 times in 2019-2023, its level remains the lowest compared to EU member states. Thus, in 2023, the average monthly wage in US dollars is 61.4% of the average wage in Serbia, 60.4% in Bulgaria, 41.8% in Romania, 39.2% in Croatia, 40.4% in Latvia, 33.9% in Estonia and 30.9% in Lithuania.

In condition the growth of prices and tariffs and rising cost of living, the risk of poverty of the working age population is increasing. In 2023, the absolute and extreme poverty threshold indicators increased by 1.6 times compared to 2019, the absolute poverty rate increased by 6.4 p.p. and the extreme poverty rate by 3.1 p.p., including the absolute poverty rate in rural by 24.3 p.p. exceeded given indicator in urban, while in the regional aspect the highest rate was registered in the Southern zone (49.3%) and in the Central zone (39.3%). It should be noted that the deterioration of the situation was also registered in mun. Chișinău - the rate of extreme poverty increased from 1.4% in 2019 to 4.1% in 2023, or by 2.7 p.p. Based on the above mentioned, it should be concluded that the search for opportunities to improve living standards through labour migration is a characteristic and irreversible tendency for the country and will continue to be in the future, and this fact is necessary to be taken into account in the elaboration of public policies.

The principal conclusion that follows from the results of the analysis of the modern labour market in the Republic of Moldova is the tendency of reduction in the number of working age population, ageing and irreversible nature of labour migration, the risk of poverty of employed population. In these conditions, it is possible to assume the possibility of increased competition of employers for qualified specialists, change of priority in the recruitment strategy and maintenance of both the existing labour force potential and attraction of new highly qualified workers, including at the expense of foreign specialists.

In order to improve the situation in labour market, increase its stability, balance and competitiveness, it should be noted the expedient realization the following proposals:

- Creation of a register of employed population in the Republic of Moldova, including taking into account data on age, place of residence, gender, education, specialty, place of work and other necessary data for forecasting the labour force market in terms of economic activities types for a specific specialty (profession);

- Creation of a register of requirements and standards for specialities in concrete types of economic activity;

- implementation of *flexible forms of employment* (including part-time employment, remote work, hybrid mode), which will reduce some of the vacant working places by attracting labour force from remote localities of the country;

- development of applied and personal qualities in youth, as well as skills and abilities to solve emerging applied problems, that will create an opportunity for young specialists to be competitive at various levels of employers' qualification requirements, including both high- and low-qualification positions;

- revision and adjustment of education, training and retraining programmes in accordance with the new conditions of modern development of IT-based technologies, artificial intelligence and other new specialties;

- perfection of organizational forms of work with potential seekers, including the implementation of a free interactive resume builder on government platforms for more active cooperation between potential workers and employers, as well as for assessing the demand and supply of labour force in the regional aspect;

- perfection of systems and forms of wage, including the elaboration and adoption the wage intervals by legislation in accordance with the EU experience.

Introduction of the EU Directive (this is already the norm in many EU countries) on mandatory transparency in labour remuneration from June 2026, which provides concrete requirements for transparency of labour remuneration in the recruitment process, including its ranges in announcement of vacancies, gender specificity in vacancies descriptions, prohibition for employers to ask about previous wage received and others. Most European countries already include equality in their labour laws because they consider discrimination illegal [Ravio, 12.20.2024].

In the Republic of Moldova (according to the Rabota.md website), the factor of indicating the wage in the recruitment announcement causes trust and attracts more candidates for vacancies than in the absence of this condition (if the amount of wage is indicated in the title of the recruitment announcement, the difference in applicants is 53% compared to announcement without indicating wage), i.e. the importance of the given factor is obvious.

Wages are the main source of income and stimulation for the worker, the price or reward for the labour of the commodity labour force and its amount determines the living conditions, the possibility of maintaining working capacity, as well as the level of satisfaction of everyday necessities. In this context, it should be noted the role of the most important functions of wages, including: *reproductive function*, since the wage should be sufficient to reproduce the physical, mental, professional and other costs of labour force, *stimulating function* as it contributes to the increase in productivity and *regulatory function* as it affects the ratio of supply and demand of labour force and the employment rate. Given the importance of the above functions, one of the key issues of the state socio-economic policy should be the perfection of systems and forms of labour remuneration in condition of market economy, including forms of employment, as well as the principal method of motivation and raising of the well-being of the working age population or labour force.

Acknowledgement

The article was developed within the framework of the Subprogramme: Demographic transition in the Republic of Moldova: particularities, socio-economic implications and consolidation of demographic resilience (2024-2027).

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DIGITALIZATION IN THE HOSPITALITY INDUSTRY: THE RELATIONSHIP BETWEEN KEY INDICATORS OF ICT PRODUCT USAGE AND THE VALUE OF SERVICES PROVIDED IN THIS SECTOR

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ABSTRACT: *Digitalization has become a key factor in the development and competitiveness of the hospitality industry. This study examines the relationship between the use of Information and Communication Technologies (ICT) and the value of services provided in the hospitality sector, focusing on key digitalization indicators. Using statistical data from the National Institute of Statistics, an econometric analysis was conducted to determine the impact of digital technologies on business performance. The results show a significant positive correlation between digitalization and economic efficiency, particularly in hotels and restaurants, where online sales, website utilization, and employee internet access play a crucial role. Additionally, cloud computing and electronic transactions contribute to operational optimization and customer experience enhancement. The study highlights the necessity of digital investments to maintain competitiveness and suggests tailored digitalization strategies for different segments of the industry.*

Keywords: *Digitalization, Hospitality Industry, Information and Communication Technologies (ICT), Online Reservations, Cloud Computing, E-commerce*

JEL Classification: *L83, L86, M15, O33, C80*

1. INTRODUCTION

In an era marked by rapid technological progress, digitalization has become a crucial factor in the development and competitiveness of the hospitality industry. The use of information and communication technologies (ICT) in hotels and restaurants is no longer just an option but a necessity for optimizing operational processes, enhancing customer experience, and increasing economic efficiency. The implementation of digital solutions, from reservation management systems and electronic payments to service automation and the use of artificial intelligence, can significantly influence the performance of this sector.

The hospitality industry encompasses a wide range of businesses, from large multinational chains and integrated resorts to small, independent operators, each varying in size and complexity. The adoption and impact of digitalization within the sector differ

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considerably, with some companies rapidly integrating new technologies, especially in customer interactions, while others adopt them more gradually (Wynn & Lam, 2023).

The emergence of digitalization in the hospitality industry on a global scale marks a significant transition from the traditional provision of services to innovative digital platforms (Adekuajo, Fakeyede, Udeh, & Daraojimba, 2023). The shift to digital platforms goes beyond merely responding to technological advancements; it is a strategic approach aimed at meeting the evolving expectations of consumers, who increasingly prioritize convenience, personalization, and a seamless service experience (Kandampully, Bilgihan, Van Riel, & Sharma, 2023).

The digital transformation of the hospitality industry has redefined hotel operations and enhanced customer experience. By leveraging advanced technologies, hotels can optimize processes across property management, marketing, and guest services, creating a more efficient, responsive, and engaging environment (Anwar, Deliana, & Suyamto, 2024). This streamlines hotel operations while enhancing customer satisfaction, ultimately fostering stronger customer loyalty in an increasingly competitive digital landscape.

This article aims to analyze the relationship between key indicators of ICT product usage in the hospitality industry and the value of services provided to the population. Using a data-driven statistical approach, the study will determine the impact of technology on this sector, highlighting the extent to which digitalization contributes to improving service quality and revenue growth.

To achieve this objective, the research methodology includes statistical processing of data provided by the National Institute of Statistics, as well as the application of analytical methods to identify relevant correlations between ICT usage and the economic performance of accommodation and food service establishments. Thus, the study will provide a clear perspective on how technology investments can influence the development of the hospitality industry and will highlight current trends in this field.

2. DIGITALIZATION IN THE HOSPITALITY INDUSTRY

In a landscape marked by continuous technological evolution, success in the hospitality industry depends on the ability of operators to integrate innovative digital tools that enhance customer experience and streamline operational processes.

Data has become the new currency, and to leverage it effectively, hospitality companies must adopt a new data management architecture at scale, one that decentralizes ownership and processing, allowing for the creation of a flexible, scalable, and open framework (Vouk, 2022).

In this new digital era, connectivity also plays a crucial role, and the use of social media and online platforms has become indispensable for service promotion and direct customer interaction. Hotels and restaurants increasingly rely on digital channels to attract and retain consumers, providing them with instant access to information and seamless booking options.

Simultaneously, e-commerce has fundamentally transformed the hospitality industry, enabling fast and secure transactions tailored to user preferences and new consumption models.

Beyond communication and sales channels, cloud computing solutions have become an essential component of digitalization, offering flexible and scalable infrastructures for the efficient management of hotel resources and restaurant operations. The implementation of these technologies optimizes internal processes, reduces costs, and enhances customer service, thereby strengthening the market position of companies in this sector.

Thus, digitalization not only reshapes the dynamics of the hospitality industry but also fundamentally redefines how services are delivered and consumed, transforming the interaction between providers and customers into a personalized, efficient, and accessible experience.

2.1. Digital Connectivity, Social Media Usage, and Website Utilization in the Hospitality Industry

The emerging hospitality industry is characterized by a customer-centric approach and a high degree of personalization, as well as a boom in online distribution, including through mobile channels (Perelygina, Kucukusta, & Law, 2022).

In the hospitality industry, digital transformation has been reflected in changes brought by online distribution channels, the use of platforms, and the widespread adoption of smartphones and applications, which have reshaped the operational model and services offered to customers. Emerging digital technologies have enhanced working conditions for employees while optimizing operational processes (Ye & Chen, 2024).

Rising customer expectations and the growing need for efficiency have made the hospitality sector increasingly reliant on information and communication technologies for handling various tasks, such as managing reservations, processing service requests, responding to inquiries, and enabling real-time communication with colleagues and clients (Peng, Nie, & Chen, 2023).

The integration of digital technologies is a core component of digital transformation, with their successful implementation relying on employee acceptance. In the hospitality industry, a highly labor-intensive sector, the workforce is both the most valuable and costly resource. Employee engagement and performance play a crucial role in driving sustainable development and securing a competitive edge for hotels (Ye & Chen, 2024).

Digital transformation extends beyond technology, encompassing key factors such as employees, organizational structure, and operational processes. Internet access has become essential for carrying out professional activities in the hospitality industry, facilitating fast and efficient connectivity. The use of fixed and mobile connections allows employees to perform their tasks flexibly, whether they are at the office, in the field, or interacting directly with customers. Access to email, documents, and business applications remotely contributes to optimizing workflow and ensuring effective communication between departments (Ye & Chen, 2024).

Social media is profoundly transforming how tourists search for and discover information, as well as how they collaborate to create content about service providers and destinations of interest. Furthermore, web applications and digital tools are reshaping the behavior of modern travelers and driving tourism organizations to adapt their business models and operations. This influence extends to service development, marketing strategies, partnership building, and knowledge management (Christou & Sigala, 2016).

In the hospitality industry, social media plays a crucial role in marketing and maintaining a constant relationship with customers. These platforms enable hotels and restaurants to promote their services, interact directly with consumers, and collect valuable feedback to improve customer experience. Integrating websites with social media enhances online visibility, attracts more potential customers and strengthens brand image. Rapid communication and personalized interaction through these channels increase customer loyalty and facilitate the creation of a digital community around a hospitality brand.

Social media platforms provide the hospitality sector with an opportunity to showcase and promote their products, thereby increasing the visibility and popularity of hotels and restaurants (Bhatt & Dani, 2022). Hotels, restaurants, resorts, and travel agencies are among the businesses that have integrated social media as an essential component of their marketing strategies. Platforms such as Facebook (one of the major channels through which most hospitality properties promote themselves and build market awareness), YouTube (which enables the hospitality sector to create dedicated channels and directly connect with customers), Instagram (one of the most popular global platforms used for gathering information and

promoting hotel or restaurant brands), Twitter, TikTok, and LinkedIn allow businesses to engage with customers in real-time, promote their products, and generate leads through organic content and targeted advertising (Bhatt & Dani, 2022) (Chetna & Wadhwa, 2024).

The digital presence of hospitality companies is significantly supported by websites, which serve as the primary source of information for customers. A well-structured website provides essential details about services, pricing, availability, and amenities, ensuring an optimized browsing experience for users. Integrated functionalities, such as online booking systems and digital payment support, simplify the purchasing process and enhance customer satisfaction. Additionally, search engine optimization and mobile compatibility are critical factors in attracting a larger number of visitors and maintaining competitiveness in the market (Chang, Kuo, Hsu, & Cheng, 2014).

Currently, websites are widely regarded as a cost-efficient distribution channel. In the hospitality industry, with easy access to information, customers frequently evaluate and compare products offered on different websites to find the best deals. Thus, if a website's information does not meet expectations, customers will turn to other channels. The rapid development of websites as a distribution tool intensifies competition both locally and globally among various players in the hospitality industry (Law, 2018).

In conclusion, digital connectivity, including internet access and business applications, optimizes workflow and enhances performance. At the same time, social media and websites have become essential tools for promotion and customer engagement, improving online visibility and differentiation in the market. Digital transformation continues to evolve, requiring the hospitality sector to maintain adaptability to remain competitive and meet market demands.

2.2. E-commerce in the Hospitality Industry

In recent decades, the hospitality industry has undergone major transformations, establishing itself as one of the most dynamic sectors globally. With its strong potential for economic growth, it plays a crucial role in job creation, poverty alleviation, and reducing regional disparities. The number of start-ups in the field has rapidly increased, leading to the emergence of new businesses across various sectors, from travel and accommodation services to food, beverages, and entertainment. As a predominantly service-based and information-intensive industry, e-commerce plays an essential role, serving as a key element for the survival and success of businesses in this sector (Mishra & Gupta, 2020).

E-commerce models have continuously evolved to keep pace with a dynamic market and to efficiently integrate specific protocols within an increasingly competitive operational landscape (Hua, Morosan, & DeFranco, 2015). With e-commerce now a necessity, web-based technologies have transformed the competitive landscape of the hospitality and tourism industry, allowing businesses to connect with a global customer base. The continuous availability of these platforms facilitates 24/7 transactions and delivers valuable business insights at every level. As internet accessibility expands, companies have greater opportunities to optimize operations, enhance customer engagement, improve acquisition and conversion rates, and monitor performance—ultimately strengthening brand awareness and driving online bookings (Hua N. , 2016).

The importance of e-commerce has driven companies to focus on understanding consumer behavior in the digital environment (Hua, Morosan, & DeFranco, 2015), as it continuously evolves and becomes increasingly complex, with business models and practices dynamically shifting.

The implementation of online booking and ordering systems has revolutionized how customers access hospitality services. These solutions enable fast and efficient user experience,

reducing waiting times and facilitating access to essential information (availability, pricing, amenities). Integrating these systems with property management platforms optimizes reservation management, inventory control, and customer behavior analysis, providing a competitive advantage in terms of operational efficiency and customer satisfaction.

An important component in assessing the digital performance of hospitality businesses is the proportion of electronic sales in total revenue. This metric reflects the degree of digitalization in operations and the effectiveness of online channels in generating revenue. As more reservations and orders are made online, companies can focus on optimizing the digital experience, reducing costs associated with traditional sales methods, and thereby increasing profitability.

2.3. Cloud Computing Services Used in the Hospitality Industry

The hospitality industry is undergoing major transformations driven by the increasing volume of data, the influence of social networks, and customers' growing demand for personalized experiences, necessitating the implementation of cloud computing technologies to address these changes (Vella, Yang, Naveed Anwar, & Jin, 2018).

Cloud computing has become a vital solution for optimizing IT costs in small, medium, and micro-enterprises. Its adoption brings significant advantages, including reduced capital expenditures, enhanced access to ICT systems, strengthened data security, and lower costs for agile development. The key goal is to provide continuous access to up-to-date ICT services through the cloud, eliminating the need for complex in-house infrastructure management.

The hospitality industry holds great potential for adopting cloud-based information systems. Hotels rely on fast and reliable data transmission to maintain a competitive edge, and these systems enable seamless access to crucial information for both customers and management, helping shape future business strategies (Syah, Muda, Lumbanraja, & Kholis, 2023). Cloud computing enhances decision-making processes through accuracy, real-time data availability, and integration of accounting information, improving managerial performance (Wiboonrat, 2014).

In the hospitality sector, adopting cloud services is essential for supporting digital transformation and optimizing operations. These services enable efficient storage and management of customer information, reservations, and internal operations, providing integrated solutions for accounting, facilitating email communication and document sharing, and allowing remote access to files and office applications, thereby increasing operational flexibility and efficiency.

Utilizing these technologies reduces costs by eliminating the need for substantial investments in local IT infrastructure while ensuring access to scalable resources and always-available information, which contributes to better customer engagement and improved business performance.

Additionally, cloud service providers continuously invest in encryption technologies, backup systems, and monitoring solutions to protect sensitive data and comply with regulations, strengthening customer trust and maintaining the competitive advantage of companies in this sector.

Many businesses in the hospitality industry use cloud services to optimize their operations and deliver high-quality digital experiences. For instance, hotels leverage SaaS (Software as a Service) platforms for managing reservations and internal processes. Cloud services are also used for data storage, performance analysis, and backup management, enabling quick access to essential information. Solutions like Office 365 and Google Workspace are widely adopted for employee collaboration and communication, enhancing efficiency and competitiveness in the industry.

3. CASE STUDY: STATISTICAL ANALYSIS OF THE IMPACT OF DIGITALIZATION ON PERFORMANCE IN THE HOSPITALITY INDUSTRY

The data sources used for this case study were obtained from the website of the National Institute of Statistics (http://statistici.insse.ro:8077/tempo-online/), as follows:

- PSC101C – The value of services provided to the population, classified by activities according to CAEN Rev.2 (Institutul Național de Statistică, 2024)
- TIC100A – Key indicators regarding the use of ICT products in enterprises with at least 10 employees, including hotels and restaurants, activities of travel agencies and tour operators, as well as other reservation and tourist assistance services (Institutul Național de Statistică, 2025)

The database used in our analysis covers a 14-year period, from 2010 to 2023, and includes 30 relevant variables.

The analyzed variables are:

a) Dependent variable - Market Services Provided to the Population, segmented into nine categories (Table 1)

Table 1. Summary of Dependent Variables

	Dependent Variable Name	Notation
1	Hotels and other similar accommodation facilities	HOSAF
2	Vacation accommodation and short-term stay facilities	VAST
3	Caravan parks, campsites, and holiday camps	CAMP
4	Other lodging services	OLS
5	Restaurants	REST
6	Catering services for events and other food services	CATE
7	Bars and other beverage service activities	BARS
8	Activities of travel agencies and tour operators	TATO
9	Other reservation and tourist assistance services	ORTAS

b) Regressor Variables - 21 indicators of digitalization in the hospitality industry, grouped as follows: 12 indicators for hotels and restaurants (Hotels & Restaurants - H&R) (Table 2) and 9 indicators for travel agencies and related services (Travel Agencies & Reservation Services - TATO & RTAS) (Table 3).

Table 2. Summary of Regressor Variables in H&R

No.	Regressor Variable Name	Notation
1	Share of employed persons with internet access for professional purposes	H_RSEPIAP
2	Share of enterprises where employed persons have internet access for professional purposes	H_RSEEIAP
3	Share of enterprises that owned a website	H_RSEOW
4	Share of enterprises where the website provided descriptions of goods or services, including pricing information	H_RSEWPD
5	Share of enterprises where the website enabled online orders or reservations	H_RSEWO
6	Share of enterprises where the website allowed tracking or status updates for placed orders	H_RSEWT
7	Share of enterprises that received online orders	H_RSEOR

No.	Regressor Variable Name	Notation
8	Share of enterprises that conducted online sales of goods and services (via their own websites or applications)	H_RSEOS
9	Share of enterprises that conducted EDI-type sales of goods or services	H_RSEEOS
10	Share of EDI-type sales as a percentage of total turnover	H_RSEDI
11	Share of electronic sales in total turnover, excluding VAT	H_RSES
12	Share of enterprises that purchased cloud computing services used on the internet	H_RSECC

Table 3. Summary of Regressor Variables within TATO & RTAS

Nr. crt.	Denumire variabilă regresor	Notație
1	Share of employed persons with internet access for professional purposes	TatoSEPIAP
2	Share of enterprises where employed persons have internet access for professional purposes	TatoSEEIAP
3	Share of enterprises where the website enabled online orders or reservations	TatoSEWO
4	Share of enterprises where the website allowed tracking or status updates for placed orders	TatoSEWT
5	Share of enterprises that received online orders	TatoSEOR
6	Share of enterprises that conducted online sales of goods and services (via their own websites or applications)	TatoSEOS
7	Share of enterprises that conducted EDI-type sales of goods or services	TatoSEEOS
8	Share of EDI-type sales as a percentage of total turnover	TatoSEDI
9	Share of electronic sales in total turnover, excluding VAT	TatoSES

These indicators reflect employees' access to the internet, website usage, online sales, cloud service adoption, and electronic transactions.

Methodology

The econometric models are estimated using Stepwise Linear Regression in the EViews software, which automatically selects the most significant regressor variables. The p-value threshold is set at 0.1 (10%), allowing the inclusion of a larger number of variables. Multicollinearity is checked for each model using Variance Inflation Factors (VIF) to ensure the validity of the estimates.

Model Results

For each of the nine dependent variables, significant correlations were identified between digitalization and the value of services provided.

a) Model with the dependent variable HOSAF (Hotels and similar accommodation facilities)

- Positive relationship with the use of websites for service information, employees' internet access, and online sales.

Table 1. Model with the dependent variable HOSAF

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	-6436.824	1079.060	-5.965212	0.0010
H_RSEWPD	150.3788	14.77171	10.18019	0.0001
H_RSEPIAP	134.2671	22.94226	5.852391	0.0011
TATOSEDI	-277.8861	43.33946	-6.411849	0.0007
H_RSEEOS	291.1525	62.84985	4.632508	0.0036
TATOSEEIAP	65.23608	15.75737	4.140037	0.0061
H_RSEEIAP	-59.48282	18.31808	-3.247220	0.0175
H_RSEOS	33.46019	17.80728	1.879018	0.1093

R-squared	0.988114	Mean dependent var	4925.429
Adjusted R-squared	0.974248	S.D. dependent var	1780.840
S.E. of regression	285.7809	Akaike info criterion	14.44389
Sum squared resid	490024.5	Schwarz criterion	14.80906
Log likelihood	-93.10721	Hannan-Quinn criter.	14.41008
F-statistic	71.25837	Durbin-Watson stat	1.774221
Prob(F-statistic)	0.000024		

The model with the dependent variable HOSAF is valid. The variation of this variable is represented by 97.4% of the variables included in the model, while the remaining 2.6% is accounted for by other variables.

Table 2. VIF for the model with the dependent variable HOSAF

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	1164371.	199.5966	NA
H_RSEWPD	218.2035	84.15937	7.294863
H_RSEPIAP	526.3472	41.87590	1.542835
TATOSEDI	1878.309	3.060647	1.601816
H_RSEEOS	3950.104	3.865911	1.366034
TATOSEEIAP	248.2946	383.3370	3.184384
H_RSEEIAP	335.5519	398.3374	7.494982
H_RSEOS	317.0992	16.05128	5.024441

b) Model with the dependent variable VAST (Vacation accommodation and short-term stay facilities)

- Major influences: electronic sales, employee internet access, and the use of websites for information.

Table 3. Model with the dependent variable VAST

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	-639.7504	166.4626	-3.843209	0.0032
H_RSES	82.91933	12.34934	6.714472	0.0001
H_RSEWPD	10.20455	2.205868	4.626091	0.0009
H_RSEPIAP	15.52445	7.647465	2.030012	0.0698

R-squared	0.970049	Mean dependent var	582.2500
Adjusted R-squared	0.961064	S.D. dependent var	434.3440
S.E. of regression	85.70612	Akaike info criterion	11.97468
Sum squared resid	73455.39	Schwarz criterion	12.15727
Log likelihood	-79.82277	Hannan-Quinn criter.	11.95778
F-statistic	107.9592	Durbin-Watson stat	1.685724
Prob(F-statistic)	0.000000		

Table 4. VIF for the model with the dependent variable VAST

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	27709.79	52.81260	NA
H_RSES	152.5063	10.83639	2.976821
H_RSEWPD	4.865855	20.86618	1.808663
H_RSEPIAP	58.48372	51.73323	1.906010

The model with the dependent variable VAST is valid. The variation of this variable is represented by 96.1% of the variables included in the model, while the remaining 3.9% is represented by other variables.

c) The model with the dependent variable CAMP (Campsites and Vacation Camps)

As observed in Table 5, the variables exhibit a positive correlation: Share of enterprises that received online orders for Hotels and Restaurants, Share of employed persons with internet access for professional purposes for Hotels and Restaurants, and the Value of services provided to the population in Caravan parks, campsites, and holiday camps.

Table 5. Model with the dependent variable CAMP

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	-9.053465	19.08521	-0.474371	0.6445
H_RSEOR	0.902338	0.409830	2.201739	0.0499
H_RSEPIAP	1.821634	0.943792	1.930123	0.0798

R-squared	0.543733	Mean dependent var	42.82857
Adjusted R-squared	0.460775	S.D. dependent var	18.64706
S.E. of regression	13.69290	Akaike info criterion	8.259041
Sum squared resid	2062.450	Schwarz criterion	8.395982
Log likelihood	-54.81329	Hannan-Quinn criter.	8.246365
F-statistic	6.554343	Durbin-Watson stat	1.449011
Prob(F-statistic)	0.013357		

Table 6. VIF for the model with the dependent variable CAMP

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	364.2453	27.19764	NA
H_RSEOR	0.167960	3.889664	1.137301
H_RSEPIAP	0.890743	30.86881	1.137301

The model with the dependent variable CAMP is valid. The variation of this variable is represented by 46.07% of the variables included in the model, while the remaining 53.93% is represented by other variables.

d) Model with the Dependent Variable OLS (Other Lodging Services)

As observed in Table 7, the variables demonstrate a positive association: Share of enterprises that conducted online sales of goods and services (via their own websites or applications) for Hotels and Restaurants, Share of enterprises where employed persons have

internet access for professional purposes for Travel Agencies, and the Market Services Provided to the Population in the category of Other Lodging Services.

Table 7. Model with the dependent variable OLS

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	-738.7351	547.3748	-1.349596	0.2043
H_RSEOS	19.52324	4.866712	4.011588	0.0020
TATOSEEIAP	12.00790	5.409447	2.219802	0.0484

R-squared	0.597348	Mean dependent var	674.1643
Adjusted R-squared	0.524138	S.D. dependent var	226.9782
S.E. of regression	156.5758	Akaike info criterion	13.13237
Sum squared resid	269675.7	Schwarz criterion	13.26931
Log likelihood	-88.92657	Hannan-Quinn criter.	13.11969
F-statistic	8.159423	Durbin-Watson stat	1.476311
Prob(F-statistic)	0.006716		

According to Table 8, there is no multicollinearity since the values in the Centered VIF column do not exceed 10. The model with the dependent variable OLS is valid. The variation of this variable is represented by 52.41% of the variables included in the model, while the remaining 47.59% is accounted for by other variables.

Table 8. VIF for the model with the dependent variable OLS

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	299619.1	171.0994	NA
H_RSEOS	23.68489	3.993955	1.250205
TATOSEEIAP	29.26212	150.5001	1.250205

e) The model with the dependent variable REST (Restaurants)

- Relevant factors: electronic sales, website information, and order updates online.

Table 9. Model with the dependent variable REST

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	-9964.084	2348.371	-4.242976	0.0017
H_RSES	1205.310	168.4123	7.156899	0.0000
H_RSEWPD	249.5767	38.76677	6.437904	0.0001
TATOSEWT	155.7048	47.40066	3.284866	0.0082

R-squared	0.962815	Mean dependent var	13257.10
Adjusted R-squared	0.951660	S.D. dependent var	7081.417
S.E. of regression	1556.949	Akaike info criterion	17.77380
Sum squared resid	24240897	Schwarz criterion	17.95639
Log likelihood	-120.4166	Hannan-Quinn criter.	17.75690
F-statistic	86.30911	Durbin-Watson stat	2.257850
Prob(F-statistic)	0.000000		

According to Table 10, there is no multicollinearity as the values in the Centered VIF column do not exceed 10.

Table 10. VIF for the model with the dependent variable REST

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	5514848.	31.85026	NA
H_RSES	28362.72	6.106885	1.677597
H_RSEWPD	1502.862	19.52890	1.692749
TATOSEWT	2246.822	18.03706	1.012371

The model with the dependent variable REST is valid. The variation of this variable is represented by 95.16% of the variables included in the model, while the remaining 4.84% is accounted for by other variables.

f) Model with the dependent variable CATE (Catering services for events)

As observed in Table 11, there is a positive relationship between the variables: Share of enterprises where the website provided descriptions of goods or services, including pricing information for Hotels and Restaurants, Share of enterprises that received online orders for Hotels and Restaurants, Share of employed persons with internet access for professional purposes for Hotels and Restaurants, Share of enterprises where employed persons have internet access for professional purposes for Travel Agencies, and the Market Services Provided to the Population in the category of Catering services for events and other food services.

Table 11. Model with the dependent variable CATE

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	-3011.090	422.0036	-7.135224	0.0002
H_RSEWPD	44.55402	4.006185	11.12131	0.0000
H_RSEOR	48.27844	6.225737	7.754654	0.0001
H_RSEPIAP	87.43366	7.918979	11.04103	0.0000
H_RSEOW	-36.09945	4.436755	-8.136452	0.0001
TATOSEEIAP	25.30905	5.074128	4.987862	0.0016
H_RSEWT	-38.48873	11.20119	-3.436129	0.0109

R-squared	0.992429	Mean dependent var	1547.814
Adjusted R-squared	0.985939	S.D. dependent var	734.3955
S.E. of regression	87.08493	Akaike info criterion	12.07850
Sum squared resid	53086.49	Schwarz criterion	12.39803
Log likelihood	-77.54948	Hannan-Quinn criter.	12.04892
F-statistic	152.9204	Durbin-Watson stat	2.360779
Prob(F-statistic)	0.000000		

Selection Summary

Table 12. VIF for the model with the dependent variable CATE

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	178087.0	328.7565	NA
H_RSEWPD	16.04952	66.66279	5.778275
H_RSEOR	38.75981	22.19174	6.488655
H_RSEPIAP	62.71022	53.72924	1.979548
H_RSEOW	19.68480	101.3890	4.168766
TATOSEEIAP	25.74677	428.0721	3.555998
H_RSEWT	125.4667	53.46416	6.289868

The model with the dependent variable CATE is valid. The variation of this variable is represented by 98.59% of the variables included in the model, while the remaining 1.41% is accounted for by other variables.

g) The model with the dependent variable BARS (Bars and beverage service activities)

As shown in Table 13, the variables exhibit a positive correlation: Share of enterprises that purchased cloud computing services used on the internet for Hotels and Restaurants, Share of electronic sales in total turnover, excluding VAT for Hotels and Restaurants, and the Market Services Provided to the Population in the Bars and other beverage service activities sector.

Table 13. Model with the dependent variable BARS

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	1519.009	254.6080	5.966068	0.0001
H_RSECC	146.8130	43.65279	3.363199	0.0063
H_RSES	125.7554	58.10153	2.164408	0.0533

R-squared	0.835201	Mean dependent var	3144.443
Adjusted R-squared	0.805238	S.D. dependent var	1087.607
S.E. of regression	479.9812	Akaike info criterion	15.37278
Sum squared resid	2534202.	Schwarz criterion	15.50972
Log likelihood	-104.6095	Hannan-Quinn criter.	15.36010
F-statistic	27.87402	Durbin-Watson stat	2.007097
Prob(F-statistic)	0.000049		

Table 14. VIF for the model with the dependent variable BARS

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	64825.23	3.939341	NA
H_RSECC	1905.566	7.171622	2.100948
H_RSES	3375.788	7.647989	2.100948

The model with the dependent variable BARS is valid. The variation of this variable is represented in proportion of 80.52% by the variables included in the model, while the remaining 19.48% is represented by other variables.

h) The model with the dependent variable TATO (Travel Agencies and Tour Operators)

- Significant correlation with employee internet access and online order tracking.

Table 15. Model with the dependent variable TATO

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	-3827.844	1610.606	-2.376648	0.0367
H_RSEEIAP	70.45334	17.70052	3.980297	0.0022
TATOSEWT	60.00121	22.87521	2.622980	0.0237

R-squared	0.696795	Mean dependent var	4153.021
Adjusted R-squared	0.641667	S.D. dependent var	1255.516
S.E. of regression	751.5635	Akaike info criterion	16.26960
Sum squared resid	6213325.	Schwarz criterion	16.40654
Log likelihood	-110.8872	Hannan-Quinn criter.	16.25692
F-statistic	12.63954	Durbin-Watson stat	2.053140
Prob(F-statistic)	0.001411		

According to Table 16, there is no multicollinearity since the values in the Centered VIF column do not exceed 10.

Table 16. VIF for the model with the dependent variable TATO

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	2594052.	64.29472	NA
H_RSEEIAP	313.3086	53.77728	1.011855
TATOSEWT	523.2752	18.02787	1.011855

The model with the dependent variable TATO is valid. The variation of this variable is represented by 64.17% of the variables included in the model, while the remaining 35.83% is represented by other variables.

i) Model with the dependent variable ORTAS (Other Reservation and Tourist Assistance Services)

As observed in Table17, there is a positive relationship between the variable Share of EDI-type sales as a percentage of total turnover for Hotels and Restaurants and the Market Services Provided to the Population in the category of Other Reservation and Tourist Assistance Services.

The model with the dependent variable ORTAS is valid. The variation of this variable is represented 20.62% by the variables included in the model, while the remaining 79.38% is explained by other variables.

Table 17. Model with the dependent variable ORTAS

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	104.9365	50.17750	2.091305	0.0584
H_RSEDI	131.5614	62.87997	2.092262	0.0583

R-squared	0.267290	Mean dependent var	195.1500
Adjusted R-squared	0.206231	S.D. dependent var	107.7812
S.E. of regression	96.02624	Akaike info criterion	12.09868
Sum squared resid	110652.5	Schwarz criterion	12.18998
Log likelihood	-82.69079	Hannan-Quinn criter.	12.09023
F-statistic	4.377562	Durbin-Watson stat	1.608713
Prob(F-statistic)	0.058341		

As observed across the nine models, two very important variables are Share of employed persons with internet access for professional purposes for Hotels and Restaurants (H_RSEPIAP) and Share of enterprises where the website provided descriptions of goods or services, including pricing information for Hotels and Restaurants (H_RSEWPD), as they appear in four of these models. In all four models, the coefficient of these variables is positive and significant.

After reviewing all nine models, it is evident that a very high proportion of the coefficients have a positive sign, which indicates a positive and significant relationship between Digitalization (measured by key ICT utilization indicators in enterprises with 10 or more employees—Hotels and Restaurants, as well as Travel Agencies) and performance in the Hospitality Industry (measured by the value of services provided to the population based on CAEN activities).

4. CONCLUSIONS

The study on digitalization in the hospitality industry and the relationship between the use of ICT products and the value of services provided has highlighted the significant impact that the adoption of digital technologies has on this sector. The statistical data analysis demonstrated that employees' use of the internet for professional purposes, the presence of an informative website, and the possibility of online sales are essential factors contributing to the increase in the value of services provided.

The results of the econometric models used indicate a positive and significant relationship between digitalization and the economic performance of accommodation and food service establishments. In particular, the variables "Proportion of employees with internet access for professional purposes" and "Proportion of enterprises that own a website providing information about products and pricing" were found in four of the analyzed models, confirming their essential role in the development of the hospitality sector.

Additionally, the models showed that online sales, the use of cloud services, and the implementation of EDI solutions for commercial transactions positively influence the financial performance of companies in this field. Thus, companies that invest in technology manage to optimize internal operations, enhance customer experience, and strengthen their competitive position in the market.

However, there are significant differences between the various segments of the hospitality industry. For example, the impact of digitalization is stronger in the hotel and restaurant sectors, where customer interaction and access to online platforms are essential. In contrast, for camping accommodations or other reservation and tourist assistance services, the

influence of technology is lower, indicating the need for customized digitalization strategies for each market segment.

In conclusion, the study's findings support the idea that digitalization plays a crucial role in increasing the competitiveness of the hospitality industry. Investments in digital infrastructure, expanding internet access for employees, and developing online platforms are recommended measures to accelerate digital transformation. In a dynamic economic context where consumer preferences are constantly evolving, the integration of ICT technologies is no longer just an option but a necessity for the long-term success of companies in this sector.

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INTELLIGENT INFORMATION SYSTEMS FOR THE CIRCULAR ECONOMY: A NATIONAL SECURITY-ORIENTED APPROACH AND ADAPTIVE DECISION MAKING

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ABSTRACT: *The ability of states to implement sustainable and adaptive policies becomes essential for maintaining internal balance and protecting critical infrastructures. The circular economy, in this equation, is emerging not only as an alternative ecological model but as a genuine strategic instrument for strengthening economic and national security. This article aims to investigate how emerging digital technologies, such as artificial intelligence (AI), can support real-time decision-making within circular economic systems, thus contributing to optimizing resource allocation, anticipating imbalances, and attracting private investment in circular infrastructure. The method used for modeling is that of decision trees, chosen for its ability to highlight conditional relationships and critical thresholds in investment decision-making. The existence of significant correlations between the degree of circularity and the level of investment is highlighted, supporting the hypothesis that data-driven decision-making intelligence can become a catalyst for economic resilience. The paper formulates a series of recommendations for public policies aimed at integrating digitalization and the circular economy into national security strategies.*

Keywords: *information systems, adaptive decision, predictive modeling*

JEL Classification: *C35; C38; E27; G28; H25*

1. INTRODUCTION

In a context marked by the accelerated transition towards sustainability and increasing pressures on economic and social infrastructures, the circular economy is emerging as a development model capable of simultaneously responding to environmental, economic, and security challenges. Unlike the traditional linear economic paradigm – characterized by the extraction, use, and disposal of resources – the circular economy proposes a closed-loop system, based on reuse, remanufacturing, recycling, and the efficient use of materials [3]. This model not only conserves natural resources but also increases the strategic autonomy of states, reducing dependence on imports and the risks associated with global supply chains. In parallel, technological progress in the last two decades has allowed the development of intelligent systems capable of supporting adaptive decision-making in real time by integrating large volumes of data from diverse sources [8,9]. Technologies such as artificial intelligence (AI) and Big Data analysis provide the premises for a reactive and predictive circular governance, in which economic actors can anticipate fluctuations in material flows, assess emerging risks, and adjust operational policies with a high degree of finesse [5]. Thus, a convergence between

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digitalization, sustainability and national security is emerging, in which information systems become true mediators of macroeconomic stability and the protection of critical infrastructures [11,14,15].

This paper aims to investigate this interdependence through an empirical approach, focused on the analysis of a set of key indicators of the circular economy at the level of the European Union member states. The analyzed indicators – people employed in circular sectors (PE), resource productivity (RS), circular material use rate (CR), waste recycling rate (RW) and private investment in circular infrastructure (PVA) – are used to build a decision-making model based on decision trees, with the aim of identifying relevant relationships between these factors and substantiating the hypothesis that digitalization of decisions can stimulate investment and economic resilience [1,12,7]. The main objective of the research is to demonstrate that smart technologies, integrated into a real-time decision-making framework, can significantly contribute to optimizing the circular economy and, implicitly, to strengthening national security. The research questions guiding the approach are the following:

1. What are the significant relationships between circularity indicators and the level of private investment in circular infrastructure?

2. What decision-making rules can be extracted through decision tree modeling, and how can they be used in the context of strategic planning?

3. To what extent can intelligent digital systems be considered an essential factor in supporting adaptive decisions with an impact on economic security? By articulating these directions, the article contributes to expanding the conceptual and operational framework of the circular economy, bringing to the forefront the critical role of digitalization in the smart and secure management of resources.

2. INTELLIGENT INFORMATION SYSTEMS AND ADAPTIVE DECISIONS

Accelerating transformations of global economic ecosystems, the ability to make adaptive decisions in real time is becoming an essential condition for the efficient functioning of sustainable economic models. Adaptive decisions refer to those decision-making processes that are able to respond quickly and flexibly to changes in the environment, based on a continuous interpretation of data, algorithmic rules or human intervention assisted by technology. Within the circular economy, this type of decision involves not only reacting to imbalances in supply chains or resource management, but also the ability to anticipate changes, optimize reuse processes and strategically capitalize on information flows [14]. The implementation of adaptive decisions is facilitated by an intelligent digital infrastructure, in which three fundamental technologies converge: artificial intelligence (AI), the Internet of Things (IoT) and Big Data. Artificial intelligence contributes to the development of sophisticated predictive models, capable of anticipating the demand for recycled materials, optimizing circular logistics routes or identifying areas at risk of imbalance between production and consumption. Big Data analysis, on the other hand, integrates and correlates large and heterogeneous data sets – originating from industrial infrastructures, economic platforms or recycling networks – to generate relevant insights that can inform strategic decisions at national or regional level.

Therefore, intelligent systems act as a binder between circular objectives and adaptive decision-making capacity, providing not only the speed and accuracy necessary for effective interventions, but also the informational robustness required in an environment characterized by uncertainty and volatility.

2.1. Circular Economy and National Security

The circular economy is no longer perceived exclusively as an environmental protection tool, but increasingly as a fundamental pillar of economic and national security. By reducing dependence on imported primary resources – often concentrated geopolitically in unstable regions – circularity directly contributes to strengthening the strategic autonomy of states. This autonomy is translated into the ability of economic systems to function and adapt in crisis conditions, ensuring the continuity of production, the protection of jobs and the stability of the internal market. In addition, the reuse and recycling of materials generate internal economic flows, which reduce vulnerability to external fluctuations and support the development of resilient industrial ecosystems. The link between circular infrastructure and critical infrastructure is increasingly evident in the security strategies developed at the level of the European Union and the Member States. While critical infrastructure includes those systems essential for the functioning of society – energy, water, transport, health, communications –, the circular economy directly influences their resilience by constantly providing secondary materials, reducing pressure on supply chains and extending the lifespan of equipment. In addition, the digitalization of these processes allows for real-time monitoring of risks, facilitating rapid decisions in the face of systemic threats, be they economic, ecological or cyber.

Thus, the integration of circular economy principles into critical infrastructure is not only an option for economic efficiency, but a necessity for national resilience, especially in a global context marked by geopolitical tensions, energy crises and climate instability. Sustainability becomes, in this sense, an integrated component of economic defense, and adaptive decisions supported by intelligent systems – a means of strategic protection.

3. METHODOLOGY

The methodology of this study aims to integrate decision-based analysis with an empirical framework based on key indicators of circular performance at the European Union level. Given the main objective of the research – to explore how intelligent systems can support adaptive decisions and investments in circular infrastructure – a quantitative approach was adopted, supported by predictive modeling using decision trees.

This methodological choice is motivated by the interpretable and robust nature of decision trees in complex contexts, where the relationships between variables can be nonlinear or conditional. Decision trees allow not only to estimate the values of a dependent variable (in this case, private investment in the circular economy – PVA), but also to extract logical rules and critical thresholds that can be directly used in strategic decision-making, including in automated decision support systems.

3.1. Data and its source

The data used in the analysis were taken from the official EUROSTAT platform, being selected for the period 2010–2022 and covering most of the Member States of the European Union. The dataset includes five indicators relevant for the analysis of circular performance, as follows:

• PE (Persons Employed) – Number of people employed in circular economy sectors, expressed in thousands of people.

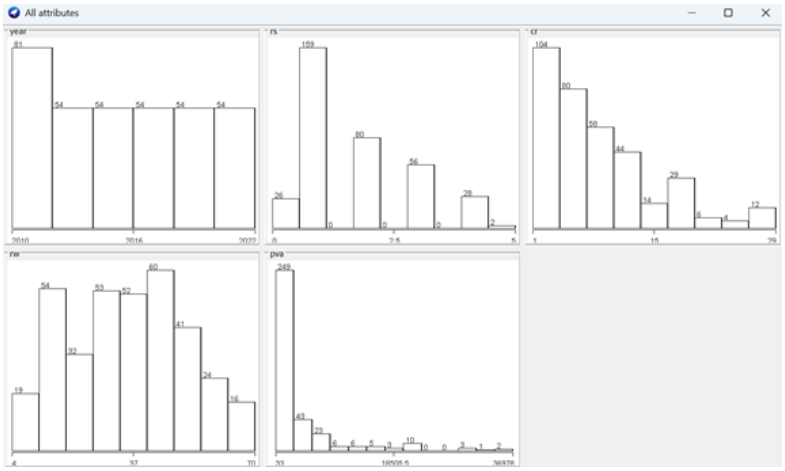
• RS (Resource Productivity) – Resource productivity, measured in euro/kg, indicating the economic efficiency in the use of materials.

• CR (Circularity Rate) – Circular rate of material use, expressed as a percentage (%), reflecting the proportion of reused materials in total material consumption.

• RW (Recycling Waste Rate) – Municipal waste recycling rate, expressed as a percentage (%), representing the efficiency of collection and treatment systems.

• PVA (Private Investment in Circular Economy) – Value of private investments in circular infrastructure, expressed in million euros.

Figure 1. Distribution of dataset values performed by the author using WEKA 3.8.6 software



The figure shows the distribution of values for the variables used in the analysis, providing an overview of the structure of the data set used in the decision-making modeling. The analysis of the distribution of the year variable highlights a relatively uniform distribution of the data over the period 2010–2022, with a slight agglomeration recorded in 2010, when a frequency peak is noted (81 observations). This early concentration suggests that, although the data include the recent period in a balanced way, the representation before 2016 is slightly denser, which may influence the temporal consistency of the derived decision-making models.

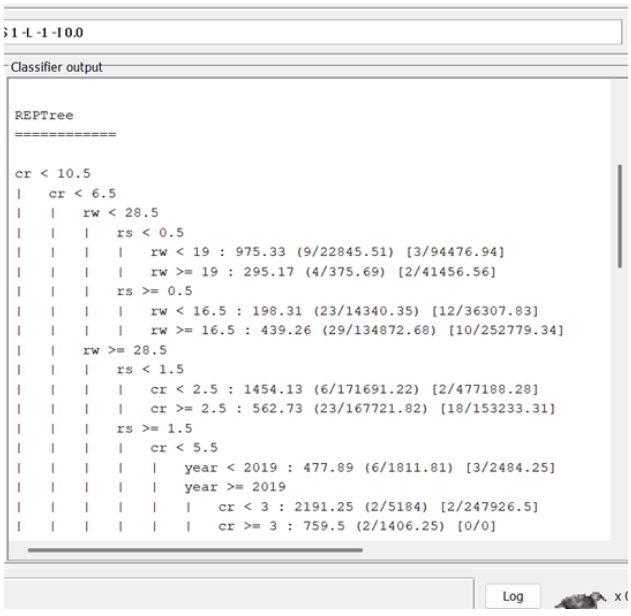
Regarding the distribution of the RS variable (resource productivity), it is characterized by a strongly positive asymmetric profile (skewed to the right), with an overwhelming majority of values placed below the threshold of 2 euro/kg. This strong trend towards low values reflects, in most of the countries analysed, a low economic efficiency in the use of resources, which can be attributed both to the low level of technological development of the productive sectors and to the absence of coherent national policies on the efficient recovery of materials. Only a limited number of observations exceed the value of 4 euro/kg, indicating that the high performance in this area is exceptional and concentrated in a few advanced economies. The variable CR (circular material use rate) also shows an asymmetric distribution, dominated by values between 1% and 2%, which indicates that the circular economy is still in its infancy in most European countries, and the actual proportion of reused materials remains modest in relation to the real recycling potential. Only a few observations exceed the upper thresholds of 15% or 20%, which highlights an advanced level of circularity only in certain countries with a consolidated tradition and infrastructure in the field of recycling. The distribution of the variable RW (waste recycling rate) is relatively balanced, but tends to be concentrated in an intermediate range, between 30% and 50%, which suggests that policies for selective collection and treatment of municipal waste are widely implemented in the EU, but with varying degrees of efficiency. Disparities become evident through the presence of extreme observations: a small number of states achieve excellent performance, with recycling rates above 65%, while others

fall below the 20% threshold, indicating systemic deficiencies. Regarding PVA (private investment in the circular economy), the distribution reveals a strong leftward skew, with an overwhelming majority of values below 10,000 million euros. Approximately 249 observations fall below this threshold, while only a few countries record significantly higher values, sometimes reaching almost 37,000 million euros. This distribution emphasizes a deep polarization of private capital in favor of a few strong economies, most likely Germany, France or the Netherlands, while the rest of the countries remain dependent on public policies or external investments for the development of circular infrastructure.

3.2. Results and discution

The decision tree in the image (Fig.2) is generated with the REPTree (Reduced Error Pruning Tree) algorithm, a regression model that estimates the target variable pva (private investment in the circular economy) depending on the variables cr (circular rate), rw (waste recycling rate), rs (resource productivity) and year. The tree is trained on the full dataset (Use training set) and provides quantitative estimates of PVA based on combinations of logical conditions. The structure generated by the REPTree decision tree confirms the conceptual relevance of the circular material rate (CR) as the main decision factor in estimating private investment in the circular economy (PVA). This attribute functions as the root node of the model, segmenting the entire data set based on a critical threshold of 10.5%. This automatic choice of the CR variable as the starting point for branching suggests that the degree of material circularity of an economy constitutes, in predictive terms, the strongest explanatory variable of private investment behavior.

Figure 2. Structure of the REPTree decision tree. Realized by author with WEKA software



For values below this threshold – i.e. in the case of low circularity economies – the tree introduces a series of additional conditions, based on the waste recycling rate (RW), resource productivity (RS) and the reference year (year). This hierarchical structure suggests an adaptive decision logic, in which the impact of each variable is dependent on the maturity level of the others. For example, in situations where both CR and RW are very low, and RS does not exceed 0.5 euro/kg, the estimated private investments are minimal, which reflects a systemic deficit of

economic attractiveness in the absence of minimum circular and technological performances. As the values of RW increase (e.g. above 19% or 28.5%) and RS reaches pragmatic levels (≥0.5), the model indicates a moderate increase in investments, which can be interpreted as a progressive response of private capital to the functional improvement of recycling infrastructures and the achievement of a minimum of operational efficiency. However, the absolute levels of investment still remain relatively low in these scenarios, which confirms that recycling alone is not sufficient to generate a large-scale investment effect in the absence of appropriate technological support. An interesting direction of the decision analysis is given by the interaction between CR, RS and the reference year. Thus, under conditions where RS ≥ 1.5 and CR is still low (below 5.5%), the REPTree model distinguishes between observations made before and after 2019, identifying a temporal inflection point. After this year, if the level of circularity is extremely low (CR < 3), private investment increases significantly, which can be correlated with recent European policy interventions, such as the European Green Deal, the Recovery and Resilience Plan (NRRP) or other financial instruments aimed at supporting the circular transition. This finding is essential for understanding the post-crisis investment dynamics, demonstrating that temporal interventions and public policies can transform marginal conditions into opportunities to attract private capital. The interpretation is supported by the decision rules of the generated tree, whose conditional nodes are presented below:

```
IF cr < 10.5 THEN
  IF cr < 6.5 THEN
    IF rw < 28.5 THEN
      IF rw < 0.5 AND rs < 0.5 AND year < 19 THEN
        PVA ≈ 975.33
      ELSE IF rw >= 19 AND rs < 0.5 THEN
        PVA ≈ 295.17
      ELSE IF rs >= 0.5 AND rw < 16.5 THEN
        PVA ≈ 198.31
      ELSE IF rs >= 0.5 AND rw >= 16.5 THEN
        PVA ≈ 439.26
    ELSE IF rw >= 28.5 AND rs < 1.5 THEN
      IF cr < 2.5 THEN
        PVA ≈ 1454.13
      ELSE IF cr >= 2.5 THEN
        PVA ≈ 562.73
    ELSE IF rs >= 1.5 AND cr < 5.5 THEN
      IF year < 2019 THEN
        PVA ≈ 477.89
      ELSE IF year ≥ 2019 THEN
        IF cr < 3 THEN
          PVA ≈ 2191.25
        ELSE IF cr ≥ 3 THEN
          PVA ≈ 759.5
```

The decision-making model validated by these rules provides not only a quantitative estimate of investments based on circular performance, but also a logical map of the maturation of circular economies, highlighting critical thresholds, ceiling effects and inflection points that can guide both public strategies and the behaviors of private actors in the sustainable transition process.

4. CONCLUSION

In conclusion, the REPTree not only provides a numerical estimate of PVA according to circularity indicators, but above all generates a logical map of the investment decision-making process, in which circular variables do not act in isolation, but in contextual interdependence. Each identified decision-making threshold – be it 10.5% in CR, 0.5 in RS or the year 2019 as a temporal benchmark – delimits strategic regions of policy intervention, thus providing a valuable tool for decision-makers who wish to align economic policies with those of sustainability and national security. The present study highlights, through an integrated decision-making and analytical approach, the major potential of smart technologies in supporting the transition to a circular economy, in close correlation with the objectives of economic security and strategic stability. By using a model. based on decision trees, the research identified the concrete conditions under which circularity indicators – employment in circular sectors (PE), resource productivity (RS), circular material rate (CR) and waste recycling rate (RW) – can act as relevant predictors of private investment in circular infrastructure (PVA).

The results obtained demonstrate that, in contexts characterized by low resource productivity, investments can still be attracted by progressive improvements in recycling and reuse capacity. At the same time, in economies with high circular performance, investments are decisively influenced by the level of technology and the efficiency of industrial processes, signaling the existence of a maturity threshold beyond which only further technological progress can generate added value. Another key result aims to identify saturation effects: in certain contexts, the increase in the circularity rate no longer determines a significant contribution of private capital, suggesting the need for a recalibration of investment strategies and fiscal or financial stimulus instruments. This finding highlights the fact that, in order to support sustainable development, public policies must be dynamic and contextualized, adapting to the level of circular maturity of each state or region.

From the perspective of economic security, the paper confirms that the circular economy is not only a mechanism for making the use of resources more efficient, but also a tool for strengthening strategic autonomy, contributing to reducing external dependence, protecting supply chains and the continuity of critical infrastructures. In this sense, the integration of intelligent decision-making systems – capable of processing data in real time and generating adaptive reactions – becomes not only opportune, but necessary.

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ANALYSIS OF THE DYNAMICS AND INTERDEPENDENCE OF MONEY SUPPLY (M3) WITH GROSS DOMESTIC PRODUCT AND INFLATION RATE IN ROMANIA IN THE PERIOD 2010 - 2023

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ABSTRACT: *In this research, we analyze the evolution of three key economic indicators of Romania during the period 2010-2023: Broad Money (M3), Gross Domestic Product (GDP) nominal, and the Inflation Index (Inflation Rate = CPI). The study is based on data from official sources – the National Bank of Romania (NBR), the National Institute of Statistics (NIS), and Eurostat – and aims to highlight the trends of these indicators, their interrelationships, and the influence of monetary and fiscal policies.*

We will present the developments over time of each indicator, supported by comparative graphs and tables, followed by an econometric analysis (regressions, ARIMA and VAR models) to explore causal relationships. Finally, we will discuss the impact of macroeconomic policies on the money supply, economic growth, and inflation during the considered period.

Keywords: *Broad money supply, Gross Domestic Product, Inflation rate, econometric model*

JEL Classification: *C4, E4, G2*

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1. EVOLUTION OF INDICATORS: BROAD MONEY SUPPLY (M3), GROSS DOMESTIC PRODUCT GDP) NOMINAL, AND INFLATION RATE (CPI) DURING THE PERIOD 2010-2023

Table 1 presents the values of the broad money supply (M3) (year-end balance), GDP at current prices, and the annual inflation rate over the years 2010-2023:

Table 1. Evolution of the broad money supply (M3), nominal GDP, and the inflation rate in Romania - (period 2010-2023)

Year	Money supply in the broad sense (M3) --billions RON--	Nominal Gross Domestic Product (GDP) in current prices --billions RON--	Inflation rate (CPI)--%--
2010	202.7	522.6	6.1
2011	216.2	557.3	5.8
2012	222.0	596.7	3.3
2013	241.6	639.3	4.0
2014	260.3	669.5	1.1
2015	286.3	710.3	--0.6
2016	314.2	765.1	--1.5
2017	350.6	857.9	1.3
2018	381.2	1,011.7	4.6
2019	422.6	1,047.7	3.8
2020	487.4	1,058.9	2.6
2021	564.4	1,189.0	5.1
2022	603.1	1,409.7	13.8
2023	667.8	1,590.0	10.4
	SER01	SER02	SER03

Data sources: NBR (for M3 and inflation) and INS/Eurostat (for GDP). The GDP values for 2020-2023 are estimated from semi-definitive NIS data and official forecasts.

Note: M3 represents, according to NBR, the broad money supply which includes, in addition to M2, other financial instruments such as loans from repo operations, shares/units of money market funds, and negotiable securities with a maturity of up to two years inclusive.

M2 represents the intermediate money supply that includes, in addition to M1, deposits with an initial duration of up to two years inclusive.

M1 represents the money supply in a narrow sense and includes M0 - the cash in circulation, as well as current accounts and demand deposits.

1.1. Broad money supply (M3) - trends and developments

The broad money supply (M3) recorded a significant increase during the period from 2010 to 2023, more than tripling its value. If at the end of 2010 the M3 balance was 202.7 billion RON, by the end of 2023 it reached 667.8 billion RON. The growth was relatively constant until 2019, accelerating later in the years 2020-2021, as can be seen from the graphical representation in Figure 1.

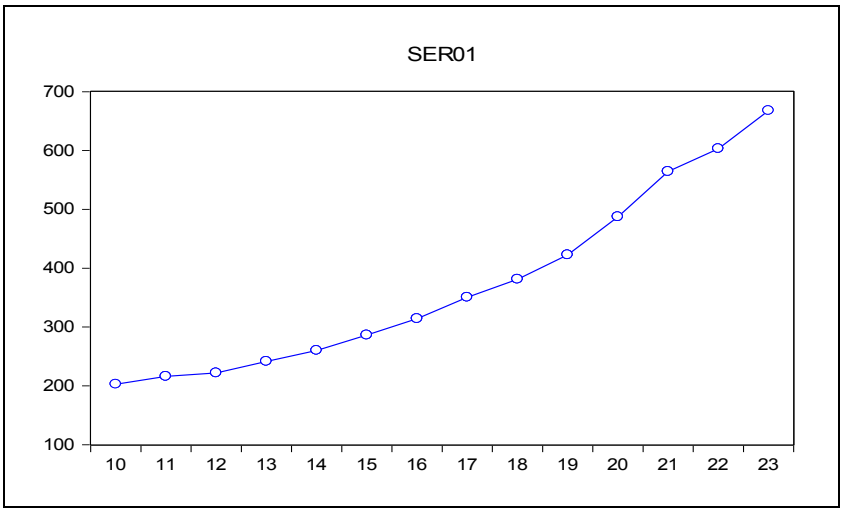
The main stages of the evolution of the M3 money supply were:

- In the years 2010-2014, a period of moderate growth is identified, with M3 increasing from 202.7 billion RON in December 2010 to 260.3 billion RON in December 2014. The annual growth rate varied between 6-8%, in line with the timid resumption of lending after the financial crisis and with relatively low

inflation. For example, in 2013, the money supply had increased by 8.8% compared to 2012, and in 2014 by 7.8% compared to 2013.

- The 2015-2019 time frame shows a stronger upward trend, M3 reached RON 422.6 bn in December 2019, an increase of 62% compared to 2014. The annual growth of money supply accelerated slightly, amid the easing of monetary policy (the NBR lowered the monetary policy interest rate in 2014-2017) and the increased demand for loans in RON. For example, in 2018 alone, money supply grew by **8.9%** compared to 2017, and in 2019 annual growth was **10.9%.** These rates have outpaced the pace of real economic growth, suggesting more abundant liquidity in the economy.

Figure 1. Graphical representation of the dynamics of the broad money supply (M3) from 2010 to 2023



- The years 2020-2021 show a strong monetary expansion. The COVID-19 pandemic and the response measures led to rapid money supply growth. By the end of 2020, M3 had reached RON **487.4 bn, +15.3%** above the 2019 level, one of the highest growth rates in the last decade. This development was spurred by **loose monetary policy** (the NBR cut the interest rate from 2.5% to 1.5% in 2020 and injected liquidity) and **fiscal measures** (payment deferrals, credit guarantees) that maintained lending. The money supply also continued to grow in 2021 (+15% nominal), reaching 564.4 bn. RON. The growth in 2021 was fueled by the post-pandemic domestic demand recovery and the maintenance of real-negative interest rates (inflation exceeding nominal interest).

In the last two years of the period under review, 2022-2023, the pace of monetary growth slows down. As the NBR started tightening monetary policy to combat inflation (policy interest rate rising to 7% in 2022), money supply expansion moderated. In December 2022, M3 was RON 603.1 bn, up only **6.9%** from 2021, inflation-adjusted means even a contraction in real terms (-8.2%). By the end of 2023, the money supply reached RON 667.8 bn, with the nominal annual pace remaining modest (+10.7% from 2022). This reflects both the effect of **higher interest rates** (which have slowed the growth of credit and overnight deposits, the components of M3) and the prudent measures of the NBR to keep liquidity under control to tame inflation.

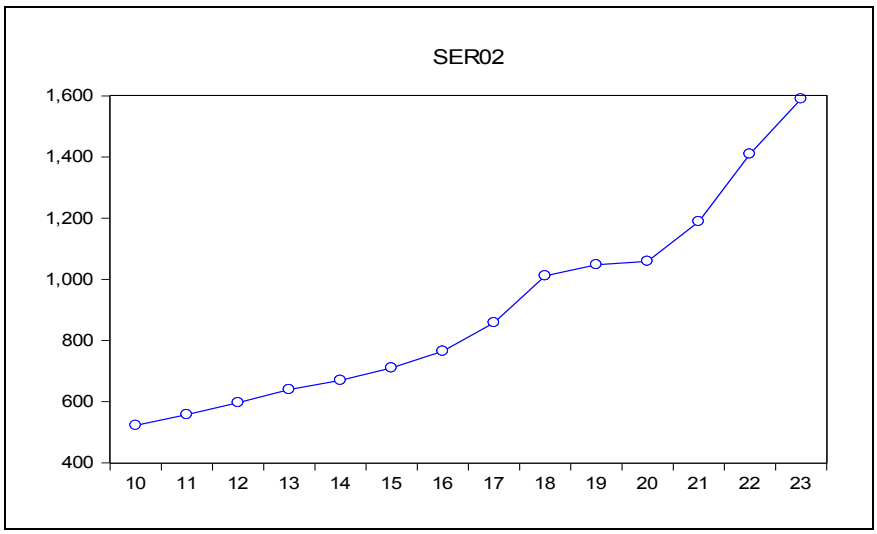
An overview over the period under review shows that the **M3 money supply increased more than 3 times** over the 2010 - 2023time span, confirming a consistent monetary

expansion. This expansion was initially correlated with nominal GDP growth and the convergence objective (financial and economic) towards the EU average, but in recent years it has also contributed to inflationary pressures, especially when it outpaced real economic growth.

1.2. Gross Domestic Product (GDP) nominal - evolution and growth rate

Romania's nominal GDP (at current prices) increased substantially over the period analyzed, reflecting both the **real growth of the economy** and **the effect of inflation** on the market value of goods and services. In absolute terms, GDP rose from **522.6 billion RON in 2010** to an estimated **1,590.0 billion RON in 2023**, i.e. a **nominal tripling** in 13 years, as can be seen from the graph in Figure 2.

Figure 2. Plot of the dynamics of gross domestic product in current prices from 2010 to 2023



Some key milestones in the dynamics of nominal GDP are outlined below:

- In the years 2010-2012, Romania was emerging from recession after the 2009 crisis, so nominal GDP developed modestly. From 522.6 billion RON in 2010, GDP fell slightly in 2011 (due to lower inflation and modest economic growth) and recovered to 596.7 billion RON in 2012. Real growth was low (1.1% in 2011, almost 0% in 2012) and relatively high **inflation** (5-6%) contributed most to the increase in nominal value.
- The years 2013-2015 are part of a period of economic recovery. Real growth has accelerated (3-4% per year) and inflation has gradually fallen towards zero. Nominal GDP increased from 639.3 billion RON in 2013 to 710.3 billion RON in 2015. A notable factor was the **VAT reduction in 2015** (lowering the rate on food), which led to negative inflation in 2015-2016 and kept nominal GDP growth below the pace of real expansion. For example, in 2015 Romania had inflation of -0.6%, so although real GDP grew by 3.9%, nominal GDP rose by only 6% (to 710.3 billion RON).
- Between 2016-2019 there is an economic boom and robust nominal growth. Romania's economy had among the highest growth rates in the EU (e.g. +4.8% real in 2016, +7.1% in 2017 fueled by tax cuts and wage increases. Inflation turned positive after 2017, but remained moderate until 2019 (around 3-4%). The combination of high real growth and moderate inflation led to large jumps in

nominal GDP: from 765.1 billion RON in 2016 to **1,047.7 billion RON in 2019.** Practically, **GDP "jumped" the 1,000 billion RON threshold in 2018**, when it reached 1,011.7 billion RON, and continued to 1,047.7 billion RON in 2019, with Romania climbing in the EU ranking by size of economy (12th place after nominal GDP). Nominal annual nominal growth over this period was +10% per year, reflecting solid economic fundamentals and a slight inflationary impulse.

- **The year 2020 identifies a pandemic recession** and its effects. 2020 brought a real contraction of -3.7% due to lockdowns and the global economic shock. However, **nominal GDP did not fall significantly** due to still positive inflation (+2.6%) and currency devaluation (which increased the value in RON of foreign output). GDP in 2020 was estimated at **1,058.9 billion RON**, practically at the same level as in 2019. Thus, the real decline translated only into a stagnation in nominal value - an indication that prices continued to rise even in a context of low demand (partly due to supply-side causes, such as the price increases of some raw materials/imports).
- The period 2021-2022 followed, bringing a strong and surprising upturn. With the easing of restrictions, real GDP grew by +5.9% in 2021 and +4.7% in 2022. In addition, however, **inflation accelerated** (from 5.1% in 2021 to 13.8% in 2022). This mix led to **explosive nominal growth**: GDP reached 1,189.0 billion RON in 2021 and ~**1,409.7 billion RON** in 2022. Nominal growth in 2022 was +18% - the highest in decades - mainly driven by high inflation (external shock on energy and food prices) and a rebound in consumption. Thus, 2022 marks the transition of the economy to a new nominal scale (exceeding 1,400 billion RON GDP).
- The year 2023 marks a *moderation in growth*. Amid a **cooling global economy** and tight monetary policies, real GDP growth in 2023 was modest (estimated at +2.5- +3%). But still high inflation (10.4% annual average) kept nominal GDP on an upward slope. Estimates point to a GDP of **1,580-1,600 billion** RON in 2023, that is +12-13% compared to 2022. This suggests that almost all of the nominal growth in 2023 comes from price increases, while real growth was almost flat.

In conclusion, **Romania's GDP (in current RON) increased by about 3 times between 2010 and 2023**, which largely corresponds to the increase in money supply. This is not accidental: monetary expansion and credit financed investment and consumption, contributing to nominal GDP growth. On the other hand, when nominal GDP grew very fast (e.g. 2022), it was largely due to inflation - a signal of overheating, not necessarily of real output advance.

1.3. Inflation - the price level and its fluctuations

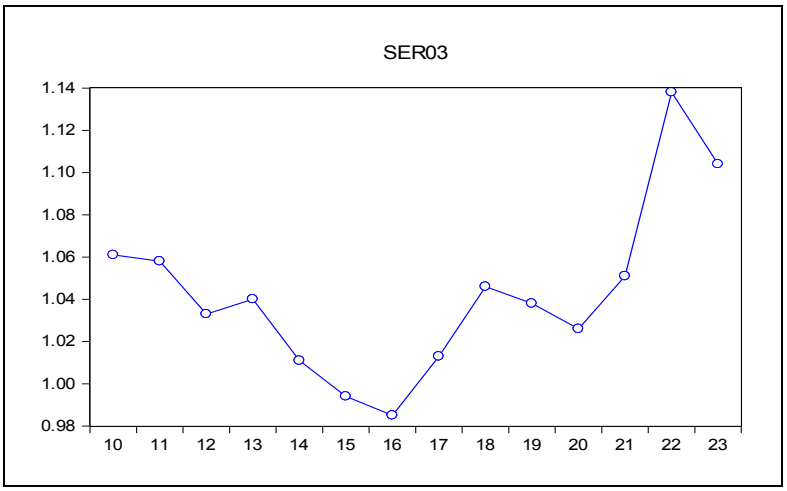
The inflation index considered is the consumer price index (CPI) - the average annual inflation rate. The time interval under analysis, 2010-2023, has seen **pronounced variations in inflation**, from relatively high levels in the early 2010s, to a period of **very low or negative inflation** in 2014-2016, followed by a gradual increase and **inflationary boom** in 2022, as can be seen from the graphical representation in Figure 3.

The main stages of inflation were:

- In 2010-2013, inflation is gradually decreasing. In 2010, average inflation was 6.1%, exceeding the NBR target (which was 3.5%±1). This high level was inherited from VAT increases in 2010 and the devaluation of the leu. Subsequently, on the back of weak demand and tighter monetary policy, inflation fell to 3-4% in 2012-2013. The NBR maintained an **inflation targeting** regime, managing to bring price growth back close to the target range (e.g. 3.3% in 2012, 3.98% in 2013).

- The years 2014-2016 show very low inflation, even deflation. In 2014, the average inflation rate fell to 1.1%, and in 2015 and 2016 Romania even recorded **negative inflation** (deflation): -0.6% in 2015 and -1.5% in 2016. This phenomenon was unprecedented for the post-2000 economy and was mainly due to **cuts in indirect taxes** (reduction of VAT on food in mid-2015 and the general VAT rate decreased from 24% to 20% in 2016). The effect of these fiscal measures was a cheapening of consumer goods in the statistics, which *masked* underlying inflationary pressures. The NBR responded by reducing the monetary policy interest rate to historical lows (1.75% in 2015-2016) to avoid a deflationary spiral. The 2015-2016 period thus marked the **historic low of inflation** in Romania (the first deflation in decades).

Figure 3. Graphical representation of the inflation index dynamics from 2010 to 2023



In the years 2017-2019 there is a return of inflation. Once the effect of VAT cuts faded, inflation returned to positive territory. In 2017, the annual average was 1.3%, then rose rapidly to **4.6% in 2018** and remained high at 3.8% in 2019. This resurgence in inflation was driven by **strong fiscal stimulus** (revenue increases that drove demand up), **rising fuel and tobacco prices** (higher excise taxes) and the base effect after deflation. The NBR reacted gradually, raising the key interest rate from 1.75% (2017) to 2.5% in 2018, but inflation remained above target (target 2.5%±1). In 2018, Romania had the second highest inflation in the EU (after Estonia). However, **inflation of 3-4%** was manageable and in line with rapid economic growth - some economists considered it a "price to pay" for real convergence. By the end of 2019, inflation was showing signs of slowing down (falling towards 3.8% p.a.), a sign that the NBR's measures and the easing of fiscal stimulus were starting to have an effect.

- The years 2020-2021 follow with moderate inflation and expected growth. In 2020, with the pandemic recession, inflation fell to **2.6%**, mainly due to the collapse in oil prices in the first part of the year and weak demand in sectors such as services and transportation. The NBR cut interest rates again (to 1.5%), providing liquidity, which prevented prices from falling below zero. In 2021, however, as the economy recovered, inflation started to rise again, reaching **5.1%** for the full year. The second half of 2021 already saw the first signs of the coming cost crisis: energy and gas hikes, tightened supply chains - so that by December 2021 annualized inflation had exceeded 7%. The NBR started a new round of **monetary tightening** at the end of 2021, raising interest rates to 2% and then above, anticipating inflationary pressures.

- The year 2022 brings a major inflation shock. The year 2022 brought the highest inflation in two decades (excluding the immediate post-transition periods.) The average annual inflation rate was **13.8%**, and year-end inflation was over 16%. The main factors were **supply shocks**: the explosion in electricity, natural gas and fuel prices (in the context of the war in Ukraine and the European energy crisis), the rise in global commodity prices and the drought that made food more expensive. Robust domestic demand and rising labor costs also contributed to the spillover of higher prices throughout the consumption basket. The NBR reacted aggressively, raising the benchmark interest rate from 2.5% (Jan. 2022) to 6.75% at the end of the year, but monetary policy measures have had a delayed effect. High inflation in 2022 eroded purchasing power and led to positive real interest rates only towards the end of the year.
- In the year 2023 **inflation is slowing down**, has shown signs of **deceleration**. The estimated annual average is **10.4%,** and towards the end of the year the annualized rate fell below 10% for the first time since 2021. The decline was due to the base effect (energy prices stabilized compared with the jump in 2022), the government capping some utility prices, the tightening of monetary policy (high interest rates tempering credit and consumption) and the slowdown in the economy. However, inflation remains above the NBR's target (which is 2.5%±1), mainly due to higher food prices (Romania having one of the highest food inflation in the EU in 2023). The NBR forecasts a **gradual decline** in inflation towards the target range only in 2024, assuming the absence of other external shocks.

To summarize, **inflation in Romania in the years 2010-2023 was volatile**: it went from relatively high levels (5-6%) at the beginning of the decade, to historical lows (deflation) in the middle of the decade, then rose moderately again (3-4%) and culminated in an episode of double-digit inflation in 2022. These swings were influenced by fiscal policies (indirect tax increases/decreases), external shocks (international energy prices) and domestic monetary policy. Inflation control remained the central objective of the NBR, which used interest rates and money supply control to bring it on the desired path - with notable success in some periods (e.g. 2017, when inflation was temporarily brought back within the target range), but with difficulties in the face of unpredictable shocks (e.g. 2022).

2. RELATION BETWEEN INDICATORS AND COMPARISONS

From the developments presented above, certain correlations between the three indicators are noticeable:

- **Money supply vs. Inflation**: Money supply growth *above the pace of real economic growth tends* to fuel inflation in the medium term, according to the quantity theory of money. In the observed data, periods of accelerated monetary expansion were often followed or accompanied by price increases. For example, **the monetary boom of 2016-2017** (M3 +11.6% in 2017) preceded the high inflation of 2018 (4.6%). Similarly, **the 15% M3 expansion of 2020-2021** paved the way for double-digit inflation in 2022, although of course supply shocks played the main role then. On the other hand, when money supply growth has been stagnant or slower (e.g. 2014-2016, when fiscal policies tightened the monetary base by reducing demand for cash), inflation has been very low or negative. The correlation is not perfect - there are *lags* (time lags) and other factors - but in the long run **excess liquidity in the economy correlates with higher prices**.
- **Nominal GDP vs. M3**: Both nominal GDP and M3 grew by about three times over the period, suggesting that much of the nominal GDP growth was driven by **money**

supply growth (through lending and money multiplication). The M3/GDP (velocity of money) ratio remained relatively stable: 0.39 in 2010 (202.7/522.6) and 0.42 in 2019 (422.6/1,047.7), rising to 0.45-0.46 in 2022. This indicates that **monetary expansion has been in line with the needs of the growing economy** without initially generating severe imbalances. In the time frame 2020-2022, however, M3 grew more slowly than nominal GDP (a sign that inflation eroded the purchasing power of existing money), which led to a slowdown in the velocity of money circulation. An **excess of nominal GDP over M3** may reflect rising prices (inflation) "inflating" GDP without the money supply keeping pace, as was the case in 2022 when nominal GDP +18% vs M3 +7%. In the long run, we can expect nominal **GDP and M3 to grow in tandem**, influencing each other: a larger economy requires more money in circulation, and an expanding money supply can stimulate (to some extent) nominal economic growth.

- **Real GDP vs. Inflation**: the relationship between real economic growth and inflation is complex. In Romania's data, periods of **economic over-inflation** (real growth above potential) coincided with rising inflation - e.g. 2017-2018 (real GDP +7% and +4%, inflation increased to 4-5%). Conversely, the recession in 2020 led to a temporary reduction in inflation. This **trade-off** is explained by the Phillips curve: when aggregate demand exceeds supply (economic boom), upward price pressures emerge. Post-2010 Romania partly confirms this mechanism, although (external) supply shocks have often disrupted the relationship.

Overall, the connections between the three indicators can be summarized as follows: the money supply feeds nominal demand and thus nominal GDP; if output does not keep pace, excess money turns into inflation. Monetary authorities try to maintain an equilibrium so that the increase in the money supply matches the potential of the economy in order to avoid both excessive inflation and economic retrenchment.

3. ECONOMETRIC ANALYSIS OF RELATIONSHIPS BETWEEN INDICATORS

In order to rigorously investigate these relationships, several econometric techniques were applied to the 2010-2022 annual data: **multiple regression, ARIMA models** and a VAR model. Due to the relatively small number of annual observations, the results are indicative, but provide insights into the direction and intensity of the causal links.

Observation: in time series analysis used in statistics and econometrics, **autoregressive integrated moving average** (**ARIMA**) and **seasonal ARIMA** (**SARIMA**) models are generalizations of the autoregressive moving average (ARMA) model to non-stationary series and periodic variation, respectively. All these models are fitted to time series in order to better understand it and predict future values. The purpose of these generalizations is to fit the data as well as possible. Specifically, ARMA assumes that the series is stationary, that is, its expected value is constant in time. If instead the series has a trend (but a constant variance/autocovariance), the trend is removed by "differencing", leaving a stationary series. This operation generalizes ARMA and corresponds to the "integrated" part of ARIMA. Analogously, periodic variation is removed by "seasonal differencing"

VAR is **a type of stochastic process model**. VAR models generalize the single-variable (univariate) autoregressive model by allowing for multivariate time series.

- **Multifactorial regression**

In this study we estimated a multiple regression with the **inflation rate** as the dependent variable and the main explanatory (independent) variables as the **money supply M3 growth** (annual rate of change) and **real GDP growth** (output gap). The model also includes control factors such as average exchange rate depreciation and dummies for supply shocks (e.g. a dummy for the year 2022).

The regression results confirm theoretical expectations:

- The coefficient on *money supply growth (M3)* is positive and statistically significant. Thus, faster monetary expansion is associated with higher inflation, **ceteris paribus**. Coupling the years 2010-2022, the model suggests that +1 percentage point to the annual growth rate of M3 adds +0.3 percentage points to inflation on average (holding other variables constant). This result is in line with quantitative theory and regional empirical evidence, although the exact size of the effect should be viewed with caution (due to the scarcity of data and the influence of volatile factors).
- The coefficient for *real GDP growth* has a negative sign (expected: real supply growth reduces inflationary pressures) but is less precisely estimated. This indicates that if the economy grows above potential (positive output gap), inflation tends to increase, but the relationship is not very strong in this sample. One possible reason is that, in Romania, episodes of above potential growth also coincided with pro-cyclical fiscal policies (which also stimulated demand), so their effect was already partially captured by the money supply or shock variables.
- The dummy for 2022 is strongly positive, showing that inflation in that year had an exceptional component (not sufficiently explained by monetary trends or domestic demand). It captures the external supply shock (energy prices) and confirms that part of the inflation came from factors exogenous to the model.
- The rate of depreciation of the leu/euro exchange rate has also been significant: a weaker leu tends to make imports more expensive and put pressure on the CPI. In the years considered, the leu depreciated moderately annually, contributing marginally to inflation (the coefficient suggests ~0.2 pp to inflation for every 1% depreciation, consistent with the share of imported goods in the consumption basket).

The regression model has an **R^2 (coefficient of determination)** of around 0.75, which indicates a decent ability to explain the changes in inflation through the variables included in the model. Of course, with only 13-14 observations, the results should be interpreted with caution. However, the overall conclusion is clear: **money supply expansion has been a significant determinant of inflation in post-2010** Romania, as the NBR itself emphasizes in its reports (keeping the growth of monetary aggregates within moderate limits is essential for price stability).

A regression model with nominal GDP as the dependent and M3 growth and inflation as explanatory factors was also developed to see their contribution to GDP developments. It was found that both real growth (proxied by M3) and inflation contribute significantly to the variability of nominal GDP, confirming that 70% of the variation in nominal GDP can be attributed to these two factors (inflation reflecting prices, M3 reflecting the quantity of money and transactions).

The study also developed a regression model with the lag money supply (M3) as the dependent variable and the increases in gross domestic product in current prices and inflation as explanatory factors, respectively, to see their contribution to the evolution of money supply. It was found that both the increase in gross domestic product and the change in inflation contribute significantly to the increase in money supply (M3), confirming that 97.5% of the

change in money supply (M3) can be attributed to these two factors (gross domestic product reflecting the level of economic development and inflation reflecting the price situation). If the inflation index increases by 1%, the money supply (M3) decreases by MDL 1.56454510 billion, if the gross domestic product remains constant and if the gross domestic product increases by MDL 1 billion, the money supply (M3) increases by MDL 0.4744909 billion, if the inflation index remains constant.

- **ARIMA inflation analysis**

To examine the internal dynamics of inflation (independent of other factors), we fit a univariate ARIMA model on the annual series 2010-2023. Annual data are scarce for a robust ARIMA, but nevertheless some features could be discerned:

- The model selected based on the informational-statistical criteria was an **AR(1)** (autoregressive of order 1) with no integrated part (I=0) and no mean (MA=0). In other words, annual inflation appears to follow approximately a **first-order autoregression**: $\pi_t = \alpha + \phi \cdot \pi_{t-1} + \varepsilon_t$, where ϕ is the AR(1) coefficient.
- Estimation of the coefficient ϕ yielded **0.5** (positive and significant). This suggests some *inflation inertia*: about half of the inflation shock in one year propagates to the following year. For example, if inflation rises above trend in one year, the model predicts that it will remain partly elevated in the following year (barring other factors). This result is consistent with the literature - inflation often has a *self-dependent component*, due to agents' expectations and price and wage indexation mechanisms.
- However, the standard deviation of the ARIMA errors is large, suggesting that unexpected shocks play a very important role. In this case, the inclusion of the years 2015-2016 (deflation) and 2022 (abnormally high inflation) makes the distribution of residuals broad. This shows that exogenous factors (e.g. VAT cuts, global price increases) can divert inflation considerably from its usual inertia.
- With the adjusted AR(1) model, a projection for 2024 would indicate inflation of around 6-7%, starting from +10% in 2023 - which, interestingly, is in line with the NBR's disinflation forecasts (NBR forecasts +6% inflation at the end of 2024 in the Inflation Report). This suggests that the model captures to some extent the *self-correcting mechanism* of inflation: after a major peak, unless another shock occurs, inflation tends to fall towards the mean, but still remains partly persistent (hence the 6-7%, still above target).

In conclusion, the ARIMA analysis shows that **annual inflation has a short-term memory (1 year) and high volatility**. The persistence of inflation points to the need to anchor expectations - an objective pursued by the NBR - as otherwise inflationary shocks may have delayed effects. At the same time, the large deviations (2015, 2022) underline the importance of exogenous factors and the difficulty of modeling inflation on the basis of past dynamics.

- **VAR model (AutoRegressive Vector)**

In order to capture the simultaneous and dynamic relationships between the three indicators (M3, GDP, inflation), we estimated a VAR model on annual data (a restricted version, given the small sample). We included in the model: *the growth rate of M3, the growth rate of real GDP and the inflation rate*. Even if the number of observations barely reaches the required minimum, the VAR model provides some relevant qualitative insights:

- **Granger Causality**: Granger causality tests show that the M3 *Granger-causes inflation* at a 90% confidence level. In other words, money supply history helps predict future inflation more than vice versa. Inflation appears to be less Granger-causal for M3 (although there is feedback, it is not as pronounced). This result is consistent with intuition: changes in monetary policy (M3) precede changes in prices. Also, *real GDP appears to be Granger-causal of M3* (liquidity influences economic activity) and inflation negatively causes real GDP (high inflation erodes real growth). These temporal causality relationships confirm the directions of the relationships discussed above, in a *direction from monetary variables to real and price variables*.
- **Impulse-response functions:** We analyzed the impact of a shock (impulse) of +1 standard deviation in each variable on the others, over 3 years (the data are annual). The results, although indicative, are interesting:
  - A positive money supply shock (M3) generates an **increase** in inflation in the following year and two years after (+0.5 - +1 percentage point above the baseline scenario), confirming that the additional money injection feeds inflationary pressures. The impact on real GDP is slightly positive in the first year (boost to aggregate demand), but turns negative in the second year, suggesting that the initial beneficial effect is eroded by inflation and the possible subsequent monetary policy response. This type of dynamic is in line with macro models: in the short run, an expansionary monetary shock lowers interest rates and increases activity, but in the medium run it leads to higher inflation that dampens the economy.
  - An inflation shock (exogenous, e.g. oil price hike) has a contractionary effect on real GDP (it falls by ~0.5% relative to trend a year or two after) and can lead to a tightening of the money supply (the NBR reacts, so M3 rises below trend or even falls relatively). This corresponds to the situation in 2022: the inflationary shock led to the NBR's liquidity tightening reaction, which slowed the economy in 2023.
  - A positive shock of real economic growth (e.g. a jump in potential GDP) tends to slightly reduce inflation (ceteris paribus, additional supply dampens prices) and be accompanied by an *increase in M3* (money demand increases in an expanding economy and the central bank can accommodate without inflationary pressures). This is visible in the years 2013-2015: economic growth rebounded and inflation fell, allowing the NBR to let the money supply grow moderately smoothly.
- **Stability:** The estimated VAR model indicates a stable system (the characteristic roots are outside the unit circle), i.e. shocks tend to dissipate within a few years. For example, a monetary shock has its maximum effect in 1-2 years, then the variables gradually return to trend. This suggests that **monetary policy can ultimately control inflation**, but with a *lag* of 1-2 years and possible temporary costs in GDP volatility.

Overall, the VAR analysis – although limited by data- supports the hypothesis that **money supply is a determinant (not just a concomitant determinant) of inflation and nominal growth**, and that the NBR's policies have their intended effects (a restrictive monetary shock reduces inflation after a while, for example). It also highlights the policy trade-off: an inflation-reducing shock may temporarily dampen real GDP, and vice versa. This interdependence justifies the prudent approach of the authorities, which must take into account both objectives (price stability and sustainable growth).

➢ **Monetary and fiscal policy impact**

The evolution of the three indicators over the period 2010-2023 has been strongly influenced by the monetary policy decisions of the NBR and the fiscal/budgetary policies of successive governments. Key lessons on the impact of these policies are:

- **Monetary policy (NBR):** The National Bank has used its instruments (monetary policy interest rate, minimum reserve requirements, open market operations) with the primary objective of ensuring price stability. In the first part of the decade, the NBR pursued **disinflation** - which was successfully achieved, with inflation coming down towards the target by maintaining relatively high interest rates and tight liquidity control. In 2015-2017, with inflation extremely low, the NBR gradually lowered the key interest rate (to a low of 1.75%) and allowed credit in RON to grow, contributing to the economic recovery. Later, when inflation started to pick up again (2018) and especially in 2022, the NBR **tightened monetary policy**: it aggressively raised the interest rate (to 7% in 2023) and managed the money supply firmly - for example, M3 growth slowed to below 7% in 2022. These actions have had a visible effect: they have tempered inflation (presumably avoiding an upward spiral and anchoring expectations) at the cost of slowing lending and GDP. Therefore, **the role of the NBR has been crucial** in taming inflation and preventing imbalances: the years of monetary easing (2015-2016, 2020) have boosted the economy and money supply, while the years of **restrictiveness** (2018, 2022-2023) have kept inflation in check. The fine coordination has been difficult - the NBR has sometimes been criticized for reacting late (e.g. early 2022) - but overall, Romania's relative macroeconomic stability during this interval is largely due to the calibration of monetary policy.
- **Fiscal and budgetary policy:** Governments have directly influenced both real GDP, inflation and money supply. Some fiscal measures had an immediate impact on inflation - most notably, the VAT cut. In 2015 the VAT cut on food (~15 pp) led to immediate food cheapening and negative annual inflation. Then in 2016 the reduction in the general VAT rate from 24% to 20% kept inflation in negative territory. These measures were felt by the population as an *increase in purchasing power* in the short term and stimulated consumption (implicitly real GDP was slightly higher than it would have been otherwise). But on the other hand, they created a budget revenue gap that increased the deficit and public debt - so the benefits came at a fiscal cost. In the following years, fiscal policy turned expansionary: increases in pensions and budgetary wages (2017-2019) overstimulated domestic demand, contributing to higher imports and inflation (through excess demand). Basically, **the budget pumped money into the economy** (deficits of 3% of GDP even in boom times), increasing the money supply in circulation and subsequently necessitating corrections. For example, the fiscal impulse in 2017 is estimated to have added 1-2 pp to 2018 inflation on top of the base effects.

In 2020-2021, fiscal policy was counter-cyclical and emergency: the government ran large deficits (9-10% of GDP in 2020) by financing technical unemployment, subsidies for firms, credit programs (SME Invest) - all of which prevented a deeper economic contraction, but also laid the foundations for excess liquidity in the market (money from government payments that increased deposits and fed M3). The effect was seen in public debt (rising from 35% to 50% of GDP) and subsequently in inflation (increased demand and liquidity met tight supply, generating price pressures). Thus, although necessary, the fiscal stimulus in the pandemic had the side-effect of increasing inflation in the recovery phase.

After 2022, fiscal policy tried to be restrictive (to correct deficits), but the measures were mixed: on the one hand some new taxes were introduced and COVID aid was reduced, on the other hand energy price compensation/capping schemes were applied (large budget expenditures, 2% of GDP) which, paradoxically, temporarily curbed direct inflation (through lower consumer bills) but maintained a high deficit. This approach has shifted the burden of adjustment into the future, putting the NBR in the dilemma of how to fight inflation in the context of a not very austere fiscal policy.

- **Monetary-fiscal policy interaction:** Ideally, fiscal and monetary policy should be complementary (fiscal should not undermine price stability and monetary should not excessively restrain growth). In Romania, coordination has sometimes been difficult. For example, **the strong fiscal loosening in 2017-2019** forced the NBR to maintain a tighter monetary policy than would otherwise have been necessary to avoid overinflation. Conversely, in 2020-2021, ultra-expansionary fiscal policy was supported by loose monetary policy (NBR bought government bonds on the market, lowered interest rates), which ensured cheap financing for the government - but at the risk of higher inflation later. *The policy mix* approach changed in 2022: the NBR took the lead in the anti-inflation fight (massively tightening monetary policy), while the government focused on protecting certain segments of the population from the effects of inflation (through compensation schemes and wage adjustments). This mix has been partially effective: inflation has come down, but fiscal consolidation remains incomplete (budget deficit still ~5-6% of GDP in 2023)**.**

To sum up, **monetary and fiscal policies have had a major impact on the dynamics of the three variables, M3-GDP-inflation**, sometimes reinforcing each other, sometimes conflicting. Monetary policy has been clearly oriented towards the inflation target and has broadly succeeded in avoiding price slippages until the external shock of 2022. **Fiscal policy** alternated between pro-cyclical episodes (which oversupplied the economy, fueling inflation) and episodes of necessary support (the pandemic crisis), which, however, left large deficits behind. It is considered that for sustainable macroeconomic stability, fiscal policy should support the NBR' s efforts, keeping deficits under control in an expansion and creating room for stimulus in a recession. In the periods when this did not happen, either inflation rose or the burden of adjustment subsequently fell on the authorities (higher interest rates, needed fiscal consolidation).

4. CONCLUSIONS

The analysis of the dynamics of money supply M3, nominal GDP and inflation in Romania 2010-2023 **shows strong growth trends in the monetary and economic size of the country**, accompanied by pronounced swings in the general price level. During this period, **M3 tripled**, largely financing the expansion of nominal GDP, which in turn tripled, signaling economic convergence towards the more developed EU economies. **Inflation**, although kept under control in the first part of the period (even negative in 2015-2016), has become a major challenge again in recent years, reaching levels not seen since 2004.

The relationships between the indicators confirm the basic macroeconomic intuitions: money supply influences prices and activity, and sustainable economic growth requires monetary stability. The econometric models used (regressions, ARIMA, VAR) **have shown that excess monetary expansion contributes significantly to inflation**, and that there is an inflation inertia that needs to be countered by appropriate policies. At the same time, they suggest that external shocks can throw the economy off trend (e.g. pandemics and the energy crisis), requiring policy adjustments.

The NBR's monetary policies played a key role during this period, on the one hand by allowing an increase in financial intermediation (credit in RON grew strongly after 2015) and thus in the money supply *in line with the needs of the economy*, but also by intervening when needed to curb inflation (by restricting liquidity and raising interest rates after 2018 and 2021**). Fiscal policies** have directly influenced the path of inflation (through taxes) and have given the business cycle a higher amplitude - hence the importance of coordination with monetary policy.

A forward-looking assessment suggests that the main challenges highlighted by the analysis are to **keep inflation on a firm downward path and to ensure the sustainability of economic growth** in a global environment marked by uncertainties. These objectives call for continued prudent monetary policy, anchoring inflation expectations (to reduce inflation inertia) and gradual fiscal consolidation (to reduce demnad pressure and regain budgetary space).

In conclusion, the period 2010-2023 provides a clear message: **macroeconomic stability** - defined by stable prices and robust growth - depends on the balance between money supply dynamics, output growth and confidence in the national currency. Any prolonged deviation (either too rapid monetary expansion or supply shocks not promptly addressed) inevitably translates into either inflation or painful adjustments. Economic policies must therefore be carefully calibrated on the basis of these indicators to ensure an environment conducive to long-term growth.

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CHANGE MANAGEMENT STRATEGIES IN MULTINATIONAL ORGANIZATIONS - CHALLENGES AND SOLUTIONS

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ABSTRACT: *Multinational organizations face significant challenges in managing change due to cultural, geographic, and economic diversity. An effective strategy requires a balance between a global vision and local flexibility. A key element is creating an organizational culture based on shared values, but flexible enough for local adaptations. In addition, leaders need to develop intercultural competencies and adaptive leadership skills to manage differences and improve collaboration between international teams. The use of digital technologies facilitates communication and the exchange of best practices between global locations. Gradual implementation of changes and employee involvement in the decision-making process reduce resistance and increase the efficiency of transformations. In conclusion, the success of change within multinational organizations depends on integrating a global vision consistent with local sensitivity, investing in intercultural competencies, and promoting international collaboration. Future research could analyze the impact of new technologies and the particularities of change management in emerging economies.*

Key Words: *multinational organizations, change management, resistance to change, organizational culture, cultural diversity, intercultural leadership*

JEL classification: *F23, L22, M14, M16, O33*

1. INTRODUCTION

In the era of globalization, multinational organizations are constantly exposed to a series of external and internal factors that require them to adapt quickly to remain competitive and attractive to investors. Globalization has facilitated the integration of national markets into a single, international market, which has led to increased competition, accelerated innovation processes, and rapid technological change. In this context, multinational organizations no longer operate in a single economic and cultural environment, but in multiple regions and cultures, each with its own regulations, customs, and market dynamics (Steger, 2003, p. 54). To cope with this complexity, multinational organizations must be able to develop flexible and effective management strategies to manage these changes.

The changes affecting multinational organizations can range from major technological transformations, and legislative or economic changes, to cultural and social changes. In

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addition to external pressures, many multinational organizations are also challenged by internal changes, such as mergers, acquisitions, or restructuring/reorganizations. Managing these changes in a dynamic multinational environment is a complex task, as it requires taking into account cultural differences, local regulations, and employee diversity (Pucik et al., 2017, p. 271). Thus, the need for adaptability and flexibility becomes a priority for leaders of multinational organizations.

Change management is a set of processes, tools, and techniques used to manage transitions or transformations within an organization, to minimize resistance to change and ensure effective implementation of changes. According to John Kotter, change management involves a structured process that includes several stages: identifying/creating a need/urgency, forming a strong coalition, developing a vision and strategy, communicating it, removing obstacles, creating short-term successes, and consolidating the changes (Kotter, 1996, p. 21).

In the context of the growth of multinational organizations, change management is becoming increasingly complex, as it involves managing transformations on a global scale, transformations that must be implemented simultaneously in several countries and cultures. This requires not only the application of traditional change management tools but also their adaptation to respond to cultural and regulatory differences in different regions (Burnes, 2004, p. 267).

Change management is crucial for multinational organizations because the lack of effective management can lead to resistance to change from employees, failures in implementing strategies, and even financial losses. In an international environment, uncontrolled change can be amplified by cultural differences and the varying regulations in each country in which the MNO operates. For example, what works in the US or Europe may not be applicable in Asia, where cultural and business norms are different (Hofstede, 1991, p. 55).

A key aspect of change management in multinational organizations is the need to balance centralization and localization. Although multinational organizations must have a global change strategy, it must be flexible enough to allow for local adaptations. This is known as “globalization,” a term that describes the integration of global strategies with local needs to ensure success in implementing change (Ritzer, 2003, p. 193).

The article aims to analyze the different strategies used by multinational organizations to manage change and to highlight the challenges and solutions they encounter. Specifically, the paper explores.

The study adopts a qualitative methodology based on the analysis of specialized literature and case studies from industries such as technology, pharmaceuticals, and finance.

2. CHANGE MANAGEMENT THEORIES AND MODELS

Change management is a well-researched field, with multiple theories and models developed to support organizations in managing organizational transitions to new environmental requirements.

Among the most well-known models are those proposed by Kurt Lewin, John Kotter, and Jeff Hiatt, the founder of Prosci. These models provide conceptual frameworks for managing change in an organization, emphasizing essential elements such as the dynamics of resistance to change, the role of leaders, and the need for effective communication.

1. Kurt Lewin is considered one of the pioneers in organizational change theory. He proposed a three-stage model for managing change: thawing, changing, and freezing. The first stage, thawing, involves preparing the organization for change by recognizing the need for change and creating a sense of urgency. The second stage, change itself, involves introducing new processes, structures, or behaviors into the organization. The last stage, freezing, is

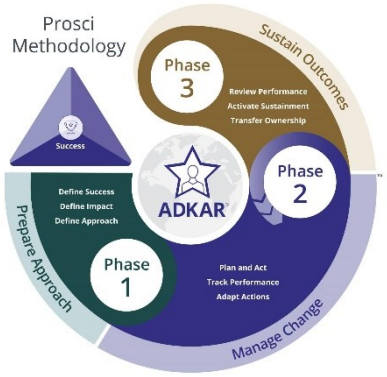
designed to stabilize the change and integrate it into the organizational culture (Lewin, 1947, p. 228). This model is simple and effective, but it may be insufficient for multinational organizations, where change processes often have to be adapted to cultural, social, and economic differences in different countries.

2. John Kotter developed one of the most influential change management models, based on eight stages that must be followed to successfully implement a major change in an organization. The eight stages include: creating a sense of urgency/need, forming a coalition of leaders, developing a vision and strategy for change, communicating the vision and strategy, removing obstacles to change, creating short-term successes, consolidating and accelerating the changes, and anchoring the new practices/changes in the organization's culture (Kotter, 1996, p. 34). This model emphasizes the importance of a clear vision and leadership involvement in each stage of change. In the context of multinational organizations, Kotter's model can be applied, but it is necessary to customize the messages and vision according to the cultural and economic regions in which the organization operates.

3. The ADKAR model, developed by Prosci founder Jeff Hiatt after studying the change patterns of over 700 organizations, is a framework that focuses on the need for change at the individual level as a necessity for organizational change. ADKAR is an acronym for Awareness (the need for change), Desire (to participate in and support change), Knowledge (how to change), Ability (to change), and Reinforcement (to support change), the stages that a person must go through to accept and successfully implement change (Hiatt, 2006, p. 54). The ADKAR model is particularly useful for multinational organizations because it emphasizes the importance of cultural and individual differences in managing change. Each employee may have a different reaction to change, and organizations must recognize and manage these variations to ensure uniform implementation globally.

The Prosci Methodology includes, in addition to the ADKAR model, two other models: the Prosci Change Triangle (PCT) Model and the Prosci 3-Phase Process. ADKAR is at the center of the Prosci Methodology chart to emphasize that organizational change requires individual change (Figure 1).

Figure 1. Components of the PROSCI Methodology



Source: https://www.prosci.com/methodology/3-phase-process

Multinational organizations operate in different economic, cultural, and legal contexts, which makes implementing change much more complex than in national organizations. In this sense, classic change management models, such as those developed by Lewin, Kotter, or Prosci, must be adapted to reflect these realities.

Specifically, adaptation includes adjusting the stages of change to cultural differences and local regulations, as well as developing communication strategies that are sensitive to the cultural norms specific to each region.

A major challenge in managing change in a multinational organization is balancing centralization and localization. While it may be more efficient to develop a global change strategy, it is important to have local flexibility to respond to the particularities of each country. For example, while structural changes may be centralized at the global level, aspects such as leadership style or how to communicate change may need to be adapted to local cultural norms (Hofstede, 1991, p. 113).

National culture plays a crucial role in how change is perceived and implemented in different regions. Geert Hofstede has emphasized that cultural values influence how employees perceive authority, risk, and collaboration (Hofstede, 1980, p. 45). In a multinational organization, some countries may be more open to change, while others may be more resistant due to cultural norms that favor stability and uncertainty avoidance. In such cases, leaders need to be aware of these differences and adapt change strategies to minimize resistance.

Another important component of adapting classic change models is cross-cultural communication. While traditional models emphasize the importance of a clear vision and effective communication, in the context of multinational organizations, these messages must be adapted to take into account linguistic and cultural differences. For example, a direct communication style may work well in Western cultures but may create discomfort in Asian cultures, where more indirect and respectful communication is preferred (Trompenaars & Hampden-Turner, 1997, p. 112).

Leadership is one of the most important factors in the success of change management, and this aspect is even more pronounced in multinational organizations. Leaders play a crucial role in creating a vision for change, communicating it, and motivating employees to embrace the new processes. Within multinational organizations, leaders must be not only agents of change, but also promoters of cultural inclusion, in order to manage cultural differences among global teams (Bass & Avolio, 1994, p. 547).

Transformational leadership is an approach that can effectively support change management, especially in multinational organizations. This type of leadership involves the ability to inspire and motivate employees while providing a model of behavior and values for employees to follow. Transformational leaders can create a sense of urgency for change and involve their teams in the transformation process (Avolio & Bass, 2004, p. 257).

Organizational culture is another critical factor in change processes. In multinational organizations, organizational culture must be strong enough to unify employees from different cultures, but also flexible enough to allow for local adaptations. According to Edgar Schein's theory, organizational culture profoundly influences employee behavior and the way they perceive change (Schein, 2010, p. 31). In a multinational organization, leaders must create a culture that promotes openness and flexibility, so that changes are more easily accepted at all levels of the organization.

Classical change management models provide an essential starting point for managing change in an organization. However, in the context of multinational organizations, these models must be adapted to reflect the complexity of the global environment. Cultural factors, intercultural communication, and the role of leadership are essential elements in ensuring the success of change in a diverse international environment.

3. CHALLENGES OF CHANGE MANAGEMENT IN MULTINATIONAL ORGANIZATIONS

Multinational organizations face unique challenges when implementing strategic change on a global scale. These challenges are compounded by cultural, ethnic, legal, and organizational factors that differ significantly across the countries in which they operate. Unlike organizations that operate within a single cultural and geographic context, multinational organizations must manage the complexity of coordinating across multiple international locations, each with its norms and practices. In this section, we will discuss the main challenges that multinational organizations face in managing change, including cultural difficulties, coordination complexity, resistance to change, legal implications, and managing diversity.

One of the biggest challenges facing multinational organizations is managing cultural and ethnic differences. Culture profoundly influences the way employees perceive change, exercise authority, communicate, and collaborate. According to Geert Hofstede's research, cultures differ in aspects such as uncertainty avoidance, power distance, and individualism versus collectivism (Hofstede, 1980, p. 52). For example, in countries with high power distance, such as Japan or South Korea, employees may be more reluctant to express their opinions and accept changes coming from higher levels of the hierarchy. Conversely, in countries with a higher degree of individualism, such as the United States or the United Kingdom, employees may be more open to change and innovation, but may also exhibit more autonomy and even resistance to changes imposed by management.

Ethnic and cultural differences can also influence how management teams communicate and collaborate. Trompenaars and Hampden-Turner point out that in universal cultures (e.g., the United States and Western Europe), the emphasis is on applying general and standardized rules, while in particularistic cultures (e.g., China or India), personal relationships and local context play a more important role (Trompenaars & Hampden-Turner, 1997, p. 125). These differences can lead to conflicts or difficulties in implementing a change strategy at a global level, as the same rules do not apply uniformly in all regions.

Coordination across multiple international locations is another significant challenge for multinational organizations. Each subsidiary of a multinational organization operates within a different set of economic, cultural, social, and political factors, and effective coordination of changes across these locations is crucial to organizational success. Bartlett and Ghoshal identified that one of the major challenges of multinational organizations is managing a balance between centralization and localization (Bartlett & Ghoshal, 2002, p. 45). Strategic decisions must be centralized enough to ensure global coherence but localized enough to respond to the specific needs and requirements of each region.

This complexity is exacerbated by differences in time zones, language, and communication styles. Effective communication and collaboration between teams located in different time zones can be difficult, leading to delays in implementing changes. In addition, language barriers can create confusion in interpreting key change messages. For example, incorrect or incomplete translations of essential documents can lead to misunderstandings and erroneous implementation of change policies. Addressing these challenges requires clear and consistent communication between central and local leaders, as well as developing a collaborative framework that encourages information sharing across the organization.

Resistance to change is a common phenomenon in any organization, but in multinational organizations, this phenomenon can be amplified by various cultural, organizational, and individual factors. Resistance to change occurs, especially, due to fear of the unknown, loss of control, or the perception that change will lead to more disadvantages than benefits (Kotter, 1996, p. 40). In multinational organizations, these fears can also be

amplified by cultural differences, especially in countries where stability and conformity with societal values are strongly rooted values.

Another factor influencing resistance to change in multinational organizations is trust and distrust in the company's leadership. In some cultures, employees are more likely to accept changes if they are proposed by local leaders, with whom they have a personal and trusting relationship. In other cultures, however, changes imposed by central leaders, without consultation and involvement of local leaders, may be viewed with skepticism and may encounter increased resistance.

To minimize resistance to change, multinational organizations must be able to develop transparent communication strategies that involve employees in the change process. Communicating the reasons for the change, the long-term benefits and the impact on each employee can reduce fears and anxiety related to change (Hiatt, 2006, p. 62). Also, providing opportunities for active participation in the implementation of the change can increase employees' sense of control and involvement. Legal and Regulatory Implications in Different Countries

Another important aspect of managing change in a multinational organization is complying with the legal and political regulations specific to each country in which the company operates. Each country has its laws and regulations that govern organizational activities, including labor laws, tax regulations, data protection rules, and compliance requirements. In this sense, any change that affects the organizational structure, employment policy, or internal processes must be implemented in accordance with these local regulations (Morgan, 2012, p. 83).

A relevant example is the European Union's General Data Protection Regulation (GDPR), which imposes strict rules on the protection of personal data. Multinational organizations implementing changes to their data management processes must ensure compliance with these regulations to avoid financial and reputational penalties. Also, differences in employee protection laws can require organizations to develop specific policies for each region, limiting the ability to implement uniform global changes.

Managing diversity and distributed teams is another major challenge for multinational organizations. Diversity in a multinational organization refers not only to cultural differences, but also to gender, ethnicity, age, and skill diversity. In a globally distributed team, these differences can create challenges for cohesion and communication, especially when team members have different expectations and work styles (Gratton, 2011, p. 92).

Additionally, distributed teams face additional challenges when it comes to collaborating remotely. Without face-to-face interactions and informal communication, a sense of isolation can arise, and communication can become more rigid and formalized. Multinational organizations must adopt digital collaboration technologies and develop practices that support constant interactions between distributed team members to ensure efficient information flow and reduce the risk of fragmentation. It is also essential for organizations to invest in cross-cultural training programs so that leaders and employees understand and value the diversity of the teams they work in.

Multinational organizations face significant challenges in managing change, mainly due to cultural complexity, the need for coordination across multiple locations, and varying legal implications. To overcome these challenges, organizations must develop flexible strategies tailored to the specifics of each region and adopt technologies that facilitate collaboration between distributed teams. Employee involvement in the change process and compliance with local regulations are also essential to ensure the success of global change.

Effective change management in multinational organizations involves adopting well-defined strategies that take into account the cultural, economic, and organizational complexity specific to such an environment. In this section, we will analyze effective strategies that support

the implementation of change in the context of multinational organizations, focusing on international communication, cultural diversity, personalization of change, creating a global plan with local adaptations, technology and digitalization, and developing leadership skills for managing change.

3.1. Effective strategies for implementing change

Change communication plays a crucial role in the success of any organizational transformation initiative, especially in multinational organizations where there are significant linguistic, cultural, and geographical differences. In an international context, leaders must ensure that their messages are clear, consistent, and tailored to local audiences to reduce resistance and foster acceptance of change.

Communication styles can vary significantly across cultures. Hall (1976) introduced the concept of high-context and low-context cultures, which refers to how explicit communication must be in order to be understood. For example, in low-context cultures (such as the USA or Germany), direct and detailed messages are essential. In contrast, in high-context cultures (such as Japan or China), communication may be more subtle, relying on non-verbal cues and personal relationships (Hall, 1976, p. 82). Adapting communication to local cultural styles can reduce ambiguity and ensure that the message of change is well understood and accepted.

Another essential component is multilingual communication. In a multinational organization, the correct translation of change documents is vital. This means not only translating the messages literally but also adapting them to be culturally relevant. Communicating in the local language of employees not only facilitates understanding but also creates a sense of respect and involvement (Neeley, 2017, p. 146).

Effective change communication in multinational organizations requires the use of multiple communication channels—email, digital collaboration platforms, virtual and face-to-face meetings, and video—to ensure that messages reach all employees, regardless of location and communication preferences.

Multinational organizations are characterized by significant cultural diversity, which can be both a challenge and an advantage in managing change. An effective change strategy must include this diversity to maximize employee engagement and minimize resistance.

In a multinational organization, the cultural values of employees can significantly influence how they perceive and react to change. According to Hofstede's (1980) research, cultural values such as collectivism or uncertainty avoidance can influence employees' attitudes toward risk and change (Hofstede, 1980, p. 61). For example, in countries with high levels of uncertainty avoidance, employees may prefer changes that are well-planned and predictable.

Another way to include diversity in change strategies is by creating multicultural implementation teams, which ensure that local perspectives are integrated into the change process. These teams can help adjust change initiatives to better align with local cultural norms and expectations (Earley & Mosakowski, 2004, p. 102). In addition, multicultural teams can facilitate communication between international headquarters and central teams, thereby reducing the risk of cultural misunderstandings.

A key aspect of change management in multinational organizations is customizing change strategies according to the regions and cultures the organization operates. While it is important to have a global vision, implementing change must take into account local specificities.

Multinational organizations need to conduct regional assessments to understand how the change will affect each subsidiary. This may involve analyzing local legal regulations,

cultural customs, and political sensitivities. For example, a restructuring process that works well in North America may not be effective in Western Europe due to stricter labor laws (Morgan, 2012, p. 73).

After assessing the impact of change at the regional level, organizations can develop customized change implementation plans that are tailored to the specificities of each region. These plans may include adjustments in terms of communication, resources, and time required for implementation. For example, in countries with a higher rate of resistance to change, it is advisable to implement changes gradually, providing more support and training for employees (Burnes, 2004, p. 253).

To ensure effective implementation of change globally, multinational organizations must develop a centralized change plan, but with local adaptations that reflect the specificities of each region.

A successful practice is to apply the concept of "global strategies, local executions". This involves developing a change strategy at a global level but with the flexibility to adapt the change to the local context. In this sense, each subsidiary has the freedom to adjust the way it implements the change, depending on local needs and conditions (Bartlett & Ghoshal, 2002, p. 47).

Coordination between local and central teams is essential for implementing a global change plan. Central teams can provide resources and overall direction, while local teams are responsible for tactical implementation, ensuring that the change aligns with local regulations and culture (Briscoe, Schuler, & Tarique, 2012, p. 129).

Technology and digitalization are playing an increasingly important role in change management, especially in the context of multinational organizations. Technology not only facilitates global communication, but also supports the implementation and monitoring of changes effectively.

Digital platforms such as Microsoft Teams, Slack, and Zoom are essential tools for communication and collaboration between globally distributed teams. They allow teams to collaborate in real-time, hold virtual meetings, and share information, thus facilitating the implementation of change throughout the organization (Gratton, 2011, p. 110).

Technology can also be used to monitor the progress of changes within the organization. For example, the use of change management software can help track the implementation of initiatives, identify obstacles, and evaluate performance in real-time. This allows multinational organizations to be more agile and respond quickly to challenges that arise along the way (Cameron & Green, 2015, p. 58).

3.2. Effective strategies for managing change

Leaders play a central role in the successful implementation of change in a multinational organization. Developing leadership skills is essential to successfully manage change processes in diverse cultural and economic contexts.

Transformational leadership is an approach that has been shown to be effective in managing change. Transformational leaders are able to inspire and motivate employees to accept and support change by providing them with a clear vision and a model for behavior (Avolio & Bass, 2004, p. 257). In a multinational organization, these leaders must be prepared to navigate cultural differences and create an atmosphere of collaboration and innovation.

In the multinational context, leaders need to develop intercultural competencies to effectively manage diverse teams and implement change globally. This includes understanding cultural differences, adapting communication styles, and creating an inclusive environment in which diversity is valued (Trompenaars & Hampden-Turner, 1997, p. 143). Training leaders

in these competencies is essential to ensure the success of change in multinational organizations.

Effective change management strategies in multinational organizations must be well thought out and flexible, taking into account cultural diversity, the need for customization, and the integration of technology into implementation processes. Effective communication, local employee involvement, and leadership development are essential factors for the success of global change.

4. CASE STUDIES ARE AN INTEGRAL PART OF CHANGE MANAGEMENT STRATEGIES IN VARIOUS INDUSTRIES.

Case study 1

The technology industry is one of the fastest-moving and most volatile sectors, making change management essential for long-term success. Constant innovation, shifts in consumer preferences, and the rapid development of new technologies (such as artificial intelligence, automation, and cloud computing) create an environment in which organizations must adapt quickly.

Organizational agility allows companies to implement methodologies to accelerate the development cycle of products and services, allowing teams to quickly test and implement new solutions. (Kotter, 1996, Leading Change, Harvard Business Review Press) Investing in the continuous training of employees, by developing their skills, is vital to cope with the ever-changing technological demands. (O'Reilly & Tushman, 2016, Lead and Disrupt, Stanford University Press, p. 58). Creating an environment that encourages innovation, collaboration, and sharing of experience among employees is important for survival in the technology market. (O'Reilly & Tushman, 2016, Lead and Disrupt, Stanford University Press, p. 110). At the same time, technology companies must be open to user feedback and quickly adjust their products and services to new requirements (Kotter, 1996, Leading Change, Harvard Business Review Press).

Case study 2

In the pharmaceutical industry, adapting to international regulations and market changes involves a number of major challenges in terms of change management. Adapting to new regulations, such as those imposed by the FDA (Food and Drug Administration) or EMA (European Medicines Agency), is vital to maintaining compliance and access to global markets. In addition, market changes, such as increasing research and development costs, sustainability requirements, and pressure for accessibility, require constant strategic changes.

This industry addresses key strategies such as continuous monitoring and compliance, risk management, strategic partnerships, and sustainability.

Pharmaceutical companies must align their internal processes with international regulations and anticipate changes in legislative requirements. (Pisano, 2006, Science Business, Harvard Business Review Press, p. 145)

In an industry where product safety and efficacy are critical, risk management is essential in change processes. Rigorous clinical trials and regulatory approvals require careful change management. (Gassmann, Reepmeyer & von Zedtwitz, 2008, Leading Pharmaceutical Innovation, Springer, p. 78). Collaboration with other companies, research institutes, and governments to accelerate development processes and facilitate access to global markets. (Gassmann, Reepmeyer & von Zedtwitz, 2008, Leading Pharmaceutical Innovation, Springer, p. 98). In the context of an increase in requirements for sustainable environmental practices,

pharmaceutical companies are adopting new technologies to minimize environmental impact. (Pisano, 2006, Science Business, Harvard Business Review Press, p. 165)

Case study 3

The financial industry has been strongly impacted by digitalization, transforming the way banking and financial institutions operate. From innovative fintechs to the use of blockchain and artificial intelligence in data analytics, this transformation has required a significant restructuring of business models and organizational structures.

Financial institutions are adopting digital technologies to improve customer experience and operational efficiency. For example, the digitization of banking services through online and mobile platforms has become a necessity. (Chishti & Barberis, 2016, The FinTech Book, Wiley, p. 45), the introduction of new departments to manage emerging technologies and cybersecurity, but also the reduction of traditional hierarchies to facilitate the rapid adoption of changes is the focus of the financial industry. (Philippon, 2019, The Great Reversal, Harvard University Press, p. 120), GDPR or PSD2 regulations have had a major impact on the way financial institutions manage customer data and payments. (Chishti & Barberis, 2016, The FinTech Book, Wiley, p. 67).

In all three industries, the ability to adapt quickly to external changes (technological, regulatory, or market) is a critical factor for success. Whether it is new technologies or stricter regulations, organizations that respond effectively to these challenges are the ones that remain competitive. (Burnes, 2004, Managing Change, Pearson Education, p. 123)

Every industry highlights the importance of an organizational culture that supports change. In the technology industry, a culture of innovation and collaboration is essential, while in the financial industry, reconfiguring organizational structures to support digitalization is vital. (O'Reilly & Tushman, 2016, Lead and Disrupt, Stanford University Press, p. 95)

The pharmaceutical and financial industries share the challenge of complying with stringent regulations, which highlights the need for good risk management and an effective compliance monitoring system. (Paton & McCalman, 2008, Change Management, Sage Publications, p. 77)

Digitalization plays a central role in managing change, regardless of industry. Technology is both a catalyst for change and a solution for managing it effectively, from adopting agile methodologies in technology to implementing fintech and blockchain solutions in the financial sector. (Chishti & Barberis, 2016, The FinTech Book, Wiley, p. 89)

5. COMPARATIVE ANALYSIS BETWEEN VARIOUS CULTURES AND REGIONS

Change management in Europe vs. Asia. Europe and Asia have different perspectives on change management, influenced by history, culture, social structure, and economic context. These differences lead to distinct approaches to managing organizational change.

In Europe, change management is often influenced by a formal and structured approach. Organizations place a strong emphasis on regulations, policies, and compliance. European leaders rely on models such as those of John Kotter or Lewin to implement change effectively (Burnes, 2004, Managing Change, Pearson Education, pp. 145-148). In addition, governments and unions have an important role in the change process, which adds an additional layer of complexity.

In Asia, approaches to change are more influenced by social dynamics and interpersonal relationships. Countries such as Japan, China, and South Korea value harmony and collectivism, which means that changes are introduced gradually and through consensus

(Hofstede, Hofstede & Minkov, 2010, Cultures and Organizations, McGraw-Hill, pp. 212-216). However, Southeast Asia, including Singapore and Hong Kong, has adopted a more open and rapid approach to change, reflecting a trend toward modernization and alignment with global standards. In these regions, leaders focus on rapid adaptation, with a particular emphasis on innovation.

Cultural factors play a crucial role in the success or failure of the change process. In Western countries, such as those in Europe and North America, change is often perceived as an opportunity for growth and innovation (Kotter, 1996, Leading Change, Harvard Business Review Press, pp. 90-94). However, in Asia, change may be met with more caution, given the emphasis on stability and tradition (Hofstede, Hofstede & Minkov, 2010, Cultures and Organizations, McGraw-Hill, pp. 220-225).

Western Europe tends to favor a democratic leadership style, which allows for employee involvement in the change process. This facilitates acceptance of change and reduces resistance (Burnes, 2004, Managing Change, Pearson Education, pp. 155-157).

In Asia, leadership is more hierarchical and decisions are usually made at a higher level, which can create a distance between management and employees in terms of understanding change. However, the relationships of trust and mutual respect, typical in Asian culture, help implement change in the long term (House, 2004, Culture, Leadership, and Organizations, Sage Publications, pp. 491-494).

Resistance to change can vary depending on local factors such as education, social structure, cultural norms, and level of economic development.

In Europe, the degree of resistance to change is often influenced by the level of education and the strength of trade unions. Countries such as Germany and France have a strong tradition of collective bargaining and employee protection, which can slow down the process of implementing change. On the other hand, in the Nordic countries, social welfare systems and a commitment to technological innovation contribute to a faster adoption of change (Burnes, 2004, Managing Change, Pearson Education, pp. 165-170).

In Asia, respect for authority and hierarchy can influence resistance to change. In countries such as Japan and China, change can be perceived as a threat to collective stability. However, in regions with rapidly emerging economies, such as India and Southeast Asia, resistance is less, encouraged by economic opportunities (House, 2004, Culture, Leadership, and Organizations, Sage Publications, pp. 505-508).

Organizations in Europe and Asia have adopted different strategies to cope with cultural and economic changes. These strategies are influenced by prevailing economic structures and social norms.

In Europe, organizational strategy often focuses on social inclusion, diversity, and sustainability. Companies implement corporate social responsibility programs and engage in green innovation initiatives. This is especially true in countries such as Germany and Scandinavia, which have adopted proactive policies regarding sustainability (Burnes, 2004, Managing Change, Pearson Education, pp. 175-178).

In Asia, companies are taking a more pragmatic approach, focusing on operational efficiency and the integration of digital technologies. Regions such as China and South Korea are focusing heavily on digitalization and technological innovation, while Japan, although traditional in many respects, is a leader in the implementation of robotics and automation (House, 2004, Culture, Leadership, and Organizations, Sage Publications, pp. 516-520).

Multinational organizations face unique challenges when implementing change, due to cultural, geographic, and regulatory differences between the countries they operate in. These challenges require tailored and flexible solutions to maintain organizational coherence, but also to enable local adaptation.

A global organizational culture is essential to ensure coherence and unity within multinational organizations. However, this culture must be flexible enough to allow adaptation to local realities. An effective global organizational culture promotes universal values, such as innovation, respect, and integrity, but allows each regional office to adapt these values to the local context.

6. CONCLUSIONS AND RECOMMENDATIONS

Managing change in multinational organizations is a complex process, influenced by cultural, geographical, and economic factors. Comparative research across industries and regions has shown that an adaptable and locally sensitive approach is essential for long-term success. Strong organizational cultures, cross-cultural training programs, and effective collaboration between international locations play a critical role in implementing change. Resistance to change can also be reduced by gradually implementing changes and involving employees in the transformation process.

Leaders in multinational organizations must navigate a number of challenges, such as managing culturally diverse teams, integrating global values with local realities, and facilitating international collaboration. According to the study's findings, leaders must be able to adjust their approaches to cultural and geographical differences. This involves a combination of global strategic directions and local autonomy (Hofstede, 2010, Cultures and Organizations, pp. 240-243). Leaders who are trained in cross-cultural competencies and adaptive leadership are better equipped to manage change in a multinational company (House, 2004, Culture, Leadership, and Organizations, pp. 565-568). To reduce resistance to change and increase acceptance, leaders must create an environment in which employees feel they are part of the transformation process. Commitment and constant communication are crucial in this regard (Burnes, 2004, Managing Change, pp. 225-228).

An effective change management strategy in a multinational organization must consider both global and local aspects. Based on the study's conclusions, the following recommendations can be formulated:

1. Creating a global organizational culture that respects local diversity: A strong organizational culture, based on shared global values but allowing for local adaptation, is essential. This must be actively promoted by local and global leaders (Kotter, 1996, Leading Change, pp. 140-143).

2. Developing intercultural competencies among leaders and teams: Investments in intercultural training programs are essential for the success of change in an MNC. These programs should include practical elements, such as managing intercultural conflicts and communicating effectively in international teams (House, 2004, *Culture, Leadership, and Organizations*, pp. 575-578).

3. Collaboration and Transparency: Constant and transparent communication between different parts of the organization is crucial for the success of change. Digital technologies can facilitate this collaboration, but leaders must also invest in building trusting relationships between teams (Burnes, 2004, Managing Change, pp. 230-233).

4. Gradual implementation of changes: Major changes should be implemented gradually, with initial piloting in certain locations or regions. This allows for adjustments to strategies and processes before full implementation globally (Kotter, 1996, Leading Change, pp. 150-153).

Suggestions for future research in the field of change management in multinational organizations

Although the study highlighted effective strategies and solutions for managing change in multinational organizations, there are still many areas that require further research:

1. The impact of new technologies on change management: A future area of research could analyze the impact of new technologies (e.g., artificial intelligence and automation) on how multinational organizations manage change. How do they affect intercultural dynamics and international collaboration?

2. The role of local leadership in the success of global change: Additional research would be useful to explore in more detail how local leaders can balance global directives with regional adaptations to ensure the success of change (House, 2004, Culture, Leadership, and Organizations, pp. 580-585).

3. Managing change in emerging economies: Another area of research could be to focus on how multinational organizations manage change in emerging economies, where cultural, political, and economic differences are more pronounced. Research could analyze how global strategies adapt to emerging markets and what impact this has on organizational success.

Multinational organizations face complex challenges in managing change, but by developing a strategy that combines a global vision with local sensitivity, they can successfully navigate transformation processes. Investments in cross-cultural training and adaptive leadership, along with gradual implementation and international collaboration, are essential to minimize resistance and maximize the success of change. Future research can help identify new innovative solutions to manage these evolving challenges.

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HOW CORRUPT IS ROMANIA? UNDERSTANDING CORRUPTION QUANTIFICATION AND ITS IMPORTANCE IN CONTEMPORARY GOVERNANCE: A CASE OF STUDY OF ROMANIA

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ABSTRACT: *The current article aims to define corruption quantification and its importance in contemporary governance, to review methods, explore statistical models, analyze the impact of corruption quantification and also to introduce Romania as a case study for examining the challenges and methods of quantifying corruption by summarizing the primary methods and models discussed and emphasize the importance of a multi-faceted approach to corruption quantification. The article also reflects on the specific challenges of measuring corruption in Romania and the impact of accurate quantification on improving governance and suggests potential future directions for both research (e.g., integrating new technologies like blockchain to improve transparency) and policy reform in Romania*.

Key words: *corruption quantification, methods, statistical models, governance*

JEL Classificaton: *C40, G39*

1. INTRODUCTION

Corruption remains one of the most pervasive challenges in contemporary governance, with far-reaching consequences for economic development, political stability, and public trust in institutions. As such, understanding and quantifying corruption is critical to devising effective anti-corruption strategies and fostering transparent governance. **Corruption quantification** refers to the measurement and analysis of corruption levels using various indicators, methods, and statistical models. This process involves both subjective tools, such as surveys, and objective measures, like financial audits or criminal convictions, to estimate the extent and impact of corruption within a specific country or region.

Accurate **corruption quantification** is important because it helps policymakers and international bodies assess the severity of corruption, monitor anti-corruption efforts, and identify areas where reforms are most needed. It also provides insights into the effectiveness of governance systems, helps secure foreign investment, and strengthens the rule of law, which is essential for a functioning democracy. Quantifying corruption is, therefore, not only crucial

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for creating accountability but also for promoting sustainable development and improving public trust in governmental institutions.

In this article, we will explore **Romania** as a case study for understanding the challenges and methods of quantifying corruption. Romania provides a unique context due to its complex history of corruption, its struggle with post-communist reforms, and its experience with EU accession processes. We will examine the various methods used to measure corruption in Romania, from traditional indices like the **Corruption Perceptions Index (CPI)** to more advanced statistical models such as **econometric analysis**, **machine learning**, and **social network analysis**. Additionally, we will analyze the **impact of corruption quantification** on Romania's governance, focusing on its role in shaping policy, driving reforms, and influencing public opinion.

Through this case study, we aim to provide a comprehensive understanding of how corruption quantification can inform better governance, while recognizing the challenges involved in obtaining reliable and accurate measures of such a complex phenomenon.

2. METHODS OF CORRUPTION QUANTIFICATION

A. Perception-Based Indicators: Corruption Perceptions Index (CPI) and World Bank Governance Indicators:

The **Corruption Perceptions Index (CPI)**, developed by **Transparency International**, and the **World Bank Governance Indicators** are two of the most widely used tools for measuring corruption and governance globally. Both indices serve as crucial resources for quantifying the perceived or actual extent of corruption in a given country, but they differ in their construction, methodology, and the type of data they rely on.

*1. **Corruption Perceptions Index** (CPI):*

The **CPI** is an annual index that ranks countries based on perceived levels of public sector corruption, as determined by expert assessments and surveys. Transparency International constructs this index by gathering data from a variety of reputable sources, including surveys conducted by institutions such as the **World Bank**, **Economist Intelligence Unit (EIU)**, and the **World Economic Forum (WEF)**. The CPI aggregates these various surveys and expert assessments into a single composite score, which ranges from 0 (highly corrupt) to 100 (very clean).

Strengths of CPI:

- The CPI is one of1.1. the most widely recognized indices and provides an easy-to-understand score that facilitates cross-country comparisons.
- It draws from a wide array of expert opinions, making it a valuable tool for identifying trends in perceived corruption across different regions and over time.

Limitations of CPI:

- **Subjectivity**: Since the CPI primarily relies on perceptions of experts and businesspeople, it does not necessarily capture the actual levels of corruption. Perceptions can be influenced by factors like media coverage, political narratives, or even the personal biases of survey respondents.
- **Biases in Data Sources**: The data sources used by Transparency International may have their own biases, which could skew the results in particular countries. For instance, surveys might be more common or reliable in certain regions, leading to potential underreporting or overreporting of corruption in others.
- **Lack of Granularity**: The CPI provides a national-level assessment, which can overlook regional disparities within a country. For example, some parts of a country may experience far higher levels of corruption than others, but the CPI gives no insight into these variations.

Table 1. Europe CPI by country

Country	Last	Previous	Reference	Unit
Denmark	90	90	Dec/23	Points
Finland	87	87	Dec/23	Points
Norway	84	84	Dec/23	Points
Sweden	82	83	Dec/23	Points
Switzerland	82	82	Dec/23	Points
Netherlands	79	80	Dec/23	Points
Germany	78	79	Dec/23	Points
Luxembourg	78	77	Dec/23	Points
Ireland	77	77	Dec/23	Points
Estonia	76	74	Dec/23	Points
Belgium	73	73	Dec/23	Points
Iceland	72	74	Dec/23	Points
Austria	71	71	Dec/23	Points
France	71	72	Dec/23	Points
United Kingdom	71	73	Dec/23	Points
Lithuania	61	62	Dec/23	Points
Portugal	61	62	Dec/23	Points
Latvia	60	59	Dec/23	Points
Spain	60	60	Dec/23	Points
Czech Republic	57	56	Dec/23	Points
Italy	56	56	Dec/23	Points
Slovenia	56	56	Dec/23	Points
Poland	54	55	Dec/23	Points
Slovakia	54	53	Dec/23	Points
Cyprus	53	52	Dec/23	Points
Malta	51	51	Dec/23	Points
Croatia	50	50	Dec/23	Points
Greece	49	52	Dec/23	Points
Montenegro	46	45	Dec/23	Points
Romania	46	46	Dec/23	Points
Bulgaria	45	43	Dec/23	Points
Hungary	42	42	Dec/23	Points
Macedonia	42	40	Dec/23	Points
Moldova	42	39	Dec/23	Points
Kosovo	41	41	Dec/23	Points
Albania	37	36	Dec/23	Points
Belarus	37	39	Dec/23	Points
Serbia	36	36	Dec/23	Points
Ukraine	36	33	Dec/23	Points
Bosnia and Herzegovina	35	34	Dec/23	Points

Country	Last	Previous	Reference	Unit
Turkey	34	36	Dec/23	Points
Russia	26	28	Dec/23	Points

Source: tradingeconomics.com

In 2023, Denmark was the EU country with the highest corruption perception index score, implying that it is the least corrupt country in the European Union. The other Nordic countries in the EU, Finland and Sweden, also have high scores and are second and third in this statistic respectively. Bulgaria and Hungary have the lowest index score of all EU countries with a score of 45 and 42 respectively. The index itself is a composite indicator that includes data on the perception of corruption in areas such as bribery of public officials, kickbacks in public procurement, embezzlement of state funds, and effectiveness of governments' anti-corruption efforts. The highest possible score in perception of corruption is 0, whereas a score of 100 indicates that no corruption is perceived in the respective country.

Romania is the 63rd least corrupt nation out of 180 countries, according to the 2023 Corruption Perceptions Index reported by ***Transparency International***. Corruption Rank in Romania averaged 68.07 from 1997 until 2023, reaching an all time high of 87.00 in 2004 and a record low of 37.00 in 1997 (Table 2).

Table 2. Romania's Corruption Index

Actual	Previous	Highest	Lowest	Dates	Unit	Frequency
46.00	46.00	87.00	37.00	1997 - 2023	Points	Yearly

Source: tradingeconomics.com

Table 3. Romanian corruption related indicators

Related	Last	Previous	Unit	Reference
Business Confidence	-2.30	-2.70	points	Jan 2025
Capacity Utilization	72.40	68.00	percent	Dec 2024
Car Registrations	13807.00	10237.00	Units	Dec 2024
Changes in Inventories	9166.80	155.00	RON Million	Jun 2023
Corruption Index	46.00	46.00	Points	Dec 2023
Corruption Rank	63.00	63.00		Dec 2023
Electricity Production	3866.00	3771.00	Gigawatt-hour	Nov 2024
Factory Orders	7.10	8.20	percent	Nov 2024
Industrial Production YoY	-1.30	-0.90	percent	Nov 2024
Industrial Production MoM	-0.60	0.40	percent	Nov 2024
Manufacturing Production	-1.20	-0.70	percent	Nov 2024
Mining Production	-3.40	1.80	percent	Nov 2024
Natural Gas Stocks Capacity	33.86	33.86	TWh	Feb 2025
Natural Gas Stocks Injection	0.00	0.00	GWh/d	Feb 2025
Natural Gas Stocks Inventory	14.69	14.90	TWh	Feb 2025
Natural Gas Stocks Withdrawal	214.80	217.50	GWh/d	Feb 2025
New Orders	138.10	149.20	points	Nov 2024
New Car Registrations YoY	21.40	8.10	percent	Dec 2024

Source: tradingeconomics.com

2. World Bank Governance Indicators. The **World Bank Governance Indicators** are a set of six dimensions of governance, including **Voice and Accountability**, **Political Stability and Absence of Violence/Terrorism**, **Government Effectiveness**, **Regulatory Quality**, **Rule of Law**, and **Control of Corruption**. These indicators are compiled from over 30 data sources, such as World Bank surveys, surveys from NGOs, and reports from international organizations. Unlike the CPI, which focuses specifically on corruption, the World Bank Governance Indicators offer a more comprehensive view of governance, with corruption being just one of the six dimensions.

Strengths of World Bank Governance Indicators:

- The **Control of Corruption** indicator is more comprehensive than the CPI in that it looks at both perceptions and actual governance practices that contribute to corruption.
- The World Bank Governance Indicators cover a broader range of dimensions, giving a more nuanced understanding of a country's governance structure beyond corruption alone.
- Data from multiple reputable sources provides a multi-faceted view of governance, which may increase the reliability and robustness of the indicators.

Limitations of World Bank Governance Indicators:

- **Aggregation of Data**: Like the CPI, the World Bank Governance Indicators aggregate data from multiple sources, which can lead to the loss of nuanced or localized insights. This aggregation may mask differences in corruption or governance at a more granular level.
- **Data Quality Issues**: The indicators rely on a variety of different data sources, some of which may not be consistent across countries or regions. In particular, governance data in developing or conflict-affected countries may be less reliable due to gaps in data collection or the absence of formal institutions.
- **Perception Bias**: Much like the CPI, the **Control of Corruption** component of the World Bank Governance Indicators is partially based on perceptions, which introduces the same biases and limitations discussed above. For example, in countries where political or economic stability is perceived to be lower, corruption levels might be viewed as higher even if objective measures of corruption do not support such views.

How These Tools Are Constructed and Limitations: both the CPI and the World Bank Governance Indicators are built using a blend of subjective and objective data, with a significant reliance on expert opinions, surveys, and assessments from international organizations. While these tools have contributed to the study and understanding of corruption in a global context, they share common limitations:

1. **Subjectivity and Perception Bias**: Both indices are largely based on surveys of experts and business leaders, whose views may not necessarily reflect the reality of corruption on the ground. These perceptions can be influenced by recent events, media portrayal of corruption, or even the respondent's own experiences and biases. As a result, countries that experience political instability or media attention regarding corruption scandals may have artificially high perceived corruption levels, even if actual corruption levels are not as severe.
2. **Limited Focus on the Public Sector**: While the CPI focuses solely on the public sector, the World Bank Governance Indicators include a broader range of governance dimensions. However, both indices tend to overlook corruption in the private sector or informal sectors of the economy, where illicit activities might also be prevalent but are harder to capture.

3. **Lack of Granularity**: Both indices provide national-level data, which can obscure regional differences in corruption levels. For example, a country with high national-level scores for corruption control might still have regions with significant corruption problems. Furthermore, the indices tend to overlook corruption in specific industries (e.g., healthcare, education) or sectors that are not well-documented in global surveys.
4. **Data Quality Issues**: Both indices depend on the availability and quality of data, which can be problematic in countries with limited statistical capacity or political will to collect accurate data. In countries with weak institutions or ongoing conflicts, corruption may be underreported or inaccurately assessed, leading to skewed results in these indices.

*In summary, while both the **Corruption Perceptions Index (CPI)** and the **World Bank Governance Indicators** are invaluable tools for gauging corruption and governance at a global level, they are far from perfect. Their reliance on perception-based data, national-level aggregation, and the subjective nature of their data sources means they should be used with caution. These indices provide useful starting points for analysis but should be supplemented by more granular, locally-focused research when possible to develop a fuller understanding of corruption dynamics in a given country.*

B. Objective Measures of Corruption: Convictions, Financial Audits, and Government Expenditure Reviews

While **perception-based indicators** like the **Corruption Perceptions Index (CPI)** and **World Bank Governance Indicators** provide a broad overview of corruption levels, **objective measures** of corruption focus on quantifiable data that are more directly tied to observable actions and events. These methods are crucial for offering a more concrete understanding of corruption, as they rely on actual evidence rather than subjective assessments. Common objective measures include:

1. *Convictions:* **o**ne of the most direct ways to quantify corruption is by examining criminal convictions related to corrupt activities. This includes cases where government officials, business leaders, or other individuals are prosecuted for bribery, embezzlement, fraud, or other forms of corruption.

Strengths of Conviction Data:

- **Direct Evidence**: Convictions provide tangible evidence of corruption, linking corrupt practices to legal consequences.
- **Public Accountability**: The frequency of convictions can indicate the effectiveness of the judicial system and law enforcement in combating corruption.

Challenges:

- **Underreporting and Underprosecution**: Many corruption cases go unreported or are not pursued by authorities due to political pressure, lack of resources, or fear of retaliation. Even when corruption is detected, it may not result in a conviction, particularly in environments with weak rule of law.
- **Political Influence**: In some countries, political considerations may influence whether corruption cases are pursued. High-ranking officials or powerful individuals may avoid prosecution, skewing the data.
- **Data Accessibility**: Information about convictions is often difficult to obtain, especially in countries with opaque legal systems or where corruption is endemic.

2. *Financial Audits:* conducted by independent institutions (such as government agencies, international bodies like the **World Bank**, or third-party auditors) are another crucial tool for quantifying corruption. These audits track public spending, procurement practices, and financial transactions within government departments and agencies.

Strengths of Financial Audits:

- **Transparency**: Audits can reveal discrepancies, misuse of funds, or mismanagement, which may indicate corruption. A well-conducted audit can highlight areas where funds are being diverted or used inefficiently.
- **Track Record**: Financial audits, when conducted regularly, can reveal trends in corruption, such as an increase in wasteful spending or funds being siphoned off for personal gain.

Challenges:

- **Data Gaps**: In many countries, financial auditing practices may be inconsistent or incomplete, meaning that not all government departments or spending areas are subject to scrutiny.
- **Manipulation**: Governments or officials may manipulate or obstruct the audit process, making it difficult to obtain reliable data. For example, fake receipts, altered financial records, or suppressed documents can obscure the true nature of corruption.
- **Complexity**: Audits can be technically complex, and understanding the nuances of financial mismanagement may require expertise in accounting and finance. This makes it difficult for non-specialists to fully comprehend audit reports or to act on the findings.

3. Government Expenditure Reviews (GERs) are comprehensive analyses of public spending, aimed at evaluating the effectiveness, efficiency, and transparency of government programs. These reviews often focus on large-scale projects like infrastructure development or public health spending, which are prone to corruption.

Strengths of GERs:

- **Comprehensive Coverage**: GERs often look at entire sectors or large projects, providing a holistic view of how public funds are used. This can help to uncover inefficiencies and corrupt practices that might not be visible in smaller-scale audits.
- **Impact Analysis**: Expenditure reviews help assess the outcomes of government spending, linking funds to specific results or benefits. If there is no tangible benefit or if outcomes are disproportionately low, it may indicate corruption or mismanagement.

Challenges:

- **Difficulty in Attribution**: Determining whether inefficiencies or poor outcomes are due to corruption or other factors (e.g., incompetence, lack of training, or bureaucratic inefficiencies) can be difficult.
- **Political Resistance**: Expenditure reviews may face resistance from politicians or government officials who have a vested interest in concealing inefficiencies or corruption. Furthermore, findings may be ignored or dismissed, particularly if they point to high-level corruption.
- **Inadequate Data**: For GERs to be useful, governments must keep accurate and up-to-date records. In many countries, however, data may be incomplete or outdated, hindering the review process.

C. Hybrid Approaches: Combining Subjective and Objective Data

To address the limitations of relying solely on perception-based or objective data, many researchers and organizations have begun using **hybrid approaches** that combine both types

of data. These methods seek to balance the strengths and weaknesses of each approach, offering a more comprehensive picture of corruption.

Corruption Risk Indicators (CRI): one example of a hybrid approach is the use of Corruption Risk Indicators (CRIs)**.** These indicators combine subjective data (e.g., survey responses, expert assessments, or public opinion) with objective data (e.g., government expenditure reviews, convictions, financial audits) to generate a more nuanced and accurate picture of corruption risks within a country or sector.

How CRIs Work:

- **Survey Data**: CRIs might integrate survey data on public perceptions of corruption, asking citizens or experts to rate how pervasive corruption is in various sectors (e.g., healthcare, education, infrastructure).
- **Statistical Analysis**: These perceptions are then combined with objective data on financial audits, convictions, and government spending, often using statistical techniques such as regression analysis to correlate corruption perceptions with actual outcomes.
- **Corruption Risk Profiling**: The result is a comprehensive **Corruption Risk Profile**, which assesses the likelihood of corruption in different parts of the public sector. For example, the profile might indicate that corruption risk is particularly high in procurement processes but lower in judicial systems.

Advantages of CRIs:

- **Balanced View**: By combining both subjective and objective data, CRIs provide a more balanced view of corruption, addressing the limitations inherent in relying on either type of data alone.
- **Improved Accuracy**: These hybrid approaches can improve the accuracy of corruption quantification by identifying correlations between perceived corruption and objective indicators, helping to validate or challenge perceptions.
- **Sector-Specific Insights**: CRIs can be tailored to focus on specific sectors or regions, providing more granular insights into where corruption risks are most concentrated.

Challenges with Hybrid Approaches:

- **Complexity in Data Integration**: Combining subjective and objective data requires sophisticated statistical techniques and expertise. Without careful data integration, hybrid models may fail to provide accurate results.
- **Data Availability**: The success of CRIs and similar approaches depends on the availability and quality of both subjective and objective data. In many developing or conflict-affected countries, data might be incomplete or unreliable, which can hinder the development of effective hybrid models.
- **Modeling Biases**: Both subjective data (based on perceptions) and objective data (based on legal or financial records) can be biased in their own ways. If not properly accounted for, these biases could distort the final corruption risk assessment.

*Conclusion: incorporating both **objective measures** such as convictions, financial audits, and government expenditure reviews, along with **hybrid approaches** like **Corruption Risk Indicators**, allows for a more comprehensive and accurate quantification of corruption. While each method has its challenges—such as underreporting, manipulation, or data gaps—the combination of subjective and objective data offers a promising way to improve corruption measurement. However, for these methods to be truly effective, they require robust data collection mechanisms, transparency in governance, and strong political will to combat corruption. As countries, including Romania, work to improve their corruption measurement frameworks, hybrid approaches may play a critical role in fostering a clearer understanding of corruption's scope and impact.*

3. STATISTICAL MODELS FOR CORRUPTION QUANTIFICATION

The challenge of measuring corruption has prompted the development of a variety of **statistical models** designed to analyze and quantify its impact. Traditional methods, such as surveys and indices, provide valuable insights into public perception but lack precision in capturing the complexities and nuances of corruption at various levels. By using more advanced **econometric models**, **machine learning techniques**, and **social network analysis (SNA)**, researchers have made strides in uncovering hidden patterns and relationships that were previously difficult to detect. However, these models also face significant challenges in terms of data quality and biases. Below, we delve into the different types of statistical models used for corruption quantification and discuss the challenges associated with them.

1. Econometric Models

Econometric models are widely used to assess the **economic impact** of corruption, particularly how it relates to macroeconomic outcomes like **GDP growth**, **income inequality**, **foreign direct investment (FDI)**, and **public spending**. These models typically rely on **regression analysis** and **panel data analysis**, which help researchers control for multiple variables while identifying correlations between corruption and various economic outcomes.

Regression Models and Panel Data Analysis:

- **Regression analysis** is used to estimate the relationship between corruption and various economic indicators. A common approach involves specifying a regression equation where corruption (often measured by indices such as the **Corruption Perceptions Index (CPI)**) is the independent variable, and economic outcomes like **GDP growth**, **FDI**, or **income inequality** are the dependent variables.
- **Panel data analysis** is particularly useful in econometric studies, as it allows researchers to account for data over time and across countries or regions. Panel data can offer insights into how changes in corruption levels over time might affect economic performance. By including both time-series and cross-sectional data, these models allow researchers to observe not only how corruption evolves but also how its economic consequences differ across countries or regions.

Studies Using Econometrics:

- A well-known **study by Mauro (1995)** used cross-country regressions to demonstrate that corruption negatively affects GDP growth. It showed that countries with higher levels of corruption experience slower economic growth, especially in developing economies.
- Research by **Dreher et al. (2007)** used econometric models to investigate the relationship between **corruption** and **foreign direct investment (FDI)**. The study found that high levels of corruption are often associated with lower FDI inflows, as investors are deterred by the risks of bribery, corruption, and the lack of a transparent legal environment.
- Another study, **Svensson (2005)**, employed econometric techniques to analyze the relationship between corruption and **public spending**. It found that corruption can lead to inefficient public spending, as resources are often diverted from crucial public services to private pockets, further exacerbating issues like poverty and inequality.

While econometric models are powerful in assessing relationships between corruption and economic outcomes, they also have their limitations. For instance, they rely heavily on **the availability of accurate data** and may not capture the full range of economic costs associated with corruption, particularly in countries where data collection is sparse or unreliable.

2. Machine Learning Models

In recent years, **machine learning (ML)** techniques and **natural language processing (NLP)** have emerged as powerful tools to analyze large datasets related to corruption. These approaches can analyze vast amounts of data from diverse sources such as **news articles**, **legal records**, and **social media** to identify patterns and trends that are not easily detectable using traditional methods.

Machine Learning and NLP for Corruption Detection:

- **Natural Language Processing (NLP)** enables the analysis of **unstructured text data**, such as news reports and social media content. By applying sentiment analysis, topic modeling, and text classification, NLP can help uncover **patterns of corruption** and **public sentiment** towards corruption-related events. This can be particularly useful in tracking corruption scandals and identifying emerging trends.
- **Supervised learning algorithms** can be trained on labeled datasets (e.g., identifying articles related to corruption) to predict new instances of corruption. By using these models on historical data, researchers can identify the types of events or patterns that precede corruption scandals or reveal covert practices.
- **Unsupervised learning algorithms** such as clustering can identify groups of entities (e.g., businesses or government officials) that are linked through corrupt activities, without pre-existing labels or prior knowledge.

Advantages of ML Models:

- **Handling Big Data**: One of the most significant benefits of using ML is its ability to process and analyze large amounts of data that would be impossible to handle manually. For example, analyzing the entire corpus of news articles or legal documents related to corruption can uncover valuable insights about patterns of corruption in different sectors or countries.
- **Pattern Recognition**: Machine learning models can identify **hidden patterns** that traditional methods might miss, including unusual behavior in financial transactions, irregularities in public procurement, or even subtle changes in public opinion.
- **Dynamic Analysis**: Machine learning models can continuously update their predictions based on new data, allowing for real-time detection of corruption-related events as they occur.

Challenges:

- **Data Quality**: ML models depend on large amounts of reliable, labeled data. In cases where corruption-related data is sparse or unreliable, ML models may not perform well. Inaccurate labeling or biases in data can skew the results.
- **Interpretability**: Many ML models, particularly deep learning models, are often described as "black boxes," meaning that their decision-making processes are not transparent. This lack of interpretability can be problematic when trying to explain the reasons behind a prediction, especially in sensitive areas like corruption detection.
- **Bias in Algorithms**: If the training data contains biases—such as disproportionate representation of certain countries, sectors, or types of corruption—the ML models could perpetuate or even amplify these biases.

3. Social Network Analysis (SNA)

Social network analysis (SNA) is a method used to examine the **relationships and connections** between individuals, organizations, or entities within a network. In the context of corruption, SNA can be used to track and analyze the networks that facilitate corrupt practices, such as the ties between **businesses, government officials, and criminal organizations**.

Tracking Corruption Networks:

- SNA models can help uncover the **systemic nature of corruption** by mapping out how corrupt networks operate. For example, SNA can identify key individuals who serve as **nodes** in the corruption network and analyze how they connect with other entities to facilitate corrupt practices, such as money laundering, bribery, or kickbacks.
- By using SNA to map out these connections, researchers can identify **core actors** within corrupt systems, such as politicians, business leaders, or bureaucrats, and track how they collaborate with one another. This approach allows for a more granular understanding of how corruption operates at different levels of society.

Applications of SNA:

- **Mapping Corrupt Networks**: By identifying and visualizing relationships between corrupt officials and businesses, SNA can reveal **hidden connections** and help identify new corruption risks before they escalate.
- **Identifying Structural Weaknesses**: SNA can also be used to analyze the structure of government institutions, helping to identify where corruption is most likely to occur. If certain individuals or departments are heavily connected to corrupt actors, reforms can be targeted at those areas.

Challenges:

- **Data Access**: To effectively use SNA for corruption analysis, data on social networks must be accessible. In many cases, the information about relationships between individuals or entities is not readily available, or it is difficult to verify.
- **Dynamic Networks**: Corruption networks are often fluid, with individuals frequently shifting alliances or entering and leaving networks. This dynamic nature makes it difficult to map networks over time, and models may need continuous updates to reflect changing relationships.

4. Challenges and Limitations of Statistical Models

While **econometric models**, **machine learning**, and **social network analysis** represent powerful tools for quantifying and analyzing corruption, they all face significant challenges that must be carefully considered:

- **Data Quality and Availability**: High-quality data is a prerequisite for any statistical model. In the case of corruption, however, data is often incomplete, biased, or unreliable. For example, corruption-related datasets may be based on estimates, subject to underreporting, or influenced by political interests.
- **Bias in Algorithms**: In machine learning models, biases in the training data can lead to skewed results. If certain corruption-related patterns are underrepresented or if the data is not representative of the broader population, the model's predictions can be misleading.
- **Measurement of Covert Actions**: Many instances of corruption are hidden or covert, making them difficult to detect and measure accurately. This is particularly true when analyzing practices like bribery or illicit financial flows, which are intentionally kept secret.

Conclusion: quantifying corruption through statistical models offers valuable insights into its economic and political impacts. **Econometric models** provide a foundation for understanding the broader consequences of corruption on GDP growth, foreign investment, and public spending. **Machine learning** and **social network analysis** offer more dynamic and detailed methods for uncovering patterns and networks that traditional methods may miss. However, challenges related to data quality, biases, and the covert

nature of corruption remain significant obstacles. Despite these challenges, the integration of these models into corruption research holds the potential to transform how we understand and combat corruption on a global scale.

4. IMPACT OF CORRUPTION IN ROMANIA

Corruption has had far-reaching consequences for Romania, affecting not only its political and social fabric but also its economic development and integration into European structures. By analyzing the economic and political impacts, case studies, and anti-corruption efforts, we can better understand the pervasive nature of corruption and its implications for Romania's governance and development.

1. Economic Impact of Corruption in Romania

Corruption in Romania has significantly undermined the country's economic potential, contributing to slower growth, diminished foreign investment, and inefficient public spending. Several studies and reports underscore the profound negative effects of corruption on Romania's economy, which has struggled to recover from the legacy of state socialism and to meet the standards required by European Union (EU) integration.

Slower Economic Growth: Corruption can create an unfavorable business environment, increase the costs of doing business, and reduce the efficiency of the private sector. The **World Bank** has highlighted that corruption, particularly in public procurement, has a direct impact on the overall business climate, deterring investment and stifling innovation. In Romania, corruption has increased transaction costs and reduced competition in sectors like construction, healthcare, and infrastructure, leading to slower growth compared to other EU countries.

Reduced Foreign Investment: The negative perception of corruption, as captured in indices like the **Corruption Perceptions Index (CPI)**, can also deter foreign direct investment (FDI). Investors are often hesitant to engage in markets where corrupt practices are prevalent, fearing that they might face bribery demands or lack confidence in the legal protection of their investments. Studies show that in Romania, while FDI flows have improved since the 1990s, they have not reached the levels expected from a country with Romania's potential. Corruption is frequently cited as one of the primary barriers to greater foreign investment.

Inefficiencies in Public Spending: Public spending in Romania, particularly in infrastructure and public services, has been plagued by corruption, which diverts funds away from critical development projects. Public procurement systems have been a hotspot for corrupt practices, including kickbacks and rigged bidding processes, resulting in inefficient allocation of public resources. The **European Court of Auditors** has frequently criticized Romania's management of EU funds, citing irregularities and corruption in the implementation of projects designed to modernize infrastructure and improve social services.

Corruption [15] is identified and experienced as a self-generating, spiral phenomenon, starting with corruption, followed by a slowdown in economic activity, a shortage of budget resources, increasingly higher debts for public servant salaries, and ending with an increase in the initial level of corruption. Calculations indicate a very close indirect link between the degree of corruption and the GDP per capita. There is also a clear correlation between the country's corruption index and the reform performance index in transition countries, with key components including progress in the political system, media independence, the viability of the

[15] https://www.contributors.ro/2-melanjul-politic-romanesc-si-tranzitia-ca-stare-de-spirit/

legal system, public administration efficiency, and the development of the private sector. (Gheorghe Savoiu).

The Gross Domestic Product per capita in Romania was last recorded at 12386.46 US dollars in 2023 (Table 4). The GDP per Capita in Romania is equivalent to 98 percent of the world's average. GDP per Capita in Romania averaged 7235.71 USD from 1990 until 2023, reaching an all time high of 12386.46 USD in 2023 and a record low of 4057.26 USD in 1992, according to World Bank. GDP per Capita in Romania is expected to reach 12783.00 USD by the end of 2025, according to Trading Economics global macro models and analysts expectations. In the long-term, the Romania GDP per capita is projected to trend around 13256.00 USD in 2026 and 13746.00 USD in 2027, according to our econometric models.

Table 4. Romanian GDP related indicators

Related	Last	Previous	Unit	Reference
Full Year GDP Growth	2.10	4.10	percent	Dec 2023
GDP	351.00	298.89	USD Billion	Dec 2023
GDP Growth Rate YoY	1.20	0.90	percent	Sep 2024
GDP Constant Prices	302006.80	302237.70	RON Million	Sep 2024
GDP from Agriculture	10879.40	14062.50	RON Million	Sep 2024
GDP from Construction	20160.20	20540.10	RON Million	Sep 2024
GDP from Manufacturing	45527.80	48873.30	RON Million	Sep 2024
GDP from Public Administration	40553.20	40490.60	RON Million	Sep 2024
GDP from Services	61958.50	61228.90	RON Million	Sep 2024
GDP Growth Rate	0.00	0.10	percent	Sep 2024
GDP per Capita	12386.46	12131.74	USD	Dec 2023
GDP per Capita PPP	40517.55	39684.31	USD	Dec 2023
Gross Fixed Capital Formation	56027.50	78838.90	RON Million	Sep 2024

Source: tradingeconomics.com

Table 5. GDP per capita by country in Europe

Country	2023	2022	Reference	Unit
Luxembourg	105997	109715	Dec/23	USD
Ireland	91783	97317	Dec/23	USD
Switzerland	89943	90057	Dec/23	USD
Norway	78939	79435	Dec/23	USD
Denmark	61032	60346	Dec/23	USD
Iceland	58393	57816	Dec/23	USD
Sweden	55521	55894	Dec/23	USD
Netherlands	50100	50547	Dec/23	USD
United Kingdom	47005	47343	Dec/23	USD

Country	2023	2022	Reference	Unit
Finland	45939	46655	Dec/23	USD
Austria	45852	46698	Dec/23	USD
Belgium	44283	44198	Dec/23	USD
Germany	42879	43361	Dec/23	USD
Andorra	40162	39721	Dec/23	USD
France	38976	38816	Dec/23	USD
Euro Area	37400	37450	Dec/23	USD
European Union	34163	34169	Dec/23	USD
Italy	33774	33364	Dec/23	USD
Malta	31190	30761	Dec/23	USD
Cyprus	30769	30557	Dec/23	USD
Spain	28047	27703	Dec/23	USD
Slovenia	25643	25350	Dec/23	USD
Portugal	22378	22126	Dec/23	USD
Greece	20827	20288	Dec/23	USD
Estonia	20245	21141	Dec/23	USD
Czech Republic	19800	20237	Dec/23	USD
Slovakia	19217	18898	Dec/23	USD
Lithuania	18214	18535	Dec/23	USD
Poland	17270	17179	Dec/23	USD
Croatia	17234	16712	Dec/23	USD
Latvia	16945	17015	Dec/23	USD
Hungary	16287	16345	Dec/23	USD
Turkey	14630	14055	Dec/23	USD
Romania	12386	12132	Dec/23	USD
Russia	10421	10030	Dec/23	USD
Bulgaria	9780	9551	Dec/23	USD
Montenegro	8375	7889	Dec/23	USD
Serbia	7736	7493	Dec/23	USD
Belarus	6483	6207	Dec/23	USD
Bosnia and Herzegovina	6421	6271	Dec/23	USD
Macedonia	6350	6218	Dec/23	USD
Albania	5394	5155	Dec/23	USD
Kosovo	4854	4666	Dec/23	USD
Moldova	3685	3582	Dec/23	USD
Ukraine	2207	2043	Dec/23	USD

Source: tradingeconomics.com

The Romanian economy grew by 2.1% in 2023, slowing sharply from the expansions of 4.1% and 5.7% recorded in 2022 and 2021, respectively. Full Year GDP Growth in Romania averaged 3.33 percent from 2012 until 2023, reaching an all time high of 7.10 percent in 2017 and a record low of -3.70 percent in 2020 accordind to Institutul National de Statistica. Full Year GDP Growth in Romania is expected to reach 2.00 percent by the end of 2024, according to Trading Economics global macro models and analysts expectations. In the long-term, the

Romania Full Year GDP Growth is projected to trend around 3.20 percent in 2025 and 3.70 percent in 2026, according to our econometric models.

Table 6. Romania's CPI, GDP per capita, GDP growth

YEAR	CPI	RANK	GDP per capita	Full year GDP Growth
2012	44 points	66		
2013	43	69	8,29K USD	3,5%
2014	43	69	8,66	3,1%
2015	46	58	8,98	4%
2016	48	57	9,29	4,8%
2017	48	59	10,1	7,1%
2018	47	61	10,8	4,5%
2019	44	70	11,3	4,2%
2020	44	69	10,9	-3,7%
2021	45	66	11,6	5,7%
2022	46	63	12,1	4,1%
2023	46	66	12,4	2,1%
2024			12,6	2,65%
2025	Forecast		12,8	3,2%
2026			13,3	3,7%
2027			13,7	3,7%

Source: Made by author based on data of tradingeconomics.com

2. Political Impact of Corruption in Romania

Corruption has also had significant political consequences in Romania, affecting the legitimacy of government institutions, eroding public trust, and impeding democratic reforms. The politicization of anti-corruption bodies, such as the **National Anti-Corruption Directorate (DNA)**, and scandals involving high-ranking officials have illustrated the deep-rooted challenges to establishing a fair and transparent political system.

Erosion of Public Trust: Corruption has eroded public trust in Romanian government institutions. The public's perception of widespread corruption in both local and national politics has resulted in cynicism and disillusionment with the political process. According to surveys conducted by organizations like the **Eurobarometer**, Romanian citizens are among the most distrustful of their government in the EU, with corruption seen as one of the primary reasons for this lack of confidence.

Politicization of Anti-Corruption Bodies: One of the significant challenges Romania faces is the politicization of anti-corruption bodies. The **DNA** has made considerable progress in prosecuting high-ranking politicians and officials, but this success has often been met with political resistance. Various political leaders have accused the DNA of being used as a political tool to target their opponents, undermining the institution's independence and credibility. This has created a polarized political environment where anti-corruption measures are sometimes viewed not as neutral efforts but as partisan attacks, further eroding trust in the rule of law.

Undermining Democratic Processes: Corruption in Romania has also had a broader impact on the democratic process. It has contributed to the entrenchment of patronage networks, where political loyalty is prioritized over merit, and public resources are allocated to those who support the ruling elite. This has undermined the development of democratic institutions, reduced political competition, and hindered reforms necessary for strengthening democracy. Corruption also creates opportunities for oligarchic elites to control large sectors of the economy and politics, further consolidating their power and limiting accountability.

The consequences of the economic risk posed by the antidemocratic and corrupt political class have unfortunately extended even to the political security of the state: the formation of a political component that imposes its will on society, contributing to the substantial increase of state debts; the reduction of budget payments, resulting in the failure of policies supporting entrepreneurship, social protection, education, healthcare, the environment, and public sector salaries; the violation of citizens' constitutional rights and guarantees, the discrediting of the public system, and the lack of respect for the state by the population; the deterioration of the environment, with the dominance of economic-political interest groups seeking immediate profits; the decrease in the performance of reforms and the economic development of the country [16].

3. Case Studies of Corruption in Romania

To understand the impact of corruption more concretely, it is helpful to look at specific **case studies** that illustrate both the persistence of corruption and the attempts to combat it in Romania.

DNA and High-Ranking Official Trials: The **National Anti-Corruption Directorate (DNA)** has been a central actor in Romania's fight against corruption, particularly in prosecuting high-ranking political and business leaders. The DNA's efforts have led to the conviction of former prime ministers, ministers, and other senior officials. For instance, **Liviu Dragnea**, the former leader of the Social Democratic Party (PSD), was convicted of corruption-related offenses and sentenced to prison. While the DNA's success in securing convictions has been significant, its work has also been politically contentious, with critics accusing it of overreach and bias, especially when targeting opposition figures.

The Colectiv Nightclub Fire Scandal: The **Colectiv nightclub fire**, which killed 64 people in 2015, brought to light corruption within the Romanian public safety and regulatory systems. The fire, caused by inadequate fire safety measures and regulatory oversight, led to protests across the country. Many critics argued that corrupt practices and bribery in the approval of safety permits contributed to the tragedy. The ensuing investigations uncovered systemic corruption within Romania's local government and the fire safety inspection system. Although some individuals were prosecuted, the case highlighted the challenges in holding officials accountable for regulatory failures that endanger public lives.

Trial of High-Ranking Officials: High-profile corruption trials have highlighted both the success and limitations of anti-corruption measures in Romania. While the DNA has secured convictions of high-ranking officials, the process of prosecuting top-level corruption is often slow and fraught with political interference. Additionally, many of the trials have led to only partial convictions or have been delayed due to appeals, further complicating the fight against corruption.

4. Reforms and Anti-Corruption Efforts in Romania

Despite the challenges posed by corruption, Romania has made significant strides in its anti-corruption efforts, often driven by its commitment to European Union (EU) standards and the expectations of EU accession.

The Role of the EU: The EU has played a pivotal role in pushing Romania to strengthen its anti-corruption measures. During Romania's accession process, the EU made anti-corruption reform a condition for membership, and since joining the EU in 2007, Romania has been under the **Cooperation and Verification Mechanism (CVM)**, which monitors the

[16] https://www.contributors.ro/2-melanjul-politic-romanesc-si-tranzitia-ca-stare-de-spirit/

country's progress in judicial reform and anti-corruption efforts. While Romania has made some progress, EU officials continue to express concern about the pace of reforms and the persistence of corruption at all levels of government.

National Anti-Corruption Directorate (DNA): The **DNA** has been one of the most prominent agencies in Romania's anti-corruption efforts, securing thousands of convictions, including high-profile cases. However, its independence has been under threat in recent years, with political figures seeking to undermine its work. Despite these challenges, the DNA remains an essential player in Romania's fight against corruption, and its success in prosecuting corruption within the public sector has led to some public trust in the legal system.

Public Procurement and Judicial Reforms: Efforts to improve transparency in **public procurement** have been another area of focus in Romania's anti-corruption reform agenda. The introduction of online procurement platforms and the implementation of transparency measures in the allocation of EU funds have helped to reduce corruption in these areas. Similarly, judicial reforms aimed at increasing judicial independence and reducing political influence have been critical in strengthening Romania's rule of law. However, progress has been slow, and efforts to reform the judiciary have often been met with political resistance.

5. CONCLUSION

The features of Romanian corruption have always remained the same: the erosion of ethical values and the demoralization of society; the non-transparent and contradictory legislative system; the low salary level in the public sector; the state policy that generates the search for methods of obtaining unofficial income; the promotion of candidates to positions without real achievements, based solely on political reasons or affiliation with interest groups or fraudulent intentions; poor information and widespread public tolerance (in this regard, Romania has the highest level of tolerance for corruption among the EU-27); the transformation of fighting corruption into fighting political opponents, etc.

Corruption in Romania has had a profound impact on both the country's economic and political development. From slower growth and reduced foreign investment to the erosion of public trust in institutions, the consequences of corruption are far-reaching. The work of institutions like the **DNA** and the ongoing anti-corruption reforms, both at the national and EU levels, illustrate the challenges and successes of efforts to combat corruption. While Romania has made progress, particularly in improving transparency and prosecuting high-ranking officials, there is still much work to be done to address the deep-rooted corruption that continues to affect the country's governance and development.

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COMPETITIVENESS AND INNOVATION IN THE CONTEXT OF THE CIRCULAR ECONOMY

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ABSTRACT: *In a globalized economy, competitiveness and innovation are essential factors for sustainable development. In this context, the circular economy offers an efficient and sustainable growth model, promoting waste reduction, efficient use of resources and regeneration of materials. The paper analyzes the impact of the integration of circular economy principles on competitiveness and highlights the role of innovation as a driver of the transition to a more sustainable economic model. The study explores the improvement of economic and ecological performance, highlighting the benefits of implementing innovative technologies and policies favorable to the circular economy. The conclusions highlight the need for an integrated approach, where innovation and sustainability have become fundamental pillars of long-term competitiveness.*

Keywords: *Competitiveness, Innovation, Circular Economy, Sustainability.*

JEL Classification: *Q55; Q56.*

1. INTRODUCTION

The circular economy is a model of production and consumption in which existing materials and products are reused, repaired, refurbished, and recycled whenever possible. In this way, the product life cycle is extended. In practice, this means minimizing waste. At the end of a product's life cycle, its materials are preserved as economically as possible through recycling. Recycled materials can be used productively to create new value. This represents a shift away from the traditional linear economic model, which relies on large quantities of cheap and readily available materials and energy.

The European Union generates over 2.2 billion tons of waste each year and constantly updates its waste management legislation to promote the transition to a more sustainable model, known as the circular economy. Reusing and recycling products would slow down the consumption of natural resources, reduce landscape and habitat disruption, and help limit biodiversity loss.

Another benefit of the circular economy is the reduction of total annual greenhouse gas emissions. According to the European Environment Agency, industrial processes and product

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use account for 9.10% of the EU's greenhouse gas emissions, while waste management represents 3.32% [1].

It is estimated that more than 80% of a product's environmental impact is determined at the design stage, so creating more efficient and durable products from the outset will help reduce energy and resource consumption. Shifting to more reliable products that can be reused, upgraded, and repaired will lead to a reduction in waste. Packaging is an increasingly pressing issue, with an average European generating nearly 180 kg of packaging waste per year. The EU aims to improve packaging design to encourage reuse and recycling.

The transition to a circular economy could enhance competitiveness, drive innovation, boost economic growth, and create jobs -700,000 jobs in the EU alone by 2030. Redesigning materials and products for circular use would also foster innovation across various economic sectors. Consumers would benefit from more durable and innovative products, improving their quality of life and saving them money in the long run [1].

The European Union's circular economy policy has been strengthened in recent years, but it has not yet become sufficiently mandatory or well-directed to accelerate Europe's transition to a regenerative economy. This means shifting from the current focus on waste to a more direct use of resources. Developing a circular economy is a key component of the EU's efforts to combat climate change and pollution. Europe's heavy dependence on natural resources for materials, food, and fuel has a significant environmental and climate impact. However, after a rapid increase in resource consumption, this trend has recently stabilized, with EU GDP rising while overall material consumption has slightly declined. At the same time, Europe's reliance on global imports for raw materials, metal ores, and fossil fuels is increasing amid a more challenging geopolitical landscape.

The EU is taking measures to transition to a circular economy, which means abandoning linear production and consumption models. In recent years, Europe has made positive strides toward a circular economy, including higher recycling rates and the emergence of circular business models, such as the sharing economy.

By 2022, Europe had consumed more recycled materials than any other region in the world. However, progress in the EU has been slow, and the ambitious goal of doubling the level of circular economic activity by 2030 remains far from being achieved. Many circular economic policies are still relatively new, and some have yet to be fully implemented at the national level. Moreover, it will take time for the impact of these measures to ripple through business models, consumption patterns, and ultimately, resource use.

Future actions, such as setting targets and promoting higher-quality recycling - where materials retain their original function and value for as long as possible - will be crucial in strengthening the EU's resource independence and reducing imports. In addition to implementing eco-design principles, it is also essential to enhance circularity by maximizing product lifespan through reuse, repair, and refurbishment [2].

2. INNOVATION AND COMPETITIVENESS: PILLARS OF THE CIRCULAR ECONOMY FOR A SUSTAINABLE FUTURE

Innovation in the circular economy plays a crucial role in promoting sustainable production and reducing resource waste. By adopting circular economy strategies such as recycling and reuse, companies can manage resources efficiently and minimize environmental impact. Green innovation and corporate sustainability are key aspects of this process, and implementing resource efficiency policies and proper waste management can significantly contribute to achieving these goals.

By offering sustainable products and services, companies can support the circular economy and sustainable production. These represent innovative and advanced solutions that

help reduce environmental impact and ensure the efficient use of resources. Companies must recognize the importance of adopting sustainable practices and provide products and services that meet current needs without compromising the ability of future generations to meet their own.

Sustainable products and services can take various forms, including eco-friendly technologies, recyclable materials, and energy-efficient production processes. For example, some companies are involved in the production of lithium-ion batteries, which have a lower environmental impact and can be fully recycled. These batteries can be used in various industries, including logistics, to optimize equipment efficiency and performance.

In the following sections, we will analyze the latest available Eurostat data regarding competitiveness and innovation within the circular economy monitoring framework.

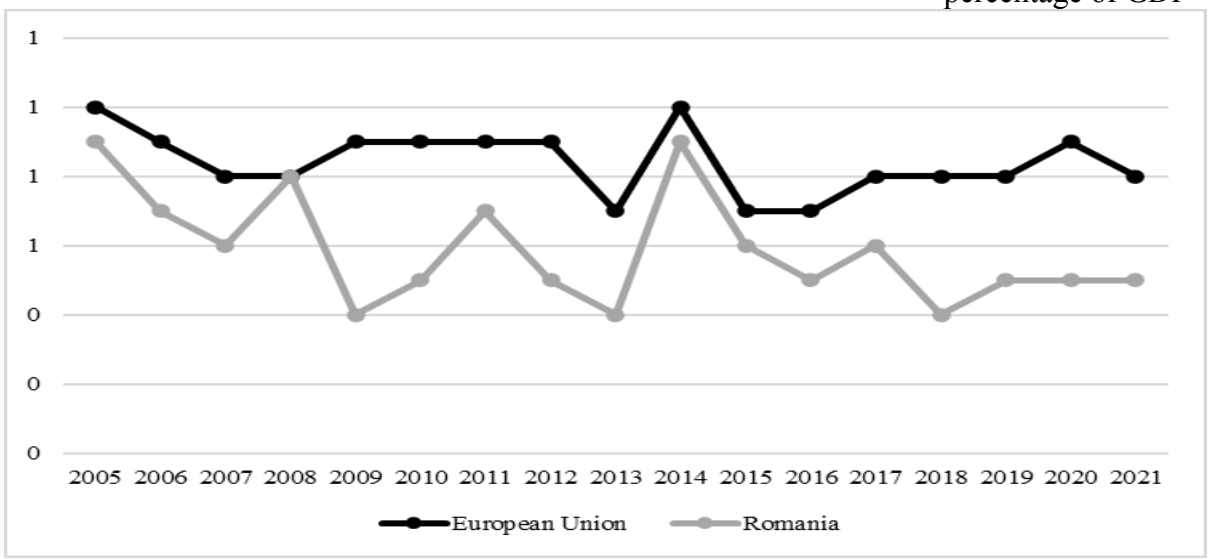
2.1. Private Investment, Jobs and Gross Value Added Related to Circular Economy Sectors – Indicators of Competitiveness

Private investments, jobs, and gross value added related to circular economy sectors are key indicators used to monitor progress toward a circular economy within the thematic area of "competitiveness and innovation." Innovation and investments (in eco-design, secondary raw materials, recycling processes, and industrial symbiosis) are essential elements of the transition to a circular economy. The circular economy can make a significant contribution to job creation and economic growth.

Analyzing job trends and the growth of relevant sectors helps determine whether the transition to a circular economy is delivering the expected results. Sectors closely linked to the circular economy, such as recycling, repair, and reuse, require a large workforce and contribute to local employment. It is important to note that the analyzed sectors represent only a subset of the broader economic impact of the circular economy [3].

Figure 1. Private investment related to circular economy sectors

- percentage of GDP -

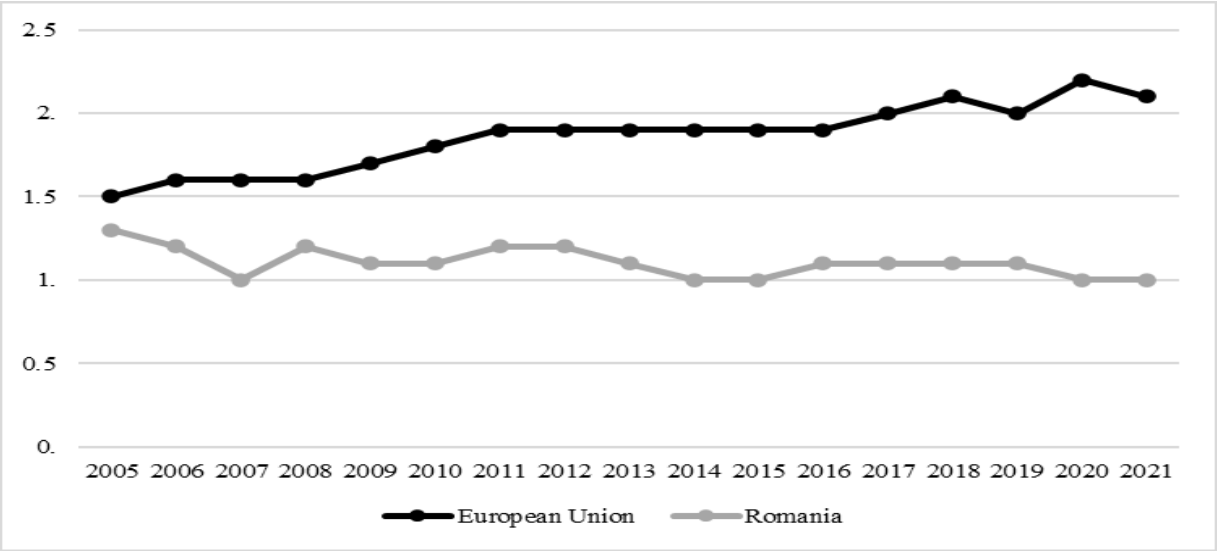


Source: Author owns processing based on Eurostat data (2025)

Private investments in circular economy sectors in Romania have generally been below the EU average, fluctuating between 0.4% and 0.9% of GDP between 2005 and 2021. The only year in which they reached the EU average was 2008, with 0.8% of GDP (Figure 1).

Figure 2. Gross added value related to circular economy sectors

- percentage of GDP -

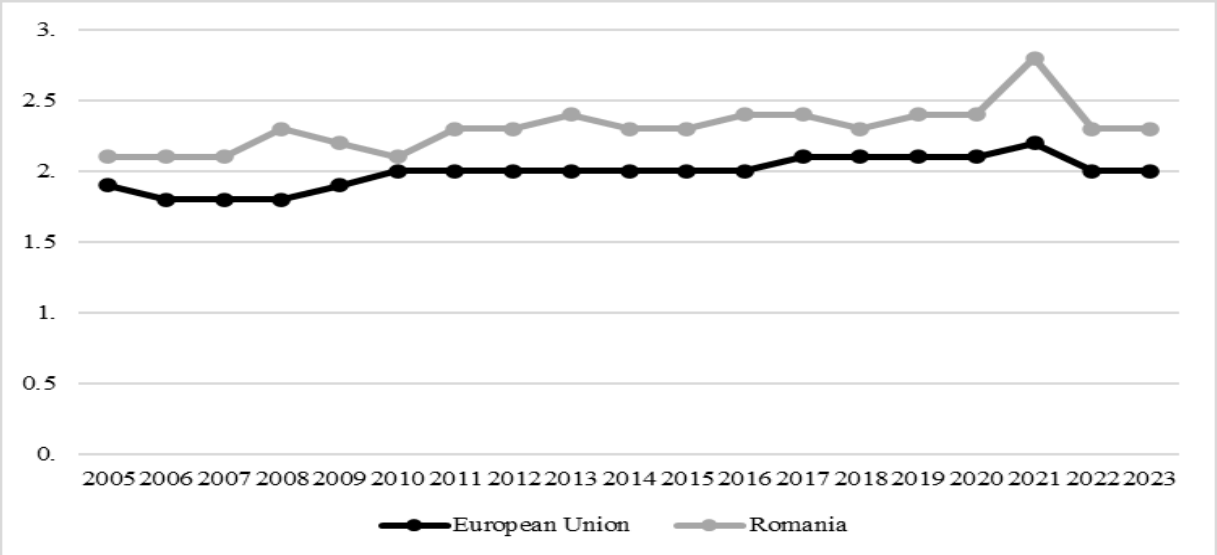


Source: Author owns processing based on Eurostat data (2025)

The gross value added in circular economy sectors in Romania has followed a downward trend, decreasing from 1.3% of GDP in 2005 to 1% of GDP in 2021, while the EU average has followed an upward trend during the same period, reaching 2.1% of GDP in 2021 (Figure 2). The gap between Romania and the EU average has been steadily increasing.

Figure 3. People employed in circular economy sectors

- percentage of total employment - numerator in full-time equivalent -



Source: Author owns processing based on Eurostat data (2025)

The employment level in circular economy-related sectors in Romania, measured as a percentage of total full-time employees, was above the EU average between 2005 and 2023, fluctuating between 2.1% and 2.8%, while the EU average ranged from 1.8% to 2.2%. The highest employment level in Romania's circular economy sectors was recorded in 2021 (Figure 3).

2.2. Patents Related to Waste Management and Recycling - Indicator of Innovation

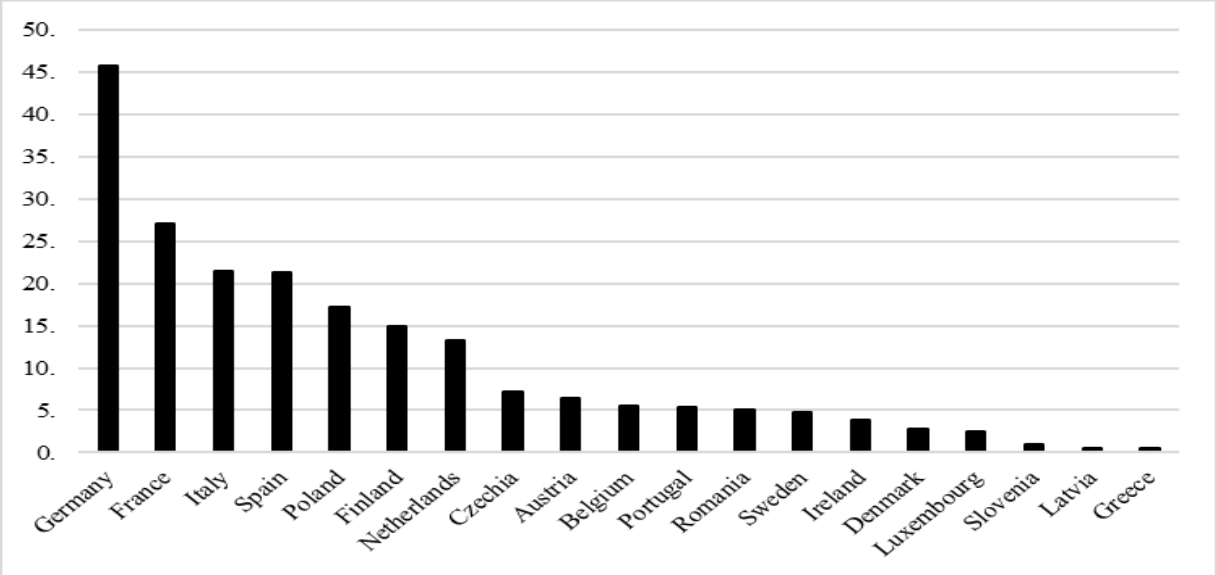
Waste management and recycling-related patents are an indicator used to monitor progress toward a circular economy within the thematic area of "competitiveness and innovation." Innovation will necessarily play a key role in the transition to a circular economy by developing new technologies, processes, services, and business models. Patent statistics are one of the widely used indicator families for assessing technological progress in a specific industrial sector. They are widely accepted as result-oriented indicators of innovation.

Recently, for example, the number of patent applications has been used as an indicator in the Raw Materials Scoreboard. The development of innovative techniques for waste collection, transport, storage, and especially material recycling will help reduce the EU's dependence on critical commodities, strengthen its resilience to potential disruptions in material supply, and support the competitiveness of domestic industries. The number of patent families in these fields thus provides insight into innovation activity in recycling and material reuse technologies within the EU, as well as in the global context [4].

This indicator measures the number of patents related to recycling and secondary raw materials. The term "patents" refers to patent families, which include all relevant documents for a distinct invention (e.g., applications submitted to multiple authorities), thereby preventing multiple counting. While the indicator provides insight into the most relevant innovative recycling technologies, it does not cover all waste management technologies or other circular economy-related services and business models. It is also important to highlight that not all relevant innovations are or can be patented [4].

Figure 4. Patents related to recycling and secondary raw materials in UE (2020)

- number -



Source: Author owns processing based on Eurostat data (2025)

In Figure 4, only 19 out of the 27 EU member states are represented, as eight countries (Slovakia, Malta, Lithuania, Hungary, Estonia, Cyprus, Croatia, and Bulgaria) did not report any patents related to recycling and secondary raw materials to Eurostat in 2020, the latest year for which data is available. Germany ranks first with 45.67 patents related to recycling and secondary raw materials, followed by France with 27.09 patents and Italy with 21.51 patents. Romania ranks 12th in the EU hierarchy.

Figure 5. Patents related to recycling and secondary raw materials in Romania

- number -

Source: Author owns processing based on Eurostat data (2025)

According to the latest available data from the Eurostat database, between 2000 and 2020, Romania had a low number of patents related to recycling and secondary raw materials, reaching a peak of 9.5 patents in 2018 (Figure 5). This is linked to political, financial, and regulatory factors that seem to be one of the main challenges faced by companies and research institutions. The lack of multidisciplinary collaborations in the research phase, the lack of education regarding the circular economy, and the difficult organizational framework for research activities appear to be the main causes [5].

3. CONCLUSIONS

The circular economy can decisively contribute to achieving the EU's environmental objectives by reducing pressure on natural resources, ensuring sustainable growth, jobs, and the long-term competitiveness of the EU. However, the transition to this must be organized by both the private and public sectors at all levels of the value chain. The state contributes with actions in the legislative and educational sphere, in building the necessary infrastructure to collect and recycle waste separately from the population, but also through support measures granted to the private sector. On the other hand, the private sector has the obligation to adapt its products and make them easy to repair, reuse, and recycle, through investments in research and new technologies, partnerships with other companies or with the public sector.

The circular economy brings a series of advantages over the linear model, especially regarding environmental protection, pollution reduction, conservation of natural resources by reducing material consumption and dependence on raw materials, job creation, and generating savings for consumers, but it also requires efforts and collaboration between the private sector, the state, and civil society, to overcome the inherent challenges of any transition, related to: regulations and policies, market inertia, financing, workforce in the extractive sector, monitoring, and evaluation.

At the European level, through a set of initiatives and policies included in the European Green Deal, the circular economy guides the green transition towards a modern, competitive, and resource-efficient economy.

At the same time, the Circular Economy Action Plan identifies seven key sectors vital for achieving a circular economy: plastics, textiles, waste from electrical and electronic

equipment, food, water and nutrients, packaging, batteries and vehicles, buildings and construction. The initiatives target the entire life cycle of products, starting from how they are designed, promoting circular economy processes, encouraging sustainable consumption, and aiming to ensure that waste is prevented and that the resources used are kept in the EU economy for as long as possible [6].

Eco-innovation, by reducing environmental impact, increasing resilience to external pressures, and using resources more efficiently, is vital in supporting this transition to a circular economy and achieving the objectives of the European Green Deal. The 8th EU Environmental Action Programme supports the environmental and climate action objectives of the European Green Deal by accelerating the transition to a regenerative economy that gives back to the planet more than it takes, particularly "through continuous innovation, adaptation to new challenges, and co-creation." The biennial thematic report presents best practices, reasons, and challenges for eco-innovation to support a circular industrial transformation. Eco-innovation in companies leads to cost reduction, improves the ability to capture new growth opportunities, and enhances their reputation among customers. Eco-innovation is therefore a powerful tool for environmental protection, with a positive impact on the economy and society [7].

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ROMANIAN INDUSTRIAL SECTOR IN EUROPEAN CONTEXT

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ABSTRACT: *The Romanian industry plays an important role in the national economy and in Romania's integration into the European market. Since 1990, the Romanian industry has been affected by outdated technological infrastructure, high energy consumption, and underfunding of research and development. This article analyzes the position of the Romanian industrial sector in the European context, highlighting both the progress made and the challenges faced. It also explores the development prospects of the European and Romanian industrial sector, emphasizing the opportunities that must be overcome to ensure a resilient and sustainable industrial economy. The conclusions underline the necessity of coherent public policies and a strategy to ensure the sustainable and competitive development of the Romanian industry.*

Keywords: *European Union, Romania, industry, competitivenss.*

JEL Classification: *O14, Q01*

1. INTRODUCTION

Industry represents an important pillar of the European economy, significantly contributing to economic growth, employment, and the transition to a sustainable development model. In order to strengthen the European Union industrial competitiveness and promote a more sustainable, resilient and digitalised economy, at European Commission published the industrial policy [1]. An important place in the EU's industrial policy is occupied by the European industrial strategy, updated in May 2021, which focuses on the following key areas:

- addressing EU strategic dependencies;
- strengthening the resilience of the single market;
- accelerating the green and digital transitions.

Complementing the European industrial strategy, at the beginning of 2025 was adopted the European Clean Industry Deal, outlining the development directions of European industry, focusing on digitization, innovation and reducing environmental impact.

In this context, Romania's industrial sector is influenced by the European Union strategies and policies, which driving its adaptation to the new technological and environmental requirements set at the European level and have a direct impact on its competitiveness.

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2. OVERVIEW OF THE ROMANIAN INDUSTRIAL SECTOR IN THE EUROPEAN CONTEXT

Industry is the backbone of the European economy, and directly provides 35 million jobs. In 2024, compared with 2023, in European Union the annual average industrial production decreased by 2,3% and in December 2024, compared with December 2023, industrial production decreased by 1,7% [2].

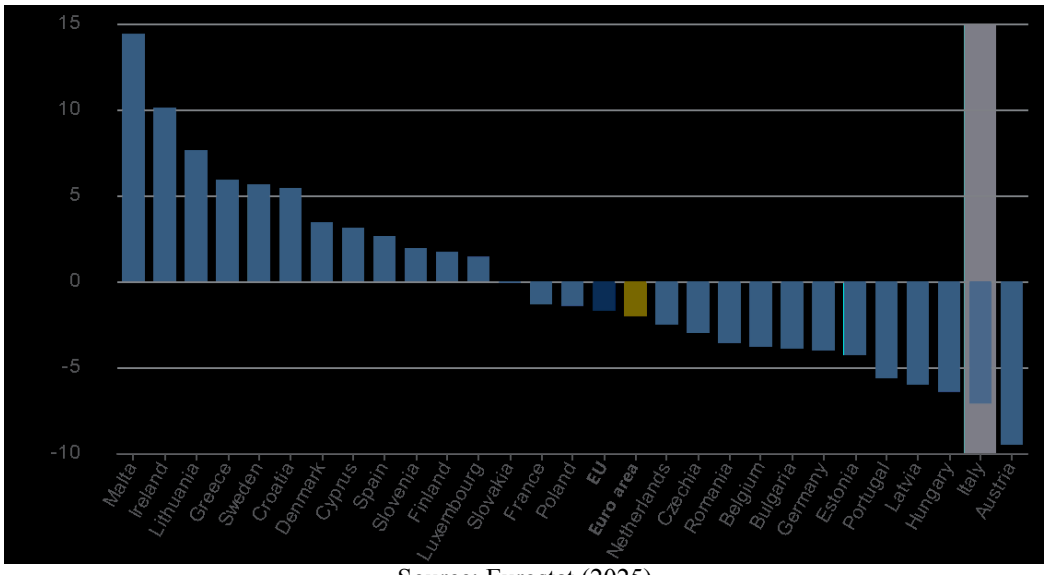
Table 1. Industrial production in EU- % change compared with same month of the previous year

2024	Jul	Aug	Sept	Oct	Nov	Dec
Total industry	1,5	-0,1	-1,7	-0,5	-1,5	-1,7
Intermediate goods	3,9	-2,4	-3,5	-2,7	-1,8	-2,3
Energy	1,2	2,2	1,5	-0,9	0,3	0,6
Capital goods	4,0	-0,4	-5,1	-1,8	-2,8	-7,5
Durable consumer goods	4,2	-4,4	-2,7	-2,6	0,5	-1,8
Non-durable consumer goods	4,4	2,9	5,1	4,3	0,5	8,2

Source: Author owns processing based on Eurostat data (2025)

In the EU, in December 2024, compared with December 2023, industrial production decreased by 2,3% for intermediate goods, 7,5% for capital goods 1,8% for durable consumer goods and increased by 0,6% for energy and 8,2% for non-durable consumer goods (Table 1). The largest annual decreases were recorded in Austria (-9,5%), Italy (-7,1%) and Hungary (-6,4%) (Figure 1). The highest increases were observed in Malta (+14,4%), Ireland (+10,1%) and Lithuania (+7,6%) [2].

Figure 1. Industrial production in December 2024 % change compared with December 2023



Source: Eurostat (2025)

Industrial production has a major importance for Romania, which has a significant industrial tradition and a substantial base of raw materials and energy sources/mineral resources. According to data provided by the National Institute of Statistics, Romania's industrial production decreased by 1,5% in 2024, the most drastic decreasing being in

electricity and thermal energy production, gas, hot water, and air conditioning, with 4,7% [3]. In January 2025, compared to December 2024, industrial production in Romania declined, as a gross series, with -2,3%. This decrease was driven by contractions in the extractive industry (-8,3%) and the manufacturing industry (-2,4%). However, the production and supply of electricity and heat, gas, hot water, and air conditioning increased by 0,8%. Despite these conditions, Romania demonstrated a positive performance in the industrial sector at the beginning of 2025, surpassing the European Union average [4].

The industrial turnover, encompassing both the domestic and external markets, increased nominally by 5,6% in 2024 compared to the previous year. This evolution was primarily influenced by the manufacturing industry, which grew by 5,9%, while the extractive industry registered a decline of 1,8%. Across major industrial groups, turnover growth was recorded in the following sectors: capital goods industry (+11%), durable consumer goods industry (+7,5%), fast-moving consumer goods industry (+3,8%), and intermediate goods industry (+3%). Conversely, the energy industry experienced a decline of 2,5% [5]. Thus, although certain industrial sectors in Romania have registered increases in 2024, the industry, as a whole, continued to face significant challenges, as reflected in the overall decline in industrial production.

Over the past decade, Romania's economy has undergone some of the most profound structural shifts in Europe and the share of industry and agriculture in GDP has registered the steepest decline in the EU. As a result, the contribution of industry to GDP formation dropped from 25.2% in 2013 to just over 20% at present, in the conditions in which, at the European level, industry has strengthened its role in GDP formation. Even if in 2013, Romania ranked second in the EU in terms of industry's share in the economic mix, following the Czech Republic, a decade later, the country has fallen to eighth place [6]. Even under these conditions, the industrial sector still holds a significant share in the economy.

In the current geopolitical and economic context, industrial policies within the European Union are crucial to ensuring security, prosperity, and climate change mitigation. New policies, focused on the sustainable transformation of Member States' industries, reflects a shift in strategic thinking at both the European and national levels. In this regard, Mario Draghi's report proposed a dual approach to the challenges of industrial transition, centered on decarbonization and competitiveness objectives [7].

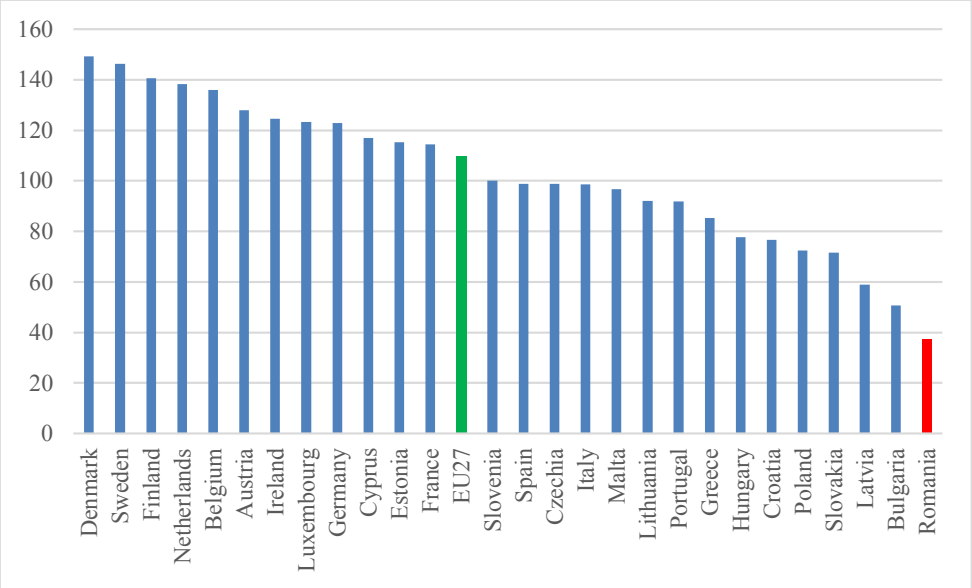
Competitiveness is at the heart of the EU's agenda and, Commission takes action to maintain European industry's global competitiveness, reach climate-neutrality by 2050, and make Europe fit for the digital age [8]. Europe now faces major transformations, the first of which is the need to accelerate innovation and find new growth engines. The EU's competitiveness is currently being squeezed from two sides. On the one side, EU companies are facing weaker foreign demand and rising competitive pressures from Chinese companies. On the other side, Europe's position in the advanced technologies that will drive future growth is declining. Only four of the world's top 50 tech companies are European and the EU's global position in tech is deteriorating: from 2013 to 2023 [7].

As a key driver of the EU's long-term competitiveness and prosperity, research and innovation policy is a powerful tool to achieve Europe's ambitious digital and green objectives and to enhance its resilience and technological sovereignty. In this context, the European Innovation Scoreboard serves as a performance compass for Europe's commitment to fostering innovation [9]

The European Union's innovation performance, as measured by the European Innovation Scoreboard, increased by 10% since 2017. Between 2023 and 2024, the EU's innovation performance improved by 0,5 percentage points as a result of the innovation performance increasing in 15 Member States. In 2024, Denmark occupied first position as the most innovative Member State, ahead of Sweden which was the leading EU Member State

from 2017-2022 (Figure 2.). Compared to the 2023 edition, the performance of Member States has remained relatively stable and most EU Member States have increased their innovation performance since 2017 [9].

Figure 2. European Innovation Scoreboard index in 2024



Source: Author owns processing based on Eurostat data (2025).

At the European level, according to the European Innovation Scoreboard 2024, Romania is an emerging innovator and occupies the last position in the EU in terms of innovation performance. Among the relative strengths of the Romania are: broadband penetration, exports of medium and high technology products and air emissions by fine particulates. On the other hand, relative weaknesses are: population with tertiary education, SMEs introducing business process innovations, innovative SMEs collaborating with others.

Alongside innovation, European industrial development strategies consider research and development as one of the key factors for boostimng economic competitiveness. Unfortunately, Romania faces significant challenges in strengthening its competitiveness through research and development and for many years research in Romania is underfunded. Although EU policy recommends allocating 3% of GDP to research and development `—1% from public funds and the remainder from private sources—public expenditure on research and development has been continuously declining in recent years (Figure 3.).

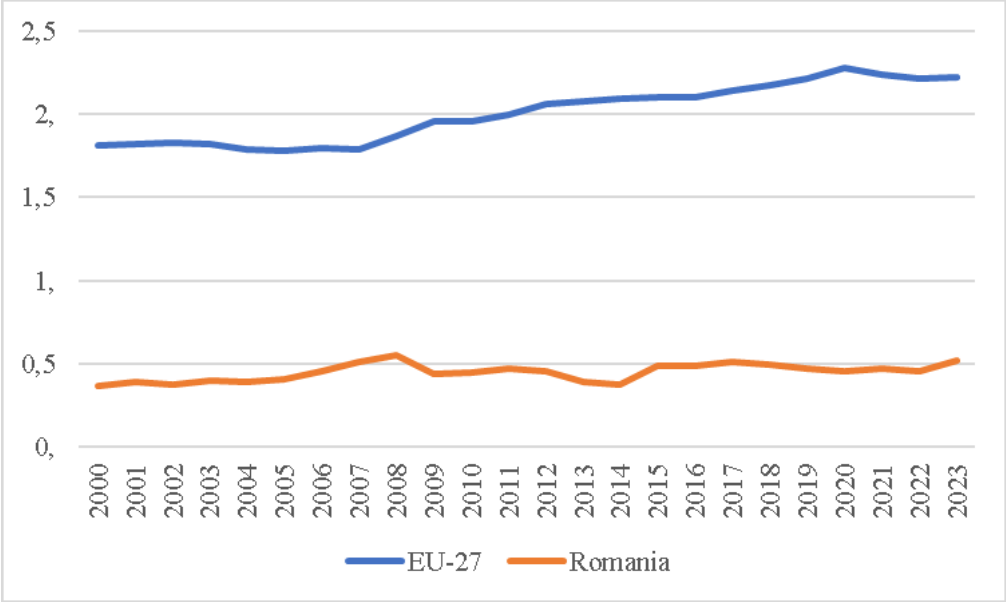
The level of research- development expenditure in Romania does not exceed 0,5% of GDP, significantly below the EU-27 average of approximately 2.2% of GDP [10] Chronic underfunding of research and development represents a major challenge for Romania, with profound implications for the country's economic, social, and technological progress. In an increasingly competitive world, where innovation serves as the primary driver of economic growth, insufficient investment in this field limits development potential and undermines Romania's ability to compete on the global stage. The effect of research- development underfunding is evident in economic performance, the migration of highly skilled personnel, the lack of innovation and technological development, and the declining quality of education.

This persistent Romania’s weakness is reflected in the low levels of investments in applied and experimental research. A lack of collaboration and coordination between public institutions, universities, and the business sector exacerbates this issue, further hindered by a limited and insufficiently attractive talent pool for researchers and innovators.

Applied research should be leveraged through innovation to generate positive economic impacts. However, Romania has consistently ranked last in the EU's Innovation Scoreboard, indicating that research is not effectively contributing to economic performance and competitiveness. Nevertheless, through the National Strategy for Research, Innovation, and Smart Specialization 2021-2027, Romania reaffirms its strategic commitment to increasing public research and development spending to reach 1% of GDP by 2027 [11].

Figure 3. Evolution of public research and development expenditures in Romania, 2000-2023

-% of GDP



Source: Author owns processing based on Eurostat data (2025).

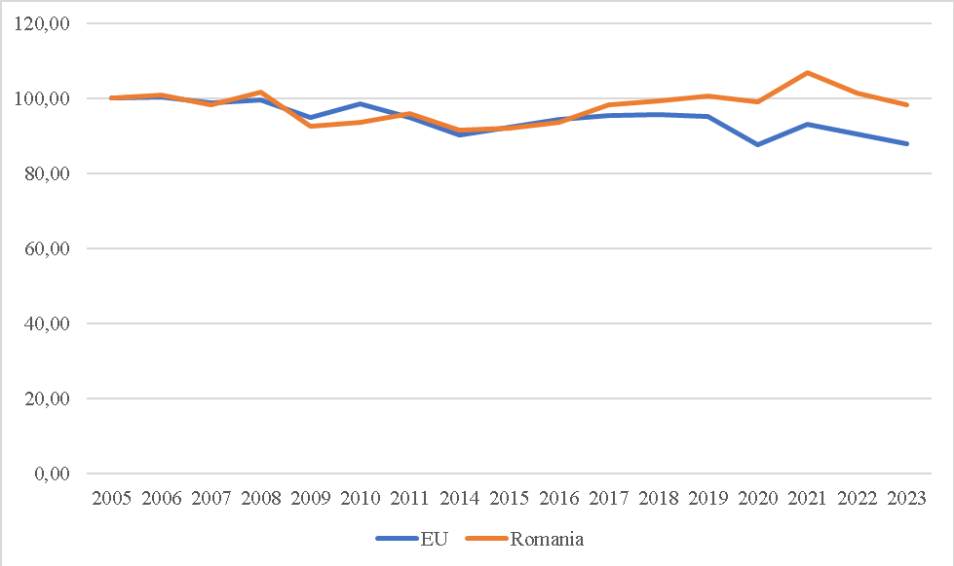
Also, Romania lags in the integration of digital technologies, ranking 27th in the EU for digital technology adoption, according to the 2024 Digital Economy and Society Index (DESI) [12]. The share of SMEs with at least a basic level of digital intensity stood at 22%, far below the EU average of 55%. Therefore, efforts must be intensified to meet the Digital Decade target, which aims for 90% of SMEs to achieve a basic level of digital intensity by 2030. Currently, only 12% of SMEs engage in online sales, and a mere 4% conduct cross-border e-commerce, positioning Romania behind most EU member states. Adoption of advanced technologies, such as cloud computing, remains low at just 11%, compared to the EU average of 34%. In terms of artificial intelligence, only 1% of Romanian businesses have integrated AI technologies (EU average: 8%). The use of big data analytics also remains relatively low at 5%, compared to the EU average of 14. On a slightly more positive note, the proportion of businesses with a medium-to-high level of green ICT initiatives stands at 68%, slightly above the EU average of 66% [12].

Regarding Romania's energy efficiency, the period from 2005 to 2023 was characterized by a general decline in final energy consumption, influenced by energy efficiency measures, the increasing share of renewable sources, and structural transformations in the economy. According to data from the National Institute of Statistics, in 2023, the final energy consumption for the entire economy decreased by 3.2% compared to 2022, due to declines recorded in industry (-13.8%), households (-4.3%), and agriculture and forestry (-2.7%) [13]. During this period, significant progress and initiatives aimed at aligning the country with the European Union objectives on sustainability and greenhouse gas emission reduction were highlighted. EU energy efficiency measures focus on policy areas with the greatest potential

for energy savings, like industry, the public sector, the construction and renovation of buildings, the transport and energy supply sectors

In 2023, compared to 2005, energy efficiency has improved both in the EU and in Romania (Figure 4). However, Romania remains below the European average in terms of energy efficiency [14] due to the greater dependence of its economy on energy-intensive sectors and the different pace of adopting energy efficiency measures.

Figure 4. Energy efficiency in Romania, 2005-2023- Index, 2005=100



Source: Author owns processing based on Eurostat data (2024).

We can consider that Romania has made progresses in improving energy efficiency, both by reducing energy consumption and by implementing policies and measures aligned with EU objectives, but but the differences with developed countries have not been completely eliminated. So, although Romania has recently shown signs energy efficiency improvement, it still faces major challenges that require the implementation of effective strategies to ensure sustainable and competitive growth.

In order to improve energy efficiency along the entire energy chain, to reduce greenhouse gas emissions, and increase the competitiveness of economic activity across all sectors of the economy in 2024 has beed adopted the Romania's Energy Strategy 2025-2035, with a perspective to 2050. In order to significantly improve energy efficiency at the national level, the Strategy proposes, by 2035 and with a view to 2050, the following: optimizing energy production, transmission and distribution processes to minimize losses and costs; using advanced technologies and practices to improve the efficiency of power plants, networks and other infrastructure; efficiently use of fossil fuels, the development and use of renewable energy resources, such as solar, wind and hydroelectric energy, and green gases (biomethane, hydrogen, synthetic methane, etc.), promoting energy efficiency among consumers – both industrial and residential, prioritizing investments in technologies and projects that offer the best return on investment over time [15].

3. CONCLUSION

The Romanian industry is undergoing a continuous transformation, shaped by both internal and external factors, such as European industrial policies, digitalization, and the need for a transition towards a green economy. While certain industrial sectors, such as capital goods

and durable consumer goods, have recorded growth, challenges persist in key areas such as research and development, digitalization, and energy efficiency. The main challenges of the Romanian industrial sector are:

- Declining industrial production– Romania experienced a contraction in industrial production in 2024 amid a broader industrial recession across Europe. This trend highlights the fragility of certain sectors and the lack of coherent policies to support domestic production.
- Underfunding of research and development – Romania invests well below the European average in research and development, hindering innovation and reducing the competitiveness of industrial companies.
- Delayed digitalization – The slow integration of digital technologies into the industrial sector negatively impacts productivity and efficiency.
- Skilled workforce shortage – The emigration of highly qualified labor and the lack of effective vocational training programs weaken the industry's ability to adapt to new technological requirements.

To overcome these challenges and ensure the sustainable and competitive development of Romania's industry, concrete measures are needed in several key areas:

- Increasing investments in research and innovation by: creating attractive funding schemes for companies investing in research and development, aligning applied research with business sector needs, increasing public funding for research, with the goal of reaching at least 1% of GDP by 2027.
- Accelerating industrial digitalization by: implementing a national industrial digitalization program, modeled after initiatives in other EU countries, to support the adoption of advanced technologies (automation, artificial intelligence, Internet of Things)., developing innovation incubators and technology hubs to support industrial start-ups.
- Stimulating domestic production and reducing import dependency by: launching a reindustrialization program to support strategic sectors and reduce key import dependencies, encouraging the production of industrial equipment through subsidies and tax incentives for local companies, supporting Romanian companies in integrating into European supply chains through export assistance programs.
- Transitioning to a green and energy-efficient industry by: providing subsidies for sustainable technologies, including renewable energy production for industrial use, promoting energy efficiency through modernization programs and digitalization of energy consumption.

Romania is in a crucial position to reshape its industry and increase its competitiveness in the international market. By investing in technological modernization, energy efficiency, research and development, as well as by capitalizing on the green and digital transition, Romania has the opportunity to strengthen its economic role in the region. However, success will depend on the adoption of coherent and sustainable strategic measures that facilitate the transition to a modern, digitalized, and sustainable economy. Investments in innovation, education, and green technologies are essential to positioning Romania as a strong industrial hub in the region. In this context, the active involvement of the government, private sector, and academic institutions is crucial for developing a resilient industrial sector capable of addressing future challenges.

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SUSTAINABILITY IN THE CAPITAL MARKETS AND SUSTAINABLE INDICES

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ABSTRACT: *The integration of sustainability principles into capital markets has gained increasing significance, driven by environmental, social, and governance (ESG) concerns. This paper examines the role of sustainable practices in capital markets, focusing on their potential to address ecological challenges, promote social equity, and enhance corporate governance. The research aims to evaluate how ESG criteria influence corporate financial performance, and market structures, with particular emphasis on sustainability indices. The study employs desk analysis of reports and a literature review to explore the evolution of ESG-focused investments, the challenges of quantifying and reporting sustainability, and the impact of ESG criteria on financial performance. Special attention is given to sustainable indices such as the S&P 500 ESG Index and the Dow Jones Sustainability World Index, comparing their methodologies and effectiveness in reflecting sustainable practices. Findings highlight the growing importance of ESG principles, which increasingly shape investment strategies and corporate policies.*

Keywords: S*ustainability, ESG principles, Capital markets, Sustainable indices, green economy*

JEL Classification: *G10, G11, Q01, Q56, M14*

1. INTRODUCTION

Over the past few decades, sustainability has become a pressing subject in virtually every sector of the global economy. This reflects a growing realization of how deeply economic

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activities affect our environment and society. The Sustainable Development Goals (SDGs), adopted by the United Nations in 2015, represent a global call to action to eradicate poverty, protect the planet, and ensure that all people enjoy peace and prosperity by 2030 (United Nations 2015). Among these goals, SDG 8, 9, and 12 are closely tied to fostering economic growth and sustainability, highlighting the delicate balance between economic development and environmental stewardship (Oprea & Duta 2024). Capital markets are closely linked to these SDGs as they immobilize investments that drive economic growth.

The capital markets, which serve as the backbone of international financial flow, find themselves at the forefront of both mounting challenges and emerging opportunities related to sustainability. The heightened importance of environmental, social, and governance (ESG) considerations has led to a rethinking of investment strategies, corporate governance frameworks, and the long-term goals of organizations (Comms, 2023). Stakeholders, ranging from individual investors to governments and large-scale institutional actors, increasingly recognize that sustainable economic activities can safeguard the planet while simultaneously generating long-term financial returns (Boitan, 2020).

The notion of integrating sustainability in capital markets is multifaceted. On one hand, ESG principles offer a tool to gauge the long-term viability and social responsibility of firms, an aspect that is very important for risk management in portfolios. On the other hand, sustainable investments also enhance firms' reputations, ensuring that companies remain socially conscious while meeting financial objectives (Arribas, 2020). Driven by a marked rise in investor's demand for ethically grounded investments, stock market indices dedicated solely to sustainable companies, referred to as "sustainable stock indices", have become very popular. These indices, although they are still in relatively primitive stages, aim to measure and track the performance of companies that demonstrate robust ESG credentials (SSE 2023).

However, integrating sustainability into capital markets is not without obstacles. Overarching issues such as the absence of standardized ESG reporting, a propensity for "greenwashing," and the lack of universally accepted ESG ratings, have led some sceptics to question the authenticity of sustainable investment products. As with any paradigm shift, there is an evolutionary process at play in which methodological frameworks, regulatory environments, and investor awareness must converge to create a smooth transition.

Against this backdrop, the paper explores how ESG integration influences companies' financial performance, investor behaviour, and capital market structure. Specifically, it delves into the progression of sustainable investments, their current performance indicators, and the growing prominence of sustainable stock indices. Throughout, the analysis highlights the ongoing challenges as well as the attendant opportunities to shape more equitable and resilient capital markets. The paper concludes by emphasizing why deeper alignment between sustainability and financial markets is imperative and beneficial for all stakeholders in an era of intensifying global environmental and social pressures.

2. LITERATURE REVIEW

The study of sustainability in the capital markets spans various theoretical perspectives and methodological approaches. Despite the diversity in empirical findings, a unifying theme in much of the academic literature is the growing significance attributed to ESG factors in explaining, and often enhancing, corporate financial performance.

The research of Miralles-Quiros (2021) underscores the accelerating pace at which firms produce and disclose ESG reports. A central question posed in this paper is whether these sustainability reports are credible, especially since firms increasingly resort to external auditors to mitigate potential biases. According to the study, ESG reporting can enhance a firm's stock price, particularly when the content of the report is deemed reliable. This indicates that the

market's response to sustainability disclosures goes beyond mere compliance; it hinges on perceived authenticity and thoroughness of the disclosed information. Notably, the research finds that companies listed on major stock exchanges tend to publish comprehensive ESG reports more frequently, even when they are not mandated, suggesting a growing perception that ESG disclosures translate into tangible economic advantages. Moreover, the paper reveals that between 2011 and 2019, the overall quality of ESG reporting has improved as companies strive to boost their share prices through sustainability narratives. This finding resonates with broader trends in investor sentiment, where stakeholders increasingly reward businesses that demonstrate substantive commitments to environmental responsibility and social well-being. The authors propose that governments and regulators could standardize assurance reporting, thereby ensuring comparability, reducing greenwashing, and strengthening the trust investors place in ESG disclosures (Miralles-Quirós et al., 2021).

The paper of Arribas (2021) evaluates the conceptual underpinnings of socially responsible investments, focusing on whether these indices genuinely eliminate unethical or irresponsible companies. Two limitations are highlighted namely the absence of universally recognized definitions for ESG-compliant businesses and the controversies regarding audit agencies that rate these firms. The research examines the Dow Jones Sustainability Index (DJSI) World and finds that around 10% of its constituent companies faced controversies, though the number of such companies declined by 40% from 2011 to 2016. This finding indicates a trend toward stricter enforcement of sustainability benchmarks but also uncovers inherent methodological flaws, such as geographic bias in the composition of the DJSI and calls for more transparent rating methodologies. Also, the observations underscore the complexities of measuring ESG performance uniformly across diverse regions, industries, and cultural contexts. While the existence of sustainability indices signals increased market demand for ethical investments, it is paramount to refine their underlying rating processes to bolster the credibility and impact of ESG-oriented portfolios (Ariba et al., 2021).

In a similar way, Blankenberg's (2018) study focuses on whether socially responsible investments necessarily imply a compromise on financial returns. Through empirical tests comparing traditional and socially responsible portfolios across three-year and five-year timelines, Blankenberg (2018) concludes that traditional portfolios often exhibit slightly superior performance. However, the study attributes this discrepancy to contextual factors, chief among them is the heightened volatility in green-energy-dominated industries during financial crises (e.g., 2008-2009), when oversupply and reliance on external funding drastically undermine profitability. Despite identifying short-term volatility among sustainable investments, Blankenberg (2018) posits that ESG-driven portfolios remain competitive, particularly when they are more diversified. The main weakness of the argument is that the limited sample size, only 20 stocks per portfolio, and a relative lack of diversification in the ESG basket may have skewed the findings. The paper ultimately maintains that socially responsible portfolios have substantial potential for long-term competitiveness, especially when they minimize volatility through broader industry and geographic diversification (Blankenberg, 2018).

The research of Jain (2024) operates on a similar premise but adopts a different methodological lens. By analysing closing prices from a variety of traditional and ESG indices between January 2013 and December 2017, the findings confirm the heightened volatility of ESG-focused indices. Surprisingly, the study also detects a significant correlation between ESG indices and their traditional counterparts in both short-term and long-term horizons, suggesting that broad market fluctuations affect both types of investments in a comparable manner. When examining risk-adjusted returns, Jain (2024) concludes that there is no statistically significant difference between ESG and traditional indices. This revelation is very important, because it runs counter to the popular notion that socially responsible investments

invariably produce inferior financial returns. Instead, it argues that ESG indices can be viable alternatives, perhaps even equally competitive with their conventional counterparts over time. This nuanced perspective aligns well with Blankenberg's (2018) findings, reinforcing the view that ESG volatility does not necessarily translate into weaker performance (Jain et al., 2024).

La Torre's (2020) paper extends the conversation by zeroing in on whether ESG-conscious firms enjoy advantages in the stock market. The focus is the Eurostoxx50 companies, among the largest and most liquid stocks in Europe. The authors employ multiple linear regression models to evaluate the correlation between ESG scores and stock returns, highlighting a foundational challenge: the inconsistency and opacity of ESG scoring systems.

Their analysis uncovers that ESG factors do not uniformly affect stock returns; rather, there is a pronounced sectoral dimension. Energy companies, in particular, exhibit clearer and more significant correlations between their ESG scores and market performance. This finding suggests that while ESG data can be somewhat inconclusive in a broad, cross-sectional context, it can still offer considerable explanatory power in certain high-impact industries. Like many other studies in the field, La Torre's conclusion reiterates the limitation of lacking a universal rating or measurement standard that can be applied unilaterally across markets (La Torre et al, 2020)

Finally, Shaik & Rehman (2023) work adds a geographic dimension to the debate, focusing on the comparative efficiencies of sustainable and conventional indices across various global regions. According to the study, ESG indices in the Middle East, the United States, Europe, and some emerging markets marginally outperform their conventional counterparts. By contrast, similar indices underperform in Asia, Africa, and Latin America. Additionally, Rehman observes that ESG indices in developed economies appear less volatile, a phenomenon potentially linked to robust regulatory frameworks and public policy support. The paper thereby underscores how regional contexts, shaped by local laws, infrastructure, and investor preferences, can dramatically influence the efficiency and attractiveness of ESG investments. When viewed alongside Arribas's (2021) analysis, it becomes evident that global ESG frameworks must contend with significant divergence in governance and cultural norms, leading to an uneven adoption of socially responsible principles worldwide (Shaik & Rehman, 2023).

3. METHODOLOGY

This study merges insights from the aforementioned literature with an original analytical framework designed to evaluate the impact of sustainable stock indices on both corporate performance and investor behaviour. First, a thorough review of relevant research was conducted, including the central findings of Miralles-Quiros (2021), Arribas (2020), Blankenberg (2018), Jain (2024), La Torre (2020) and Rehman (2023). Using a thematic analysis approach, recurring constructs (e.g., ESG indices, credibility and assurance in ESG reporting, performance versus volatility, regulatory discrepancies) were identified as critical areas of focus. Building on the literature, the study performed a comparative assessment of a selection of sustainable indices (e.g., DJSI World, S&P 500 ESG) against their conventional benchmarks (e.g., Dow Jones Global, S&P 500). Total returns, price volatility, and sectoral composition were examined over a multi-year horizon to gain insights into whether ESG-aligned portfolios produce unique risk-adjusted returns. While the raw performance data for these indices was derived from official sources such as S&P Dow Jones Indices, publicly available company financial statements, and prior academic works, the present study focuses on overarching trends rather than employing rigorous econometric modelling of each dataset. Last, the study scrutinized major ESG rating providers' methodological frameworks (e.g., the Corporate Sustainability Assessment used by Dow Jones, and the specialized exclusion criteria

of the S&P 500 ESG). The goal was to contextualize how such frameworks shape or constrain index composition. The implications for policy reforms, especially regarding standardization and heightened transparency, were also explored.

4. RESULTS AND DISCUSSIONS

As an overview of selected sustainable stock indices versus traditional Indices, as previously mentioned, the S&P 500 ESG Index includes top-performing S&P 500 companies by market capitalization while excluding controversial industries (e.g., tobacco, weapons, coal) and omitting those that fall below certain ESG thresholds (S&P Dow Jones Indices, 2025). A comparison of the annual total returns of the S&P 500 versus the S&P 500 ESG Index is presented in Table 1.

Table 1 – Comparison Between Traditional and Sustainable S&P 500 Indices Total Returns

Year	S&P 500 Annual Total Return	S&P 500 ESG Index Annual Total Return
2023	26.29%	27.99%
2022	-18.11%	-17.67%
2021	28.71%	31.78%
2020	18.40%	19.79%
2019	31.49%	33.39%
2018	-4.38%	-3.95%
2017	21.83%	21.26%
2016	11.96%	12.55%
2015	1.38%	0.53%
2014	13.69%	13.93%

Source: representation made by author, based on the data retrieved from Spglobal (2025)

Although the two indices track similarly, certain years reveal slight outperformance by the ESG benchmark. For instance, in 2021, the S&P 500 ESG Index posted a notably higher return than the traditional S&P 500. However, this could be influenced by back-data biases, since the ESG index was launched in 2019, and its particular methodology of excluding specific industries or low-ESG-scoring companies. Also, the S&P 500 ESG Index tends to feature the biggest and most successful companies. Their inherently large market capitalizations may partly explain the marginal performance advantage.

Compared to the S&P 500 ESG approach, the Dow Jones Sustainability World Index (DJSI World) employs the Corporate Sustainability Assessment (CSA) to identify the top 10% of companies based on long-term economic, environmental, and social criteria (S&P Dow Jones Indices, 2025). This results in a composition that is more noticeably distinct from the traditional Dow Jones Global Index. The annual price returns of the two indices over several years are presented in Table 2.

Table 2 – Comparison Between Traditional and Sustainable Dow Jones Indices Price Returns

Year	Dow Jones Global Index Price Return	Dow Jones Sustainability World Index Price Return
2023	19.51%	20.20%
2022	-19.88%	-17.77%
2021	16.14%	17.99%

Year	Dow Jones Global Index Price Return	Dow Jones Sustainability World Index Price Return
2020	14.08%	12.66%
2019	23.71%	24.14%
2018	-11.68%	-10.84%
2017	21.84%	24.18%
2016	5.87%	4.68%
2015	-4.02%	-6.66%
2014	2.12%	-1.05%

Source: representation made by author, based on the data retrieved from Spglobal (2025)

In some years, the sustainability index outperforms (e.g., 2017, 2019, 2021, 2023), while in other years it either underperforms or exhibits marginal differences compared to the Dow Jones Global Index. Notably, the DJSI World's methodology leads to a smaller, more specialized group of firms (around 300+), creating a portfolio that sometimes diverges more from the market norms than broader ESG indices like the S&P 500 ESG. Additionally, DJSI World was launched much earlier, in 1999, then the S&P 500 ESG Index in 2019, which may account for a more evolved methodology and possibly higher acceptance among market participants.

Recent evidence suggests that many publicly traded companies now recognize the importance of thorough ESG disclosures in shaping investor perception. Initially, many firms treated ESG reporting primarily as a public-relations exercise, often triggered by scandals or negative publicity. Over time, however, such reports have evolved into more detailed, standardized documents. This development aligns with the findings of Miralles-Quiros (2021), who noted that ESG disclosures have become more robust over the past decade, potentially helping companies manage reputational risks and appeal to socially conscious investors.

Nevertheless, there remains a persistent challenge of "greenwashing," particularly in the absence of an industry-wide template for ESG disclosures. Companies that invest in externally audited, comprehensive reports often find themselves overshadowed by peers publishing incomplete or selectively presented metrics. This discrepancy highlights the urgent need for policy interventions that harmonize and verify ESG reporting.

Regarding the performance patterns of sustainable Stock Indices, consistent with Blankenberg (2018)'s and Jain et al. (2024) discussions, the differences in annual returns between ESG indices (e.g., DJSI World) and their conventional counterparts (e.g., Dow Jones Global) often remain modest, with neither type consistently outperforming the other over the entire sample period. Some indices such as the DJSI World showed marginally higher returns in certain years, while in others, they underperformed their mainstream equivalent. This pattern aligns with Jain's finding that, on a risk-adjusted basis, ESG indices can match, and occasionally surpass, traditional indices, pushing back against the assumption that sustainability equates to lower returns (Jain et al., 2024).

Regarding the volatility concerns, echoing Blankenberg's (2018) assertion that ESG portfolios can be more volatile, the data also revealed higher levels of annualized volatility in certain ESG indices, especially those highly exposed to alternative energy firms. Thus, the volatility stems partly from the sensitivity of green industries to regulatory changes, reliance on governmental subsidies, and market oversupply issues (as seen in solar or wind technologies). Yet, for large-cap dominant ESG indices like the S&P 500 ESG, the volatility differential was minimal compared to the traditional benchmark, suggesting that the size and diversification of component firms mitigate fluctuations. (Blankenberg, 2018)

Energy and industrial sectors continue to exhibit the most pronounced performance disparities. Sustainable indices that emphasize renewable energy can experience more significant swings, responding to changes in policy support or fluctuations in commodity prices

(e.g., oil vs. solar). These findings (S&P Dow Jones Indices) support La Torre et al. (2020) conclusion that sectoral variables can overshadow the broad-based ESG effect on performance.

Rehman's (2024) contention that geographical factors dictate the extent to which ESG indices outperform conventional ones was also borne out by the data reviewed here. ESG indices in developed markets, such as the U.S. or Western Europe, often displayed returns on par with or slightly above their benchmarks and with marginally lower volatility. By contrast, ESG products in emerging markets or regions with less comprehensive regulatory environments exhibited inconsistent, and sometimes underwhelming, performance records. The discrepancies in corporate governance standards, adherence to environmental regulations, and general economic infrastructure all contribute to these divergent results.

Recent evidence reveals a clear shift among institutional investors, such as pension funds and insurance companies, toward integrating ESG criteria as part of standard due diligence. Heightened regulatory focus, notably in the European Union, has introduced new guidelines, e.g., the EU Taxonomy for sustainable activities (European Commission and United Nations). Even in markets without strict ESG mandates, there is a growing expectation that future regulations will become stricter. This development is driving many companies to adopt at least baseline ESG measures to remain competitive and safeguard themselves against potential sanctions (Arribas, 2020).

Despite the encouraging developments, systemic gaps remain. Most notably, the absence of a universal ESG rating methodology can result in contradictory scores for the same company across different rating agencies. Recent developments also underscore the rise of external audits for sustainability reports while highlighting the lack of uniform standards (Miralles-Quirós, 2021). Consequently, well-intentioned companies may receive suboptimal ESG scores due to technical discrepancies in reporting, whereas those adept at marketing could paint an overly optimistic picture of their sustainability record. These trends align with Arribas (2021) caution about potential flaws in the rating process and underscore the urgent need for standardized ESG definitions and criteria.

5. CONCLUSIONS

Over the last decade, corporations have increasingly embraced transparent ESG disclosures, recognizing the reputational and financial benefits thereof. External assurance mechanisms have improved the trustworthiness of these disclosures, although further standardization remains necessary to fully address "greenwashing" concerns. Empirical evidence on whether ESG indices outperform conventional ones remains inconclusive. While certain indices, such as the DJSI World, occasionally post higher returns, others underperform in specific contexts, suggesting that ESG integration alone does not guarantee superior financial performance. Nevertheless, risk-adjusted analyses often show parity or marginal outperformance by ESG portfolios, debunking the assumption that sustainability inherently equates to lower returns.

Industry and geographic factors exert meaningful effects on how ESG initiatives translate into performance. Renewable energy companies contribute to higher volatility, while robust regulatory frameworks in developed economies can enhance the stability and appeal of ESG investments. Concerns about the consistency and comparability of ESG scores and sustainability reporting signal the necessity for global standardization. Such harmonization would curtail greenwashing, enable investors to make more informed choices, and level the playing field for genuinely responsible businesses.

From a policy perspective, there is a clear mandate for regulators to prioritize uniform ESG reporting requirements and stringent verification procedures. Creating incentives for more rigorous ESG disclosures, alongside punitive measures for greenwashing, can reinforce trust

in sustainable capital market products. Firms, for their part, should invest in credible sustainability metrics and transparent governance structures to meet stakeholder expectations and stay ahead of evolving regulations.

The convergence of investor demand, societal expectations, and forward-looking corporate management is likely to accelerate the mainstreaming of sustainability principles. As the global community continues to grapple with climate change, social inequality, and governance failures, the capital markets can serve as a dynamic forum where financial returns and sustainability objectives align. The ongoing evolution of sustainable stock indices, alongside ever-more sophisticated ESG assessments, signals that this alignment is not merely aspirational but increasingly integral to how we conceptualize and operationalize the global economy of the future.

The research has some limitations. First, the reliance on secondary data for index performance restricts the capacity to identify confounding factors, such as macroeconomic conditions and sector-wide shocks. Second, while the frameworks of major ESG rating providers were reviewed, the study did not undertake a deep technical dissection of algorithms or weighting schemes, an exercise that would require proprietary access.

As sustainability moves from a peripheral consideration to an integral component of capital markets, future research might further investigate the interplay between ESG-specific variables and financial outcomes across a broader timeframe. Longitudinal studies that capture multiple economic cycles could yield deeper insights into the resilience and risk profiles of ESG-focused investments. Additionally, the development and refinement of universal ESG frameworks would benefit both practitioners and researchers, enabling a more accurate evaluation of the link between corporate responsibility and financial metrics.

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RECENT DEVELOPMENTS IN ROMANIA'S TRADE IN CREATIVE SERVICES

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ABSTRACT: *Going through multiple transformation processes over the last three decades, Romania' economy has managed to approach the general positive trends of EU economies, trade in services being one of the representative areas in this regard. This paper emphasises the latest developments in trade in creative services in Romania, in the context of the general increasing evolution of service sector and trade in services as well as their contribution to national economic development. The results of our investigation highlight the positive trends of service industries, in general, and creative ones, in particular, supported by favourable determinants. The infrastructure facilities, as well as the quality skills and human capital stand out, making it possible for Romania to assert itself in the export of software services. Also, the progress in the implementation of digital technologies sustains Romania's performance in exports of creative services related to the information technology services.*

Keywords: *creative services, Romania, trade in services, digital delivery services, IT services.*

JEL Classification: *F23, F43, L86, O11, O14.*

1. INTRODUCTION

The relatively recent concept of creative economy is gaining greater importance globally, capitalizing on some of the most valuable resources, such as human creativity and ideas, on the one hand, and intangible assets such as intellectual property, knowledge and technology, on the other hand. Related to this, a series of creative industries have developed, with complex and high added value economic activities, notably those associated to the creative services. Given their valuable content and high contribution to economic performance, creative services stand out in particular. The internationally recognized creative services are as follows: research and development; software; audio-visual services; information technology services; advertising, market research and architecture; cultural, recreational and heritage services (UNCTAD, 2024a). Given their extensive coverage and especially their support to the value added in all economic sectors, creative services are heavily promoted, their international trade being in a continuous increasing trend (in 2023, the global creative services exports got a new record of USD 1,519 billion, an increase of almost 3 times compared to the 2010 level, coming to represent 19% of global services exports) (UNCTAD, 2024b). However, the distribution of this category of services is uneven, the main benefits of the trade in creative services being achieved by developed countries (in 2023, they dominated the global export of creative services exports with 80%, respectively USD 1,207 billion). At the same time, at the level of the

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structure of creative services group, a high concentration is observed, in which two categories of services, namely software, as well as research and development, account for 72% of global total creative services exports (UNCTAD, 2024b).

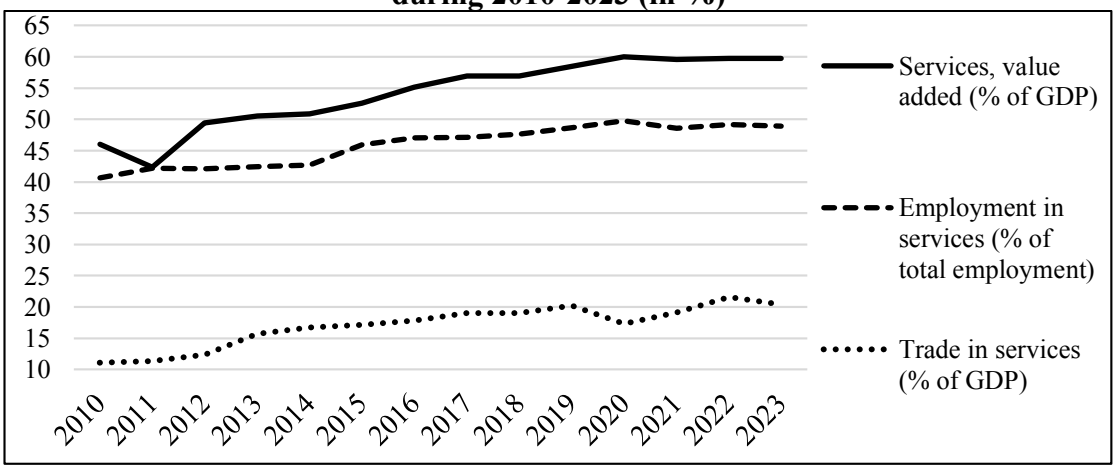
Romanian economy, an Eastern European country that has undergone significant reforms during the last decades, stands out for its service sector developments, even the participation in global trade in services flows in still modest (0.56% in the global commercial services trade and 1.46% in the European Union commercial services trade, in 2023) (WTO, 2025a). Its creative industries are a growing sector that connects modern innovation with its cultural heritage (ERCI, 2025). From software, digital media and design to traditional crafts and performing arts, Romania has managed to become visible in the global creative economy, especially through developments during the last years (UNCTAD, 2024c). This segment of services contributes to Romania's foreign trade, as well as to the its economic growth.

The objective of this paper is to emphasise the relevant recent aspects related to Romania's developments in trade in creative services, underlying the determinant factors that supported their evolutions and also the perspectives of the creative services exports.

2. THE EVOLUTION OF ROMANIA'S TRADE IN SERVICES – GENERAL APPROACH

During the past three decades, Romanian economy has undergone many restructuring processes aimed at macroeconomic development, the accession to the European Union (EU) acting as a major support. As part of this process, Romania has engaged in significant reforms, the most prominent being related to the adoption of favourable foreign business regulations, especially those aimed at trade liberalization and opening up to foreign investments. As a consequence, after intensive transformation processes, the service industries are the most significant structure in Romanian economy, given the services contribution to the value added of GDP (60.7%, in 2023), employment (48.9% of total employment, in 2023), and trade in services of GDP (20.4% in 2023) (WBG, 2025a). The continuation of positive developments in the economy targets the European Union average of these indicators (value added of 65.5% of GDP, employment in services of 72% and trade in services of 30.8% of GDP). The evolution of the main macroeconomic indicators of the service sector highlights its positive progress, which is appreciated for its role to the economic development of the Romanian economy (Figure 1).

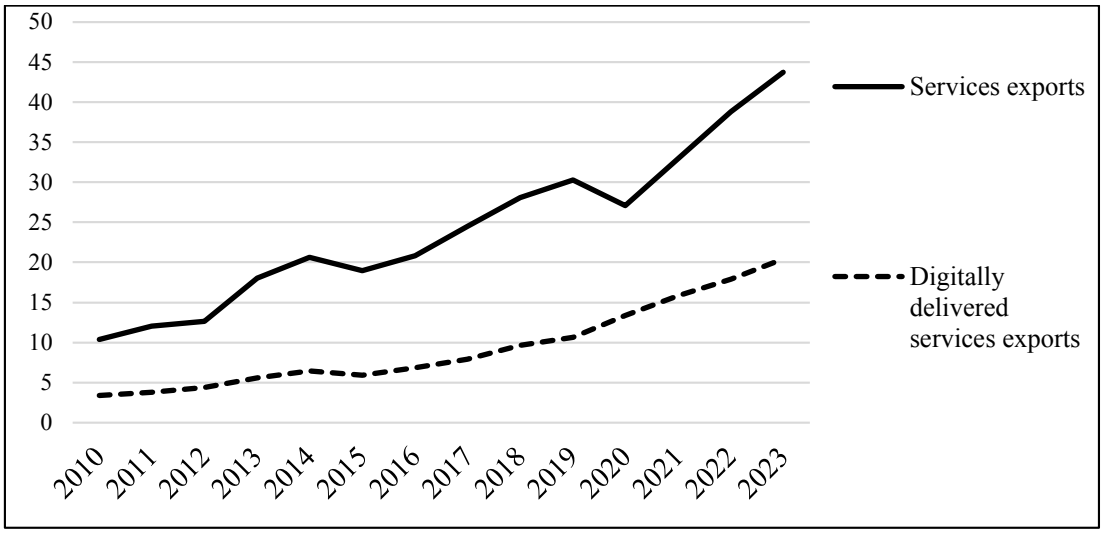
Figure 1. The service sector development indicators of Romania, during 2010-2023 (in %)



Source: Author's representation based on WBG (2025a).

Romania's trade in services has seen upward trends since the 2000s, the data presented in Figure 2 revealing the setting of new records year after year (except in 2020 because the restrictions imposed during the COVID-19 pandemic), both for total service exports (USD 43.69 billion, in 2023), as well as digital service exports (USD 20.44 billion, in 2023) (WTO, 2025). During this period, Romania managed to maintain a trade surplus in services, having an important contribution in improving the total trade balance (with a very large deficit recorded for goods trade balance) (WTO, 2024a; WTO, 2024b).

Figure 2. The exports of total services and digitally delivered services of Romania, during 2010-2023 (in USD billion)

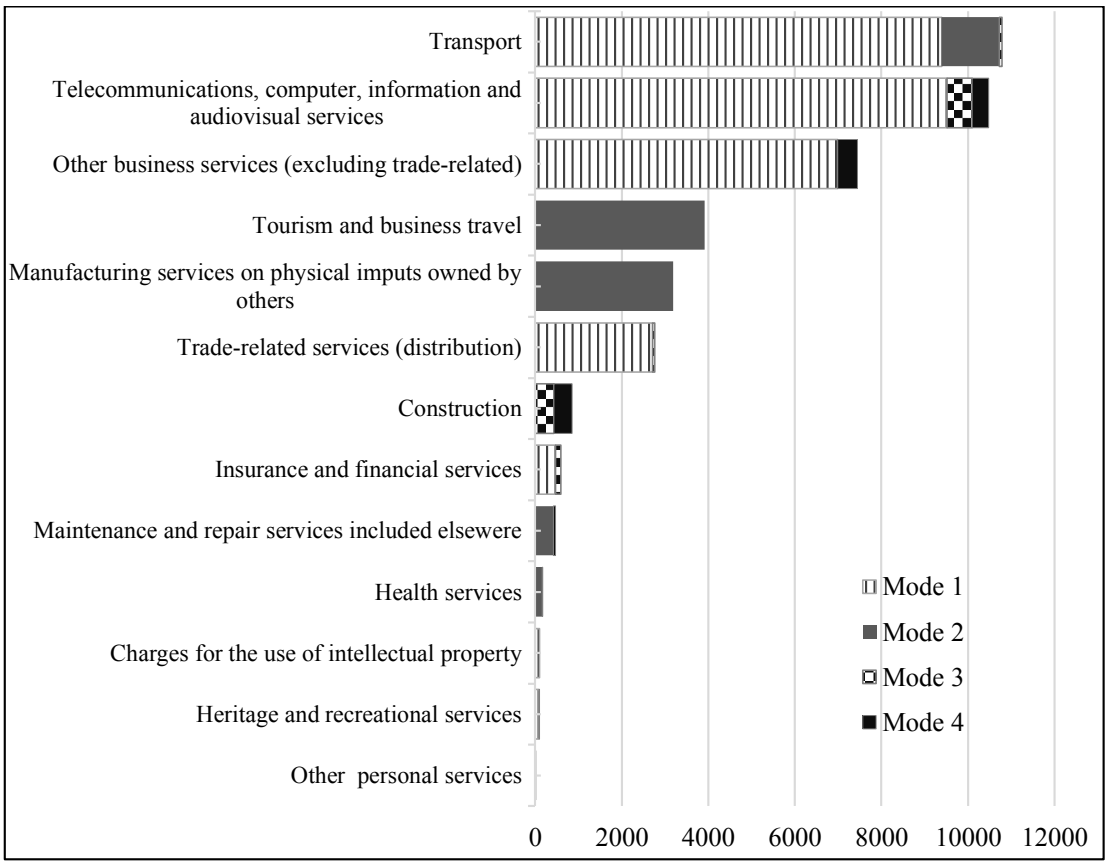


Source: Author's representation based on WTO (2025a, 2025b)

The data on the main categories of exported services, according to the balance of payments classification, reveals that Romania's service exports are dominated by transport (26.4% of total), telecommunications, computer, information and audiovisual (25.7%) and other business services (18.3%), in 2022 (the latest available data) (WTO, 2025a). The analysis of the distribution of service exports across the four modes of service supply (classified by the WTO's General Agreement on Trade in Services - GATS), highlights the intensification of the use of digital technologies. In 2022, 71.6% of total services were exported by mode 1 of GATS (cross-border trade: services provided from one country to another), a significant increase from 57.2% in 2012 (WTO, 2025a).

Given the major challenges of the global economy, Romania's trade in services, as well as trade in digital services, have to ensure and support the resilience and economic competitiveness. Due to the high level of international connectivity of the Romanian economy, the prospects of its trade in services will continue to be influenced by phenomena in the global economy, including the intensification of the use of smart technologies in service industries and geopolitical tensions.

Figure 3: The structure of service exports of Romania, by domain and mode of supply*, in 2022 (in USD million)



Note: *GATS defines four modes of services supply: mode 1 - cross-border trade, mode 2 - consumption abroad, mode 3 - commercial presence, and mode 4 - presence of natural persons (WTO, 1995).
Source: Author's representation based on WTO (2025a).

At the same time, Romania's trade in services, mainly in services intensive in new technologies and human capital, depends on national policies regarding increased investments in education, infrastructure and innovation that will ensure the growth of the competitiveness of service exports.

3. THE TRADE IN CREATIVE SERVICES IN ROMANIA – EVOLUTIONS AND DETERMINANT FACTORS

The creative services make an important contribution to supporting Romania's service exports, this situation being recognised by its position in the top of the main global economies ranked by the share of creative services in total service exports. Accordingly, in 2022, Romania ranked fifth with 28.4% (after Ireland with 65.1%, Israel 36.5%, Sweden 33.7%, and Japan 32.1%). At the same time, in 2022, Romania ranked the second position in the global top of the countries with the highest annual growth rate of creative service exports with 15% (after Israel with 18% and followed by Spain 13%, Portugal 10% and Denmark 7%) (UNCTAD, 2024c).

Taking into account the list of creative services recognized by international organizations (mainly UNCTAD and WTO), the data recorded in the Romania's balance of payments indicates that creative services have a significant contribution to service exports primarily dominated by those included in the large group of telecommunications, computer,

information and audiovisual services (Figure 3) (WTO, 2025a). The data presented in Table 1 reveals a detailed perspective of the export values of Romania's main creative services categories in 2021 (the latest available data), within which software exports lead with 18.3% of total creative services exports. At this level of analysis, it is also relevant to note the main destinations of Romanian exports of creative services, with the data in Table 1 highlighting Western European countries (predominantly Germany, France, Ireland, the United Kingdom, the Netherlands and Switzerland) and the United States in the top positions.

Table 1. The exports of creative services of Romania, in 2021, by main categories and international partners (in USD, %)

Categories of creative services*	Total value (USD)	Share of total service exports (%)	Main export partners	
			Country	Value (USD)
Computer services - software	6,043,566	18.32	Germany	1,261,984
			USA	861,508
			United Kingdom	670,022
Architectural, engineering, scientific, and other technical services	1,663,524	5.04	Germany	430,399
			France	250,623
			Netherlands	107,393
Information services	1,196,815	3.63	USA	241,279
			Germany	191,013
			United Kingdom	182,615
Advertising, market research, and public opinion polling services	1,169,612	3.55	Irland	231,226
			Switzerland	141,574
			United Kingdom	130,456
Research and development	906,689	2.75	Germany	361,919
			France	207,689
			Irland	74,513
Other personal, cultural, and recreational services (other than audiovisual and related)	128,091	0.39	France	5,559
			United Kingdom	4,613
			Germany	3,312
Audiovisual and related services	74,513	0.23	France	2,602
			Germany	1,892
			Irland	473
Total	**32,992,541**	**33.89**	-	**5,362,664**

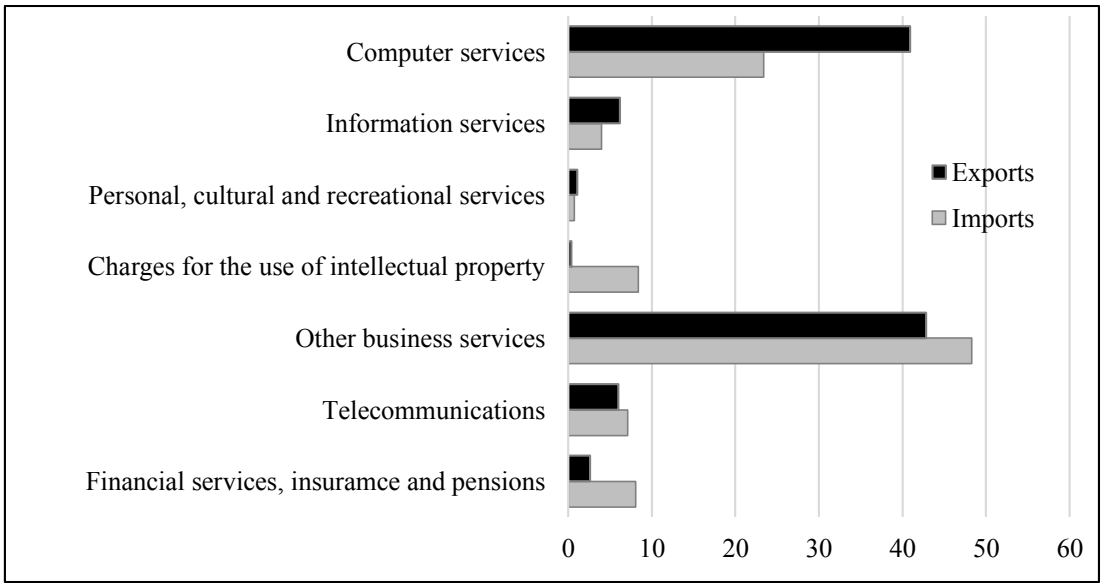
Note: *The creative services categories are listed as in the ITC classification.
Source: Data extracted by the author from the ITC (2025).

The creative services industries and trade in this category of services are fundamentally related to the level of skills and digital infrastructure. From this perspective, Romania obtains good results in terms of specific indicators, as follows: the mean years of schooling is 11.3 (in 2021, the latest available data), the share of individuals using the internet is 86% (in 2022), and the share of individuals with an internet account is 69% (in 2021) (UNCTAD, 2024c). The value of World Bank Human Capital Index is also relevant in appreciating the conditions for developing creative service industries, in this respect Romania recording 0.6 (in 2020) (WBG, 2025b).

The expansion of creative service exports (mainly software but also the other services) has been considerably supported by the intensification of the development and use of digital tools and recently the artificial intelligence (AI), which have increased the potential for innovation, as well as for getting access to global markets. Digital technologies will have a significant contribution to the future growth of the creative services industries in Romania, in this regard, investments in infrastructure and human capital along with a regulatory framework favourable to their development and use being crucial. The data represented in Figure 4

emphasises that the main categories of services traded by digital means are the creative ones or associated with them, respectively computer services, information services, as well as personal, cultural and recreational services. It is also observed the trade surplus get in the computer services and information services, these results reflecting the Romania's level of specialization in these domains.

Figure 4. The main categories of digitally delivered services exports and imports of Romania, in 2023 (in % of total)



Source: Author's representation based on WTO (2025b).

The growth of Romania's creative service industries has been also sustained by the foreign direct investment (FDI) projects implemented during the last decades with an also major role in modernizing and developing the entire economy. FDI has supported the information technology (IT) services growth, nowadays Romania becoming a significant player in the global IT market, thanks largely to the investment projects of multinational tech companies, in establishing here development and support centres (RAIFT, 2023). These investments have contributed to improving skills and stimulating innovation, essential conditions for the development of creative service industries and also trade in creative services. As a result, Romania has become a hub for IT and software services exports, with the sector representing an increasing share of the country's services exports (according to NBR, in 2024, the group of telecommunication, computer and information services achieved 25.4% of the total service exports) (NBR, 2025).

Foreign companies in IT have been increasingly attracted to Romania due to its good specialized labour force, sustained by the strong university programs in STEM (science, technology, engineering and mathematics) providing high competences in software development and data science, as well as foreign language proficiency. The large number of skilled IT professionals, focused on computer science, mainly in the major cities of Romania (such as Bucharest, Cluj-Napoca, Iasi and Timisoara), has sustained the good results in the export of creative services. Romania scores second highest in the EU regarding the proportion of information and communications technology graduates (6.7% of the total higher education graduates). However, the proportion of information and communications technology specialists of total national workforce is only 2.6%, with an increasing trend during the last years, but still much lower than the EU average (4.5%). The difference between graduates and specialists in information and communications technology is explained to a large extent by the

brain drain (EC, 2023). Also, until 2025, employees involved in computer software development activities benefited from income tax exemption, which represented a supporting factor for the development of this field (PwC, 2025).

The level of communication costs is another major factor in supporting IT-related services. In this respect, Romania is in the first position in terms of competitiveness compared to EU countries, with the lowest level of communication prices (38% compared to the EU average) (Eurostat, 2020). In addition, the development of IT services in Romania is also supported by the high internet penetration rate (88.9% internet penetration rate of the total population, in 2023) and high-speed internet coverage (among the top ten EU countries) (Portal, 2023).

The data regarding the good results of Romania's creative service exports are also supported by the study conducted by NICRT (2018). The analyses undertaken demonstrate the upward evolution of the economic contribution of the creative and cultural industries to national GDP (3.8% in 2018 from 3.3% in 2015), gross value added (4.2%, in 2018 from 3.7% in 2015), turnover (EUR 13,053 thousand in 2018 from EUR 9,334 thousand in 2015), net profit (EUR 1,675 thousand from EUR 819 thousand in 2015) and employment (244,943 in 2018 from 206,881 in 2015). The data in Table 2 reveals that the main creative service industries generate more than 70% of turnover, 75% of net profit and around 70% of the employment, all related to the entire group of creative and cultural industries, in 2018. Among them, IT services are far ahead of other creative service segments, the distance reconfirming the importance of them within the creative services developed in the Romanian economy.

Table 2. Economic performance of the main creative service industries in Romania, in 2018 (in %, EUR)

Indicators / Creative services	Turnover (% of total creative and cultural industries)	Net profit (EUR*)	Number of employees
IT services	41.5	693,396	108,335
Advertising	14.8	223,514	21,738
Audio visual and media	10.4	206,788	18,569
Architecture	2.6	29,480	9,027
Research	3.3	92,205	12,542
Total	**72.6**	**1,251,108**	**170,211**

Note: *Calculated by the author based on the average annual exchange rate RON/EUR published by National Bank of Romania in 2018.

Source: Realized by author based on NICRT (2020).

As highlighted by the above statistical analyses, in addition to IT services, Romania's export of creative services is complemented by a number of other domains. Among these, the following stand out: digital media and game development (due to a skilled workforce, competitive costs and a growing number of startups); international film productions (given the scenic landscapes and cost-effective services) and festivals; music events and festivals (covering a wide range of musical styles from classical to electronic, with a growing international audience) (ERCI, 2025). Also, in the advertising field, Romania has a well-developed market, thanks to a significant number of specialized agencies, supported by human skills in traditional and digital media.

4. CONCLUZION

Running through multiple economic transformation processes in the last three decades, Romania is making efforts to get closer to the general positive trends of EU economies, trade

in services being one of the representative areas in this regard. The creative services are increasingly significant contributors to Romanian service exports, with 28.4%, in 2022 (ranking it fifth in the world by the share of creative services in trade in services). The annual growth rate of creative service exports of 15 % ranked Romania the second position in the global top of the countries with the highest annual growth rate of creative service exports in 2022.

The IT sector stands out among the creative services exported by Romania, with over 40% of Romania's total service exports in 2023. The development of Romania's creative service has been sustained by the foreign direct investment, especially in IT services, nowadays Romania becoming a significant player in the global IT market. At the same time, other creative services are in rapid growth in Romania, with a presence on the international market, especially in the areas of audiovisual.

All recent results related to the growth of creative services are due to the quality of human capital and skills developed in the Romanian university educational system and also digital enhancements, given that many creative services are internationally trades through digital means. Digital tools and artificial intelligence have the capacity to generate important changes both in the development of Romania's creative services, enhancing their scope and efficiency, and also in their expansion on foreign markets.

The high level of specialization and added value of creative services exported by Romania support the future development of creative service industries in Romania, especially in the context of the latest evolutions of smart technologies with important potential in increasing the competitiveness of creative industries, and of the entire economy.

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