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O ČASOPISU

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ARTICLES – ČLANCI

Impact of ESG Implementation on Credit Ratings and Financial Performance: A Sustainability Perspective[*]

Darko Ban[1], Dejan Miljenović[2]

Abstract

The purpose of this paper is to analyse how the implementation of the ESG concept affects the credit rating and financial performance from a business micro-perspective. Environmental, social, and governance factors and risks, as components of the ESG concept, are challenging companies and pose sustainability risks to which companies react differently. The development of green financial instruments is an additional incentive for companies to commit to the process of green transition. Assessing ESG performance helps recognise strengths and weaknesses of the corporate sector in the process of contributing to global sustainability goals. Current sustainability achievements of companies can be analysed through ESG ratings. This research found that differences in rating agencies' methods for defining ESG criteria and assessing ESG ratings do not ultimately lead to significant deviations in ratings. The implementation of the ESG concept in large companies (corporations) has no impact on profitability in the short term. Therefore, the effects of sustainability investments should be monitored over the long term. The research results indicate positive relationships between governance factors, ESG ratings, and the credit ratings of large companies. Based on the given results, it is concluded that investing in sustainability and ESG implementation has an overall positive impact on a company's performance.

Keywords: *sustainable finance, green investments, ESG ratings, financial performance*

JEL classification: *G11, G24, G32, Q56*

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1. Introduction

According to the European Environment Agency (2024), sustainable finance involves the integration of environmental, social, and governance (ESG) criteria into investment decision-making processes. The concept of environmental, social, and governance (hereafter: ESG) criteria was first introduced in the United Nations (hereafter: UN) report, the Global Compact (2004), Who Cares Wins: Connecting Financial Markets to a Changing World (Eccles et al., 2019). With the introduction of the ESG concept, a methodology for ranking companies based on their triple-bottom-line performance in the area of sustainability was also introduced.

The ESG concept stems from the broader framework of corporate social responsibility and involves analysing non-financial performance elements to improve technological processes aiming to reduce a company's environmental impact while positively influencing its financial results (Hughes et al., 2021). As a recently developed approach, ESG is constantly considered as a determinant of the sustainable growth of companies, just as is the case with the traditional financial determinants of corporate growth (Malinić et al., 2020). Devalle et al. (2017) outline that the interplay between ESG factors and credit risk is an inevitable factor in overall financial stability and capacity to meet long-term obligations.

In order to determine the short-term effects of the implementation of the ESG concept on the company's financial results, the focus was placed on the net profit margin, which is a clear indicator of a company's bottom-line profitability. This methodology enables the direct assessment of financial repercussions and provides valuable insights into the efficiency and effectiveness of initial ESG investments from a purely profit-driven perspective (Agranat, 2023).

The study includes an overview of related research through the literature. It outlines the methodology for selecting the sample from which the independent and dependent variables are derived, the methodology for determining the relationships between the variables, an analysis of the research findings, and a discussion leading to a conclusion of the paper.

2. Literature review

In corporate practice, high ESG ratings and sustainability standards integrated into business operations are expected to enable better access to green financial instruments, suggesting that an improvement in a company's ESG rating has a positive impact on its creditworthiness. In practice, to ensure that sustainability information is as relevant as financial information, sustainability issues that are financially relevant or material to the company's business model must be identified (Eccles et al., 2012). According to Vortelinos et. al. (2024) and Alain et al. (2017), there is a positive correlation between

ESG ratings and credit ratings. Chodnicka-Jaworska (2021) states that ESG ratings have a strong and positive influence on credit ratings, which can also be explained by the methodology used to determine credit ratings, as rating agencies include ESG factors in their assessments. Rating agencies take into account the degree of corporate social responsibility when assessing a company's creditworthiness (Attig et al., 2013). Similarly, Jiraporn et al. (2014) find that corporate social responsibility has a positive impact on creditworthiness. According to Kim and Li (2021), ESG ratings have a positive effect on creditworthiness, with the relationship being stronger for large companies. Agosto et al. (2022) also suggest that ESG ratings can be used to predict a company's credit rating.

Implementing the ESG concept in business operations and investing in sustainability can also have an impact on a company's financial performance. Various factors play a role here, e.g., industry specifics, the alignment of investments with the business focus, the size of the company, the source of financing, the amortisation period of the investments and other variables. According to Bissoondoyal-Bheenick et al. (2023a), company size plays an important role in examining the correlation between ESG ratings and financial performance. Chen et al. (2023) found that the implementation of the ESG concept in companies has a positive effect on financial performance, with this effect being more pronounced for large companies. A higher ESG score correlates with better financial performance (Wang, 2024). Companies with effective ESG management reduce financial costs, which has a positive impact on their financial performance (Fatemi et al., 2018). However, the hypothesis that sustainability investments increase profitability is not supported by all studies. According to Garcia and Orsato (2020) and McGowan (2022), companies that invest in environmental and social responsibility may waste resources and incur additional costs, resulting in a negative impact on the business. Some authors are indifferent about the relationship between ESG and company performance. Hussain et al. (2018) and Li (2024) conclude that ESG ratings do not affect a company's financial performance. Financial performance is a broad array of metrics, including profitability, revenue growth, operational efficiency, and market valuation, which collectively reflect a company's financial health and operational success (Earnhart, 2018). In this research focus is on net profit margin. This focused approach allows for a more granular assessment of the causal links between ESG adoption and financial profitability, particularly within the constrained timeframe of short-term financial reporting (Seco et al., 2024).

The historical overview of key studies incorporating non-financial factors in credit risk assessment begins in the 1990s with a focus on corporate governance and corruption (e.g., Ciocchini et al., 2003), continues in the 2000s with the integration of intangibles such as human capital (Situm, 2014), reaches a milestone with the early inclusion of intellectual capital in credit evaluation (Iazzolino et al., 2013), and since the 2010s has been dominated by the ESG approach (e.g.,

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Kiesel & Lücke, 2019; Bonacorsi et al., 2024), which today links these factors to sustainability and credit risk reduction.

Numerous studies confirm a positive relationship between ESG performance and credit ratings using either aggregated scores or multiple ESG data providers (Attig et al., 2013; Jiraporn et al., 2014; Chodnicka-Jaworska, 2021; Kim & Li, 2021; Agosto et al., 2022; Vortelinos et al., 2024), but their approach cannot disentangle the true effect of ESG factors, and especially the distinct contributions of the Environmental (E), Social (S), and Governance (G) pillars from the confounding influence of methodological heterogeneity across agencies (Dorfleitner et al., 2015; Chatterji et al., 2015; Berg et al., 2019; Abhayawansa & Tyagi, 2021; Billio et al., 2024). This research is the first to examine the relationship between ESG performance and credit ratings exclusively within a single rating agency's consistent methodological framework (Moody's ESG Issuer Profile Scores and Moody's long-term issuer ratings), thereby eliminating cross-provider methodological divergence and enabling a clean decomposition of the individual contributions of the Environmental, Social, and Governance pillars.

This study analyses the relationship between ESG ratings and a company's financial performance. The hypothesis is that ESG ratings and financial performance are either uncorrelated or show a weak or negative correlation. This is because the ESG implementation concept is a long-term investment in sustainability and stability, while financial performance is often assessed annually.

The research objective of this paper is to determine the relationship between ESG ratings of large companies and their credit ratings. The main hypothesis is:

> H1: *There is a positive relationship between ESG ratings and the long-term credit ratings of large companies.*

In addition, the impact of ESG ratings on the financial performance of large companies is analysed. The auxiliary hypothesis is:

> H2: *ESG ratings have no impact on the financial performance of large companies.*

3. Data and methodology

In this part of the article, the most important characteristics of the research sample are explained and integrated into the methodological framework conducted through the empirical research.

3.1. Sample

The introduction of corporate social responsibility practices also creates a basis for ESG-based reporting. Many companies are already analysing and developing their own sustainability indicators or relying on indicators prescribed by international sustainability reporting standards. According to Bissoondoyal-Bheenick et al. (2023b) and Del Vitto et al. (2023), the methods for calculating ESG ratings vary, and it is possible to obtain different data for the same rated companies.

The weighting of environmental, social and governance factors in ESG ratings depends on the calculation methodology (Billio et al., 2024). ESG data providers use different methodologies, which can lead to discrepancies in ESG ratings for the same companies. These discrepancies can arise due to different theoretical interpretations of ESG factors, different calculation methods, and challenges in data measurement (Abhayawansa & Tyagi, 2021). Dorfleitner et al. (2015) notes that different ESG data providers use methodologies that differ in the number of scores assessed, with only weak convergence of scores; however, the final results often show some degree of correlation. According to Chatterji et al. (2015), the ratings of sustainability indicators by different rating agencies show a very low correlation.

The determination of ESG ratings is preceded by the definition of triple-bottom-line measurement criteria, which are based on the structure of sustainability impacts and contributions that must be defined at the sector level. This explains why the assessment results differ, as even slight differences in the assessment of the qualitative criteria can lead to different ratings. Differences in the calculation reflect differences of opinion on the relevance of different ESG categories, and it is legitimate for different raters to have different views on these issues (Berg et al. 2019). Discrepancies occur even with easily measurable data, and measuring social impact and the quality of corporate governance remains a challenging task for company owners and managers.

The size of a company influences its resilience to changes in the environment and its ability to implement different business concepts such as ESG. Due to their capacity, large companies have an advantage in implementing ESG concepts compared to small and medium-sized companies, and ESG ratings positively influence creditworthiness (Organisation for Economic Co-operation and Development [OECD], 2020). According to Akgun et al. (2021), the lack of ESG rating data for small and medium-sized enterprises (SMEs) steers investors towards large companies. Large companies provide more detailed financial and non-financial reports, making them a more suitable sample for research.

The study uses data from a single source, Moody's Investor Service (Moody´s Ratings), for the entire sample, including observations of ESG ratings, credit ratings,

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and net profit margins. Data was collected for fifty large companies covering their financial performance, ESG ratings and credit ratings (Table 1). Using the same database for the entire sample ensures the consistency and accuracy of the data series. The sample includes large companies from different parts of the world, selected based on the criterion that they have a turnover of more than 10 billion euros in 2023.

The following variables (Table 1) were derived from the sample of fifty large companies: the independent variable ESG Rating 2023 (hereafter: ESGR), the independent variable E Rating 2023, which represents the environmental factor of the ESG rating (hereafter: ER), the independent variable S Rating 2023, which represents the social factor of the ESG rating (hereafter: SR), the independent variable G Rating 2023, which represents the governance factor of the ESG rating (hereinafter: GR), the dependent variable Credit Rating 2023 (hereinafter: CR) and the dependent variable Net Profit Margin Ratio 2023/2022 (hereinafter: NPMR).

Table 1: Sample and data groups

No.	Company name	ESGR	ER	SR	GR	CR	NPMR
1	ABBVIE INC	CIS-3	3	4	1	A3	0.44
2	Accenture	CIS-1	2	2	1	Aa3	0.96
3	Adobe	CIS-1	2	2	1	A1	1.04
4	AIA Group	CIS-2	3	4	2	A1	1.05
5	Allianz SE	CIS-2	3	4	2	Aa2	0.80
6	Amazon	CIS-3	3	3	2	A1	11.00
7	Apple	CIS-2	3	3	2	Aaa	1.00
8	ASML	CIS-2	3	2	1	A2	1.07
9	AT&T	CIS-3	2	3	3	Baa2	2.74
10	Bank of America	CIS-2	3	4	2	A1	0.92
11	Bank of China	CIS-2	3	3	2	A1	0.96
12	Bank of Communications	CIS-2	3	3	2	A2	0.73
13	Berkshire Hathaway	CIS-2	3	3	1	Aa2	3.25
14	BHP Group	CIS-3	5	4	1	A1	0.52
15	BNP Paribas	CIS-2	3	4	2	Aa3	1.07
16	Broadcom	CIS-3	3	2	3	Baa1	1.16
17	Brookfield Corporation	CIS-3	3	4	3	A3	0.49
18	Cardinal Health	CIS-3	4	4	2	Baa2	1.31
19	China Com. Construction	CIS-3	2	4	3	Baa1	1.19
20	China Construction Bank	CIS-2	3	3	2	A1	1.04
21	China Life insurance	CIS-2	3	4	2	A1	0.65
22	China Mobile	CIS-2	2	3	2	A1	0.98

Table 1: Sample and data groups

No.	Company name	ESGR	ER	SR	GR	CR	NPMR
23	China Nat. Offshore Oil	CIS-2	5	4	2	A1	0.53
24	China Railway Con. G.	CIS-3	2	4	3	A3	0.94
25	China Resources Land	CIS-3	3	4	3	Baa1	0.92
26	China State Con. Hold.	CIS-3	2	4	3	Baa2	0.97
27	Cigna Group	CIS-3	2	5	2	Baa1	0.71
28	Cisco Systems	CIS-1	3	3	1	A1	0.97
29	Coca-Cola	CIS-2	3	3	2	A1	1.06
30	Comcast	CIS-2	2	3	2	A3	2.86
31	CVS Health	CIS-3	3	4	3	Baa2	1.74
32	Daimler Truck	CIS-3	4	4	2	A3	1.28
33	Danaher	CIS-2	2	3	2	A3	0.74
34	Dell	CIS-3	3	3	3	Baa3	0.43
35	Deutsche Telekom	CIS-2	2	3	2	Baa1	2.27
36	Ford Motor	CIS-4	4	4	3	Ba1	2.97
37	General Motors	CIS-3	4	4	2	Baa2	1.03
38	Generali	CIS-2	3	4	3	A3	1.07
39	Hilton Dom. Oper. Co.	CIS-3	2	3	3	Ba1	0.78
40	IBM	CIS-2	2	2	2	A3	4.48
41	Meta Platforms	CIS-2	2	3	2	Aa3	1.46
42	Morgan Stanley	CIS-3	3	4	3	A1	1.10
43	Nike	CIS-2	3	4	2	A1	0.76
44	NVIDIA	CIS-2	3	2	1	Aa3	0.44
45	Oracle	CIS-4	2	2	4	Baa2	1.08
46	PayPal Holdings	CIS-1	2	2	1	A3	1.62
47	Samsung Electronics	CIS-2	3	2	2	Aa2	0.31
48	Tesla	CIS-2	2	3	3	Baa3	1.00
49	Visa	CIS-1	2	2	1	Aa3	0.74
50	Walmart	CIS-1	3	3	1	Aa2	0.76

Source: Author's calculations based on Moody's (2024) data

The sample consists of large companies from various industries. Therefore, the NPMR was chosen as the financial performance indicator to eliminate industry effects and provide insight into how much a company has improved its financial efficiency in 2023 compared to other companies. Even though some companies may have higher net profit margins in 2023, they may not have improved their financial results compared to 2022.

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According to Moody's (2024), companies such as Visa, PayPal, Adobe, Accenture, and Walmart are among the companies with the highest ESG ratings. Moody's credit rating system uses twenty-one different ratings. These ratings range from the highest, Aaa to the lowest, C. Ratings from Aa to Caa are further differentiated by adding numbers from one to three:within each, one indicates the strongest and three the weakest.

The lowest credit rating of C is equated with a value of one in the data analysis, while the highest rating of Aaa is equated with a value of twenty-one. Moody's assigns ESG ratings on a scale of one to five, with CIS-1 being the highest rating. For the further analysis, the ESG ratings are used inversely to reflect a positive relationship with the dependent variables. The highest ESG rating is assigned a value of five and the lowest ESG rating a value of one. The table below contains the variables and descriptive statistics.

Table 2: Variables and Descriptive Statistics

	No. Obs.	Std. Dev.	Mean	Median	Variance	Type in model
ESGR	50	0.74	3.70	4	0.54	Independent
ER	50	0.77	3.16	3	0.59	Independent
SR	50	0.80	2.74	3	0.64	Independent
GR	50	0.76	3.90	4	0.58	Independent
NPMR	50	1.60	1.39	1	2.57	Dependent
CR	50	2.24	15.60	15	5.02	Dependent

Source: Author's calculations

Table 2 shows the standard deviation, the mean, the median, and the variance values for the variables. The independent variables are similarly distributed. The dependent variable NPMR has a higher variance value than the mean, which indicates widely dispersed data points.

3.2. Methodology

A multiple linear regression model was created in which the independent variables ESGR, ER, SR, GR, the dependent variable CR and the equation parameters λ and β are shown. The parameter λ represents the intercept in the model, β is the regression coefficient and ε is the random error. The model is shown by the equation:

$$CR = \lambda + \beta_1\ ESGR + \beta_2\ ER + \beta_3\ SR + \beta_4\ GR + \varepsilon \qquad (1)$$

The variables ER, SR and GR are included in the multiple linear regression model to determine which of these variables has the greatest influence on the dependent variable CR. ESGR is the overall ESG rating, including environmental, social, and governance performance. ER measures ecological impact and sustainability, SR assesses human capital, community, and labor practices, and GR evaluates board effectiveness, transparency, and ethics. Despite the relatively small sample size of 50 observations, the robustness of the model will be ensured through the application of a diverse suite of estimation methodologies (Fain, 2020).

Before determining the correlations between the variables, the Fisher test (hereafter: F-test) and the Akaike information criterion (hereafter: AIC) are used to test how well the variables in the model fit together. According to Siegel (2012), the F-test compares two variances and measures their relationship. The validity of the model depends on the number of parameters in the model and the logarithm of the maximized value of the likelihood function for the model (Akaike, 1973/1992).

The model was checked with various tests. The coefficient of determination was measured, the AIC estimation test was performed, the extended AIC test (hereafter: AICC), which is adapted to the sample size, the Bayesian information criterion (hereafter: BIC) and the Schwarz-Bayesian information criterion (hereafter: SBC) were evaluated. The standard error of the estimate (hereafter: SEE) was measured, an F-test was performed and the p-value of the F-test was calculated.

Table 3: Variable fit in the model

	R2	AIC	AICC	BIC	SBC	SEE	F	p-value
ESGR	0.4379	110.8605	112.2241	61.5410	66.5086	1.7338	11.9460	0.0000
ER	0.2701	123.9198	125.2835	74.6004	79.5679	1.9756	5.6755	0.0022
SR	0.0256	138.3706	139.7342	89.0511	94.0187	2.2828	0.4023	0.7520
GR	0.3984	114.2607	115.6244	64.9413	69.9088	1.7937	10.1525	0.0000

Source: Author's calculations

The result of the AICC for ESGR = 112.22 shows that the variable ESGR fits the model best. The variable GR has an AICC result of GR = 115.62, which fits the model, and the variable ER also fits the model with an AICC result of ER = 125.28. The F-test results for the variables ESGR, GR and ER are above the critical F-value of 2.57 at a significance level of 5%, which confirms that these variables fit the model together. However, the variable SR does not fit the model and is not analysed further.

The critical F-value was determined using F-value tables, taking into account the degrees of freedom for the numerator and denominator, which were calculated

according to the number of parameters and observations in the model. Spearman's rank correlation coefficient is used to measure the correlation between the independent variables ESGR, ER and GR and the dependent variable CR. Normally, the correlation between two variables is measured using Pearson's correlation coefficient. In this case, however, Spearman's correlation coefficient, an approximation of Pearson's coefficient, is used as it measures rank correlation.

ESG ratings and credit ratings are rank variables whose values are determined by rank interval, making non-parametric measurement methods more precise for this type of data as they are specifically designed for ranks. Spearman's rank correlation coefficient is represented by the following equation:

$$R_S = 1 - \frac{6 \sum_{i-1}^{n} di^2}{N^3 - N} \qquad (2)$$

It often happens that measures or ranks are known, but not in such a way that the method of moments or even a Pearson method could be used to determine the correlation (Spearman, 1904). After testing the correlation based on the model mentioned, a correlation test between the variables ESGR and NPMR is performed. As the companies belong to different peer groups, an adjustment was made by using the growth in profit margin in 2023 compared to 2022 as the dependent variable. This approach ensures comparable data collected from large companies in different industries. Some industries are more profitable than others, and the net profit margin by itself is not a comparable metric unless the sample is selected based on industry criteria.

It is assumed that there is no correlation between the variables ESGR and NPMR. If a correlation exists, it is expected to be weak and negative, as investments in the ESG concept represent a cost that may have a negative impact on financial results in the short term. The correlation between ESG ratings and net profit margin growth is measured using Pearson's correlation coefficient. According to Cohen (1977), a correlation coefficient between ±0.50 and ±1, measured on a large sample, is considered a strong correlation. According to Wishart (1931), the strength of the correlation depends on the sample size, as more observations increase the standard error. For large samples, the criterion for determining the strength of the correlation must be weaker than for smaller samples.

4. Results and analysis

Table 4 shows the Spearman rank correlation matrix between the variables ESGR, ER, GR and CR, with the results indicating the direction and strength of the statistical relationship between the variables.

Table 4: Correlation Matrix of ESG Ratings and Credit Rating

Variables	ESGR	ER	GR	CR
ESGR	1.0000	0.1674	0.6836	0.6364
ER	0.1674	1.0000	-0.1208	-0.1648
GR	0.6836	-0.1208	1.0000	0.5672
CR	0.6364	-0.1648	0.5672	1.0000

Source: Author's calculations

The correlation coefficient between the variables ESGR and CR is 0.64 which indicates a positive relationship between them. According to Bujang and Bahurum (2016), a correlation coefficient of 0.6 with a significance of 90% and a test significance level of 5% can be determined with a minimum sample size of 24 observations. A correlation with a significance of 80% and a significance level of 5 requires a minimum sample size of 19 observations. As the test was carried out with 50 observations, it can be concluded that the measured correlation coefficient of 0.64 represents a strong positive correlation.

The measured correlation between the variable GR and CR is 0.57, which indicates a weak correlation, while there is no correlation between the variables ER and CR. The independent variable GR correlates with the dependent variable CR but is also correlated with the independent variable ESGR. Considering the variables exhibit moderately strong correlations, multicollinearity with a variance inflation fator (VIF) analysis was examined. The results of the analysis indicated high VIF values exceeding 10, confirming the presence of high multicollinearity. Due to multicollinearity, GR is excluded from the model. By including the variables ESGR, ER and CR in the multiple linear regression model, the results show the parameters of the regression equation.

Table 5: Multiple Linear Regression of Variables ESGR, ER and CR

Multiple Linear Regression			Value			
R			0.657184			
R²			0.431891			
R² (Adjusted)			0.407716			
F(3.47)			17.86532			
p - Value			0.000002			
Stand. Dev. Of Estimation			1.724385			
	b*	SE	b	SE	t(46)	*p*-value
Intercept			10.569	1.4895	7.0954	0.0001
ER	-0.2571	0.1121	-0.7525	0.3281	-2.293	0.0263
ESGR	0.6572	0.1121	2.002	0.3415	5.862	0.0001

Source: Authors' compilation based on data from Statistica software

Based on the results of the multiple linear regression presented, the coefficient of determination is positive and significant for the establishment of a linear relationship, which leads to the rejection of the null hypothesis that there is no linear relationship between the variables. The regression analysis confirmed that the parameters of the variables ER and ESGR are significant for the equation, as the p-value is less than 0.05. The regression equation is as follows:

$$CR = 10.57 + 2ESGR - 0.75ER + \varepsilon \tag{3}$$

The regression analysis confirms a positive relationship between the independent variable ESGR and the dependent variable CR, which confirms the results of the Spearman rank correlation matrix analysis. The main hypothesis of the study, H1: *There is a positive relationship between ESG ratings and the long-term credit ratings of large companies*, is accepted.

The potential for sectoral differences is recognised, particularly given the inclusion of 11 financial institutions (e.g., banks and insurers) in sample of 50 large companies. To address this, subsample analysis was conducted dividing the data into financial (N=11) and non-financial (N=39) companies. Subsample cross-sectional regression results reveal that, while the ER exerts no significant influence on CR among financial institutions, the positive relationship between overall ESGR and CR remains robust in both financial and non-financial companies, upholding H1 across sectors.

The independent variable ER has a slightly negative influence on the dependent variable CR, which could indicate that low values for environmental and social factors are compensated for by high values for governance factors, which leads to higher ESG ratings and better credit ratings. It can be assumed that governance risks are weighted more heavily in the calculation of credit ratings than environmental and social risks. According to the research results, the environmental ratings of large companies do not correlate with their ESG ratings.

By using the data collected from one credit rating agency for both ESG assessment and credit rating assignment, the analysis removes any potential bias that could arise from differences in weighting methodologies or data sources across providers. The results show that the positive ESG rating and credit rating relationship is driven mostly by the governance pillar, while the environmental and social pillars exhibit no significant influence. For highly rated issuers, governance ratings must be in place before environmental or social initiatives can deliver additional credit rating-relevant benefits. Environmental improvements alone are unlikely to materially upgrade the credit rating of a large corporation unless they are accompanied by equally strong governance practices.

The analysis suggests that according to Moody's rating methodology, high governance scores can lead to high ESG ratings, even if environmental and social

impacts are not rated as highly. The selected sample consists of successful large companies, so it can be expected that these companies will have high governance ratings. The hypothesis that ESG ratings influence creditworthiness is accepted. However, it is important to establish a positive linear relationship between the predictors GR and ESGR.

The correlation coefficient between the variables GR and ESGR is 0.68. Below you can see linear plots representing the combinations of the variables ESGR, ER and GR. The slope of the plot illustrates how changes in one variable affect another and shows the desirability of the statistical relationship on a scale from zero to one. The change of desirability of the statistical relationship is also represented by colours on linear plots, with warmer colours indicating a stronger tendency towards desirability.

Diagram 1: Desirability Surface/Contours; Method: Quadratic Fit
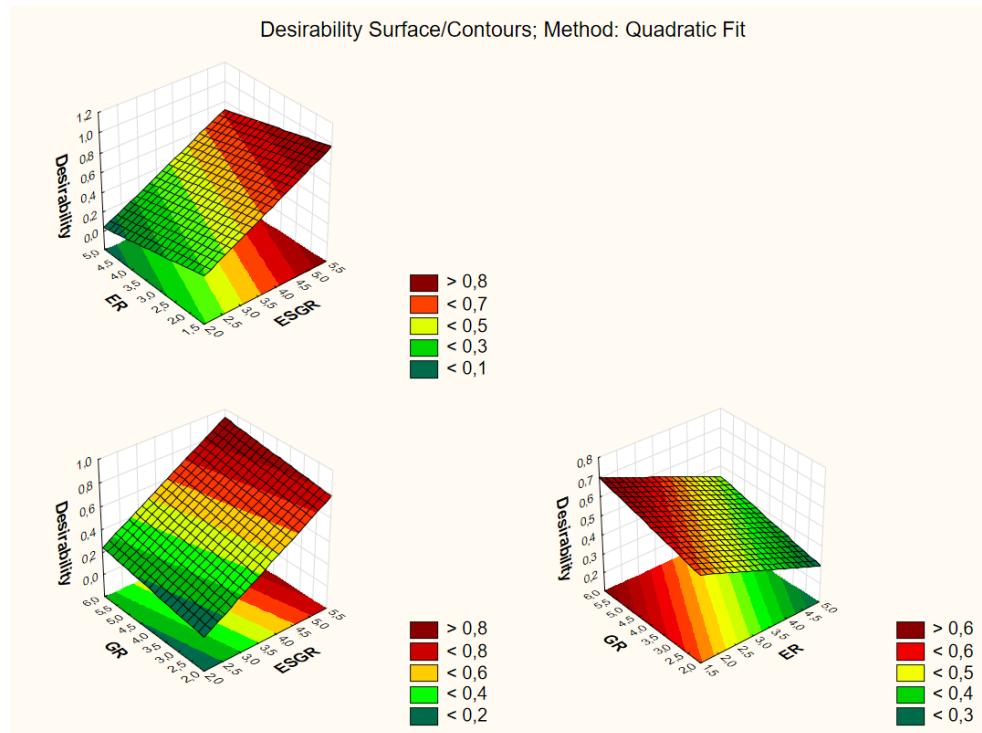
Source: Author's calculations

The GR variable has a strong positive correlation with the ESGR variable, as can be seen from the quadratic overlap diagram. The statistical relationship between the variables was estimated using the linear least squares method. The sum of squared

deviations is smaller in the overlap region where the variables have higher values, indicating a stronger statistical relationship in this area.

According to the research results, high ESG ratings imply a high score for the governance (G) factor, which is a component of the ESG rating. The rating agency Moody's includes qualitative variables in the calculation of the G-score. These variables measure the effectiveness of financial strategy, risk management, management credibility and control, organisational structure, regulatory compliance, symmetry of reporting, governance structure and internal policies (Moody's, 2024). Variables that correlate with the governance factor (G) in the ESG rating are latent variables (Rajagopal and Rajendran, 2019). According to Shill and Strand (2022), corporate managers have a latent ability to influence the quality of implementation of the ESG concept. Governance is an extremely important factor in the ESG concept. Effective governance policies and practices are best placed to facilitate a long-term corporate focus on identifying, monitoring and addressing environmental and social issues (Fairfax, 2024). Latent variables are measured by constructing a structural model and conducting a factor analysis based on the observed manifest variables within the model. There is a need to investigate which latent variables correlate most strongly with the G-score, but this will be the subject of another study.

To determine whether there is a relationship between ESG ratings and the financial performance of a company, the correlation between the variables ESGR and NPMR was measured using Pearson's correlation coefficient. The value of the correlation coefficient was -0.05. Based on the analysis of the result of the correlation coefficient of -0.05 with a significance level of 5%, the auxiliary hypothesis H2: *ESG ratings have no impact on the financial performance of large companies* is accepted.

5. Discussion

In this study, the financial performance of large companies is used as a measure of short-term impact, while credit rating is used as a measure of the long-term impact of ESG investments on their business. Net profit margin is a critical short-term indicator (Ravichandran & Singh, 2024). The long-term strategic advantages of ESG investments are enhanced brand value, improved risk management, and access to green capital (Fain, 2020).

The results of the study show that there is no correlation between ESG investments and the financial performance of large companies, thus proving H2. Some authors, such as McGowan (2022) and Garcia and Orsato (2020), are not indifferent when it comes to the impact of investing in sustainability on the profitability of companies and consider this impact to be negative. In the traditional company financial approach advocated by Milton Friedman it is assumed that the increase in social well-being weighs on additional profits.

It is important to note that large companies can more easily allocate investments in sustainability in terms of their revenues. Investing in sustainability or internalising negative externalities is not only a cost, but also an opportunity to improve business and capture new market segments. The research results on the positive impact of the triple bottom score on credit ratings confirm H1 and show a positive correlation between socially responsible management and the long-term stability of the company. Companies are investing in corporate sustainability and paying attention to climate risk management in order to fulfil market expectations that are aligned with sustainable development goals. In addition to consumers, employees are also changing their preferences when choosing their ideal employer. The research results show the importance of governance factors for ESG ratings and credit ratings. Environmental factors also have an influence on the credit rating, while social factors have no influence on the credit rating. In order to understand why the implementation of the ESG concept has no impact on returns but has an impact on the possibility of debt financing, one must be prepared to observe returns over the long term. This paper explains the importance of corporate governance practises for external financing by examining the relationship between ESG ratings and credit ratings. The pressure on corporate governance to adopt sustainable practises is increasing due to societal demands. This is a key issue in the modern economy as consumers, employees and investors increasingly prioritise sustainability.

Public policies can accelerate the return on investment in sustainability by subsidising green production and consumption. The demand for green products depends on factors such as thelevel of social development, consumer behaviour, sustainable innovation, and purchasing power. By promoting the sustainable market, green financial instruments gain importance, which can lead to a revitalisation of the consumption of green products and increase the returns on green investments.

The research results, which confirm research hypotheses H1 and H2, show the relevance of managing sustainability performance (environmental and social aspects) for financial performance. In this context, the management of an overall approach to the company's governance structures based on the ESG model should deliver results in the form of Sustainable Value (Miljenović, 2018). ESG ratings should function on the basis of an appropriate balance between environmental, social and financial aspects of corporate performance to reflect the implementation and investment in sustainability.

In further research, it would be valuable to conduct a new study exploring how other credit rating agencies besides Moody's, such as Standard & Poor's (hereinafter: S&P) and Fitch, integrate ESG ratings into credit ratings, and to compare the relationship between ESG factors and credit ratings across different agencies. To carry out such a study, a similar analysis would need to be conducted for the other rating agencies. Expanding the existing regression model with a sample of other rating agencies for the same companies is likely to result in high multicollinearity. Therefore, it would be

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more appropriate to test a separate model for each rating agency or to conduct a panel analysis with different company samples for each agency.

According to S&P (2025), ESG has a significant impact on the S&P calculation of credit ratings, with the governance factor being the most heavily weighted, accounting for 89% of the overall ESG score. The Fitch rating agency uses 106 different sector templates to implement ESG factors into credit ratings (Fitch, 2025). To expand further research, it would be interesting to compare how different rating agencies incorporate ESG factors into credit ratings for companies across several different economic sectors and analyse which latent variables describe the impact of the ESG governance factor on the credit rating.

6. Conclusion

By testing research variables, this research has confirmed that the impact of investments on overall sustainability needs to be analysed in the long term. The proposed hypotheses (H1 and H2) are even intertwined through the research analysis conducted, as the results show that the profitability of large companies is not affected by the implementation of ESG and its evaluation in the short term. Therefore, the ESG ratings assigned by the rating agencies do not reflect the financial performance of the companies. On this basis, further research should be conducted to define the time period in which ESG implementation has the full impact on the sustainability and financial performance of the company. Although the financial aspects of business performance should be analysed together with the environmental and social aspects, it is clear that companies wishing to make a sustainable contribution must first commit financial resources, as the ESG concept incurs high costs but offers long-term benefits. Investments in sustainability can also gain momentum after the amortisation period. Sustainability goals in business suggest that companies that implement the ESG concept in their operations can gain a competitive advantage and tap into new financing opportunities through green financial instruments. These instruments require assessment through ESG ratings, which then play an important role in the development of green finance and sustainable financial performance in general. Greening can take place either through a company's own initiative or under the influence of its environment. Sustainability investments are not expected to yield quick returns, as sustainability gains importance in the long term. High ESG ratings indicate that a company is stable and a safe investment. The financial market offers a growing number of green financial instruments that target companies with high ESG ratings or support the implementation of the ESG concept. If a company operates in a green industry and invests in sustainability, such an investment can have a positive impact on its financial performance. The impact of sustainability investments is stronger in the long term. The assessment of corporate governance has a significant impact

on the ESG rating, which indicates that accountability for governance decisions is expected. The rating agencies include ESG ratings in their calculation of the creditworthiness of large companies. Social, fiscal, financial, political and legal factors in the external environment are changing the market model of negative externalities, creating new principles, eliminating market imperfections and preventing the breakdown of the price mechanism to internalise negative externalities according to the *polluter pays* principle. The ESG concept offers companies the opportunity to gain a green label and conquer new market segments through its implementation. The demand for eco-designed products depends in part on the level of social development, while the greening of supply and demand enables a holistic approach to the green transition. The agenda of the global Sustainable Development Goals requires the green transformation of companies and the implementation of the ESG concept as a sequence that lays the foundation for sustainability. This should lead not only to a positive long-term impact on a company's operations in terms of financial success based on green investments, but also to broader social and environmental well-being. The ESG concept has become one of the most important factors when evaluating a company whose business model has been extended to include environmental and social aspects of business operations. Therefore, ESG ratings represent an essential part of investment information for companies that relate to green transformation and, in particular, ensure a positive, sustainable impact of companies.

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Utjecaj implementacije ESG-a na kreditni rejting i financijski rezultat poslovanja: perspektiva održivosti

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Sažetak

Cilj ovog rada je istražiti kako implementacija ESG koncepta utječe na kreditni rejting i financijski rezultat iz mikroperspektive poslovanja. Okolišni, društveni i upravljački čimbenici kao komponente ESG koncepta suočavaju poduzeća sa rizicima u području održivog razvoja te poduzeća na njih različito odgovaraju. Razvoj zelenih financijskih instrumenata dodatni je motiv poduzećima da se uključe u zelenu tranziciju. Procjenom ESG rezultata identificiraju se prednosti i slabosti korporativnog sektora u pogledu njegova doprinosa globalnim ciljevima održivosti. Postignuća poduzeća u tome području mogu se analizirati ESG rejtinzima. Ovim istraživanjem utvrđeno je da razlike u metodologiji rejting agencija pri utvrđivanju ESG kriterija i ocjenjivanju ESG rejtinga u konačnici ne rezultiraju značajnim odstupanjima u danim ocjenama. Implementacija ESG koncepta nema utjecaja na financijski rezultat velikih poduzeća (korporacija) u kratkom roku pa stoga učinke ulaganja u održivost valja promatrati u dugom roku. Rezultati istraživanja ukazuju na pozitivne odnose među upravljačkim čimbenicima, ESG ocjenama i kreditnim rejtingom velikih poduzeća. Na temelju dobivenih rezultata zaključuje se kako ulaganje u održivost i implementacija ESG-a ima pozitivne učinke na poslovne tj. financijske rezultate poduzeća.

Ključne riječi: *održivo financiranje, zelene investicije, ESG rejting, financijski rezultat*

JEL klasifikacija: *G11, G24, G32, Q56*

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Strategic Management Practices and Strategic Plans: An Empirical Analysis of Enterprise Approaches[*]

Albana Berisha Qehaja[1], Enver Kutllovci[2]

Abstract

As a continuous process, strategic management addresses the entrepreneurial dimension of organizations, organizational renewal and progress, and, in particular, developing and implementing strategies to create competitive advantages. This includes tracking and improving current programs and operations to ensure the strategic plan is on track. The outcomes of the nature and practice of the strategic management process are presented for a sample of 314 enterprises in Kosovo. The findings show that only 10.2% of Kosovan enterprises apply strategic management as a whole process, whereas 31.2% have five-year strategic plans. The results of the research showed that there is a significant relationship between the strategic management process and strategic tools. However, there is no significant relationship between strategic plans and strategic tools. We contribute theoretically by distinguishing written plans from active process engagement and by showing that process engagement, rather than mere plan possession, better predicts tool adoption in a transitional economy. This study thus provides important insights for those policymakers, practitioners, and academics looking to improve strategic management processes in similar environments.

Keywords: *strategic management process, strategic planning, strategic plan, strategic tools, Kosovan enterprises, transitional economy*

JEL classification: *D22, L20, M10, O12*

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1. Introduction

"*Success today and tomorrow requires driving while looking straight out of the front windshield*" (Godfrey et al., 2020, p. 6). While strategic planning can serve as a valuable framework for organizing and presenting a systematic overview of all management initiatives, it should not be misconstrued as guaranteeing the chosen strategy's success. Instead, it provides some certainty to decision-makers without guaranteeing success. Using strategic tools and incorporating different perspectives can help decision-makers increase the sustainable success of their strategies (Kotler et al., 2015). As Berisha Qehaja et al. (2017a) emphasize, research on strategy tools and techniques primarily focuses on their extent of utilization and classification.

While large international companies often determine the strategic path, small and medium-sized enterprises still implement sustainability principles, emphasizing sustainable competitiveness. Organizations should have a long-term strategy with clear goals that promote process improvement, fair behaviour, and active problem-solving by management (Vrabcova et al., 2022). According to Al Ghamdi (2005), many corporate executives recognize the value of strategic planning; however, only a few translate these plans into tangible market results. An enterprise's business strategy is a multifaceted plan to acquire and sustain competitive advantage. This strategic plan must exhibit innovation to adapt to the emerging knowledge from consumers, competitors, and technological shifts (Dyer et al., 2019). Firms must cultivate robust dynamic capabilities to formulate viable strategies for creating and capturing value even in potentially adverse and volatile environments. Additionally, they should shape their business landscape through market and non-market actions (Teece, 2020). According to Ivanova et al. (2019), in current business practices, the core objective of strategic management is to maintain a competitive advantage through technological progress. This requires accelerating the implementation of new technology and aligning with the broader corporate strategy.

Previous empirical studies have primarily concentrated on well-developed or stable economies, neglecting to address strategic management's distinctive challenges in transitional economies like Kosovo. This shows a gap in the literature about the specific dynamics and issues businesses face in transitional settings. According to the European Bank for Reconstruction and Development (EBRD, 2021), a transitional economy transforms from a centrally planned economic system to a market-driven economy, typically entailing the liberalization of prices, the privatization of state-owned enterprises, and the introduction of competitive markets. Kosova can be considered a transition economy, considering its history, reforms in various economic and integrated packages, and accordingly adapted institutions. It aims to shift from a post-conflict region to a country implementing policies oriented towards a market economy.

As a transitional economy, Kosovo has undergone significant reforms and adjustments of its institutions to transform itself from a post-conflict territory to a competitive country. Although these advancements have been made, strategic management practice is comparatively very weak in Kosovo's enterprises. Research has been conducted in the past to assess which tools and techniques are commonly utilized in executive management worldwide. Based on a thorough review of empirical studies published between 1990 and 2015, Berisha Qehaja et al. (2017b, p. 585) determined that: "*the ten most used strategic tools and techniques worldwide resulted as follows: SWOT analysis, benchmarking, PEST analysis, what-if analysis, vision and mission statements, Porter's five forces analysis, business financial analysis, key success factors analysis, cost-benefit analysis and customer satisfaction*".

Building upon prior research (Berisha Qehaja & Kutllovci, 2020a), which revealed low usage of strategy tools among Kosovan enterprises and reliance on fundamental tools such as SWOT analysis, this study investigates the relationship between strategic management processes, formalized strategic plans, and tool adoption to address critical gaps in organizational practices. Prior work has documented which tools managers use and how planning is practiced, yet important theoretical and empirical questions remain about what aspect of strategy practice actually drives tool adoption and strategic capability.

This paper addresses two related gaps. First, much of the literature treats formal plans (the presence of a written strategy) and strategic process engagement (formulation, implementation, and evaluation) as interchangeable indicators of strategic capability. We argue they are conceptually distinct: formalization signals documentation and commitment, whereas process engagement captures active managerial work and decision routines. Second, evidence from transitional economies is scarce. Institutional constraints, resource scarcity, and rapid change in such contexts may alter how plans and processes translate into tool use and strategic action. By studying Kosovan enterprises, we provide context-sensitive evidence that tests whether these two dimensions relate differently to the adoption of strategic tools.

Research problem. For Kosovan enterprises, we examine: a) the extent to which enterprises engage in the strategic management process, b) whether they maintain formalized strategic plans, and c) how these processes and plans relate to the use of strategic tools.

The first dimension of the problem examines how Kosovan enterprises pursue strategic management activities, including vision and mission statements, environmental analysis, strategy formulation, implementation, and evaluation. The second considers whether enterprises formulate and utilize formalized strategic plans to direct activities and decisions, providing insight into their priorities, objectives, and approaches to achieving competitive advantage. The third dimension tests the inter-

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relationship between strategic management processes and the application of strategic tools. Finally, the fourth dimension assesses whether formalized strategic plans are associated with more extensive tool use in decision-making.

The primary goal of this study is to present key findings from an empirical investigation into the nature and practice of the strategic management process in enterprises operating within the Republic of Kosova, thereby contributing significantly to our understanding of strategic management practices in transition economies.

The paper is organized as follows: First, a brief introduction is presented, followed by a literature review on strategic planning, strategic management processes, strategic plan development, and the use of tools, along with the study hypotheses. The third section presents research methods, including objectives, data, and methodology. Section four presents and discusses the results of the tested hypotheses. The final section concludes with key findings, limitations, and directions for future research.

2. Literature review and hypotheses development

This section explores the theoretical foundations of strategic planning and strategic management processes, as well as their impact on organizational effectiveness. It provides more insight into the impact of strategic tools in assisting managerial decision-making and for better performance. Through an exploration of the relationships between these constructs, this section establishes a basis for hypotheses development while drawing insights from relevant literature.

2.1. Strategic planning

In scholarly literature, *strategic planning* is often used interchangeably with *strategic management*, but it is crucial to recognize that they are different. Strategic management is concerned with strategy formulation and implementation, evaluation, and control, whereas strategic planning is limited to formulating strategy at all organizational levels. In contemporary contexts, the later stages of the strategic management process have substantial significance. As stated by David (2011), the expression 'strategic planning' is predominantly employed in the business circle, while *strategic management* finds more significant usage in academic discourse. Nevertheless, during literature reviews, it is common to encounter *strategic planning* as a synonym for *strategic management*. Consequently, the strategic management process generates a plan that includes all managerial activities, followed by rigorous implementation, control, and evaluation. In other words, a strategic plan is a blueprint that outlines an organization's goals and priorities for a given period, typically spanning five years. It outlines an organization's vision,

mission, values, goals, and strategies for achieving them. A strategic plan is a roadmap that helps guide organizational decisions and resource allocation to move the organization toward its objectives. Strategic plans aim to provide organizations with a competitive advantage, reinforcing the critical role of strategic management in modern business practices (Dyer et al., 2019).

Scholars have long distinguished between formal, deliberate strategies and informal, emergent ones. Armstrong (1982) found that formal planning, typically associated with multi-year horizons, provides structure and consistency in organizational decision-making. In contrast, Mintzberg (1994) emphasized that informal strategies emerge through adaptation and learning, often reflecting shorter or undefined horizons. The time horizon of strategic plans is therefore critical: organizations with formal strategies tend to adopt long-term perspectives, while those relying on informal approaches operate more reactively. This distinction is directly relevant to our hypotheses, as the presence or absence of a formal strategic plan, and its intended duration, shapes the likelihood of enterprises employing strategic management tools.

This process's composition underwent significant changes before culminating in its current form. Strategic planning originated in the mid-1950s. During this era, strategic planning emerged as an effective means of guiding businesses to pursue their goals. However, a fundamental limitation of this approach is its exclusive focus on the strategy formulation phase, which interprets the strategy itself as the sole outcome of strategic planning. The main drawback of strategic planning is that it does not include any stage other than strategy formulation. Kume (2010) mentioned three significant failures in strategic planning: forecasting, selection, and formalization. Strategic management has emerged as a discipline alongside strategic planning, evolving to encompass two additional essential phases: strategy implementation and evaluation/control.

2.2. Strategic management process

The strategic management process has developed through both classical foundations and contemporary refinements. Early works by Chandler (1962), Ansoff (1965), and Learned et al. (1965) established the discipline by linking internal strengths and weaknesses to external opportunities and threats (Rumelt et al., 1994). Porter's *Competitive Strategy* (1980) further advanced the field by introducing the five forces framework, which emphasized industry dynamics and competitive positioning. These contributions marked a shift from deterministic approaches toward contingent perspectives, underscoring the need for organizations to adapt to their external environment.

Building on these foundations, Mintzberg (1990) categorized nine schools of thought: design, planning, positioning, entrepreneurial, cognitive, learning, political, cul-

tural, and environmental. Elfring and Volberda (2011) distinguished between prescriptive schools (design, planning, positioning) and descriptive schools (the remaining six). McKiernan (1997) later synthesized these perspectives into four broader streams: planning and practice, learning, competitive positioning, and the resource-based view. Ansoff (1991) critiqued prescriptive schools, while Mintzberg (1978) and Mintzberg and Waters (1985) emphasized the interplay of deliberate and emergent strategies. Mintzberg et al. (2020, p. 12) observed that "*emergent strategies are not necessarily bad and deliberate strategies good; effective strategists mix these in ways that reflect the conditions at hand, notably the ability to predict as well as the need to react to unexpected events*."

This literature shows that while historical contributions provide theoretical depth, the current emphasis is on formalized activities, vision and mission development, environmental scanning, internal analysis, goal setting, implementation, and evaluation, which make the strategic management process measurable and applicable. This study builds on that perspective by examining how Kosovan enterprises apply these structured elements in practice.

2.3. Strategic management tools and techniques

It is widely accepted that strategic management tools and techniques encompass a variety of resources that aid managers at every stage of strategic management (Afonina & Chalupsky, 2012). Strategic tools represent a diverse set of instruments to assist enterprises in fulfilling the complex demands of dynamic marketplaces while establishing and sustaining competitive advantages (Stenfors et al., 2007). Berisha Qehaja and Kutllovci (2020a) examined the usage of strategy tools in Kosovan enterprises, revealing low adoption rates overall and notable differences across sectors. Building on this, Berisha Qehaja and Kutllovci (2020b) found that competitive advantage partially mediates the relationship between the use of strategic tools and enterprise performance, accounting for 23.21% of the mediation. Stenfors et al. (2007) claimed that a range of tools from different disciplines are available to facilitate strategic-level decision-making. The sheer number of tools suggested by consultants and scholars alike is beyond the reach of detailed enumeration, and it is worth noting that there is no comprehensive consensus about what these tools should be (Jarzabkowski & Kaplan, 2015). Elfring and Volberda (2001, p. 1) state, "*The choice of a definition and the application of specific strategic management techniques is greatly dependent on which paradigmatic schools of thought in strategic management one prefers*".

Understanding strategic tools is important for three key reasons. First, it benefits scholars and practitioners, as it facilitates a transition from a normative and objective perspective towards a more humanistic and practice-oriented approach in comprehending the application of strategic tools (Gunn & Williams, 2007).

Tools and techniques play a crucial role in strategic management. However, it is essential to recognize that strategy tools cannot substitute for overarching enterprise strategies (Porter, 1996). Moreover, it is important to note that strategic tools do not integrally formulate a strategy; the responsibility for crafting strategy rests with managers (Hussey, 1997). While these tools may contribute to specific aspects of the strategic management process, they do not replace managerial expertise and practical applications (Whittington, 1996).

The need for customization in tool usage goes beyond tool features and is influenced by diverse enterprise contexts (Knott, 2006). Berisha Qehaja et al. (2017b) found that managers incorporate strategic tools into daily activities, with usage varying by enterprise size, sector, and economic development level. Porter (1996) cautioned that less visible management tools have almost supplanted traditional strategies.

2.4. Conceptual framework

Defining the strategic management process, strategic plan, and strategic tools

The conceptual framework forms the foundation of a study and guides its analysis (Bell & Waters, 2018). Fisher (2010) highlighted cause-and-effect relationships as common in conceptual frameworks. This study examines links between strategic tools, strategic management processes, and strategic plans.

Numerous studies (Miller & Cardinal, 1994; Peel & Bridge, 1998; Glaister & Falshaw, 1999; Andersen, 2000; Carland & Carland, 2003; Gibson & Casser, 2005; Thornhill & White, 2007; Wang et al., 2007; Šuklev & Debarliev, 2012; Sandada et al., 2014) have consistently indicated that small and medium-sized enterprises (SMEs) engaging in strategic planning are prone to experience enhanced outcomes, including increased sales, accelerated return on investment, improved profit margins, and a larger workforce. Bayraktar et al. (2017) find that innovation mediates competitive strategies and firm performance in Turkish manufacturing enterprises. Svatosova (2020) emphasized that identifying variables that impact e-commerce processes is crucial for successful strategic management.

Most studies treat strategic tools as an essential building block of the strategic management process, while some others have focused on their level of usage by organizations. Webster et al. (1989) argue that strategic tools are better for strategic thinking and thus make planning more efficient. Conversely, Dincer et al. (2006) suggest that these tools simplify the planning process and encourage strategic thinking, particularly in its final stages. To promote lasting sustainability and growth, it is crucial for strategic orientation and management, supported by specialized tools, to evolve alongside organizational development (Ward, 1988; Stone, 1999; Ireland, 2000; Wolf, 2000; Analoui & Karami, 2003; *as cited by* Gică, 2011).

Dincer et al. (2006) note that enterprises with emergency strategies but no formal strategic plans tend to avoid traditional strategic planning methods. Vaitkevičius (2007) found that strategic management in Lithuanian companies showed low systematization, emphasizing strategic tools like detailed analyses. Elbanna (2008) observed that businesses may use strategic tools without having structured plans. Šuklev and Debarliev (2012) emphasize that formal planning and strategic tools are distinct yet interconnected elements influencing planning effectiveness, warranting independent investigation. Strategic plans are considered positively associated with using strategic tools. In line with this, our study also examines whether enterprises lacking formal strategic plans nevertheless employ strategic tools, which is addressed within the scope of H_2.

Contemporary strategy-as-practice perspectives stress that strategy is enacted through everyday managerial activities and routines rather than only through formal documents. Research on tools-in-use further shows that the performative mobilization of tools by practitioners shapes strategic outcomes (Vaara & Whittington, 2012; Jarzabkowski & Kaplan, 2015). This perspective implies that active engagement with discrete process steps and the routines of strategizing may be stronger drivers of tool adoption and strategic capability than the mere presence of a written plan, which motivates our focus on item-level measures of process engagement and tool use.

The development of our hypotheses rests on the assumption that the strategic management process and strategic tools are interdependent. Each stage of the process requires distinct analytical support: formulation is typically aided by SWOT analysis, vision and mission statements, Porter's five forces, and value chain analysis; implementation benefits from portfolio matrices such as the BCG and GE; while evaluation and control are facilitated by the Balanced Scorecard and "*What if*" analysis. Enterprises that engage more comprehensively with these stages encounter greater complexity and decision-making demands, which naturally increases their reliance on a broader set of tools. Thus, the seriousness with which organizations approach the process logically corresponds to broader tool usage, providing the theoretical foundation for our hypotheses.

Hypotheses. The following hypotheses were formulated based on previous discussions:

- H_1: *The strategic management process will be positively related to using strategic tools.*

- H_2: *The strategic plan will be positively related to using strategic tools.*

These hypotheses are correlational, as they indicate the co-occurrence of variables in a specific manner without implying causation between them.

3. Methodology

The main research objective is to present the key findings of this empirical study on the nature and practice of the strategic management process in enterprises operating in the Republic of Kosova, thereby significantly contributing to our understanding of strategic management practices in transition economies.

3.1. Empirical data and analysis

The sampling method used in this study was random and drawn from the Kosova Tax Administration's final database. The study encompassed 1,685 registered businesses. Based on statistical parameters of a 95% confidence interval and a 5% margin of error, the required representative sample size was calculated to be 314 firms, and this threshold was met as 314 firms participated in the survey. The overall participation rate was 18.63% of the population (314/1,685), which is consistent with accepted standards in organizational and strategic management research (Baruch & Holtom, 2008; Holtom et al., 2022). Respondents were owners or managers of the firms. Data were analysed using SPSS.

According to ethical guidelines, all participants in this study gave their informed consent before participation. Given the nature of the study and the circumstances under which it was undertaken, this consent was obtained verbally. All participants were provided with the purpose of the study, the tasks required, and their rights as participants (including the right to withdraw from the study at any time).

3.2. Methods

Construct measures are essential to research methodology, particularly in the social sciences, as they help operationalize abstract concepts into measurable variables. The following are some construct measures related to the research questions we provided regarding strategic management practices in Kosovan enterprises.

Numerous authors have developed measurement scales to evaluate managers' perspectives on strategic management (e.g., Glaister & Falshaw, 1999; Dincer et al., 2006; Kalkan & Bozkurt, 2013). Glaister et al. (2008) highlighted that early research on strategic planning systems often faced criticism for using overly simplistic processes or formalization measures. Inspired by the works of Gluck et al. (1982) and Marx (1991), the latter researcher developed a multifaceted measurement scale for planning processes, encompassing a formal flexible dimension. Similarly, Miller (1987) introduced a scale for enterprise planning with eleven strategy-related statements, evaluated on a Likert scale from 0 (*not at all accurate*) to 5 (*very accurate*). Boyd and Elliott (1998) further contributed by proposing metrics to assess strategic management through seven sub-phases

rated on a five-point Likert scale. While Glaister et al.'s (2008) scale emphasizes formalization, it does not comprehensively evaluate all aspects of strategic management. Likewise, Miller's (1987) scale, though valuable, focuses solely on the strategic planning step, excluding critical stages like implementation and control.

After analysing various scales developed by different authors, this study adopted Boyd and Reuning-Elliott's (1998) measurement scale to assess the strategic management variable. Boyd and Reuning-Elliott's scale was chosen for its inclusion of questions covering all stages of the strategic management process. To ensure completeness, the scale was further refined using David's (2011) strategic management model, which defines the process as a cycle of formulation, implementation, and evaluation/control. For instance, the original question addressing only the mission statement was expanded to include the vision statement. Additionally, the general question on trend analysis was divided into separate questions for internal and external analyses (see Table 1). In this way, the measurement instrument reflects not only the planning elements but also the broader stages of the strategic management cycle. The resulting ordinal data rank responses meaningfully according to assessed criteria.

Table 1: Measurement of the strategic management process

Variable	Description	Question	Item-scale
Strategic management process	Measurement of strategic management process	1. *Vision and mission statement* 2. *External environment analysis (political, economic, social, technological, ecological, and legal factors)* 3. *Internal environment analysis (management, marketing, finance, accounting, manufacturing, research/development, information systems)* 4. *Competitor analysis* 5. *Long-term goals (5 years or more)* 6. *Annual goals* 7. *Short-term action plans* 8. *Ongoing evaluation*	(1) no emphasis (2) (3) moderate emphasis (4) (5) very strong emphasis

Source: Adapted from Boyd and Reuning-Elliott (1998)

For hypothesis testing, the ordinal scores of the *strategic management process* scale were grouped into two categories ("*emphasis*" scores 3-5, and "no/low emphasis" scores 1-2). Strategic tool usage was recoded into a binary variable (use vs. non-use). This categorization allowed the application of chi-square association measures (Phi and Contingency Coefficient), which are appropriate for categorical and ordinal data.

Strategic plan. Initially, the respondents were questioned about the presence of both formal and informal strategies. Subsequently, only respondents who confirmed the existence of written strategies were asked about the duration for which they maintained these strategies. It is inferred that enterprises possessing a written strategy for five or more years can be deemed to have strategic plans in place. Consequently, a new variable was constructed that exclusively incorporated responses from respondents with written plans spanning five years or longer (see Table 2). This measurement scale produces nominal data.

Table 2: Type of strategy and written strategic plans

Variable	Description	Question	Item-scale
Strategic plan	Strategic plan	*1. Is your strategy formal (written) or just in the form of unwritten ideas, or concepts? a) formal, b) informal.* If formal, go to question 2. *2. For how many years you have written a strategy?*	(1) 1 year (2) 2 years (3) 3 years (4) 4 years (5) 5 years, and (6) over 5 years

Source: Author's calculations

Strategic tools. To assess respondents' understanding of strategic tools, the measurement criterion was adapted by Jarzabkowski et al. (2012). Thus, for each tool listed, respondents were given the choice of 1 = We are unaware of it, 2 = We are aware but have never used it, 3 = We have used it but no longer use it, or 4 = We use it. The measurement scale produced nominal data. SWOT analysis, *What if* analysis, vision and mission statements, Porter's five forces analysis, value chain analysis, BCG matrix, GE matrix, and balanced scorecard were some of the strategic tools used in this study. According to several empirical studies, these tools have proven to be the most widely used.

Psychometric evidence. Cronbach's alpha was used to assess internal consistency: the eight-item *strategic management process* scale demonstrated acceptable reliability (α=0.79, n=314), and the *strategic tools* items (*recoded for current use*) showed acceptable reliability (KR-20/α=0.73, n=314). Factorability was checked using the Kaiser–Meyer–Olkin measure and Bartlett's test (SMP: KMO = 0.809;

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Bartlett's $\chi^2(28) = 611.66$, $p < 0.001$; Tools: KMO $= 0.765$; Bartlett's $\chi^2(28) = 510.48$, $p < 0.001$), and exploratory factor analysis (principal-axis factoring, Direct Oblimin) indicated a unidimensional solution for the *strategic management process* and a two-factor solution for the *strategic tools* (analytical/implementation vs. awareness/statement; inter-factor $r=0.477$). The strategic-plan measure is a single-item indicator and is reported at the item level; its validity is supported via expected associations with the multi-item scales.

In testing H_1 and H_2, a nonparametric test for association was employed; specifically, the *Chi-square-based measures* known as *Phi* (ϕ). The values of this test range from 0 to 1 and aim to adjust the chi-square (χ) statistic in proportion to sample size (N). This test frequently analyzes 2×2 contingency tables with nominal data. As Hair et al. (2003) indicated, the chi-square test can also be extended for application with ordinal data. The formula for calculating the Phi (ϕ) test is as follows:

$$\phi = \sqrt{\frac{\chi^2}{N}} \tag{1}$$

where, χ^2 = Chi-square and N = number of cases

Contingency Coefficient C is typically employed when dealing with contingency tables larger than 2×2. This coefficient is derived from the chi-square distribution (χ^2) and varies between zero and one. A higher contingency coefficient (C) value indicated a stronger association. This coefficient is computed using the following formula:

$$C = \sqrt{\frac{\chi^2}{\chi^2 + N}} \tag{2}$$

The primary benefit of C is its capacity to handle data in almost any form: skewed or normal, discrete or continuous, or nominal or ordinal (Cooper and Schlinder, 2014).

4. Results and discussion

After outlining our research approach, we provide the findings of our study, which shed light on Kosova's strategic management landscape.

4.1. Results

Sample characteristics. The analytic sample comprised N=314 enterprises (small=251; medium=52; large=11). Percentages reported below use these subgroup Ns unless otherwise stated.

Strategic management process. According to the adopted measurement scale, the strategic management process is considered complete only when all stages defined in the instrument are addressed. Overall, 10.2% (*n*=32) of enterprises regarded the strategic management process as important, while 89.8% (*n*=282) regarded it as partially or entirely insignificant. Among small enterprises (*n*=251), 9.6% (*n*=24) regarded the strategic management process as significant; among medium enterprises (*n*=52), 23.1% (*n*=12) did so; and among large enterprises (*n*=11), 18.2% (*n*=2) did so (See Figure 1.)

Possession of a written strategic plan. Overall, 44.90% (*n*=141) of the full sample reported having written plans, 42.68% (*n*=134) reported not having written plans, and 12.42% (*n*=39) declined to respond. By size, possession of a written plan was: small = 11.95% (*n*=30/251), medium = 17.3% (*n*=9/52), and large = 45.5% (*n*=5/11). Among those with written plans (*n*=141), 31.21% (*n*=44) reported five-year plans and 68.79% (*n*=97) reported plans of one to four years; across the full sample 14.0% (*n*=44/314) reported plans longer than five years.

Figure 1 displays the assessment of the strategic management process across firm sizes and illustrates the proportion of enterprises reporting strategic plans of five years or longer.

Figure 1: Strategic management and strategic plan according to enterprise size.
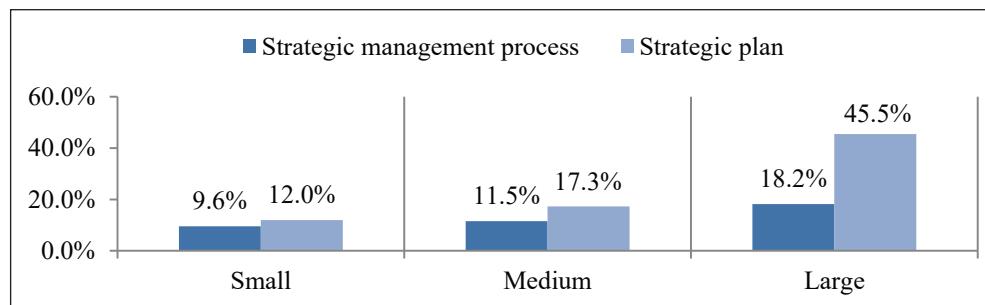
Source: Author's calculations

A chi-square test comparing small versus non-small (medium + large) firms indicated an association between firm size and presence of a written strategic plan, $\chi^2(1, N=314) = 4.41$, $p=0.036$; Cramer's V = 0.12 (*small effect*). When examined by category, medium firms did not differ significantly from small firms, $\chi^2(1, N=314) = 0.56$, $p=0.454$ (Cramer's V = 0.04), whereas large firms were more likely than non-large firms to report a written plan, $\chi^2(1, N=314) =9.35$, $p=0.002$; Fisher's exact test (two-sided), $p=0.010$; Cramer's V = 0.17. One expected cell in the large-firm comparison was < 5 (minimum expected = 1.54); Fisher's exact test was therefore used to confirm the result.

Strategic tools. Overall, 35.67% (*n*=114) of the full sample (*N*=314) reported employing at least one of the eight strategic management tools assessed, while 64.33% (*n*=202) reported using none (see Table 3).

Table 3: The usage of strategic tools

The usage of strategic tools	Percentage (%)	Number of enterprises
At least one tool	35.67	114
None of the tools	64.33	202
Total	100.00	314

Source: Author's calculations

First hypothesis testing: H_1: The strategic management process is positively related to using strategic tools. A nonparametric correlation test was employed to assess H_1, utilizing Phi (ϕ) – *Chi-square- based measures*. In addition, we examined the contingency coefficient C. The significance threshold was set at $α = 0.05$. Based on the findings in Table 4a, we can assert a statistically significant association between the strategic management process and the utilization of strategic tools (Pearson's chi-square $χ^2(1, N = 314) = 8.727, p = 0.003$), consistent with our hypothesis.

Table 4a: Chi-Square Tests: Using strategic tools, and the strategic management process

Chi-Square Tests					
	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.727a	1	0.003*		
Continuity Correction[b]	7.614	1	0.006		
Likelihood Ratio	8.313	1	0.004		
Fisher's Exact Test				0.006	0.003
Linear-by-Linear Association	8.699	1	0.003		
N of Valid Cases	314				

Note: a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.69. b. Computed only for a 2x2 table. *$p < 0.01$
Source: Author's calculations

It is important to emphasize that the chi-square ($χ^2$) test criterion was not violated; fewer than 20.0% of the cells should exhibit an expected value of less than 5. In the present scenario, none of the cells had an expected value below five, resulting in a 0.0% occurrence within the permissible 20.0% limit.

Table 4b: Symmetric Measurements: Using strategic tools and strategic management processes

Symmetric Measurements		Value	Approximate Significance
Nominal by Nominal	Phi	0.167	0.003*
	Cramer's V	0.167	0.003
	Contingency Coefficient	0.164	0.003*
N of Valid Cases		314	314

Note: *$p < 0.01$

Source: Author's calculations

The Phi test (ɸ) yielded a coefficient of 0.167 with a *p*-value of 0.003, indicating the strength of the correlation effect. Similarly, the contingency coefficient C resulted in a value of 0.164 with a *p*-value of 0.003, providing further insights into the magnitude of the correlation effect. In all tests, the *p*-value was found to be less than 0.05 ($p < 0.05$), indicating a statistically significant relationship between the use of strategic tools and the strategic management process (see Table 4b). However, the effect size is small. Consequently, we can confidently reject the null hypothesis (H_0) in favor of the supporting hypothesis (H_1).

Second hypothesis testing: H_2: The strategic plan is positively related to using strategic tools.

We conducted a nonparametric test for correlation to examine H_2 utilizing Phi (ɸ) – *Chi-square based measures*. In addition, we assessed the contingency coefficient (C). The significance criterion was set at $\alpha = 0.05$. The results in Table 5a indicate no statistically significant relationship between the variables under investigation (Pearson Chi-Square 2(1df, $N = 314$) = 2.135, $p = 0.144$).

Table 5a: Chi-Square Tests: Using strategic tools and strategic plan

Chi-Square Tests	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.135[a]	1	0.144		
Continuity Correction[b]	1.668	1	0.196		
Likelihood Ratio	2.078	1	0.149		
Fisher's Exact Test				0.174	0.099
Linear-by-Linear Association	2.129	1	0.145		
N of Valid Cases	314				

Note: a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.69.
b. Computed only for a 2x2 table

Source: Author's calculations

In this instance, the chi-square (χ^2) test criterion was not violated, as it mandates that fewer than 20.0% of the cells should possess an expected value of less than 5. Consequently, 0.0% of the cells fell within the permissible 20.0% threshold in this scenario.

Table 5b: Symmetric measurements: Strategic tools and strategic plans

Symmetric Measurements			
		Value	Approximate Significance
Nominal by Nominal	Phi	0.082	0.144
	Cramer's V	0.082	0.144
	Contingency Coefficient	0.082	0.144
N of Valid Cases		314	

Note: *$p > 0.05$

Source: Author's calculations

The Phi coefficient (ϕ) was employed as a measure of association, yielding a value of $\phi = 0.082$, with a corresponding *p*-value of 0.144. Similarly, the contingency coefficient C was computed and found to be $C = 0.082$, with an associated *p*-value of $p = 0.144$. These statistical metrics were used to assess the strength of the correlation effect. In all the tests, the obtained *p*-values exceeded the conventional significance threshold of 0.05 ($p > 0.05$) (see Table 5b). Therefore, we do not reject the null hypothesis (H_0) for H_2. No statistically significant evidence in this sample suggests that having a written strategic plan is associated with the use of strategic tools.

Summary of results:

Hypothesis H_1. A significant correlation was identified between the strategic management process and the utilization of strategic tools, as evidenced by the statistical analysis (Pearson's chi-square $\chi^2(1, N = 314) = 8.727, p = 0.003$). The magnitude of this association is small, as indicated by the Phi coefficient ($\phi = 0.167, p = 0.003$) and contingency coefficient C ($C = 0.164, p = 0.003$).

Hypothesis H_2. No statistically significant correlation emerged between the strategic plan and utilization of strategic tools (Pearson Chi-Square, χ^2 (1df, $N = 314$) = 2.135, $p = 0.144$). Consequently, no effect size was available for interpretation ($\phi = 0.082, p = 0.144; C = 0.082, p = 0.144$). Because the association is non-significant and the effect sizes are very small, we do not reject the null hypothesis (H_0) for H_2; there is insufficient evidence in this sample to conclude a meaningful relationship.

4.2. Discussion

This subsection compares our empirical findings with prior global research and highlights a gap in transitional-economy studies: empirical evidence on strategic-tool use is scarce, so our analysis provides novel, context-specific evidence from Kosovan firms and is among the few studies to examine the strategic management process in such settings.

The empirical findings of this study indicate that only 10.20% (*n*=32) of the surveyed enterprises perceive the strategic management process as crucial for their organizations, while 89.80% (*n*=282) consider it to be of partial or negligible importance. Furthermore, our research highlights that larger enterprises tend to place a greater emphasis on strategic management processes. This finding aligns with the conclusions of Matthews and Scott (1995), Frost (2003), and Kraus (2007). Our inferential tests confirm an association between firm size and presence of written plans, although effect sizes are small and the large-firm subgroup is limited, so these size-specific findings should be interpreted with caution. The absence of strategic management processes in enterprises within Kosova is a matter of considerable concern. Numerous empirical studies have underscored that the constrained achievements of these enterprises, as well as business failures, can be attributed to deficiencies in adopting strategic management practices. Empirical findings within the context of Small and Medium-sized Enterprises (SMEs), as well as large corporations implementing the strategic management process, consistently demonstrate a significant positive association between this process and enterprise performance. Empirical studies consistently show that enterprises adopting strategic management practices achieve measurable performance benefits. For instance, Lyles et al. (1993) and Schwenk and Shrader (1993) found that SMEs with formalized strategic processes reported higher growth and survival rates. Miller and Cardinal (1994) demonstrated a positive link between strategic planning and profitability, while Glaister and Falshaw (1999) observed that UK firms with long-term plans achieved stronger financial outcomes and organizational stability. More evidence from Šuklev and Debarliev (2012) and Sandada et al. (2014) highlights that in transitional economies, the intensity of strategic planning is significantly associated with enhanced competitiveness, employee expansion, and improved decision-making. These findings reinforce the importance of structured strategic management for enterprise performance.

Among the surveyed enterprises, 141 reported on written plans. Notably, only 31.21% (*n*=44) of them possessed strategic written plans with a five-year horizon, whereas 68.79% (*n*=97) had plans spanning one to four years. This pattern suggests that planning in Kosova is often short-term or semi-formal rather than embedded in a continuous, long-horizon strategic cycle. Furthermore, this study's findings indicate an association between enterprise size and the presence of a written strategic plan. Nevertheless, it should be noted that merely 14% (*n*=44) of the

sample of enterprises (*n*=314) maintained strategic plans for more than five years. Compared to the region, the presence of strategic plans among large Turkish companies was 42% (Dincer et al., 2006). Conversely, research conducted by Gică and Balint (2012) revealed that 55.5% of Romanian SMEs have strategic plans, indicating a higher proportion than Turkish companies. Furthermore, Elbanna's (2007) study in Egypt reported an even more favorable situation, with 64.2% of SMEs having written strategic plans. Remarkably, Glaister and Falshaw (1999) reported that the majority of British enterprises maintained strategic plans for more than five years, with an impressive rate of 97.3%.

Numerous empirical studies conducted on a global scale have consistently revealed a positive correlation between the implementation of strategic plans and enhanced enterprise performance (Lyles et al., 1993; Schwenk & Shrader, 1993; Miller & Cardinal, 1994; Jennings & Beaver, 1997; Glaister & Falshaw, 1999; Andersen, 2000; Thornhill & White, 2007; Wang et al., 2007; Sandada et al., 2014). Consequently, Kosovan enterprises must pay special attention to the adoption and execution of their strategic plans. However, because our data are cross-sectional, we cannot infer causality; longitudinal research is needed to test whether formalization and tool adoption drive performance improvements. In conclusion, when compared to previous research findings, it becomes evident that enterprises in Kosova exhibit a notably low level of utilization of strategic tools. For instance, as reported by Rigby and Bilodeau in 2015, large firms averaged the use of 8.1 tools in 2014, mid-sized firms increased their usage from 6.8 tools in 2012 to 7.6 tools, and smaller firms utilized 5.3 tools. Berisha Qehaja and Kutllovci (2020a) confirmed similarly low adoption rates of strategic tools among Kosovan enterprises, with reliance on basic tools such as SWOT analysis and notable differences across sectors. On a different note, Afonina's (2015) research found that Czech enterprises employed an average of 14 strategic tools. When considering all the surveyed enterprises in Kosova, the average utilization of strategic tools was only 0.68 tools per enterprise. However, if we narrow our focus to enterprises that confirm their use of strategic tools, the average increases to two strategic tools (1.91). The predominance of simple, low-cost tools (e.g., SWOT, basic financial ratios) likely reflects limited managerial capacity, resource constraints, and a focus on short-term operational issues rather than long-term strategic analysis. These findings are similar to those observed in Romanian firms, where an average of one to two strategic tools was employed, as reported by Gică and Balint in 2012. Additionally, according to Kume and Leskaj (2010), Albanian enterprises predominantly employ four strategic tools.

5. Conclusions

The findings of this study highlight several key insights regarding strategic management processes and practices within Kosovan enterprises. The analysis

reveals a significant gap between the perceived importance of strategic management and its actual adoption, with only a minority of surveyed enterprises considering it a crucial element in their organizational strategy. Furthermore, the presence of formalized strategic plans, particularly those spanning a five-year horizon, is limited among the surveyed enterprises. The utilization of strategic tools remains suboptimal, reflecting a crucial area for improvement in enhancing strategic decision-making processes within Kosovan enterprises. The results also support the hypothesis that there is a statistically significant correlation between the strategic management process and the utilization of strategic tools. However, no significant correlation was found between the presence of a strategic plan and the utilization of strategic tools, suggesting that simply having a plan in place may not necessarily translate into the effective utilization of strategic tools. In light of these findings, there is a clear need for a greater emphasis on strategic management practices, particularly among small and medium-sized enterprises in Kosova. Policymakers, business leaders, and researchers can use these insights to develop strategies to improve strategic management practices and foster sustainable growth and competitiveness within Kosovan enterprises. However, it is important to acknowledge this study's limitations, including its cross-sectional research design and reliance on standardized questionnaires for data collection. Future research should consider adopting a longitudinal approach to capture changes over time in strategic management practices and explore alternative perspectives such as the emergent strategy approach. Additionally, employing a mixed-method approach that combines quantitative and qualitative methods can provide a more comprehensive understanding of the strategic management phenomena. By addressing these limitations and building upon this study's findings, researchers and practitioners can contribute to advancing our understanding of strategic management processes and practices, ultimately enhancing organizational competitiveness and sustainability within Kosovan enterprises.

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Prakse strateškog upravljanja i strateški planovi: Empirijska analiza pristupa poduzeću

Albana Berisha Qehaja[1]*, Enver Kutllovci*[2]

Sažetak

Strateški se menadžment kontinuirano bavi poduzetničkom dimenzijom organizacija, organizacijskom obnovom i napretkom, a posebno razvojem i provedbom strategija za stvaranje konkurentskih prednosti. To uključuje praćenje i poboljšanje trenutnih programa i operacija kako bi se osigurao ispravan put strateškog plana. Rezultati o prirodi i praksi procesa strateškog upravljanja prikazani su na uzorku od 314 poduzeća na Kosovu. Nalazi ukazuju na činjenicu da samo 10,2% kosovskih poduzeća primjenjuje strateško upravljanje kao cjeloviti proces, dok 31,2% ima petogodišnje strateške planove. Rezultati istraživanja pokazali su da postoji značajna veza između procesa strateškog upravljanja i strateških alata. Međutim, ne postoji značajna veza između strateških planova i strateških alata. Naš teoretski doprinos je u razlikovanju pisanih planova od aktivnog sudjelovanja u procesima, dokazujući da aktivno sudjelovanje u procesima, a ne samo posjedovanje plana, bolje predviđa prihvaćanje alata u tranzicijskom gospodarstvu. Stoga,ova studija pruža važne uvide kreatorima politika, praktičarima i akademicima koji su usmjereni na poboljšanje procesa strateškog upravljanja u sličnim okruženjima.

Ključne riječi: *proces strateškog upravljanja, strateško planiranje, strateški plan, strateški alati, kosovska poduzeća, tranzicijsko gospodarstvo*

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The role of personality traits in shaping career and life satisfaction among freelancers: A Study from Slovenia[*]

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Abstract

This article investigates how personality traits influence financial and non-financial career satisfaction, as well as overall life satisfaction, among freelancers in Slovenia. Using structural equation modelling (SEM), the study reveals that proactiveness and self-efficacy are strong predictors of financial satisfaction, while openness to experience, conscientiousness, and self-efficacy positively influence non-financial satisfaction. It is noteworthy that non-financial satisfaction significantly increases overall life satisfaction, while financial satisfaction alone does not. The study concludes that non-financial aspects of career satisfaction are crucial for the overall life satisfaction of freelancers. These findings highlight the importance of fostering certain personality traits to improve freelancers' well-being and career success. The study offers practical implications for career development programs, strategies to support freelancers as entrepreneurs, and policy recommendations to create an enabling environment for freelancers.

Keywords: personality traits, freelancers, financial satisfaction, non-financial satisfaction, structural equation modelling (SEM)

JEL classification: J24, L26, D91

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1. Introduction

Personality traits play a central role in shaping how individuals navigate their work environments, manage uncertainty, and pursue career goals. A substantial body of research has shown that personality traits influence career outcomes, subjective well-being, and life satisfaction, particularly in work contexts characterized by autonomy and self-direction (Judge & Bono, 2001). As contemporary labor markets increasingly move away from standardized employment relationships, understanding how personality traits operate in non-traditional careers has become a key concern in career and entrepreneurship research.

The rapid development of digital technologies and globalization has fundamentally transformed the nature of work. Traditional career models based on stable employment, fixed working hours, and hierarchical advancement are increasingly complemented or replaced by freelance, project-based, and remote forms of work (Warner & Wäger, 2019). These changes place greater responsibility on individuals to manage their own careers, secure their own income, and maintain their own well-being. Freelancing represents a prominent example of these transformations, combining high levels of autonomy and flexibility with heightened income uncertainty and reduced institutional support.

Freelancers operate as self-employed professionals who independently manage projects, client relationships, and income streams, often relying on digital platforms or personal networks to access work (Shevchuk et al., 2018). While freelancing offers intrinsic benefits such as autonomy, flexibility, and self-realization, it also entails significant challenges, including financial instability, job insecurity, and blurred boundaries between work and private life (Pyöriä et al., 2017). These conditions make freelancers particularly reliant on psychological and behavioral resources that support job satisfaction, prevent burnout, and sustain productivity (Sirgy & Lee, 2018).

Existing research demonstrates that personality traits are important predictors of both financial and non-financial career outcomes among freelancers and self-employed individuals. Studies have highlighted the role of traits such as openness to experience, conscientiousness, and extraversion in shaping self-employment performance and career success (Caliendo et al., 2014). More recent work emphasizes the importance of agentic career resources, including proactiveness and self-efficacy, in facilitating opportunity recognition, self-leadership, and resilience in uncertain work environments (van den Born & Van Witteloostuijn, 2013; Barlage et al., 2023). Research on telework and digitally mediated work further suggests that conscientiousness and openness positively affect productivity, whereas extraversion may play a less central role in remote work contexts (Gavoille & Hazans, 2022).

Despite these insights, the unique dynamics of freelancing, particularly in the context of Slovenia, remain underexplored. Slovenia represents a theoretically

informative research setting, as its gig economy is still in a developmental stage compared to more mature markets such as the United States or the United Kingdom. Unlike freelancers in larger economies who predominantly rely on global digital platforms, 51% of Slovenian freelancers depend primarily on personal referrals, making their careers highly sensitive to local economic conditions and immediate social networks. Moreover, freelancing in Slovenia is embedded in a cultural context that strongly emphasizes job security, where independent work is often perceived as unstable or not a *real job*. These challenges are further shaped by structural and legal characteristics, particularly the mandatory registration of freelancers as sole proprietors (s.p.), which provides formal recognition and access to social protection, but also entails administrative burdens and tax obligations that may affect financial stability and perceived career sustainability. This combination of limited market size, cultural stigma, and constrained financial opportunities raises important questions about how personality traits operate in such environments. In particular, agentic traits such as proactiveness and self-efficacy may be especially critical for sustaining successful freelance careers under these conditions.

Against this backdrop, the present study examines how personality traits influence freelancers' subjective career success in Slovenia. Subjective career success is conceptualized through two interrelated dimensions: financial satisfaction and non-financial satisfaction (Ng & Feldman, 2014). Financial satisfaction refers to satisfaction with income and material outcomes, while non-financial satisfaction captures broader aspects of professional fulfillment, including job and career satisfaction. Although these dimensions are closely connected, dominant income-centric models of career success often assume a direct and linear relationship between financial rewards and life satisfaction.

Drawing on Self-Determination Theory (SDT), this study challenges such assumptions by proposing that, in freelancing contexts, financial satisfaction may function primarily as a *hygiene factor,* providing necessary stability, rather than as a direct source of well-being (Ryan & Deci, 2000; Herzberg, 2015). While income stability can reduce uncertainty and stress, it does not necessarily fulfil core psychological needs such as autonomy and competence. In contrast, non-financial satisfaction derived from meaningful, self-directed work may play a more central role in shaping life satisfaction and long-term career resilience in boundaryless careers. Accordingly, this study addresses the following research questions:

> *RQ1: To what extent do personality traits influence freelancers' financial and non-financial career satisfaction?*

> *RQ2: How do financial and non-financial satisfaction interact in shaping freelancers' overall life satisfaction?*

To examine these relationships, the study employs structural equation modeling (SEM), which enables the simultaneous analysis of complex associations among personality traits and multiple outcome variables while accounting for measurement error (Kock, 2015). By focusing on a transitional freelance economy and integrating personality traits with subjective career outcomes, this study contributes to a more nuanced understanding of career success in contemporary, non-traditional work contexts.

The paper is structured as follows. Section 2 reviews the relevant literature and develops the hypotheses. Sections 3 and 4 describe the data, methodology, and analytical approach. Section 5 presents the results and discussion, Section 6 presents the implications, and Section 7 concludes the paper.

2. Literature review

The literature review focuses on three closely related areas essential for understanding career outcomes in freelancing: subjective career success, personality characteristics relevant to self-managed careers, and the relationship between career satisfaction and overall life satisfaction. Together, these perspectives provide the theoretical foundation for the research model and hypotheses developed in this study.

2.1. Dimensions of career success

Career success refers to positive work-related and psychological outcomes arising from an individual's professional experiences and contributing to personal well-being and career effectiveness. The literature commonly distinguishes between objective and subjective career success.

Objective career success is typically measured through externally observable indicators such as promotions, salary growth, or material rewards (Abele & Spurk, 2009). While these indicators are easily quantifiable, they often fail to capture individuals' internal evaluations of their careers, particularly in non-traditional and self-managed work contexts. Subjective career success, in contrast, reflects personal assessments of career achievements relative to individual goals, values, and expectations (Ng et al., 2005). It encompasses constructs such as job satisfaction, career satisfaction, and life satisfaction, thereby integrating emotional experiences, perceptions of progress, and work–life balance (Gunz & Heslin, 2005; Dyke & Duxbury, 2011).

Frequently examined dimensions of subjective career success include job satisfaction, career satisfaction (Greenhaus et al., 1990; Locke & Latham, 2002), fulfilment (Maslow, 1943), and life satisfaction, which captures overall well-being across work and non-work domains (Greenhaus et al., 2012; Wrzesniewski et al.,

2013; Kossek et al., 2011). Together, these dimensions provide a comprehensive understanding of career success beyond material outcomes. The growing mobility of the workforce and the boundaryless nature of contemporary careers have further shifted scholarly attention toward subjective career success. Building on this shift, the present study challenges traditional, hierarchically defined models of career success and proposes a reordering of success criteria grounded in Self-Determination Theory. In the context of freelancing, intrinsic fulfilment and autonomy are positioned as central indicators of career success, reflecting the importance of self-directed and meaning-oriented work.

Consistent with this view, Ng and Feldman (2014) argue that individual differences are more strongly associated with subjective than objective career success. Accordingly, this study focuses on subjective career success and distinguishes between financial and non-financial satisfaction as two interrelated but conceptually distinct dimensions.

2.1.1. Financial aspect

The financial aspect of subjective career success refers to satisfaction with income derived from professional activity. Satisfaction with income is frequently used as a key indicator of subjective financial success, particularly in liberal professions and freelance contexts where earnings tend to fluctuate substantially (Van den Born& Van Witteloostuijn, 2013). In such settings, income satisfaction captures perceived financial adequacy and stability rather than absolute income levels.

2.1.2. Non-financial aspect

The non-financial aspect of subjective career success encompasses satisfaction with one's work and broader career trajectory. Job satisfaction, defined as a positive emotional state resulting from an evaluation of one's work experiences (Locke & Latham, 2002), represents an important component of this dimension. However, job satisfaction alone does not fully capture career success, as individuals may feel satisfied with their current job while remaining dissatisfied with their long-term career development, or vice versa. This distinction underscores the relevance of career satisfaction, which reflects a more holistic evaluation of professional growth, achievement, and alignment with personal goals (Greenhaus et al., 1990). Consequently, non-financial career success extends beyond immediate job-related experiences to encompass longer-term professional fulfilment.

2.2. Personality traits

Personality is commonly conceptualized as a dynamic and organized system of relatively stable traits that shapes individuals' cognitions, motivations, and

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behaviors, providing a foundation for predicting differences in career success and well-being across work contexts (Allport, 1937; Lau & Shaffer, 1999; Ryckman, 1997; Musek, 2024). From a person–environment fit perspective, career satisfaction and performance depend on the alignment between individual characteristics and environmental demands, with supportive contexts fostering development and achievement, while incongruent environments lead to dissatisfaction or withdrawal (Holland & Gottfredson, 1976; Spokane, 2000; Lau & Shaffer, 1999). In this sense, individuals who perceive their actions as self-determined are more likely to report higher levels of performance and satisfaction, particularly in work arrangements that require autonomy and self-management (Ryckman, 1997). Over the past decades, research on personality in career contexts has been largely structured around trait-based models, most notably the Big Five framework (Fiske, 1949; Norman, 1963; Goldberg, 1990; Costa & McCrae, 1992). Numerous studies have demonstrated that Big Five traits are associated with both objective and subjective indicators of career success, including job satisfaction, career satisfaction, and financial outcomes (Judge & Bono, 2001; Judge & Kammeyer-Mueller, 2007).

Although the Big Five model comprises five core personality traits, this study focuses on openness to experience, conscientiousness, and extraversion, complemented by proactiveness and self-efficacy. These traits were selected due to their strong theoretical and empirical relevance to freelancing contexts. Prior research shows that agreeableness and neuroticism, while part of the Big Five framework, have limited predictive power for career satisfaction and success in entrepreneurial and freelance settings (Brandstätter, 2011; Judge & Bono, 2001). Agreeableness is often inversely related to entrepreneurial drive because of its association with compliance rather than self-determination (Koestner & Losier, 1996), while low neuroticism reflects emotional stability that is necessary but not distinctive for freelancing success (Zhao & Seibert, 2006). Moreover, agreeableness and neuroticism are only weakly related to job and life satisfaction, further limiting their explanatory value in independent careers (Petasis & Economides, 2020).

In contrast to core personality traits, which are relatively stable dispositional characteristics, proactiveness and self-efficacy are conceptualized as context-sensitive and action-oriented capacities. This distinction is informed by preliminary qualitative interviews with Slovenian freelancers, who consistently identified proactiveness and self-efficacy primary drivers of success, often independent of broader personality descriptions. This view is supported by Major et al. (2006), who found that the Big Five explain only a limited share of variance in proactive personality. Consistent with Social Cognitive Career Theory (Lent et al., 1994) , self-efficacy is treated as a domain-specific belief related to managing the demands of independent work rather than a global trait.

Overall, the selected traits align closely with the specific demands of freelancing and reflect broader entrepreneurial tendencies such as innovation, self-determination,

and risk management. In the absence of traditional career structures, freelancers must navigate uncertain markets, manage client relationships, and coordinate project-based work independently. These conditions heighten the importance of openness for adaptability, conscientiousness for reliability, extraversion for communication, proactiveness for opportunity recognition, and self-efficacy for sustaining resilience in uncertain environments (Johnston, 2018).

2.2.1. Openness to experience

Openness to experience is associated with creativity, flexibility, curiosity, and a preference for novel ideas (Goldberg, 1990; Costa & McCrae, 1992; Spokane, 2000). This characteristic supports innovation and adaptability, which are particularly important in entrepreneurial and creative work contexts (Antončič, et al., 2015; Rauch & Frese, 2007). In freelancing, openness fosters an innovative mindset and enhances the ability to recognize and seize new opportunities, which is essential for acquiring projects and sustaining career development.

Empirical research consistently links openness to experience with higher levels of job satisfaction and positive career outcomes. Individuals high in openness tend to actively shape their work by aligning tasks with their interests and strengths, thereby enhancing both satisfaction and performance. Openness has also been associated with occupational well-being in dynamic and technology-intensive environments (Dholariya & Jansari, 2019). In the freelancing context, van den Born and van Witteloostuijn (2013) found that openness is positively related to both objective and subjective professional success.

Moreover, individuals high in openness tend to place greater value on creativity, learning, and personal growth, which makes non-financial aspects of career success particularly salient (Hirschi et al., 2021). Based on these insights, the study proposes the following hypotheses:

> • *H1.1: High levels of openness to experience will positively influence financial satisfaction among freelancers.*

> • *H2.1: High levels of openness to experience will positively influence non-financial satisfaction among freelancers.*

2.2.2. Conscientiousness

Conscientiousness is characterized by organization, responsibility, persistence, and self-discipline, reflecting an individual's capacity for self-control and achievement-oriented behavior (Brandstätter & Opp, 2014; Costa et al., 1991; Goldberg, 1990). Extensive research highlights the fact that conscientious individuals exhibit higher job performance, often associated with financial rewards and career advancement (Barrick

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& Mount, 1991; Judge et al., 1999). This trait is particularly relevant in freelancing and self-employment, where success relies heavily on self-management, reliability, and the ability to independently structure work processes (Burke et al., 2006).

In freelance contexts, conscientiousness enhances the ability to meet deadlines, manage multiple projects, and maintain consistent work quality, factors that directly contribute to income stability and client satisfaction. Empirical evidence indicates that conscientiousness is positively associated with both financial and non-financial satisfaction (Judge et al., 2002-a). Beyond material outcomes, conscientious individuals derive satisfaction from goal attainment and effective task completion, which fosters intrinsic motivation and a sense of achievement (Kanfer et al., 2001; Ashton & Lee, 2005). Meta-analytic findings further confirm that conscientiousness contributes to job and life satisfaction through sustained effort and internalized performance standards (Judge et al., 2002-b; DeNeve & Cooper, 1998).

Although some studies report mixed effects of conscientiousness in specific multivariate settings (Seibert & Kraimer, 2001; Boudreau et al., 2001), the prevailing evidence underscores its relevance for achieving both financial and non-financial satisfaction, particularly in freelance and self-employed careers where individual responsibility and persistence are central to success. Based on these insights, the following hypotheses are proposed:

> • *H1.2: High levels of conscientiousness will positively influence financial satisfaction among freelancers.*

> • *H2.2: High levels of conscientiousness will positively influence non-financial satisfaction among freelancers.*

2.2.3. Extraversion

Extraversion is characterized by energy, sociability, assertiveness, and self-confidence (Costa & McCrae, 1991). In business and entrepreneurial contexts, extraversion is often considered advantageous because it facilitates communication, persuasion, and relationship building. These characteristics are also relevant for freelancers, who must actively acquire clients, present their skills, and maintain professional relationships in the absence of formal organizational structures (Brandstätter & Opp, 2014). Higher levels of extraversion are associated with broader social networks and stronger interpersonal skills, which have been linked to career advancement and job satisfaction in various professional settings.

Empirical evidence suggests that extraverts tend to experience higher levels of job and life satisfaction, partly due to their optimistic outlook and lower perceived stress (Judge et al., 2002-b; DeNeve & Cooper, 1998). Extraversion has also been associated with higher income, occupational status, and career satisfaction across different employment contexts (Seibert & Kraimer, 2001). In freelancing, these

qualities may support client acquisition and relationship maintenance, potentially contributing to both financial and non-financial satisfaction.

However, the relevance of extraversion in freelancing may be context-dependent. Freelance work is often characterized by periods of independent, remote, and asynchronous work, which can limit opportunities for social interaction. Under such conditions, individuals with high levels of extraversion may experience lower satisfaction when their preferences for interpersonal engagement are not fully met (Kesavayuth et al., 2022). This suggests that while extraversion can be beneficial for freelancers, its positive effects may be weaker or less consistent than those of more internally oriented traits, particularly in contexts where social interaction is constrained. Based on these considerations, the following hypotheses are proposed:

> • *H1.3: Moderate levels of extraversion positively influence financial satisfaction among freelancers.*

> • *H2.3: Moderate levels of extraversion positively influence non-financial satisfaction among freelancers.*

2.2.4. Proactiveness

Prior research suggests that proactiveness represents a distinct behavioral construct that extends beyond the Big Five personality framework. Major et al. (2006) found that the Big Five traits explain only 26% of the variance in proactive personality and that proactiveness emerged as the sole predictor of motivation to learn when all five traits were considered simultaneously. This indicates that proactiveness captures a unique aspect of individual behavior related to initiative, change orientation, and self-starting tendencies, warranting its inclusion alongside traditional personality traits (Bateman & Crant, 1999).

Proactive individuals actively identify and exploit opportunities, initiate change, and persist in improving their work environments (Parker et al., 2006). Such action-oriented and future-focused behavior has been consistently linked to positive work outcomes, including enhanced job performance, organizational citizenship behavior, and favorable work attitudes (Crant, 2000; Seibert et al., 1999; Thompson, 2005). These characteristics are particularly relevant in freelancing, where individuals must independently create opportunities, adapt to market changes, and manage their own career development.

Empirical evidence further highlights the importance of proactiveness for career success. Proactive individuals tend to experience greater career advancement, higher job satisfaction, and more favorable financial outcomes (Judge & Bono, 2001; Eby et al., 2003). In boundaryless careers such as freelancing, proactiveness enables individuals to actively seek clients, diversify income sources, and adjust their career strategies in response to changing market conditions. Meta-analytic

findings confirm that proactiveness positively influences both subjective career success (e.g., job satisfaction) and objective indicators such as income and promotions (Zhang et al., 2022), underscoring its central role in shaping both financial and non-financial satisfaction among freelancers. Building on these insights, we propose the following hypotheses:

> • *H1.4: High levels of proactiveness will positively influence freelancers' financial satisfaction.*

> • *H2.4: High levels of proactiveness will positively influence freelancers' non-financial satisfaction.*

2.2.5. Self-efficacy

Self-efficacy refers to an individual's belief in their ability to perform the actions required to achieve specific goals and to effectively deploy motivation, cognition, and behavior to influence outcomes (Bandura, 1982; Wood & Bandura, 1989; Chen et al., 1998). This belief plays a central role in career-related decision-making, as individuals assess their perceived capabilities relative to the demands of their work. In freelancing, self-efficacy is particularly important because it supports self-management, persistence, and the ability to cope with uncertainty in the absence of organizational support.

A substantial body of research identifies self-efficacy as a strong predictor of performance and career success. Individuals with high self-efficacy are more likely to persist in the face of obstacles, invest sustained effort, and recover from setbacks (Bandura, 1982). In entrepreneurial and dynamic work environments, self-efficacy has been shown to positively influence success outcomes, particularly when combined with realistic optimism (Hmieleski & Baron, 2008). These findings underscore the role of self-efficacy as a key agentic resource, as individuals must first believe in their own capabilities to effectively mobilize skills and opportunities. Self-efficacy can be conceptualized as either general or domain-specific. While general self-efficacy reflects broad confidence across life domains, domain-specific forms are more informative for predicting work-related outcomes.

In the freelance context, occupational or career self-efficacy is especially relevant, as it captures confidence in managing clients, coordinating projects, and adapting to changing market demands. Empirical studies consistently show that higher levels of career self-efficacy are associated with greater career satisfaction, adaptability, and both subjective and objective career success (Spurk & Abele, 2011).

Research focusing specifically on freelancers highlights self-efficacy as a critical resource for managing project-based work and income uncertainty. High self-efficacy enables freelancers to maintain resilience, deliver consistent performance, and sustain long-term careers in boundaryless work environments (Johnston, 2018).

Further evidence indicates that self-efficacy positively influences job satisfaction, performance, and career progression, including income-related outcomes (Judge & Kammeyer-Mueller, 2007).

Consistent with Bandura's (1982) framework, self-efficacy should be assessed in relation to the specific tasks and challenges it aims to predict. In freelancing, this includes confidence in acquiring clients, managing workloads, and balancing professional and personal demands. Taken together, these characteristics position self-efficacy as a central determinant of both financial and non-financial satisfaction among freelancers. Based on the theoretical and empirical findings discussed above, we propose the following hypotheses:

> • *H1.5: High levels of self-efficacy will positively influence financial satisfaction among freelancers.*

> • *H2.5: High levels of self-efficacy will positively influence non-financial satisfaction among freelancers.*

2.3. Life satisfaction as an outcome of career success

Life satisfaction reflects an individual's overall evaluation of the quality of life across personal, professional, and emotional domains (Diener, 1984; Pavot, 1993). In freelancing, where work and private life are closely intertwined, career satisfaction, both financial and non-financial, plays a central role in shaping overall life satisfaction. Spillover Theory suggests that satisfaction in the work domain extends into broader life domains, influencing overall well-being (Staines, 1980). Financial satisfaction contributes to life satisfaction by reducing financial strain and providing stability, which enables freelancers to pursue intrinsic goals and meaningful work (Taormina & Gao, 2013; Ashraf et al., 2025). At the same time, non-financial satisfaction, such as autonomy, career growth, and work-life balance, supports intrinsic motivation and emotional well-being, strengthening life satisfaction in independent careers (Deci & Ryan, 1985; Topino et al., 2021). Based on these considerations, the following hypotheses are proposed:

> • *H3: Financial satisfaction positively influences life satisfaction.*

> • *H4: Non-financial satisfaction positively influences life satisfaction.*

2.4. Financial satisfaction as a catalyst for non-financial satisfaction

Theoretical and empirical evidence indicates that the interaction between financial and non-financial satisfaction plays an important role in shaping career and life outcomes. Financial satisfaction is primarily linked to objective career success, reflected in tangible indicators such as income and financial stability,whereas non-financial satisfaction captures subjective evaluations of professional fulfilment,

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including autonomy, work-life balance, and personal growth (Judge et al., 1995). To explain these dynamics, this study adopts Self-Determination Theory (SDT) as the primary integrative framework (Ryan & Deci, 2000). SDT emphasizes the role of intrinsic motivators, particularly autonomy and competence, which are especially salient in self-managed careers such as freelancing.

Within this SDT-based framework, Maslow's Hierarchy of Needs (Taormina & Gao, 2013) and Spillover Theory (Staines, 1980) are positioned as complementary mechanisms. Maslow's framework conceptualizes financial satisfaction as necessary for meeting basic needs, thereby enabling non-financial satisfaction to support self-actualization and intrinsic rewards. Spillover Theory further suggests that satisfaction in financial and non-financial domains jointly shapes overall life satisfaction, underscoring their interconnected nature. In freelance work, financial satisfaction functions as a stabilizing condition amid income volatility, allowing individuals to focus on professional growth and reducing stress associated with financial insecurity. Empirical findings support this catalytic role of financial satisfaction. Ashraf et al. (2025) show that income satisfaction is critical for achieving career satisfaction in project-based work environments. At the same time, non-financial satisfaction, rooted in autonomy and professional development, appears to be more strongly linked to long-term well-being and resilience. Consistent with this view, Ng et al. (2005) demonstrate that objective career achievements, such as salary and promotions, influence life satisfaction primarily through their translation into subjective well-being.

Additional research underscores the role of financial outcomes as a mediator for broader fulfilment. Atatsi et al. (2023) demonstrate that financial literacy and stability improve overall life satisfaction. Moreover, Duffy et al. (2016) show that income satisfaction mediates the relationship between career calling and life satisfaction, emphasizing that even highly meaningful work requires a financial basis to sustain well-being. Based on the above, the following hypothesis is proposed:

> • *H5: Non-financial satisfaction positively mediates the relationship between financial satisfaction and life satisfaction.*

Taken together, the proposed hypotheses describe an integrated model in which personality traits influence financial and non-financial satisfaction, while financial satisfaction indirectly contributes to life satisfaction via non-financial satisfaction.

3. Methodology

To examine the relationships between personality traits, career satisfaction, and life satisfaction among freelancers, this section outlines the conceptual model, sample characteristics, and measurement instruments used in the study.

3.1. Conceptual model

Based on the theoretical framework outlined in the previous section, we propose a model to elucidate the impact of perceived personality traits on non-financial and financial aspects of freelance satisfaction as well as on the overall life success of freelancers. This research model, depicted in Figure 1, includes the following key factors:

- Perceived personality traits: The extent to which freelancers perceive or self-assess traits about themselves. These include the following traits: openness to experience, conscientiousness, extraversion, proactiveness, and self-efficacy.

- Perceived financial satisfaction with freelancing: The extent to which a freelancer is satisfied with their progress in achieving their income goals.

- Perceived non-financial satisfaction with freelancing: The extent to which a freelancer personally values and is satisfied with the non-monetary aspects of their job and career. This includes personal development, job satisfaction, career achievement satisfaction and client support.

- Perceived life satisfaction: The extent to which freelancers perceive and rate the quality of their life. This is influenced by factors such as personal satisfaction with life, enjoyment of activities outside of work and commitment to work.

Figure 1: Research Model

Source: Authors' construction

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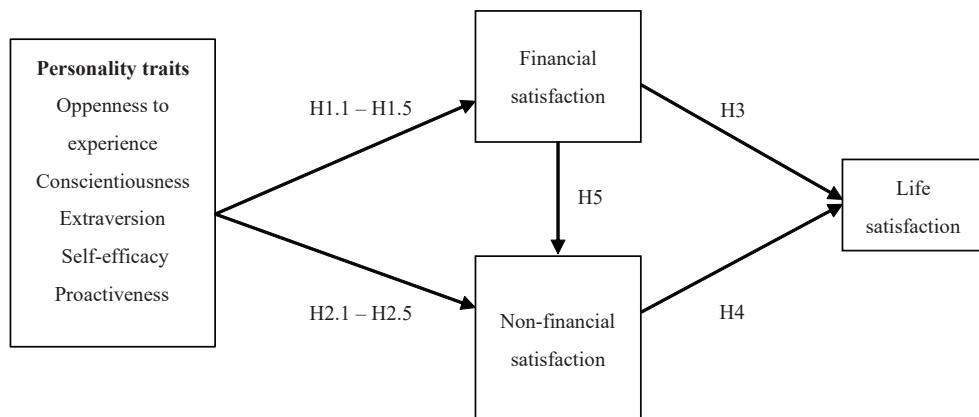
3.2. Sample characteristics

The study examined the freelance workforce in Slovenia during the period from July to September 2020. To ensure a representative sample, specific criteria for participation were applied. The focus was on freelancers who are self-employed entrepreneurs, working from home, coworking spaces, or any other location with the necessary resources. A key criterion for inclusion was that participants had worked for at least two different clients in the past year. After applying the selection criteria, 200 valid responses were obtained from the initial 342. Of these, 137 responses were gathered through Computer-Assisted Telephone Interviewing (CATI), while 63 responses were obtained via Computer-Assisted Web Interviewing (CAWI). Our survey found that 40.9% of respondents mainly use online job platforms for their job search. In addition, 57.5% of respondents work from home, a trend that will continue regardless of the COVID-19 pandemic. Coworking spaces are a popular choice, used by 40% of respondents.The minority of 2.5% work from any location that offers them the resources they need. Male freelancers make up over 50% of the sample. The largest age group is 35–44-year-olds, who make up 30.0% of respondents, followed by 45–54-year-olds at 27.9%. The least represented age groups are 65 years and older (5.5%) and 18–24 years (1.5%).

3.3. Measures

In the design of the measurement instrument for the study, scales that had previously been validated in scientific research were employed, with the necessary adaptations and extensions made to ensure alignment with the specific requirements of the study. Each variable within the instrument was scored using a 7-point Likert scale, where 1=strongly disagree and 7=strongly agree.

Established scales were used in the investigation of personality traits, using a shortened form of Goldberg (1992) Big Five personality traits questionnaire, which was further developed by Topolewska et al. (2014) to assess traits such as openness to experience, extraversion, and conscientiousness. The dimension of Openness to experience was measured using statements such as *I am full of ideas* and *I have a good imagination*. The trait of Conscientiousness was evaluated using statements such as *I get the job done right away* and *I follow a pre-set schedule*, while extraversion was assessed using statements such as *I like to be the centre of attention*.

Subsequently, the proactive personality was evaluated through the utilisation of four items derived from the Bateman and Crant (1993) scale, which is employed to assess personal dispositions for proactive behaviour (Parker & Sprigg, 1999). The Cronbach's alpha coefficient was 0.85, thereby substantiating the reliability of the measurement instrument. The questionnaire encompassed statements such as: *No matter what the odds, if I believe in something, I will make it happen*.

To measure self-efficacy, the short form of the six-item measurement scale by Damásio et al. (2014) was used, which, based on Schyns and von Collani (2002), contains statements such as *I can usually handle whatever comes my way at work.* The Occupational Self-Efficacy (OSE) scale (Rigotti et al., 2018) is derived from the original scale by Schyns and von Collani (2002) and has a high reliability (.85 to .90) and construct validity that correlates with personality traits and organizational outcomes. The OSE scale was selected instead of the Generalized Self-Efficacy and Entrepreneurial Self-Efficacy scales because it is appropriate to the organizational context and is a valid predictor of subjective career success (Tschannen-Moran & Hoy, 2007). Such a preference in this research is in accordance with social cognitive career theory (Lent et al., 1994), which relates self-efficacy and career development satisfaction.

The measurement of job satisfaction has traditionally been conducted using a three-part scale developed by Gattiker and Larwood (1986) (Cronbach's alpha = 0.78), whereas the measurement of career satisfaction is typically conducted using the widely used career satisfaction scale (Cronbach's alpha = 0.85) (Greenhaus, et al. 1990).

While such standardised measures of subjective career success typically demonstrate an acceptable degree of internal consistency, it is not necessarily the case that these characteristics are sufficient to assess the subjective career success of individual respondents. Accordingly, in order to ascertain the subjective non-financial satisfaction of freelancers, a combined career and job satisfaction scale was employed, having been adapted from that proposed by Gattiker and Larwood (1986) and based on studies conducted by Judge et al. (1995), and Judge et al. (1999). The following are illustrative examples of the questions posed: The respondents were asked whether they were satisfied with the progress they had made in achieving their overall career goals and their advancement goals. Although the scale used to measure life satisfaction (also referred to as life success) in this study was originally developed by Diener (1984), this dimension was measured using a shorter version of the four-point scale proposed by Gattiker and Larwood (1986) (Cronbach's alpha = 0.70). Example items are: *I am generally satisfied with my life,* and *I enjoy my non-work activities*.

In addition, the financial aspect of freelancers' subjective career success was measured using a single item assessing income satisfaction, consistent with previous studies. In this study, financial satisfaction is defined as a narrowly specified, unidimensional construct. This approach is particularly appropriate in liberal professions such as freelancing, where income levels fluctuate substantially, and satisfaction with income serves as a central indicator of subjective financial success (van der Zwan et al., 2018). Methodological research supports the use of single-item measures for such constructs, showing that they can achieve adequate validity and reliability when the concept is clearly defined, concrete, and easily

understood by respondents (Wanous et al., 1997; Bergkvist & Rossiter, 2007). Accordingly, the questionnaire included the following statement: *I am satisfied with the progress I have made toward meeting my income goals*

Moreover, to reduce the potential for variance in the common methods, the study used a multi-faceted research design that incorporated different data sources. A variety of data collection methods were used for the study, including telephone web interviewing, and a reputable external market research agency was retained. The agency's capacity to guarantee the anonymity and confidentiality of respondents, coupled with its ability to obtain a random sample, enabled the collection of responses that were both realistic and unbiased.

4. Empirical data and analysis

This study uses structural equation modelling (SEM) to test the hypotheses. SEM is useful for studying hidden factors like personality traits and understanding complex relationships, including direct and indirect effects. This approach allows us to model complex dynamics, such as the impact of personality traits on satisfaction and success, while accounting for measurement errors to improve the accuracy of the results. Using SEM, this study provides a robust framework for testing hypotheses and advancing understanding of freelancer work dynamics in the context of personality trait theories (Bono & Judge, 2004).

Therefore, the methodology of the study comprises several important steps. First, exploratory factor analysis (EFA) is used to simplify the data set by grouping related variables into factors. Subsequently, confirmatory factor analysis (CFA) is conducted to validate this factor structure. Then the structural equation modelling (SEM) is applied in two phases. First, the CFA is used to create a measurement model, and second, the structural relationship between the factors and variables is examined to evaluate the fit of the model and its hypotheses. EFA is performed in IBM SPSS Statistics 27, while CFA and SEM are performed using WarpPLS 7.0, which has extensive model evaluation and relationship analysis features.

4.1. Preliminary exploratory factor analysis (EFA)

In the initial phase of our analysis, we evaluated the suitability of our data for factor analysis. Specifically, we examined the relationships between variables related to personality traits, financial and non-financial satisfaction in freelancing, and life satisfaction. This evaluation demonstrated that the dataset met the preconditions for factor analysis, as confirmed by the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (KMO > 0.5) and Bartlett's test of sphericity ($p < 0.05$). While exploratory factor analysis (EFA) was utilized to validate the grouping of indicators

for latent constructs, it was not used to assess sample adequacy. We acknowledge the distinction and have clarified this in the revised text. Furthermore, subsequent confirmatory analyses were conducted through SEM to ensure the reliability and validity of the model's structure, aligning with the study's theoretical framework.

For personality traits, the EFA results in Table A1 (appendix) revealed five distinct factors: Openness to Experience (PT_1), Proactiveness (PT_2), Self-Efficacy (PT_3), Extraversion (PT_4), and Conscientiousness (PT_5). Factor loadings ($\eta \geq 0.5$) and communalities ($h > 0.5$) confirmed the strength and shared variance of the items, while reliability metrics, including Cronbach's alpha coefficients, exceeded the threshold of 0.6, indicating satisfactory internal consistency. During this analysis, one item (*I am the life and soul of the party*) was excluded due to a communality below 0.5.

For the non-financial satisfaction dimension (NFS), the EFA indicated high explanatory power, accounting for 65.60% of the variance and demonstrating excellent reliability with a Cronbach's alpha of 0.893. Similarly, the life satisfaction dimension (LS) showed a variance explanation of 64.19% and a Cronbach's alpha of 0.804, confirming the robustness of the measurement. However, the financial satisfaction dimension (FS) was measured using a single item, which precludes the application of exploratory factor analysis (EFA), as factor analysis requires multiple indicators per construct (Cronbach, 1951; DeCoster, 2004). This methodological limitation is addressed within the SEM framework, where single-indicator constructs can be appropriately specified. Following established SEM guidelines, the observed variable representing financial satisfaction was modelled with a fixed loading and weight of 1.000, allowing it to be treated as a directly observed variable in the model (Tabachnick & Fidell, 2013; Kock, 2019). This approach ensures consistency and accuracy in the estimation while maintaining the integrity of the measurement model.

Detailed results for the personality traits, non-financial satisfaction, and life satisfaction dimensions, including variable labels, communalities, factor loadings, explained variance, and Cronbach's alpha coefficients for each dimension, are provided in Appendix (Tables A1–A3).

4.2. Confirmatory factor analysis (CFA)

Moreover, CFA was carried out in a rational effort to establish a proper measurement model in preparation for the structural equation modelling SEM. This was done in accordance with the criteria proposed by Kock (2017) and Hair et al. (2010), respectively. The most important criteria were met, as shown in Table 3. The loadings of the indicators exceeded the minimum value of 0.50, and the weights of the indicators were not only positive but also statistically significant with p-values well below 0.05. This level of significance underlines the precision of the latent variable measurements. In the analysis, potential multicollinearity was accounted

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for by the variance inflation factor (VIF), which remained within the acceptable range, and the more conservative standard of Janssens et al. (2006) and the more lenient standard of Tabachnick and Fidell (2013). The impact of each observed variable was quantified, with effect sizes meeting or exceeding the threshold of 0.02, thus eliminating the necessity to exclude variables from the analysis.

Table 1 illustrates the findings pertaining to the financial aspect of freelancer satisfaction, which is contingent upon a single observed variable. The loading of the indicators, the weighting of the indicators, the variance inflation factor (VIF) and the effect size are all equal to 1.000.

Table 1: CFA Results (continues)

Factor or variable	Indicator loading	Indicator weight	P value	VIF	Effect size
PT_1 (openness to experience)					
(PT_v9) I have no difficulty understanding abstract ideas.	0.829	0.266	<0.001	2.107	0.220
(PT_v10) I am full of ideas.	0.923	0.296	<0.001	4.149	0.273
(PT_v11) I have a rich vocabulary.	0.843	0.270	<0.001	2.301	0.228
(PT_v12) I have a good imagination.	0.932	0.299	<0.001	4.520	0.278
PT_2 (proactiveness)					
(PT_v13) No matter what the odds, if I believe in something I will make it happen.	0.843	0.253	<0.001	2.431	0.214
(PT_v14) I love being a champion for my ideas, even when faced by opposition from others.	0.808	0.243	<0.001	1.964	0.196
(PT_v15) I excel at identifying opportunities.	0.785	0.236	<0.001	1.971	0.185
(PT_v16) If I believe in an idea, no obstacles will prevent me from making it happen.	0.841	0.253	<0.001	2.403	0.213
(PT_v17) When I am confident with a problem, I can usually find several solutions.	0.800	0.240	<0.001	1.046	0.192
PT_3 (self-efficiency)					
(PT_v18) I can usually handle whatever comes my way at work.	0.677	0.277	<0.001	1.320	0.188
(PT_v19) My past work experience has prepared me well for my occupational future.	0.702	0.287	<0.001	1.376	0.202
(PT_v20) I meet the goals that I set for myself in my job.	0.896	0.366	<0.001	2.622	0.328

Factor or variable	Indicator loading	Indicator weight	P value	VIF	Effect size
(PT_v21) I feel prepared for most of the demands of my job.	0.831	0.340	<0.001	2.144	0.283
PT_4 (extraversion)					
(PT_v2) I am not quiet around strangers.	0.799	0.398	<0.001	1.463	0.318
(PT_v3) I talk to a lot of different people at parties.	0.852	0.424	<0.001	1.667	0.361
(PT_v4) I do not hide away in the background.	0.804	0.400	<0.001	1.481	0.321
PT_5 (conscientiousness)					
(PT_v5) I get chores done right away.	0.748	0.382	<0.001	1.390	0.286
(PT_v6) I rarely forget to put things back in their proper place.	0.643	0.328	<0.001	1.216	0.211
(PT_v7) I do not leave my belongings around.	0.717	0.366	<0.001	1.322	0.262
(PT_v8) I follow a schedule.	0.687	0.350	<0.001	1.283	0.241
FSS (financial satisfaction)					
(IS_v1) I am satisfied with the progress I have made toward meeting my income goals.	1.000	1.000	<0.001	0.000	1.000
NFS (Non-financial satisfaction)					
(NFS_v1) I am satisfied with the success I have achieved in my career.	0.884	0.202	0.002	5.198	0.179
(NFS_v2) I am satisfied with the way I feel about my job as a whole.	0.925	0.212	0.001	6.370	0.196
(NFS_v3) I am satisfied with the opportunities to use my abilities on the job.	0.722	0.165	0.008	1.734	0.119
(NFS_v4) I am satisfied with the progress I have made towards meeting my goals for my overall daily life.	0.833	0.191	0.003	3.304	0.159
(NFS_v5) I am satisfied with the progress I have made towards meeting my goals for the development of new skills.	0.897	0.205	0.001	3.769	0.184
(NFS_v6) I am satisfied with the support I receive from my clients.	0.844	0.193	0.003	2.654	0.163
Life satisfaction (LS)					
(LS_v1) I am happy with my private life.	0.875	0.297	<0.001	2.714	0.260
(LS_v2) I enjoy my non-work activities.	0.810	0.275	<0.001	2.102	0.223
(LS_v3) I am satisfied with my life overall.	0.938	0.319	<0.001	4.285	0.299
(LS_v4) I am dedicated to my work.	0.802	0.272	<0.001	1.922	0.218

Source: Author's calculations

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Table 2 shows the reliability and validity of the factors relating to personality traits, financial and non-financial satisfaction with freelancing and life satisfaction. The results show that personality traits explain 77.1% of the variance in non-financial satisfaction and over 35% of the variance in financial satisfaction with freelancing. In addition, job satisfaction factors explain 70.7% of the variance in life satisfaction. The predictive relevance, indicated by the R-squared and adjusted R-squared values, is strong for the non-financial aspects of satisfaction and life satisfaction. Q-squared values (>0; Hair et al., 2010) confirm these results with a high predictive relevance for non-financial satisfaction (Q-squared = 0.781) and life satisfaction (Q-squared = 0.700), while financial satisfaction has a moderate predictive relevance (Q-squared = 0.400). The analysis of the reliability and validity indicators shows a robust measurement model for freelancers' assessment of the subjective professional success of freelancers. Most constructs exhibit high internal consistency, with Openness to experience (composite reliability = 0.934, Cronbach's alpha = 0.905) and non-financial satisfaction (composite reliability = 0.941, Cronbach's alpha = 0.924) showing excellent reliability. However, Conscientiousness (composite reliability = 0.793, Cronbach's alpha = 0.652) shows a lower reliability. The validity, indicated by the average variance extracted (AVE), shows that most of the constructs have good convergent validity. The threshold value for the AVE is 0.5 or more (Kock, 2019) with AVE values above 0.5. Openness to experience (AVE = 0.780) and non-financial aspect of satisfaction. The examination of multicollinearity via the variance inflation factor (VIF) shows no significant problems, with all VIF values below 10. The highest VIF value is 5.336 for non-financial satisfaction.

Table 2: Reliability and validity indicators of the formed factors

Construct	R-Square Adjusted	R-Square	Composite Reliability	Cronbach's Alpha	AVE	VIF	Q-squared
Openness to experience	-	-	0.934	0.905	0.780	1.374	-
Proactiveness	-	-	0.908	0.874	0.665	3.104	-
Self-efficiency	-	-	0.861	0.782	0.611	2.141	-
Extraversion	-	-	0.859	0.753	0.670	1.435	-
Conscientiousness	-	-	0.793	0.652	0.490	1.285	-
Non-financial satisfaction in freelancing	0.771	0.765	0.941	0.924	0.729	5.336	0.781
Financial satisfaction in freelancing	0.353	0.336	1.000	1.000	1.000	1.917	0.400
Life satisfaction	0.707	0.704	0.917	0.879	0.736	3.464	0.700

Source: Author's calculations

Accordingly, the model is generally reliable and valid and has high predictive power for the main outcomes. The model effectively captures the factors that contribute to freelancers' subjective career success and life satisfaction of freelancers.

In order to ensure the consistency and accuracy of data across the research model, we have conducted tests of the model fit with the number of indices recommended by Oishi et al. (1999) and Bono and Judge (2004). The results demonstrated that the mean path coefficients (p-value) were 0.211, which was statistically significant at p < 0.001, thus meeting the threshold of p < 0.05. The average R-squared (ARS) was 0.610 with p < 0.001, and the average adjusted R-squared (AARS) was 0.602 with p < 0.001, both of which exceeded the threshold of p < 0.05.

The average block variance inflation factor (AVIF) was 1.798, while the average full collinearity VIF (AFVIF) was 2.507. Both values are well below the threshold of 5.0, indicating that multicollinearity is not a concern in this context. The Tenenhaus Goodness-of-Fit (GoF) was 0.658, which exceeds the minimum threshold of 0.36, thereby indicating an excellent model fit. Furthermore, the Simpson's Paradox Ratio (SPR) was 0.846, exceeding the threshold of 0.7, while the R-Squared Contribution Ratio (RSCR) was 0.990, surpassing the threshold of 0.9. The Statistical Suppression Ratio (SSR) and the Nonlinear Bivariate Causality Direction Ratio (NLBCDR) were both found to be 1.000, exceeding the 0.7 threshold. These results confirm that all fit indices meet or exceed their thresholds, indicating good model fit and data consistency. This approach ensures the robustness and reliability of the model and supports the validity of the results.

Table 3 presents the reliability and validity of the constructs formed in relation to personality traits, financial and non-financial satisfaction with freelancing and life satisfaction. Personality traits were operationalized as a latent construct encompassing openness, proactivity, conscientiousness, extroversion, and self-efficacy. Although these dimensions were examined individually through specific hypotheses (H1.1, H1.2, etc.), the latent construct was included to ensure model validity and to allow testing of complex relationships through SEM analysis. This approach allows for simultaneous testing of direct and indirect influences while minimizing measurement errors.

Table 3: Reliability and validity indicators of the formed constructs

Construct	R-Square Adjusted	R-Square	Composite Reliability	Cronbach's Alpha	AVE	VIF	Q-squared
Personality traits	-	-	0.842	0.763	0.520	2.861	-
Non-financial satisfaction	0.751	0.748	1.000	1.000	1.000	5.007	0.759
Financial satisfaction	0.330	0.326	1.000	1.000	1.000	1.879	0.343
Life satisfaction	0.707	0.704	1.000	1.000	1.000	3.208	0.700

Source: Author's calculations

The model demonstrates strong predictive power for non-financial satisfaction ($R^2 = 0.748$, $Q^2 = 0.759$) and life satisfaction ($R^2 = 0.704$, $Q^2 = 0.700$), while showing moderate predictive power for financial satisfaction ($R^2 = 0.326$, $Q^2 = 0.343$). These results support the model's validity in explaining freelancers' subjective professional success.

Also, Table 3 confirms high reliability and validity for the constructs of personality traits, non-financial satisfaction, financial satisfaction, and life satisfaction. Non-financial, financial, and life satisfaction achieve perfect scores for composite reliability, Cronbach's alpha, and AVE (all at 1.000). Personality traits also exhibit adequate reliability, with composite reliability at 0.842, Cronbach's alpha at 0.763, and AVE at 0.520. Furthermore, the VIF values indicate no significant multicollinearity, ensuring the robustness of the results. Including the latent construct of personality traits in the model enhances methodological consistency and minimizes measurement error. Overall, the results in Table 4 highlight the reliability and validity of the constructs through factor loadings, average variance extracted (AVE), and composite reliability (CR), thereby confirming the theoretical soundness of the model.

Furthermore, we evaluated the consistency of the data within the research model by utilizing a range of model fit indices. The following quality indicators and criteria were in accordance with those set out by Field (2000). The average path coefficient (APC) is 0.476 with $p < 0.001$, indicating that the relationships between the constructs are statistically significant. The average R-squared (ARS) is 0.596 and the average adjusted R-squared (AARS) is 0.593, both with $p < 0.001$, indicating that the model accounts for a considerable proportion of the variance and has strong explanatory power. The average block VIF (AVIF) is 1.745 and the average full collinearity VIF (AFVIF) is 3.238, both of which are below the threshold of 5.0, indicating that there are no issues with multicollinearity. The Tenenhaus Goodness-of-Fit (GoF) value is 0.724, which exceeds the minimum acceptable value of 0.36, thereby indicating an excellent overall fit of the model. Furthermore, additional quality indices demonstrate that the Simpson's Paradox Ratio (SPR), the R-Squared Contribution Ratio (RSCR), the Statistical Suppression Ratio (SSR) and the Nonlinear Bivariate Causality Direction Ratio (NLBCDR) are all equal to 1.000, thereby meeting or exceeding their respective thresholds. The results demonstrate that the model is not subject to Simpson's paradox, that each variable makes a substantial contribution to the R-squared values, that there is no statistical suppression, and that there is a clear direction of causality between the variables.

The model shows excellent fit and quality across multiple indices, confirming its robustness and validity.

5. Results and discussion

After achieving a satisfactory fit of the measurement model, the structural model was estimated. The results are presented in Figure 2 and Table 4. Figure 2 illustrates the standardized path coefficients of the hypothesized model, while Table 4 reports the detailed SEM results, including path coefficients, effect sizes, and hypothesis testing outcomes.

Figure 2: Standardized Path Coefficients for The Hypothesized Model (construct level)
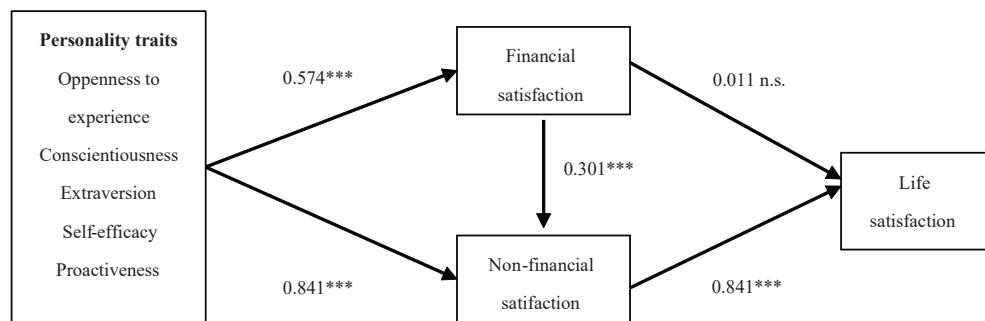
Note: *** $p \leq 0.001$; n.s.—non-significant

Source: Author's calculations

The results presented in Table 4 reveal several important findings regarding the relationships between personality traits, financial and non-financial satisfaction, and life satisfaction among Slovenian freelancers. Overall, the latent construct of personality traits shows a significant positive effect on both financial satisfaction ($\beta = 0.574$, $p < 0.001$) and non-financial satisfaction ($\beta = 0.841$, $p < 0.001$), confirming the relevance of personality-related factors in shaping subjective career outcomes in freelancing contexts.

However, further analysis of individual personality dimensions reveals a differentiated pattern of effects, indicating that not all traits contribute equally to financial and non-financial satisfaction.

With regard to financial satisfaction, proactiveness and self-efficacy emerge as the most influential predictors. Proactiveness has a strong and statistically significant positive effect on financial satisfaction (path coefficient = 0.280, $p \leq 0.001$, effect size = 0.156), suggesting that freelancers who actively seek opportunities and initiate change are better positioned to achieve higher levels of income satisfaction. This finding reflects the importance of opportunity recognition and self-initiated career management in freelance work.

Similarly, self-efficacy exhibits the strongest positive effect on financial satisfaction among all traits examined (path coefficient = 0.326, $p \leq 0.001$, effect size = 0.183). Freelancers with higher confidence in their ability to manage clients, projects, and income uncertainty report higher levels of financial satisfaction, indicating that perceived control and competence play a crucial role in navigating volatile income streams. These findings provide support for hypotheses H1.2 and H1.3.

In contrast, openness to experience does not show a significant relationship with financial satisfaction (path coefficient = −0.014, n.s., effect size = 0.004), leading to the rejection of hypothesis H1.1. Although openness may foster creativity and exploration, these qualities do not appear to translate directly into perceived financial success in the Slovenian freelance context.

Likewise, conscientiousness shows a negative but non-significant effect on financial satisfaction (path coefficient = −0.060, n.s., effect size = 0.015), resulting in the rejection of hypothesis H1.5. This suggests that organizational skills and persistence alone are insufficient to guarantee financial satisfaction in freelancing, where income is often shaped by external market conditions.

Finally, extraversion does not significantly influence financial satisfaction (path coefficient = 0.085, n.s., effect size = 0.033), leading to the rejection of hypothesis H1.4.

A different pattern emerges when examining non-financial satisfaction. Proactiveness again plays a central role, exhibiting the strongest positive effect on non-financial satisfaction (path coefficient = 0.412, $p \leq 0.001$, effect size = 0.331). Proactive freelancers appear more capable of shaping their work environments in line with personal values and career goals, which enhances job and career satisfaction. Hypothesis H2.2 is therefore strongly supported.

Self-efficacy also has a significant positive effect on non-financial satisfaction (path coefficient = 0.196, $p \leq 0.01$, effect size = 0.141), confirming hypothesis H2.3. Freelancers with high self-efficacy report greater satisfaction derived from professional growth, adaptability, and successful task completion.

In addition, openness to experience positively influences non-financial satisfaction (path coefficient = 0.102, $p \leq 0.05$, effect size = 0.052). Although the effect size is modest, this finding supports hypothesis H2.1 and indicates that creativity, curiosity, and intellectual stimulation contribute to intrinsic aspects of career success.

Similarly, conscientiousness has a positive and statistically significant, though relatively small, effect on non-financial satisfaction (path coefficient = 0.103, $p \leq 0.05$, effect size = 0.040), supporting hypothesis H2.5. Structured work habits and goal orientation appear to foster feelings of accomplishment and professional fulfillment, even when financial outcomes remain uncertain.

In contrast, extraversion does not significantly affect non-financial satisfaction (path coefficient = 0.031, n.s., effect size = 0.017), leading to the rejection of hypothesis H2.4. This suggests that interaction-oriented traits may be less relevant for freelancers' intrinsic satisfaction in predominantly independent and remote work settings.

Regarding overall life satisfaction, the results show that non-financial satisfaction has a very strong and statistically significant positive effect (path coefficient = 0.841, $p < 0.001$, effect size = 0.701), providing strong support for hypothesis H4. This highlights the central role of job and career satisfaction, autonomy, work–life balance, and personal fulfillment in shaping freelancers' overall well-being.

In contrast, financial satisfaction does not have a significant direct effect on life satisfaction (path coefficient = 0.011, n.s., effect size = 0.007), leading to the rejection of hypothesis H3. This finding indicates that income satisfaction alone is insufficient to enhance life satisfaction among freelancers.

However, financial satisfaction has a significant positive effect on non-financial satisfaction (path coefficient = 0.301, $p < 0.001$, effect size = 0.208), supporting hypothesis H5. This suggests that financial satisfaction indirectly contributes to life satisfaction by reducing stress and enabling greater focus on intrinsic career goals.

Table 4: Hypothesis testing

Hypothesis	Hypothesis path	Link direction	Type of link	Path coefficient (impact)	Effect size
H1.1	PT_1 → FS	negative	nonlinear	-0.014n.s.	0.004
H1.2	PT_2 → FS	positive	nonlinear	0.280***	0.156
H1.3	PT_3 → FS	positive	nonlinear	0.326***	0.183
H1.4	PT_4 → FS	positive	nonlinear	0.085n.s.	0.033
H1.5	PT_5 → FS	negative	nonlinear	-0.060n.s	0.015
H2.1	PT_1 → NFS	positive	nonlinear	0.102*	0.052
H2.2	PT_2 → NFS	positive	nonlinear	0.412***	0.331
H2.3	PT_3 → NFS	positive	nonlinear	0.196**	0.141
H2.4	PT_4 → NFS	positive	nonlinear	0.031n.s.	0.017
H2.5	PT_5 → NFS	positive	nonlinear	0.103*	0.040
H3	FS → LS	positive	nonlinear	0.011n.s.	0.007
H4	NFS → LS	positive	nonlinear	0.841***	0.701
H5	FS → NFS	positive	nonlinear	0.301***	0.208

Note: *** $p \leq 0.001$; n.s.—non-significant; PT (Personality Traits), FS (Financial Satisfaction), NFS (Non-Financial Satisfaction), LS (Life Satisfaction)

Source: Author's calculations

As shown in Table 4, most statistically significant relationships exceed the recommended minimum effect size threshold of 0.02 (Tabachnick & Fidell, 2013). Hypotheses H1.1, H1.4, H1.5, and H3 exhibit negligible and statistically non-significant effects and are therefore rejected. Overall, the findings indicate a non-linear and differentiated pattern in which, particularly, proactiveness and self-efficacy play a dominant role in shaping both financial and non-financial satisfaction, while traditional personality traits show more limited or context-dependent effects.

This study provides empirical evidence on how personality-related characteristics shape career and life satisfaction among freelancers, a rapidly growing yet still under-theorized segment of the labor market. The findings show that non-financial career satisfaction is the primary driver of life satisfaction, while financial satisfaction plays an indirect, enabling role. This distinction is particularly salient in freelance careers, which are characterized by autonomy, uncertainty, and limited institutional support.

Regarding non-financial satisfaction, agentic characteristics such as proactiveness and self-efficacy, along with openness to experience and conscientiousness, are positively related to job and career satisfaction. In contrast, extraversion does not exhibit a significant effect on either financial or non-financial satisfaction. These results suggest that in freelance work, internal resources that support self-management and adaptive action are more consequential for subjective career success than socially oriented traits. This finding diverges from parts of the entrepreneurship literature, where extraversion is often associated with networking intensity and client acquisition. However, contemporary freelance work is frequently organised around remote arrangements, asynchronous communication, and a high degree of independent task execution. In such conditions, social interaction plays a more limited role in daily work processes, and interaction-oriented traits may therefore be less relevant for satisfaction and success than internally oriented traits such as self-efficacy and proactiveness (Gavoille & Hazans, 2022; Johnston, 2018). Moreover, limited opportunities for interpersonal interaction may even reduce satisfaction among highly extraverted freelancers when their social preferences remain unmet (Kesavayuth et al., 2022). This interpretation is further reinforced by the Slovenian freelance context, where career sustainability often depends on maintaining a small number of stable, long-term client relationships rather than engaging in extensive networking.

The strong association between non-financial satisfaction and life satisfaction highlights the importance of intrinsic rewards such as autonomy, flexibility, and personal development in freelance careers. This result aligns with spillover theory, which posits that satisfaction in the work domain positively influences overall well-being. In contrast, financial satisfaction alone does not directly enhance life satisfaction, supporting earlier work that emphasizes the limits of income-based

success indicators in non-traditional careers (Judge & Bretz, 1994; Greenhaus et al., 2012).

At the same time, the positive relationship between financial and non-financial satisfaction indicates that financial stability functions as a stabilizing condition, reducing stress and enabling freelancers to pursue intrinsically meaningful goals. This finding is consistent with Self-Determination Theory, where financial security supports, but does not replace, the fulfillment of autonomy and competence needs (Ryan & Deci, 2000), and with Maslow's hierarchy, where basic needs must be met before higher-order fulfillment can occur.

Trait-specific findings further refine existing literature. While openness to experience and conscientiousness are often associated with financial success in traditional employment and entrepreneurship (Caliendo et al., 2014; Węziak-Białowolska et al., 2020), this study shows that their primary contribution in freelancing lies in enhancing non-financial satisfaction, such as fulfillment derived from meaningful work and effective task completion. These results underscore the contextual specificity of freelancing, where intrinsic rewards frequently outweigh monetary gains.

The absence of a significant relationship between extraversion and satisfaction contrasts with entrepreneurship research emphasizing networking and social capital (Ashraf et al., 2025). In the Slovenian freelance market, where 51% of freelancers rely on personal referrals and long-term client relationships (Huđek, 2022), success appears to depend more on professional resilience and strategic self-management than on broad social outgoingness. The predominantly remote and independent nature of freelance work may further limit the relevance of extraversion for both financial and non-financial satisfaction.

6. Implications

The findings of this study contribute to the literature on sustainable careers by demonstrating that long-term well-being in freelancing is driven primarily by non-financial satisfaction rather than income alone. Sustainable freelance careers, therefore, depend less on continuous income maximization and more on maintaining autonomy, psychological resources, and adaptive capacity over time. This perspective aligns with sustainable career models that emphasize well-being, agency, and long-term employability rather than short-term financial outcomes (De Vos et al., 2020). As such, freelancing should be understood as a distinct career logic that requires alternative success hierarchies and tailored support mechanisms.

Digital labor platforms and client organizations play a critical role in shaping freelancers' non-financial career experiences. Beyond financial compensation,

platforms can design non-financial value propositions by offering transparent contracts, predictable payment schedules, skills certification, feedback mechanisms, and recognition of professional contributions. Prior research demonstrates that autonomy, transparency, and perceived fairness are central to freelancers' well-being in platform-mediated work (Wood et al., 2019). Such practices can enhance non-financial satisfaction, reduce uncertainty, and support long-term engagement, even in contexts where income growth is constrained.

Similarly, clients can contribute to freelancers' career sustainability by ensuring timely payments, offering longer-term project continuity, and providing opportunities for skill development. These measures are likely to enhance job satisfaction, productivity, and mutual trust, thereby strengthening the overall resilience of the freelance ecosystem.

Career coaching and professional support programs for freelancers should move beyond generic networking advice and instead focus on strengthening agentic career capacities, particularly proactiveness and self-efficacy. The results indicate that these capacities are critical for both financial and non-financial satisfaction, enabling freelancers to navigate uncertainty, manage client relationships, and actively shape their careers. Training initiatives emphasizing opportunity recognition, project management, career self-management, and adaptive decision-making are therefore more likely to foster sustainable freelance careers than traditional employability-oriented interventions.

At the institutional level, the Slovenian context illustrates how regulatory frameworks shape freelance career outcomes. Freelancers are required to register as sole proprietors (s.p.), a legal status that provides social protection and formal recognition but also entails administrative obligations and tax burdens. While this framework offers legal security, the associated costs and bureaucratic complexity may reduce net income and negatively affect financial satisfaction. Combined with the country's small market size and reliance on referral-based work, these requirements restrict freelancers' ability to stabilize and scale their careers. Policy measures aimed at simplifying administrative procedures, reducing compliance costs, and improving tax transparency could therefore strengthen financial stability without undermining flexibility.

Cultural norms further influence freelancers' career experiences. Prevailing values that emphasize employment stability often frame freelancing as an inherently insecure form of work, limiting societal recognition and professional legitimacy. At the same time, increasing individualism among younger generations reflects a growing appreciation of autonomy, flexibility, and self-realization as desirable career attributes (Lavrič et al., 2020). Local coworking spaces and professional communities partially mitigate these challenges by fostering collaboration, peer learning, and skill development. However, their limited reach suggests a need for

broader institutional mechanisms that facilitate access to professional networks and market opportunities beyond local referral-based systems.

Education represents a critical lever for improving freelance career sustainability. The formal education system in Slovenia currently places limited emphasis on entrepreneurial, digital, and self-management competencies essential for successful freelancing (Širec et al., 2024). Strengthening entrepreneurial education at secondary and tertiary levels could contribute to the professionalization of freelancing, enhance career development, and increase non-financial satisfaction by reinforcing confidence and perceived competence. Educational frameworks should increasingly transition from task-based instruction toward experiential learning models that foster an entrepreneurial mindset and adaptive career skills (OECD, 2019). Moreover, career development programmes should explicitly target the cultivation of proactiveness and self-efficacy, given their positive effects on both financial and non-financial satisfaction and their contribution to long-term life satisfaction among freelancers.

Finally, the findings have important implications for debates on career inequality and precarity. Freelancers operating in small and transitional economies face structural disadvantages related to market size, institutional arrangements, and cultural legitimacy, which can constrain financial satisfaction and career mobility. These dynamics reflect broader patterns of precarious work, where institutional conditions systematically shape career vulnerability and inequality (Kalleberg, 2009). While non-financial satisfaction provides psychological resilience, it cannot fully compensate for persistent income instability and unequal access to opportunities. Policies that establish a stable financial baseline, such as simplified tax regimes, income protection schemes, and collective representation mechanisms may help reduce precarity while preserving the autonomy that freelancers value.

7. Conclusions

This study contributes to the literature by examining the relationship between personality-related characteristics and career satisfaction among freelancers, a rapidly growing yet still underexplored group within non-traditional employment contexts. By explicitly distinguishing between financial and non-financial career satisfaction and examining their respective effects on life satisfaction, the study demonstrates that non-financial satisfaction represents the primary pathway through which freelancers experience overall well-being. In doing so, the findings challenge income-centric models of career success and support theoretical perspectives that emphasize psychological needs, autonomy, and self-determined motivation as core elements of sustainable careers.

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Although a latent construct of personality traits was employed in the SEM analysis for methodological consistency, the main contribution of this research lies in its trait-specific analysis. The results reveal differentiated personality effects, showing that agentic and self-regulatory traits, particularly proactiveness and self-efficacy, play a central role in shaping both financial and non-financial satisfaction. In contrast, socially oriented traits such as extraversion do not emerge as significant predictors of career satisfaction in this context. This finding advances the literature on boundaryless and self-managed careers by demonstrating that internal resources supporting agency, adaptability, and self-management are more consequential for subjective career success than traits traditionally associated with networking and social interaction.

By conceptualizing freelancing as a form of entrepreneurial and boundaryless career, this study highlights the need for alternative success hierarchies that extend beyond financial outcomes. The results align with sustainable career frameworks by showing that long-term well-being in freelancing depends less on income maximization and more on maintaining autonomy, competence, and adaptive capacity over time. In this sense, non-financial satisfaction functions not merely as a complement to financial success but as a central indicator of career sustainability in contexts characterized by uncertainty and weak institutional support.

The Slovenian context further illustrates how institutional, cultural, and market conditions interact with individual characteristics to shape freelance careers. In a transitional economy where freelancing is still frequently perceived as unstable or less legitimate, non-financial satisfaction derived from autonomy and flexibility serves as an important psychological counterbalance to structural constraints. Addressing gaps in entrepreneurial education, reducing administrative burdens for sole proprietors, and improving access to continuous professional development may therefore contribute to the professionalization of freelancing and better alignment with more established freelance ecosystems.

While the empirical analysis is grounded in the Slovenian context, the findings may also be informative for other small and transitional freelance economies characterized by limited market size, strong reliance on personal networks, and evolving institutional support, particularly in Central and Eastern Europe. At the same time, the applicability of the results is bounded by national regulatory frameworks, cultural perceptions of self-employment, and labor market structures. Future research is therefore encouraged to examine these relationships across different institutional contexts to further refine context-sensitive models of sustainable freelance careers.

Overall, this research advances understanding of career success in freelancing by integrating personality traits, subjective career outcomes, and contextual conditions within a coherent theoretical framework. It provides a foundation for future

research examining how individual agency, institutional arrangements, and career support mechanisms jointly shape sustainable and satisfying careers in the evolving world of work.

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Appendix

Table A1: EFA Results for Personality Traits (PT) Factors

Variable label	Variable	Commu-nalities	Factors				
			PT_1	PT_2	PT_3	PT_4	PT_5
PT_v2	I am not quiet around strangers.	0.752				0.853	
PT_v3	I talk to a lot of different people at parties.	0.713				0.795	
PT_v4	I do not hide away in the background.	0.664				0.734	
PT_v5	I get the job done right away.	0.496					0.578
PT_v6	I rarely forget to put things back in their proper place.	0.627					0.779
PT_v7	I do not leave my belongings around.	0.628					0.780
PT_v8	I follow a schedule.	0.508					0.555
PT_v9	I have no difficulty understanding abstract ideas.	0.702	0.806				
PT_v10	I am full of ideas.	0.778	0.813				
PT_v11	I have a rich vocabulary.	0.613	0.713				
PT_v12	I have a good imagination.	0.775	0.848				
PT_v13	No matter what the odds, if I believe in something I will make it happen.	0.632		0.702			
PT_v14	I love being a champion for my ideas, even when up against opposition from others.	0.640		0.760			
PT_v15	I excel at identifying opportunities.	0.612		0.648			
PT_v16	If I believe in an idea, no obstacles will prevent me from making it happen.	0.700		0.728			
PT_v17	When I am confident with a problem, I can usually find several solutions.	0.570		0.539			
PT_v18	I can usually handle whatever comes my way at work.	0.385			0.567		
PT_v19	My past work experience has prepared me well for my occupational future.	0.545			0.728		
PT_v20	I meet the goals that I set for myself in my job.	0.735			0.756		
PT_v21	I feel prepared for most of the demands on my job.	0.687			0.720		
Number of Items			4	5	4	3	4
Variance Explained			15.61	14.51	12.59	10.65	10.47
Cronbach's Alpha Coefficient			0.869	0.818	0.712	0.776	0.687

Note: PTv_2–PTv_21: denote the specific variable or item related to the corresponding personality trait

Source: Authors' calculations

Table A2: EFA Results for the Non-Financial Satisfaction (NFS) in Freelancing

Variable label	Variable	Communalities	Factor
NFS_v1	I am satisfied with the success I have achieved in my career.	0.714	0.845
NFS_v2	I am satisfied with the way I feel about my job as a whole.	0.793	0.890
NFS_v3	I am satisfied with the opportunities to use my abilities on the job.	0.572	0.754
NFS_v4	I am satisfied with the progress I have made towards meeting my goals for my overall daily life.	0.622	0.789
NFS_v5	I am satisfied with the progress I have made towards meeting my goals for the development of new skills.	0.687	0.829
NFS_v6	I am satisfied with the support I receive from my clients.	0.549	0.741
Number of Items			6
Variance Explained			65.602
Cronbach's Alpha			0.893

Note: NFS_v1–NFS_v6: denote the specific variable or item within the non-financial satisfaction dimension

Source: Authors' calculations

Table A3: EFA Results for Life Satisfaction (LS) of the Freelancers

Variable label	Variable	Communalities	Factor
LS_v1	I am happy with my private life.	0.743	0.862
LS_v2	I enjoy my non-work activities.	0.531	0.728
LS_v3	I am satisfied with my life overall.	0.824	0.908
LS_v4	I am dedicated to my work.	0.470	0.686
Number of Items			4
Variance Explained			64.19
Cronbach's Alpha			0.804

Note: LSv1 –LSv2: indicates the individual variables related to the life satisfaction dimension

Source: Authors' calculations

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Uloga osobina ličnosti u oblikovanju zadovoljstva karijerom i životom među freelancerima: Studija iz Slovenije

Ivona Huđek Kanižaj[1]*, Karin Širec*[2]

Sažetak

U ovom se članku istražuje kako osobine ličnosti utječu na financijsko i nefinancijsko zadovoljstvo karijerom, kao i na cjelokupno zadovoljstvo životom, među freelancerima u Sloveniji. Korištenjem strukturnog modeliranja jednadžbi (SEM), studija pokazuje da su proaktivnost i samoefikasnost snažni prediktori financijskog zadovoljstva, dok otvorenost prema iskustvu, savjesnost, proaktivnost i samoefikasnost pozitivno utječu na nefinancijsko zadovoljstvo. Važno je napomenuti da nefinancijsko zadovoljstvo značajno povećava ukupno zadovoljstvo životom, dok se to ne događa kada je fokus samo na financijskom zadovoljstvu. Studija zaključuje da su nefinancijski aspekti zadovoljstva karijerom ključni za ukupno zadovoljstvo životom freelancera. Ovi nalazi ističu važnost poticanja određenih osobina ličnosti kako bi se poboljšala dobrobit i uspjeh u karijeri freelancera. Studija nudi praktične implikacije za programe namjenjene freelancerima kao što su razvoj njihove karijere, strategije da im se pruži podrška kao poduzetnicima i preporuke politika za stvaranje poticajnog okruženja.

Ključne riječi: *osobine ličnosti, freelanceri, financijsko zadovoljstvo, nefinancijsko zadovoljstvo, modeliranje strukturnih jednadžbi (SEM)*

JEL klasifikacija: *J24, L26, D91*

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Size Matters: Nonlinear Determinants of Sovereign Bond Liquidity in EU Markets[*]

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Abstract

The purpose of this paper is to investigate the determinants of sovereign bond market liquidity across EU member states, with particular attention to the role of market size. Using panel data for 26 EU countries over the period 2022–2024H1, the analysis applies Hansen's threshold regression methodology to test for non-linearities in the debt–liquidity relationship. The results identify a statistically significant threshold of approximately EUR 92 billion in outstanding debt, above which liquidity dynamics become self-reinforcing, and market size emerges as the dominant driver. Liquidity below this threshold is influenced more by structural and fiscal fundamentals, such as the composition of debt and the quality of sovereign credit. The findings confirm that liquidity is scale-dependent and regime-specific, with important implications for debt management and policy design. The study concludes that strategies to enhance liquidity must be differentiated: large markets rely on sustaining scale, while smaller ones require institutional and structural measures.

Keywords: *sovereign bonds, liquidity, market size, threshold regression*

JEL classification: *E44, G12, G15, H63*

1. Introduction

Liquidity in sovereign bond markets is of fundamental importance for both sovereign debt management and the functioning of the wider financial system. For governments, liquid markets lower borrowing costs by narrowing bid-ask spreads and compressing the liquidity premia demanded by investors. They also ensure a more stable and reliable source of financing during periods of stress by

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enabling a broad and diverse investor base. For investors, liquidity facilitates portfolio adjustments and risk management by allowing large positions to be rebalanced efficiently. At the systemic level, liquid government securities serve as benchmarks for pricing other financial instruments, provide essential collateral in repo and derivatives markets, and constitute the primary channel through which central banks conduct monetary policy operations (International Monetary Fund [IMF], 2012; Organisation for Economic Co-operation and Development [OECD], 2016; Financial Stability Board, 2022). Conversely, illiquid markets heighten refinancing risks, amplify price swings, and may exacerbate the impact of fiscal or macroeconomic shocks. For these reasons, international financial institutions and academic studies alike emphasize the policy relevance of fostering sovereign bond market liquidity, particularly in smaller and emerging economies.

Nevertheless, issuing public debt has been much easier than ensuring its secondary market liquidity. As McCauley and Remolona (2000) already argued, achieving active trading may require a minimum market size, beyond which government bonds can serve as reliable benchmarks and hedging instruments. More recent studies confirm that liquidity is affected not only by the amount of outstanding debt but also by a broad set of factors including issuance practices, investor composition, regulatory and tax frameworks, bonds characteristics, currency denomination, credit rating, the jurisdiction of issuance, and the infrastructure of trading and settlement (Asian Development Bank, 2019; OECD, 2016, 2017, 2018; Fang et al. 2023; Eisl et al. 2020). These insights suggest that while market size may be a necessary condition, it is not sufficient on its own, and understanding how these factors interact remains a crucial task for both academics and policymakers.

The relevance of these issues takes on a distinct character in the European Union. On the one hand, the euro area operates under a common monetary policy, harmonized regulations, and partially integrated settlement infrastructures, which foster cross-border integration. On the other hand, member states outside the euro are issuing debt both in their national currencies and in euros, creating an additional layer of diversity. Yet, as Favero et al. (2010) underline, euro area bonds are not regarded as perfect substitutes by investors. Government securities are issued by multiple sovereigns, each with distinct fiscal positions, credit ratings, issuance practices, and investor bases, while liquidity is provided by common as well as country-specific liquidity providers (Panagiotou et al., 2023). This fragmentation implies that liquidity is uneven across member states, with core issuers such as Germany or France enjoying deep markets, while smaller or peripheral countries face persistent challenges in sustaining secondary market activity.

Market fragmentation creates a unique research challenge. If financial intermediaries, settlement platforms, and monetary policy are largely shared, why do liquidity conditions differ so markedly across countries? One reason lies in country-specific fundamentals. Another lies in the scale of issuance: larger markets naturally facilitate

turnover in ways that smaller markets cannot. Yet the precise point at which market size begins to dominate other factors has not been established empirically. While McCauley and Remolona (2000) suggested that a critical threshold may lie around USD 100–200 billion, no study to date has tested for nonlinearities in this relationship across European sovereign bond markets. Finally, partial currency fragmentation makes the European case especially interesting, as it allows researchers to investigate the extent to which euro area membership itself shapes secondary market liquidity, relative to other structural determinants.

In this paper, we address this gap by focusing on EU sovereign bond markets during 2022–2024. Our central research problem is whether sovereign bond liquidity exhibits a threshold effect with respect to market size, and whether the determinants of liquidity differ systematically between smaller and larger markets. From a policy perspective, identifying a threshold matters because it helps to target efforts more efficiently: if liquidity responds differently above and below a certain size, then policymakers should not apply identical measures across all countries. In fact, larger issuers often have both the resources and the institutional incentives to develop sophisticated market-microstructure tools – such as benchmark programs, securities lending facilities, or enhanced dealer obligations – because even small yield improvements translate into substantial fiscal savings. Smaller issuers, by contrast, face tighter capacity constraints and cannot rely on size alone, making complementary measures – such as diversifying the investor base or incentivizing primary dealers – relatively more important. In this sense, the presence of a threshold informs where reforms are likely to yield the greatest marginal effect, rather than implying that any group of issuers can neglect the issue of liquidity.

Building on the literature and the policy discussion above, this paper advances two related hypotheses:

- H1 – Sovereign bond market liquidity in EU member states exhibits a non-linear relationship with market size.

- H2 – The determinants of liquidity differ systematically between markets below and above the size threshold.

These hypotheses suggest that beyond a certain debt threshold, scale effects dominate, enabling more continuous trading, tighter bid–ask spreads, and resilience in stressed conditions. Below this threshold, liquidity is more fragile and less directly related to market size. For smaller issuers, structural factors such as investor base composition, credit ratings, and issuance practices may play a comparatively greater role, since market size alone is insufficient to generate secondary trading. To the best of our knowledge, this is the first study to estimate an endogenous market-size threshold for sovereign bond liquidity in the EU and to analyse regime-specific liquidity determinants.

Taken together, these hypotheses imply that liquidity policy cannot follow a "one-size-fits-all" template across EU sovereign issuers. Instead, policy priorities should depend on a country's position relative to the critical size threshold; while large issuers may rely primarily on economies of scale complemented by targeted microstructural enhancements, smaller issuers must focus on structural reforms to strengthen liquidity.

To evaluate these propositions, this paper employs a two-step empirical strategy. First, panel regressions on semi-annual data for 26 EU countries (2022–2024) establish baseline relationships between liquidity and explanatory variables, including market size, debt-to-GDP ratios, credit ratings, euro area membership, and foreign investor participation. Second, Hansen's (2000) threshold regression methodology formally tests for the presence of a market-size threshold and estimates its value. Separate regressions are then conducted for subgroups below and above the threshold to establish whether liquidity drivers differ systematically between regimes.

By empirically testing these hypotheses, our paper contributes to several strands of literature. It extends the early insights of McCauley and Remolona (2000) by providing the first threshold estimate for EU bond markets. It complements studies such as Beber et al. (2009), Favero et al. (2010), and O'Sullivan and Papavassiliou (2020), which emphasize the dual roles of credit quality and liquidity, by showing that these roles are regime-dependent. It also advances the work of Panagiotou et al. (2023) and Richter (2022) on commonality in liquidity by highlighting the conditions under which national factors dominate versus when common effects prevail. Finally, it has direct policy relevance by offering guidance to debt management offices about the conditions under which liquidity-enhancing interventions are most effective.

The remainder of the paper is structured as follows. Section 2 provides an overview of the existing literature and synthesizes previous research on sovereign bond market liquidity. Section 3 presents the methodology, including the use of Hansen's (2000) threshold regression approach. Section 4 introduces the data and presents the empirical results. Section 5 discusses the findings in a broader economic and policy context. Section 6 concludes with key messages and identifies avenues for future research.

2. Literature review

The liquidity of sovereign bond markets has been the subject of sustained academic attention, reflecting both its importance for financial stability and monetary policy. A central debate in the literature concerns whether sovereign bond liquidity is primarily determined by common market-wide forces or by

bond- and country-specific characteristics. Richter (2022), for example, examines liquidity in a panel of developed countries. The study finds that variations in individual bond liquidity are to a large extent explained by common liquidity movements, driven by proxies such as the number of market makers or local bank returns. However, the results also highlight the absence of a true global liquidity factor, with negative cross-market correlations observed during flight-to-safety episodes. This resonates with the findings of O'Sullivan and Papavassiliou (2020), who document significant commonality in liquidity proxies such as spreads and depth. Importantly, they observe that co-movement weakens during crisis periods but remains more pronounced in the periphery than in the core. Similar conclusions are drawn by Panagiotou et al. (2023), who focus on the determinants of commonality in liquidity across European fixed-income markets. Their results suggest that supply-side factors, such as the funding constraints of financial intermediaries, explain much of the time-series variation in commonality, while demand-side proxies play a much more limited role. Clancy et al. (2019) find that significant own- and cross-market effects causing liquidity contractions in the Italian and Spanish bond markets during times of heightened risk are amplified by the German Bund's safe-haven status. Chaumont (2024) emphasizes that the liquidity of the secondary market for bonds is endogenous and varies over the business cycle.

At the same time, an extensive strand of literature emphasizes the role of bond-specific and structural characteristics. McCauley and Remolona (2000) show that larger stocks of outstanding government debt are typically associated with higher turnover and narrower bid-ask spreads, and hypothesize the existence of a market-size threshold, in the order of USD 100–200 billion, above which liquidity improves substantially. Subsequent research has supported this view, with Galliani et al. (2014) demonstrating that bond-level features such as rating, duration, and amount issued play a particularly strong role under stressed conditions. Favero et al. (2010) observe that while yield differentials display a common factor highly correlated with aggregate risk, liquidity differentials – proxied by bid-ask spreads – are more heterogeneous, suggesting that market size and structure explain differences in liquidity.

These findings link closely to the literature disentangling liquidity from credit quality. Beber et al. (2009) argue that during crises, investors tend to prioritize liquidity over credit quality, leading to a negative relation between credit standing and liquidity in sovereign bond markets. Petrella and Resti (2016) show that liquidity dynamics are driven by market-wide factors, such as quality spreads, and by bond-specific characteristics, with stressed conditions amplifying the relevance of the latter. Dell'Erba et al. (2013) complement these results by analyzing the interaction between debt levels, debt composition, and spreads in diverse markets. They find that the correlation between debt levels and spreads is high and

statistically significant in countries with a large share of foreign currency debt or high net foreign liabilities. On the other hand, Pelizzon et al. (2016) investigate the relation between credit risk and liquidity and find a strong positive relationship between credit default swap spreads and bid-ask spreads in the Italian sovereign bond market.

Further perspectives highlight the reinforcing role of funding constraints and fragmentation in European bond markets. Moinas et al. (2018) document two-way feedback between funding liquidity and market liquidity, showing that impairments in one dimension tend to exacerbate problems in the other. Sensoy et al. (2019) observe that after a period of increasing convergence, the European debt crisis reintroduced segmentation, reducing cross-market correlations and dividing euro-area markets. Pozzi and Wolswijk (2012) similarly argue that idiosyncratic factors, driven by fiscal positions, regained importance during and after the financial crisis. Together, these studies illustrate how structural weaknesses, institutional differences, and country-specific fiscal profiles reassert themselves when integration is tested under crisis conditions.

In addition to bond-level and macroeconomic perspectives, several studies rely on high-frequency data from the MTS trading platform to examine microstructure dimensions of sovereign bond liquidity. Menkveld et al. (2004) and Cheung et al. (2005) investigate the link between order flow and yield dynamics. Dunne et al. (2006) use limit order book and transaction data to find that execution quality is closely related to the size of the issuer, the issuance techniques, and the obligations imposed on primary dealers. In a further study, Dunne et al. (2007) study the determinants of benchmark status highlighting that liquidity is generally concentrated on a small number of individual instruments. Dufour and Nguyen (2012) focus on price impact, Caporale and Girardi (2013) analyze price discovery, and Paiardini (2014, 2015) considers the influence of macroeconomic announcements on Italian government bond prices and liquidity. Buis et al. (2020) examine the interaction between the primary and secondary markets for euro area sovereign bonds and find that expected issuance fees are positively related to liquidity. These studies collectively demonstrate that market liquidity is not only shaped by macro-level fundamentals but also by microstructural features of trading platforms, order flows, and dealer incentives.

Despite the breadth of the existing literature, two gaps remain. First, while several authors have hypothesized the existence of market-size thresholds beyond which liquidity improves (McCauley & Remolona, 2000), no study has formally tested this proposition using an endogenous threshold methodology. Existing contributions typically assume linear relationships between issuance volume and liquidity, which risks obscuring non-linearities that may arise once a market surpasses a critical size. Second, while the commonality in liquidity has been well documented, little is known about whether explanatory variables such as debt composition, fiscal

position, or euro-area membership differ in significance across small and large markets. If such regime-dependence exists, the determinants of liquidity in smaller EU sovereign bond markets may diverge substantially from those in larger, more established markets.

The present study seeks to address these gaps by combining panel regression analysis with Hansen's (2000) threshold methodology. This allows for the endogenous determination of thresholds in market size and enables testing whether the elasticity of liquidity with respect to outstanding debt differs across regimes. By doing so, the analysis not only provides new empirical evidence on the role of market size in shaping liquidity but also explores whether secondary determinants – such as foreign currency issuance, foreign investor participation, or euro-area membership – become more or less relevant once markets cross a critical size. In this way, the study extends the literature by identifying regime-specific dynamics in the determinants of sovereign bond liquidity across EU countries.

Beyond addressing these gaps, the novelty of this study lies in the combination of three elements that have not previously been integrated. First, the analysis focuses exclusively on EU sovereign bond markets during the most recent period with systematically reported secondary-market trading volumes, capturing current market structure and regulatory conditions. Second, by pairing these data with endogenous threshold estimation, the paper provides a more accurate characterization of scale effects than linear specifications used to date. Third, the explicit comparison of liquidity determinants across size-based regimes offers policy-relevant insights for European debt managers, whose strategic priorities differ according to market scale. Taken together, these contributions advance the literature by offering a contemporary, empirically grounded framework for differentiating liquidity policies across EU member states.

3. Methodology

The first step in the analysis is to select an appropriate measure of liquidity. In broad terms, liquidity describes the extent to which a financial market can absorb trading volume for a given change in price, and vice versa (European Central Bank [ECB], 2017). The optimal choice of liquidity measure depends on the research focus, as different dimensions of liquidity capture different aspects of market functioning (Galliani et al., 2014).

Liquidity measures for bonds are generally classified into two main categories: order-based and trade-based (Galliani et al. 2014; ECB, 2017). Pre-trade measures rely on information observable before a trade occurs, such as indicative price quotes posted by dealers. Post-trade measures are based on executed transaction prices and volumes. The literature offers numerous specific measures (Schestag

et al., 2016). Studies focusing on yield differentials or crisis-period behaviour often favour granular measures such as bid-ask spreads. For instance, Favero et al. (2010) use bid-ask spreads as a liquidity proxy; Panagiotou et al. (2023) employs quoted spreads, effective spreads, and the Amihud ratio; and O'Sullivan and Papavassiliou (2020) use relative spreads, quoted spreads, and market quality indices. By contrast, research on broader capital market development issues may employ simpler metrics. McCauley and Remolona (2000), for example, use the turnover ratio, defined as annual trading volume divided by volume of debt outstanding.

Accurate liquidity measurement is also complicated by data constraints. Unlike equities, sovereign bonds are primarily traded over the counter (OTC), making precise transaction or quote data difficult to obtain. In the EU, data are fragmented across multiple sources. This reflects, in part, the Approved Publication Arrangement (APA) system under MiFID II, where no consolidated tape provider has emerged. The lack of a consolidated tape – an aggregated, standardised view of post-trade data – remains a central challenge, with information currently dispersed across APAs that often vary in quality and accessibility. As highlighted by International Capital Market Association (ICMA, 2022a), data quality issues, such as incorrect notional amounts and misclassification of bond types further limit usability.

Considering both (i) the alignment of the liquidity measure with the research focus and (ii) the availability of consistent cross-country data, this study follows McCauley and Remolona (2000) in adopting turnover as the liquidity measure.

High-frequency liquidity metrics, such as bid-ask spreads or Amihud price-impact measures, capture microstructural dimensions of trading. However, they are not consistently available across EU sovereign markets in a harmonised format. Additionally, such measures often reflect short-term market dynamics, whereas turnover is more appropriate for examining structural and persistent liquidity drivers such as market size and fiscal fundamentals. For research focused on long-run relationships and cross-country heterogeneity, simpler proxies are therefore preferable (McCauley & Remolona, 2000). Finally, turnover represents the only liquidity metric consistently reported for all EU sovereign issuers over the sample period, making it the most appropriate measure for the present empirical design.

To address the absence of a consolidated tape, the ICMA began publishing semi-annual data on trading volumes in 2022. ICMA estimates that its reports capture over 80% of all secondary market transactions in the EU and UK, though it acknowledges data quality limitations under the current reporting regime (ICMA, 2024b, p. 5). However, it discontinued reporting country-level figures after the first half of 2024, limiting the present study to five semesters of data. This short observation window represents a key limitation of the empirical design, as it may

restrict the detection of longer-run dynamics in liquidity determinants. Nevertheless, the limited variability observed in the country data suggests it remains informative over the available horizon. Importantly, the core relationships continue to hold with strong statistical significance across alternative inference methods and sub-sample specifications, indicating that the key findings are robust despite the short observation window.

The primary empirical framework of the research is a panel regression specified as:

$$ln(Liq_{it}) = \alpha + \beta_1 \ln(Dt_{it}) + \beta_2\, FXDt_{it} + \beta_3\, FHld\%_{it} + \\ + \beta_4\, Dt/GDP_{it} + \beta_5\, EurDmy_{it} + \beta_6\, RtDmy_{it} + \varepsilon_{it} \tag{1}$$

Where:

– i = country;
– t = semester;
– $ln(Liq)$ = natural logarithm of turnover calculated as trading amount divided by debt securities outstanding;
– $ln(Dt)$ = natural logarithm of government consolidated gross debt outstanding at face value (debt securities). Seen as a proxy for market size, it is expected to correlate positively with liquidity through economies of scale and broader investor participation;
– $FXDt$ = foreign currency debt as percentage of total. It captures currency risk and segmentation effects that may influence the breadth of the investor base and secondary market activity;
– $FHld$ = foreign debt holders as percentage of total. Seen as a proxy for international investor participation, potentially enhancing liquidity by increasing diversity of trading motives;
– Dt/GDP = government consolidated gross debt as percentage of GDP. Reflects perceptions of fiscal sustainability, which can affect sovereign risk premia and market attractiveness;
– $EurDmy$ = dummy variable expressing whether a country is member of the euro area (1) or not (0). Controls for the effects of monetary integration;
– $RtDmy$ = dummy variable expressing whether a member country's S&P long-term debt rating is in the A group of rating (1) or in the B group (0). Accounts for credit quality thresholds that can influence institutional investment mandates and trading patterns;
– ε = error term.

Since non-investment grade ratings apply only to Greece, we depart from the usual segregation between investment and non-investment grade and adopt a breakdown based on A ratings and B ratings.

Liquidity and outstanding debt are transformed into natural logarithms to reduce skewness and linearise the relationship between outstanding debt and liquidity. This improved model fit, raising the adjusted R^2 from 0.63 to 0.72.

Before proceeding to the estimation of pooled and sub-sample regressions, we conduct standard diagnostic tests in R software to assess multicollinearity, heteroskedasticity, serial correlation and cross-sectional dependence. Summary results are displayed in Table 1.

Multicollinearity is assessed using tolerance and Variance Inflation Factor (VIF) statistics for all explanatory variables, including the two dummy variables. Tolerance values range from 0.31 to 0.58, corresponding to VIF values between 1.73 and 3.18, suggesting no problematic collinearity.

We then test the assumptions underlying pooled panel OLS. The Breusch-Pagan LM test ($p = 7.1 \times 10^{-7}$) and the Koenker variant ($p = 0.0012$) strongly reject homoskedasticity, indicating that heteroskedasticity-robust inference is required. Pesaran's CD test also rejects the null of cross-sectional independence ($p = 2.6 \times 10^{-10}$), consistent with common shocks across EU sovereign bond markets. The Wooldridge test for serial correlation does not reject the null ($p = 0.155$), suggesting that autocorrelation is less of a concern in this specification. Taken together, these diagnostics motivate the use of Driscoll–Kraay standard errors, which are robust to heteroskedasticity and cross-sectional dependence, as our primary inference method. Cluster-robust (by country) results are reported as a robustness check.

Table 1: Diagnostics tests

Test	Statistic	p-value	Interpretation
VIF (mean)	2.63	-	No serious multicollinearity
Breusch-Pagan LM	22.12	7.06e-07	Rejects homoskedasticity
Koenker	-	0.001153	Heteroskedasticity (robust variant)
Pesaran CD	-	2.57e-10	Strong cross-sectional dependence
Woolridge (AR1)	-	0.155	No evidence of serial correlation

Source: Author's calculations

While the presence of heteroskedasticity is addressed by applying robust inference methods, these corrections do not capture the possibility that the relationship between liquidity and its determinants may not be fully captured by a linear specification. To account for this, we further test for structural thresholds using Hansen's methodology. While the regression initially included a broader set of explanatory variables, only debt outstanding proved consistently significant across

robust inference methods and aligns most directly with theoretical expectations regarding market size effects on secondary market liquidity. The threshold analysis was therefore specified as a univariate model relating liquidity to debt outstanding.

Following Hansen (2000), a panel threshold regression is applied to examine whether the relationship between liquidity and outstanding debt changes once outstanding debt exceeds a certain level. Unlike an arbitrary cutoff, Hansen's method endogenously determines the threshold value γ at which the slope of the debt-liquidity relationship changes. The model can be expressed as:

$$\ln(Liq_{it}) = \alpha + \beta_1 \ln(Dt_{it}) * 1(\ln(Dt_{it}) \leq \gamma) + \beta_2 \ln(Dt_{it}) * 1(\ln(Dt_{it}) > \gamma) + \varepsilon_{it} \qquad (2)$$

Where γ is the endogenously estimated threshold, and 1() is the indicator function, equal to 1 if the condition inside the parentheses is true and 0 otherwise. This specification permits different slopes (β_1 and β_2) for the ln(DebtOut), depending on whether the debt outstanding is below or above the threshold γ.

Estimation proceeds by searching over candidate γ to find $\hat{\gamma}$ that minimizes the residual sum of squares (RSS), yielding regime-specific elasticities β_1 and β_2. The null hypothesis $H_0:\beta_1 = \beta_2$ implies no threshold effect.

The supLR statistic compares the threshold and linear models by taking the maximum likelihood ratio across γ:

$$supLR = sup_{\gamma \in \Gamma} \frac{RSS_0 - RSS_1(\gamma)}{\hat{\sigma}^2} \qquad (3)$$

Because its distribution under H_0 is non-standard, inference is based on bootstrap replications. Here, 500 bootstrap replications generate the empirical distribution and p-values. In practical terms, the test examines whether allowing different slopes across regimes improves explanatory power compared to a single slope.

Finally, to explore whether other explanatory variables affect liquidity differently across regimes, separate panel regressions were estimated for the subsets of countries below and above the estimated threshold. This allows a comparison of the drivers of liquidity in smaller versus larger markets, complementing the threshold regression and providing further policy-relevant insights.

4. Empirical data and analysis

The analysis covers all EU member states except Malta, which lacks a functional sovereign debt market. Trading volume data is drawn from ICMA publications; all other variables, except ratings, come from Eurostat. The dataset is semi-

annual, spanning five periods (2022-2024) across 26 countries, for a total of 130 observations (ICMA, 2022a; 2022b; 2023a; 2023b; 2024a; 2024b). Where Eurostat does not provide semi-annual series, values are linearly interpolated to retain a balanced panel. Although some variables are officially reported only at annual frequency, their underlying economic evolution typically follows a gradual, trend-like pattern. Linear interpolation, therefore, offers a reasonable approximation over a short sample horizon and avoids creating artificial volatility in the explanatory variables.

Some data gaps required approximation. Missing values for foreign-currency debt (Denmark, Finland, Greece) and foreign holders (Greece, Germany) were replaced with cross-country averages. Estonia's reported EUR 11 billion trading volume in H2022 was treated as an outlier and replaced by the average of adjacent periods. Cross-country means provide a conservative approximation that avoids introducing country-specific biases, particularly as the variables concerned change slowly. To address the robustness of the results to these imputations, we re-estimated both the pooled and sub-sample regressions, excluding all observations in which values were imputed or adjusted. Coefficients on market size and the key structural variables remain qualitatively unchanged, and the significance of the threshold effect is preserved. These checks indicate that the main findings are not driven by data adjustments but instead reflect stable underlying relationships.

The dependent variable, liquidity, is defined as trading volume (ICMA) divided by debt outstanding (Eurostat). Table 2 shows a wide variation, from 11.43% on average in Lithuania to 202.71% in Italy. Debt levels are relatively stable with an upward trend. Composition shifts are evident in Croatia, where euro adoption in 2023 reduced the foreign currency share from 73.8% to just 0.1%. Ratings were mostly stable, with Portugal the only country upgraded from the B segment into the A segment.

Table 2: Descriptive statistics of sovereign bond markets in EU member states (2022-2024)

Country	Liq (%)	Dbt (EUR bn)	FXDt (%)	FHld (%)	Dt/GDP (%)	EurDmy	RtDmy
Austria	53.02	319	0.25	56.25	80.18	1	1
Belgium	90.94	511	0.00	50.75	104.56	1	1
Bulgaria	22.52	17	73.20	32.55	21.20	0	0
Croatia	17.27	33	44.01	16.93	65.80	0/1	0
Cyprus	13.93	14	0.00	57.08	79.00	1	0
Czechia	41.64	113	8.79	20.08	42.42	0	1
Denmark	28.42	115	11.00	26.25	34.36	0	1
Estonia	23.44	4	0.00	38.50	19.94	1	1
Finland	68.41	150	11.00	44.95	75.86	1	1
France	99.04	2,710	0.00	46.80	111.58	1	1
Germany	181.75	2,029	1.35	36.42	63.98	1	1
Greece	33.64	89	11.00	36.42	171.90	1	0
Hungary	57.48	115	28.51	27.11	74.86	0	0
Ireland	32.35	149	0.00	33.74	44.08	1	1
Italy	202.71	2,346	0.05	22.92	138.32	1	0
Latvia	17.66	14	0.00	55.06	44.42	1	1
Lithuania	11.43	22	0.00	45.53	37.92	1	1
Luxembourg	16.07	17	0.00	49.83	26.10	1	1
Netherlands	119.42	406	0.00	36.96	46.20	1	1
Poland	62.18	276	24.30	21.00	49.98	0	1
Portugal	54.38	156	0.00	20.75	107.96	1	0/1
Romania	47.44	123	52.76	40.25	49.02	0	0
Slovakia	19.26	59	0.00	40.67	58.46	1	1
Slovenia	39.02	37	0.10	45.55	71.24	1	1
Spain	84.90	1,359	0.00	36.50	108.34	1	1
Sweden	38.74	103	7.79	13.35	32.36	0	1

Source: Author's calculations based on ICMA (2022a, 2022b, 2023a, 2023b, 2024a and 2024b) and Eurostat (2022-2024) data

Diagnostic tests indicated heteroskedasticity and cross-country correlation. Regressions were therefore estimated with robust inference. The baseline uses Driscoll–Kraay errors, appropriate for EU bond markets where shocks spill across borders.

The pooled regression results for the sample of 26 EU member countries are shown in Table 3.

Table 3: Pooled regressions (Driscoll-Kraay standard error)

Variable	Coefficient	Standard error	p-value
lnDt	0.431	0.0217	3.38e-40
FHld	-0.285	0.1342	0.036
EurDmy	0.104	0.0361	0.0045
Other regressors	-	-	ns

Source: Author's calculations

The pooled regression expressed in Equation (4) finds debt outstanding highly significant with elasticity estimated at 0.43 (SE = 0.022, p < 0.001).

$$\ln(Liq_{it}) = -5.81 + 0.43 * \ln(Dt_{it}) + 0.22 * FXDt_{it} - 0.28 * FHld\%_{it} - \\ - 0.11 * Dt/GDP_{it} + 0.1 * EurDmy_{it} - 0.05 * RtDmy_{it} + \varepsilon_{it} \tag{4}$$

This implies that a 10% increase in debt outstanding raises turnover by roughly 4.3%. In addition, two other variables reach statistical significance: the share of foreign holders (coeff. = -0.28, p = 0.036) and euro area membership (coeff. = 0.10, p = 0.0045). The model accounts for a substantial portion of liquidity variation, with an adjusted R^2 of 0.72 under standard OLS approximation.

For comparison, Table 4 reports results using cluster-robust standard errors by country. This adjustment accounts for serial correlation and heteroskedasticity within each country but ignores cross-country linkages. In this specification, only debt outstanding remains statistically significant.

Table 4: Pooled regressions (Cluster-robust standard errors, by country)

Variable	Coefficient	Standard error	p-value
lnDt	0.431	0.0650	8.99e-10
Other regressors	-	-	ns

Source: Author's calculations

To test for nonlinearities, Hansen's threshold regression was applied to debt size. Results (Table 5) identify a statistically significant threshold at lnDt = 11.43, or roughly EUR 92 billion of debt outstanding. Below the threshold, elasticity is 0.25; above, 0.30. The model fits better than a linear alternative (RSS falls from 24.28 to 21.37; supLR = 14.27, p = 0.012).

Table 5: Hansen threshold regression results (log-log specification)

Item	Estimate	Notes
Estimated threshold, $\hat{\gamma}$ (lnDt)	11.43	
Implied threshold (EUR bn)	92.04	Level of debt outstanding at which elasticity shifts
Elasticity below $\hat{\gamma}$	0.25	β_1 (slope on lnDt)
Elasticity above $\hat{\gamma}$	0.30	β_2 (slope on lnDt)
Null model (linear) RSS	24.28	From pooled regression
Threshold model RSS	21.37	At $\hat{\gamma}$
supLR statistic	14.27	Test of threshold effect
Bootstrap p-value	0.012	Based on 500 replications
95% CI for $\hat{\gamma}$ (log debt)	[9.61; 14.48]	Percentile bootstrap
95% CI for $\hat{\gamma}$ (EUR mn)	[14.97; 1,947.42]	Converted to EUR bn

Source: Author's calculations

This indicates that once markets exceed EUR 92 billion, incremental issuance yields disproportionately higher liquidity, consistent with scale economies and broader investor bases.

Figure 1 plots the residual sum of squares (RSS) across candidate thresholds for lnDt. The RSS attains its minimum at $\hat{\gamma}$ = 11.43 (EUR 92 billion), with the sharp decline around the minimum confirming that the identified threshold improves model fit relative to linear alternatives.

Figure 1: Residual sum of squares (RSS) across candidate thresholds
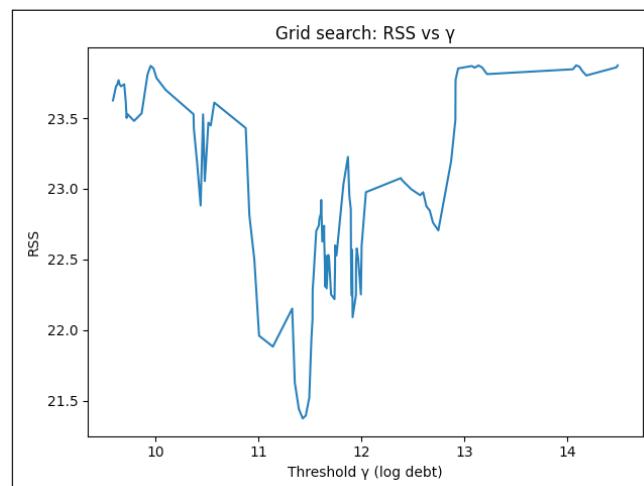
Source: Author's calculations

Having established, through Hansen's methodology, the existence of a statistically significant threshold around EUR 92 billion of outstanding debt, the analysis proceeds with separate regressions for the two groups of countries.

Sub-sample regressions confirm diverging dynamics. For larger markets (16 countries), the model achieves strong explanatory power (Adjusted R^2 = 0.70). As reported in Table 6, debt outstanding remains the strongest determinant of liquidity (coeff. = 0.42; p < 0.001), with additional effects from foreign currency denominated debt (coeff. = 0.93; p < 0.001), and euro area membership (coeff. = 0.43; p < 0.001). Stronger credit ratings (coeff. = –0.17; p < 0.001) and foreign investor participation exerts a negative effect (coeff. = -0.76, p = 0.004), while debt-to-GDP shows a marginally negative coefficient (coeff. = -0.19, p = 0.080).

Table 6: Sub-sample regression for large issuers (Driscoll-Kraay standard error)

Variable	Coefficient	Standard error	p-value
lnDt	0.416	0.02	9.16e-32
FXDt	0.932	0.153	4.48e-08
FHld	-0.759	0.257	0.0043
Dt/GDP	-0.195	0.110	0.080
EurDmy	0.433	0.104	8.90e-05
RtDmy	-0.169	0.037	1.57e-05

Source: Author's calculations

The corresponding regression equation is:

$$\ln(Liq_{it}) = -5.54 + 0.42 * \ln(Dt_{it}) + 0.93 * FXDt_{it} - 0.76 * FHld\%_{it} - 0.19 * Dt/GDP_{it} + 0.43 * EurDmy_{it} - 0.17 * RtDmy_{it} + \varepsilon_{it} \quad (5)$$

For comparison, cluster-robust standard errors by country (Table 7) yield more conservative inference: only debt outstanding remains statistically significant.

Table 7: Sub-sample regression for large issuers (Cluster-robust standard errors, by country)

Variable	Coefficient	Standard error	p-value
lnDt	0.416	0.082	3.0e-06
others	ns	-	-

Source: Author's calculations

For smaller markets (10 countries), explanatory power is considerably weaker (Adjusted R^2 = 0.13). As reported in Table 8, debt outstanding is not significant (coeff. = –0.08; p = 0.32). Instead, liquidity is associated with structural features: higher shares of foreign-currency debt (coeff. = 0.69; p < 0.001), higher debt-to-GDP ratios (coeff. = 0.93; p< 0.001), and stronger credit ratings (coeff. = 0.59; p < 0.001).

Table 8: Sub-sample regressions for small issuers (Driscoll-Kraay standard error)

Variable	Coefficient	Standard error	p-value
lnDt	-0.076	0.0753	0.316
FXDt	0.687	0.155	6.26e-05
Dt/GDP	0.932	0.178	4.56e-06
RtDmy	0.587	0.171	0.0013

Source: Author's calculations

The regression equation is:

$$\ln(Liq_{it}) = -1.59 - 0.07 * \ln(Dt_{it}) + 0.69 * FXDt_{it} - 0.24 * FHld\%_{it} + {} \atop {} + 0.93 * Dt/GDP_{it} - 0.25 * EurDmy_{it} + 0.59 * RtDmy_{it} + \varepsilon_{it} \tag{6}$$

Cluster-robust results (Table 9) confirm the same set of significant variables for small issuers.

Table 9: Sub-sample regressions for small issuers (Cluster-robust standard errors, by country)

Variable	Coefficient	Standard error	p-value
lnDt	-0.076	0.094	0.420
FXDt	0.687	0.186	0.001
Dt/GDP	0.932	0.270	0.001
RtDmy	0.587	0.257	0.027

Source: Author's calculations

To complement the regression analysis, fitted plots illustrate how liquidity relates to debt outstanding in the two regimes. Country-level averages (Table 2) are used to enhance interpretability.

For smaller markets (Figure 2), the fitted regression line is relatively flat, indicating limited elasticity of liquidity with respect to outstanding debt. This suggests that

increases in debt outstanding do not yield proportionally large improvements in turnover. Within this group, notable deviations occur: Slovenia's observed liquidity (39,02%) substantially exceed the 22,4% predicted by Equation (6), marking it as an interesting case for further investigation.

Figure 2: Liquidity vs. Debt Outstanding (log-log) – Countries below the threshold
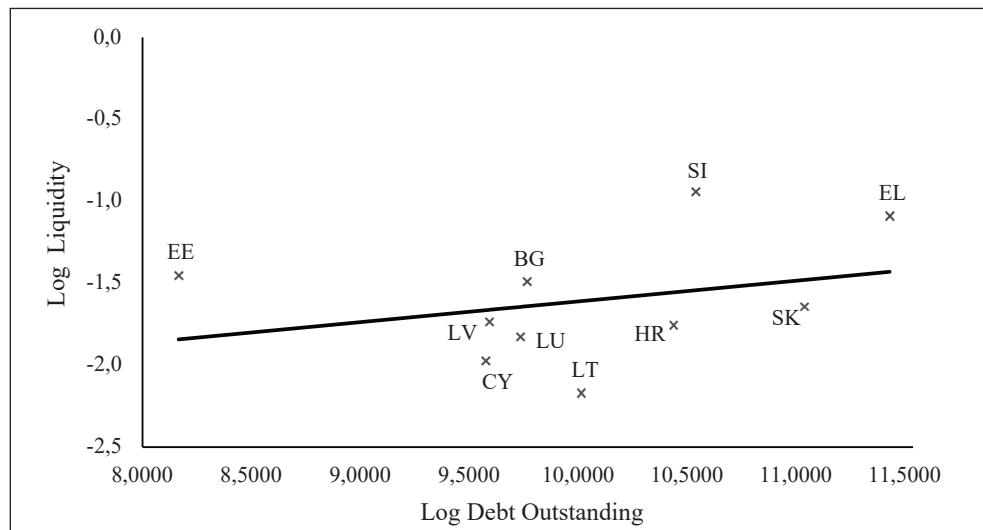
Source: Author's calculations

Figure 3: Liquidity vs. Debt Outstanding (log-log) – Countries above the threshold
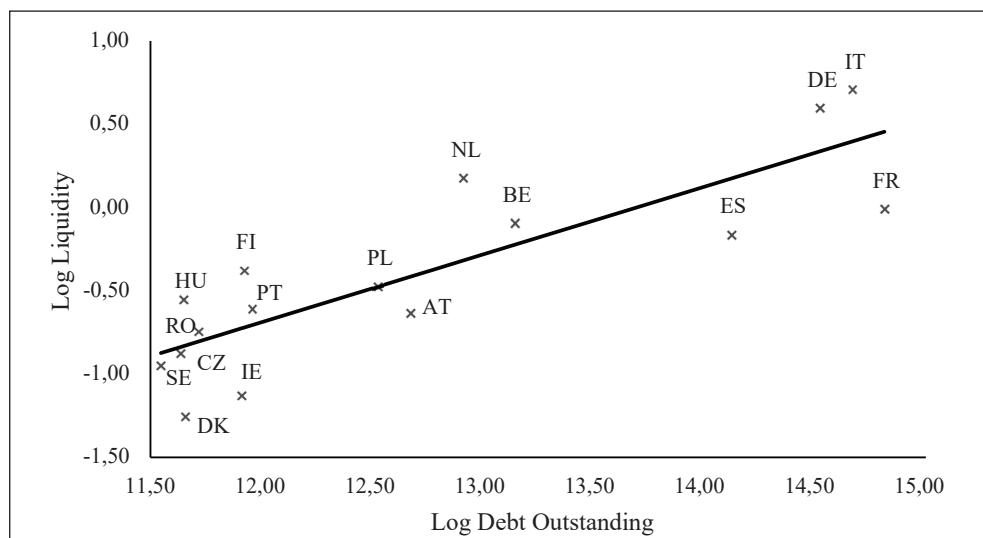
Source: Author's calculations

For larger markets (Figure 3), the slope of the fitted regression line is steeper, confirming the stronger scale elasticity highlighted in the threshold analysis. Nonetheless, heterogeneity persists. The Netherlands and Finland lie above the fitted line, exhibiting higher liquidity than predicted, whereas Denmark, France and Ireland fall below it, with observed liquidity lower than expected given their market size.

5. Results and discussion

A central finding of the analysis is that liquidity is not a simple linear function of market size but exhibits a clear threshold effect. Hansen's methodology confirms that once a sovereign bond market surpasses a critical scale – around EUR 92 billion of debt outstanding – liquidity dynamics become self-reinforcing, with market size itself emerging as the dominant driver. Subsample regressions reveal a sharp divergence across regimes: in large markets, outstanding debt is the most powerful determinant of liquidity, while in smaller markets, liquidity is not explained by size but by fiscal and structural fundamentals. This result is broadly consistent with McCauley and Remolona's (2000) conjecture that government bond markets require a critical mass – around USD 100-200 billion – to function as deep and liquid benchmarks.

The subsample evidence also helps reconcile findings from the pooled regressions. At the pooled level, debt outstanding was the only consistently robust determinant of liquidity across inference methods, while other factors (such as foreign holdings or euro area membership) lost their significance when clustered errors were taken into account. The threshold analysis clarifies why: in aggregate, the dominant effect of market size masks the heterogeneity of other determinants, which only become visible once countries are segmented into small and large markets.

Beyond market size, other determinants emerge, and their effects differ across regimes. Some variables exert consistent influence, while others display sign reversals depending on market scale.

A higher share of foreign-currency-denominated debt is positively correlated with liquidity in both groups. This feature is almost exclusively observed in non-Euro area countries, where limited domestic markets and a lack of international investors willing to hold local-currency debt encourage governments to issue in major reserve currencies. One plausible explanation is that such issuance enables smaller sovereigns to tap global institutional investors who are unwilling or unable to hold local-currency risk. In addition, issuance in foreign currencies typically supports inclusion in larger and more standardised benchmarks, increasing visibility and trading interest. Broader participation also increases the diversity of trading motives, which may translate into more active secondary trading. The finding suggests that while foreign-currency issuance is often regarded as a vulnerability,

it can also connect sovereigns to deeper pools of liquidity and thereby support secondary trading activity.

By contrast, the share of foreign investors is consistently negatively associated with liquidity, with a particularly significant effect in large markets. This may indicate that foreign investors often adopt "buy-and-hold" strategies.

Euro area membership operates asymmetrically. Mechanically, it should support liquidity by eliminating exchange-rate risk and integrating sovereign bonds into a common trading, clearing, and settlement infrastructure, which broadens the investor base and facilitates cross-border market making. Harmonised repo and collateral frameworks further increase the usability of these bonds in secured funding markets, strengthening two-way trading and reducing liquidity premia. These mechanisms appear most effective in larger markets, where euro area membership is associated with higher liquidity. In smaller markets, however, euro membership is insignificant – and even weakly negative. This highlights that euro accession alone does not guarantee liquid markets. It may also indicate that in some non-Euro area countries, relatively siloed markets develop in local currency, sheltered by regulations, positive interest rate differentials, or home-bias effects. Croatia provides a telling example. Despite joining the euro area in 2023, its liquidity remains below that of smaller euro area peers such as Slovenia or Slovakia. Structural impediments clearly play a role, but microstructural features may also be relevant: Croatia is the only country in the sample without a formal primary dealer system, limiting incentives for active market-making and hindering secondary-market depth. Moreover, Croatia has by far the lowest share of foreign holdings in its debt stock, which – though theoretically favourable given the negative coefficient for foreign holdings – appears in practice to limit market liquidity. This illustrates that institutional design and market microstructure critically condition the benefits of euro area membership.

Fiscal fundamentals also display divergent effects. In large markets, the debt-to-GDP ratio is moderately negatively related to liquidity, consistent with the interpretation that weaker fiscal positions deter investors' interest. In smaller markets, however, the relationship reverses: higher debt-to-GDP ratios are strongly and positively associated with turnover. One possible explanation is that fiscal vulnerabilities attract speculative or hedging activity. Credit ratings present the mirror image: in small markets, stronger ratings are positively correlated with liquidity, while they are negatively correlated in larger markets. The coexistence of these results, while seemingly contradictory, points to the fact that investor behaviour and motivations differ systematically across market size segments.

At the same time, several countries deviate notably from values predicted by regressions. Slovenia, for example, displays much higher liquidity than its small size and other regressors would suggest, likely reflecting supportive microstructural features such as primary dealer obligations or an active domestic investor base.

Taken together, the evidence highlights a dual structure of liquidity determinants. In large markets, liquidity is scale-driven: once critical mass is achieved, issuance volumes and integration within the euro area suffice to sustain turnover. In small markets, liquidity is shaped more by fundamentals such as debt composition and credit quality. This duality carries important policy implications.

For larger issuers, the priority is to maintain transparency and stability in issuance, ensure integration with EU financial infrastructures, and preserve the scale that underpins liquidity. For smaller issuers, policy efforts should focus on fiscal credibility, sustaining investment-grade ratings, and developing market microstructure.

Several findings align with the existing literature. Consistent with McCauley and Remolona (2000), market size remains the primary structural determinant of liquidity, with larger issuance volumes associated with significantly higher turnover. Likewise, credit quality continues to play a liquidity-enhancing role, confirming the view that perceived sovereign risk shapes secondary-market activity. However, two results deviate from standard expectations. First, the negative relationship between foreign holdings and liquidity suggests that a more internationally dispersed investor base does not necessarily translate into more active secondary trading in the EU context. Second, euro-area membership does not universally improve liquidity: while it strengthens liquidity in large markets, its effects are negligible in smaller markets, implying that monetary integration alone is insufficient. These differences underscore the importance of market scale and institutional features in shaping liquidity outcomes.

From a broader perspective, these findings refine the understanding of liquidity determinants by showing that debt size effects are contingent on market regime, and that certain variables – most notably ratings – operate differently across contexts. The study thus contributes to the literature by providing empirical evidence of threshold effects, sign reversals, and institutional contingencies, underscoring the need for differentiated policy approaches to the structural realities of individual markets.

These findings suggest clear and differentiated implications for sovereign debt management. For large issuers that have already surpassed the estimated liquidity threshold, maintaining size is crucial to preserving scale effects. Complementary tools – such as regular issuance calendars, securities lending programs, active buybacks, and incentives for primary dealers – may further enhance market depth by strengthening two-way trading. For smaller issuers, by contrast, increasing issuance volumes alone is insufficient. Policy priorities should focus on strengthening fiscal credibility, sustaining investment-grade ratings, improving secondary-market infrastructure, and broadening the investor base, including through selective use of hard-currency issues where appropriate. Countries can also benefit from aligning issuance practices with best international standards and enhancing market-making obligations, ensuring that

liquidity gains from integration are fully realised. Together, these measures offer a practical roadmap for tailoring liquidity-enhancing policies to market scale.

6. Conclusions

This study examined the determinants of sovereign bond market liquidity in EU countries, aiming to test two hypotheses: H1 – that liquidity exhibits a non-linear relationship with market size, and H2 – that the determinants of liquidity differ systematically between markets below and above a size threshold. Both hypotheses are supported. Using Hansen's methodology, a statistically significant threshold of approximately EUR 92 billion in outstanding debt was identified, beyond which liquidity becomes self-reinforcing and market size emerges as the dominant driver. This confirms the long-assumed presence of scale effects (McCauley & Remolona, 2000) and provides empirical evidence of regime-dependence in EU sovereign bond markets. Subsample regressions show that in large markets, liquidity is overwhelmingly scale-driven, complemented by euro area membership, while in small markets, liquidity is not explained by issuance volume but by fundamentals such as debt composition and credit quality. Importantly, some variables not only differ in magnitude across regimes but also change sign: higher debt-to-GDP ratios are negatively correlated with liquidity in large markets but positively in small ones; credit ratings display the opposite pattern, positively correlated with liquidity in small issuers yet negatively in large ones. These reversals highlight the role of investor behaviour and caution against uniform policy prescriptions. The results thus make a dual contribution: empirically establishing a market-size threshold and showing that the determinants of liquidity are regime-specific. Policy implications follow directly. The liquidity threshold estimated in this paper implies that strategies must be tailored to market scale. For large issuers, the key requirement is to preserve scale advantages through maintaining issued volume, transparency, and integration into euro area infrastructures. For smaller issuers, however, increasing issuance volumes alone is insufficient. Instead, efforts should focus on preserving fiscal credibility and sustaining investment-grade ratings. Results further demonstrate that deviations from predicted lines are shaped not only by fundamentals but also by institutional arrangements, suggesting that smaller issuers can outperform their size if supported by appropriate design, while large issuers cannot assume liquidity is automatic. The analysis is limited by the short time horizon (2022–2024H1), the use of turnover ratios as the sole liquidity proxy, and the exclusion of microstructural indicators such as bid–ask spreads. Future research should extend the time series, incorporate richer liquidity measures, and explore qualitative determinants such as investor segmentation, primary dealers' incentives, or case studies of outlier countries.

Overall, the findings contribute to economic science by demonstrating that sovereign bond market liquidity in the EU is shaped by a non-linear scale effect

and by regime-dependent determinants, providing new evidence for differentiated policy approaches between large and small issuers. In doing so, this paper delivers the first empirical estimate of a market-size liquidity threshold for EU sovereign bonds using recent trading data and shows that liquidity determinants are regime-specific, thereby contributing novel evidence to the academic and policy debate.

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Veličina je važna: Nelinearne determinante likvidnosti državnih obveznica na tržištima EU

Petar-Pierre Matek[1]

Sažetak

Svrha je ovog članka ispitati determinante likvidnosti tržišta državnih obveznica u državama članicama EU, s posebnim naglaskom na ulogu veličine tržišta. Korištenjem panel-podataka za 26 zemalja EU u razdoblju 2022.–2024H1, analiza primjenjuje Hansenovu metodologiju pragovne regresije kako bi testirala postojanje nelinearnosti u odnosu između duga i likvidnosti. Rezultati upućuju na statistički značajan prag od približno 92 milijarde eura izdanog duga, iznad kojega dinamika likvidnosti postaje samoodrživa te veličina tržišta izrasta u dominantan čimbenik. Ispod tog praga, likvidnost ovisi ponajprije o strukturnim i fiskalnim fundamentima poput sastava duga i kreditne kvalitete države. Nalazi potvrđuju da je likvidnost ovisna o veličini i specifična po režimima, što ima važne implikacije za upravljanje dugom i oblikovanje politika. Istraživanje zaključuje da strategije za jačanje likvidnosti moraju biti diferencirane: velika tržišta oslanjaju se na održavanje obujma, dok manja zahtijevaju institucionalne i strukturne mjere.

Ključne riječi: *državne obveznice, likvidnost, veličina tržišta, pragovna regresija*

JEL klasifikacija:*E44, G12, G15, H63*

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Unequal battles uphill: regenerative strategies of post-conflict Iraqi regions[*]

Peter Nijkamp[1], Karima Kourtit[2]

Abstract

Infrastructural and economic reconstruction of a country following a geopolitical conflict requires a balanced policy strategy. This will be illustrated here for the case of Iraq. The long-range post-conflict recovery of this country needs a strategic, evidence-based approach to optimize regional resource allocation and to speed up regional regeneration. This study employs a qualitative type of Input-Output Analysis and a Multicriteria Decision Analysis (MCDA) to assess disparities in infrastructure, governance, and economic resilience among regions, providing an analytical and data-driven framework for prioritizing regional investment strategies. By ranking regions based on their recovery capacity, the study aims to provide a targeted strategy for stabilizing Iraq's space economy and strengthening its governance institutions. Our empirical findings stress the critical need for long-term investments, balancing immediate stabilization with long-term economic transformation. However, governance fragmentation, corruption, and weak institutional frameworks remain significant barriers to resilience, limiting the effectiveness of investments and hindering sustainable economic recovery. Addressing these structural issues – through governance reforms, institutional capacity building, and transparent resource allocation – is essential for the long-term economic resilience of regions in Iraq. If implemented effectively, this strategy can advance Iraq's space economy from post-war uncertainty to sustained stability and growth.

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1. Introduction

Post-conflict recovery of nations or regions needs a thorough analytical research framework. In this introductory section, we will first present the background scene of the present study, followed by a description of the aims and scope of the research.

1.1. Setting the scene

The Middle East has, over the past decades, been a continuous arena – and sometimes a battlefield – marked by (geo-)political and economic conflicts throughout its tumultuous history. Iraq, much like its regional counterparts, has demonstrated a complex evolution in recent years, influenced by international power dynamics, national policies, and regional cultural and socio-economic complexities. Understanding Iraq's economic resilience pattern after war crises necessitates exploring its multifaceted space-time dimensions, which manifest the complexity of its development. Iraq's historical trajectory is characterized by periods of prosperity, disruption, fluctuation, and occasional revival, influenced by a complex web of conflicting factors. To fully grasp this context, one must explore the confluence of distinct long-term economic cycles attributed to Nikolai Kondratiev, medium-term cycles reminiscent of Clément Juglar's theories, and short-term entrepreneurial disturbances exemplified by Joseph Schumpeter. These interwoven cycles shape Iraq's economic pathways over many years, influencing the recovery prospects across different regions (Acemoglu & Robinson, 2012). Iraq currently faces multiple challenges in its post-conflict regeneration efforts, including governance weaknesses, severe infrastructure damage, and the need for a sustainable recovery framework that promotes resilience. The destruction caused by years of war has left governance structures fragmented, weakened institutions, and disrupted essential services, making recovery an urgent but complex task (Collier, 2009).

Two significant observations clarify Iraq's complex behaviour. First, the regions within this diverse country demonstrate a remarkable degree of heterogeneity, including significant socioeconomic disparities, cultural-religious diversity, and varied physical-geographic characteristics. Second, Iraq's institutional landscape responsible for post-conflict economic rehabilitation is marked by a profound lack of homogeneity. Various political, cultural, and economic stakeholder groups, each driven by its unique interests and agendas, contribute to a fragmented institutional framework during the recovery period. This institutional fragmentation stands as a

significant barrier to achieving sustainable (re)development in Iraq and its regions (North, 2012). A nuanced understanding of these spatial-economic complexities is essential to advance the way forward. This understanding has to be translated into a structured assessment of regional disparities, ensuring that re-development investment priorities are set accordingly (Rodrik, 2011).

Iraq faces the colossal challenge of reconstructing its infrastructure and social systems in the wake of prolonged conflicts. The destruction of roads, bridges, schools, and healthcare facilities has severely hampered economic and social recovery efforts. As a result, investment strategies must differentiate between immediate stabilization needs and long-term development goals (Barro & Sala-i-Martin, 2004; Braunerhjelm, 2022; Pascariu et al., 2023). Clearly, Iraq is not an exception in the turbulent contemporary evolution of nations or regions. Many countries worldwide face deep institutional and governance challenges and crises in their space economy. The key challenge lies in designing recovery pathways that integrate long-term investments, ensuring that post-war fragility transitions into long-term resilience and stability (Pritchett et al., 2017). The economics of resilience is essentially based on a Schumpeterian growth paradigm, in which challenges and responses form a key mechanism. Any shock may cause a downturn of the (national or regional) economy, but the nature of the responses determines the effectiveness and speed of recovery strategies (Pascariu et al., 2023). This also holds for the economy of Iraq. The economic revitalization of Iraq's regions requires a data-driven approach that accounts for both institutional constraints and investment needs (Fukuyama, 2004; Bănică et al., 2020; Kourtit et al., 2023). Addressing governance inefficiencies, fostering infrastructure rehabilitation, and supporting economic diversification are essential to achieving long-term stability. Therefore, the prioritization of recovery strategies must be based on measurable criteria for mitigating regional disparities so as to allocate investments effectively (Easterly & Levine, 2002).

It is noteworthy that human-made shocks or devastations may also have long-term beneficial outcomes. Recent studies (Costantini, 2013; Ghani & Lockhart, 2008; Bănică et al., 2020; Kourtit et al., 2023) have tested the validity of the BiD ('Blessing in Disguise') concept through a global comparative analysis of significant area devastations worldwide. These studies highlight the role of institutional quality in determining recovery outcomes. Weak institutional mechanisms, ranging from governance failures to corruption, hinder post-crisis regeneration and economic revival. This finding is particularly relevant for Iraq, where governance fragmentation significantly influences regional recovery potential (Di John & Putzel, 2009). Despite an expanding body of literature on post-conflict recovery, there remains a gap in methodologies that quantitatively rank regions based on their regeneration capacity (World Bank, 2018). This study addresses that gap by employing structured evaluation methods that prioritize investments where they

will have the greatest impact. The present paper is a follow-up to previous applied studies on the recovery of the Iraqi space economy (see e.g., Kourtit et al., 2024). More specifically, the challenge is to determine how to prioritize investments across different regions that vary significantly in their recovery needs. A core aspect of this study is the development of a decision-support framework that assesses regional disparities, allowing for targeted, evidence-based, and capability-oriented resource allocation (Sen, 1999). The main aim of the present study is to evaluate the regenerative potential of various regions within Iraq and to provide a framework for prioritizing regional investments based on their growth potential and development needs. By utilizing a ranking system based on multi-criteria decision analysis (MCDA) and qualitative input-output analysis, this study offers a strategic approach to post-war investment planning (Friesz, 2007; Todaro & Smith, 2020).

1.2. Aims and scope

The regions in Iraq exemplify the devastating impacts of war conditions on regional economies. Against the backdrop of post-conflict recovery, the present study aims to introduce an evidence-based methodology for analysing and managing Iraq's regional reconstruction efforts. By systematically assessing key economic and social indicators, it establishes a clear, structured ranking system that guides investment prioritization based on regional resilience capacity (Donaghy, 2019). The approach focuses on strategic input investments that yield valuable output revenues, while considering short-term, medium-term, and long-term investment strategies within the framework of strategic (re-)development planning.

Given the data challenges at the regional scale, the study employs analytical decision support tools such as foresight or scenario analysis (van der Heijden, 2004) and multi-criteria analysis (MCA) (Beinat & Nijkamp, 1998; Rietveld, 1980) to create sustainable and resilient development in Iraq's regional system. These tools help classify regions based on their potential for recovery, ensuring that investment decisions are both strategic and data-driven. The research utilizes general input-output data and a qualitative categorical MCA approach to assess the regenerative potential of Iraq's regions based on infrastructure quality, social sector needs, and economic requirements.

The research questions guiding this study are:

> • *How can investment strategies be structured to address both immediate stabilization needs and long-term development objectives in Iraq's adminis-trative regions or governorates?*

> • *What are the region-specific constraints and opportunities influencing recovery, and how can these be incorporated into public investment decision-making?*

> • *Is it possible to develop a systematic evaluation procedure that ranks investment priorities across Iraq's regions based on objective, measurable, or testable criteria?*

By integrating qualitative multicriteria analysis (MCA), the study identifies the regions with the highest regenerative potential and determines investment scenarios that maximize long-term economic recovery. This structured ranking approach ensures that resource allocation aligns with regional disparities, avoiding inefficient distribution of investments (Fuentes-Sánchez et al., 2021). The findings contribute to post-conflict recovery literature by providing a structured, quantitative methodology for evaluating and prioritizing regional investments, offering insights for policymakers and international organizations involved in Iraq's development.

The study is organized as follows. Section 2 provides an overview of Iraq's space economy, governance challenges, and regional disparities. Section 3 defines the key economic input and outcome (output) variables, along with the research questions guiding the analysis. Next, Section 4 deals with the details of the methodological framework, integrating Input-Output Analysis and Multicriteria Decision Analysis (MCDA) to assess the regional recovery potential through structured ranking, investment scenarios, and prioritization strategies. Section 5 applies this framework to Iraq's governorates, presenting data normalization, weighted scoring, and regional rankings to identify high-priority areas for investment. Finally, the study concludes with key findings and policy recommendations, focusing on governance reforms, economic diversification, and phased investment approaches for long-term recovery.

2. Decision support systems for post-conflict recovery strategies: An overview

The re-development of Iraqi regions in the post-war era requires wide-ranging data and an evidence-based methodological approach to choose or develop strategically prioritized and cost-effective recovery alternatives for the various regions. A structured framework is essential to ensure that recovery investments are directed toward regions with the highest potential for regeneration. In general, policy analysis provides ways to achieve goals in a structured and systematic manner. Clearly, in most cases, the goals of regional recovery are multidimensional and often mutually conflicting. Therefore, balancing trade-offs between competing priorities is a key aspect of rational policy analysis. Policy-making is essentially the choice of an optimal package of scarce resources to realize a bundle of socially desirable outcomes, which aligns with broader goals of national and regional regeneration (Simon, 1955; Ostrom, 2015; Rietveld, 1980; Dentinho et al., 2021).

The above complex trade-off issues apply not only to macroeconomic decisions but also to microeconomic (e.g., consumer choices) and meso-economic decisions, such

as regional investment prioritization and sustainable infrastructure development. The integration of multi-criteria decision analysis (MCDA) and other decision support tools strengthens the ability to manage these complexities. These tools enable a systematic comparison of regions based on infrastructure quality, economic potential, and social sector needs, allowing for better-informed recovery strategies (Chang, 2010). To maintain consistency, the assessment of recovery strategies must reflect the actual disparities between regions, ensuring that the decision-support system remains practically applicable. One widely used and generic approach to structuring these complex evaluations is multi-attribute utility theory (MAUT) (Lancaster, 1971; Keeney et al., 1979). Examples of MAUT approaches can be found in consumer theory, operations research, and decision theory (see e.g., Nijkamp & van Delft, 1977; Saaty, 1980). This analysis trend has led to a wide range of multi-attribute variants, such as multi-objective programming, multi-dimensional decision theory, or multi-criteria analysis. However, these methods require continuous refinement to ensure their applicability in post-conflict settings. We refer here to overview studies by Keeney et al. (1979), Roy (1996), Nijkamp and van Delft (1977), and Belton & Stewart (2002).

Apart from empirical weaknesses caused by incomplete or unreliable data on future events, the paramount problem in decision support models is the fact that not all arguments (independent variables) in an MAUT or broader welfare framework have the same weights. Assigning appropriate weights to critical factors—such as infrastructure, governance capacity, and investment needs—ensures a balanced and objective evaluation of recovery priorities. This study, therefore, tries to employ a hybrid weighting approach to enhance reliability, ensuring that recovery strategies remain effective across varied regional contexts. To arrive at a feasible assessment of weights attached to each variable of a utility or welfare function related to recovery strategies, various methods are available:

- Direct determination of weights, based on:
  ◦ Survey techniques among policymakers and experts.
  ◦ Simulation techniques to test the robustness of trade-off scenarios.
  ◦ Observation methods using real-world case studies of past recovery efforts.

- Indirect determination of weights, based on:
  ◦ Experimental techniques, such as conjoint analysis or contingent valuation methods.
  ◦ Minimum threshold approaches to ensure essential recovery objectives are met.

In the MCA context, preference elicitation methods (often in combination with expert opinion) have become standard, widely used tools in multidimensional

decision analysis. These were largely inspired by the path-breaking work of Keeney (1992), and they have found a rich application in operations research and decision analysis. However, these methods must be adapted to post-conflict settings, where regional disparities and data limitations require flexible decision-making frameworks. These methods help refine investment decisions by integrating both quantitative data and expert-driven insights, ensuring a realistic approach to reconstruction planning (Dupont & Noy, 2015). Most of these expert elicitation methods, however, have traditionally been reliant on subjective judgments rather than systematic data-driven validation. To counteract this, sensitivity analysis is usually applied to reinforce the robustness of weight assignments and policy recommendations (Triantaphyllou, 2000). Despite all weaknesses, MCA has generated a wide array of interesting and operational contributions to decision analysis, in particular in:

> • *Preference elicitation techniques* that help define the relative importance of different recovery factors (e.g., in disaster recovery and post-conflict economic planning, such as Iraq).

> • *Comparative assessments* using AHP, Promethee, MAMCA, Paprika or Regime models to support investment prioritization (Brans & Mareschal, 1994).

> • *Efficiency benchmarking* through Data Envelopment Analysis (DEA) to identify regions with the best recovery potential (see Charnes et al., 1978; Suzuki & Nijkamp, 2017; Kourtit et al., 2024).

It goes without saying that the assessment of regional recovery strategies in Iraq is a highly complex evaluation problem involving numerous variables, competing interests, and incomplete datasets. The use of expert elicitation methods (including Q-analysis; see Dentinho et al., 2021) and DEA models has demonstrated potential for structuring investment priorities and guiding decision-making (see e.g. Cook & Seiford, 2009). However, the weak database for many Iraqi regions presents a challenge for purely quantitative modeling, reinforcing the need for a hybrid approach that integrates expert-driven qualitative assessment with structured data-driven methodologies. By combining both approaches, this study mitigates the limitations posed by data gaps and ensures a comprehensive understanding of regional potential. This study adopts such a hybrid approach, ensuring that both data limitations and practical recovery constraints are taken into account in the decision-making process. This approach also enhances the decision-support framework, making it more adaptable to different recovery scenarios.

Finally, a caveat ought to be mentioned. The recovery strategies following the Iraqi war face multiple uncertainties, including weak institutional frameworks, socio-political instability, and economic volatility. The present study seeks to address these challenges by developing an adaptable, evidence-based investment

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prioritization framework that accounts for both short-term recovery needs and long-term resilience building. It goes without saying that the supply of adequate broadly-composed infrastructure is a sine qua non for a balanced regeneration of regional economies in Iraq. And therefore, in our empirical analysis we have tried to address in particular the regenerative development capacity of regional infrastructure. Clearly, without proper institutional coordination, even the most well-planned recovery efforts may fail to achieve sustainable outcomes (Andrews et al., 2017). By evaluating multiple recovery scenarios, this framework helps identify the most effective strategies for sustainable regional development. Despite many limitations, this study provides an expert-driven assessment of bottlenecks and potentials, leveraging all available data sources to develop an actionable roadmap for regional recovery and investment prioritization. Thus, the proposed framework serves as a strategic tool for optimizing resource allocation and facilitating sustainable post-war reconstruction. This will be further highlighted in the remaining part of this study. We will begin with a concise sketch of Iraq's recent turbulent history.

3. Observations on the Iraqi economy and its governance

Iraq's development path is characterized by a great variety of time-varying economic waves. These waves, evoking Kondratiev's waves of innovation, Juglar's investment cycles, and Schumpeter's creative destruction pathways, merge to create a dynamic and fluctuating pattern (Acemoglu & Robinson, 2012; Piketty, 2014). Understanding these economic cycles is crucial for assessing the recovery potential of different regions, ensuring that investment strategies align with their long-term trajectories (Cuaresma et al., 2008). To enhance this assessment, it is critical to integrate a precise evaluation of each region's position in the economic cycle. Figure 1 below, represents this complex performance, portraying a cascade of downward steps representing the consequences of wartime conditions in Iraq (the 'avalanche' event). During this turbulent decline marked by chain reactions, a crucial tipping point emerges, enclosed by a U-shaped curve. The subsequent path, metaphorically represented as 'the battle uphill,' denotes the challenging path toward recovery. This trajectory highlights varying degrees of recovery potential across regions (World Bank, 2022), including also the well-known BBB principle (Building Back Better).

Figure 1: Trajectory from destruction to regeneration
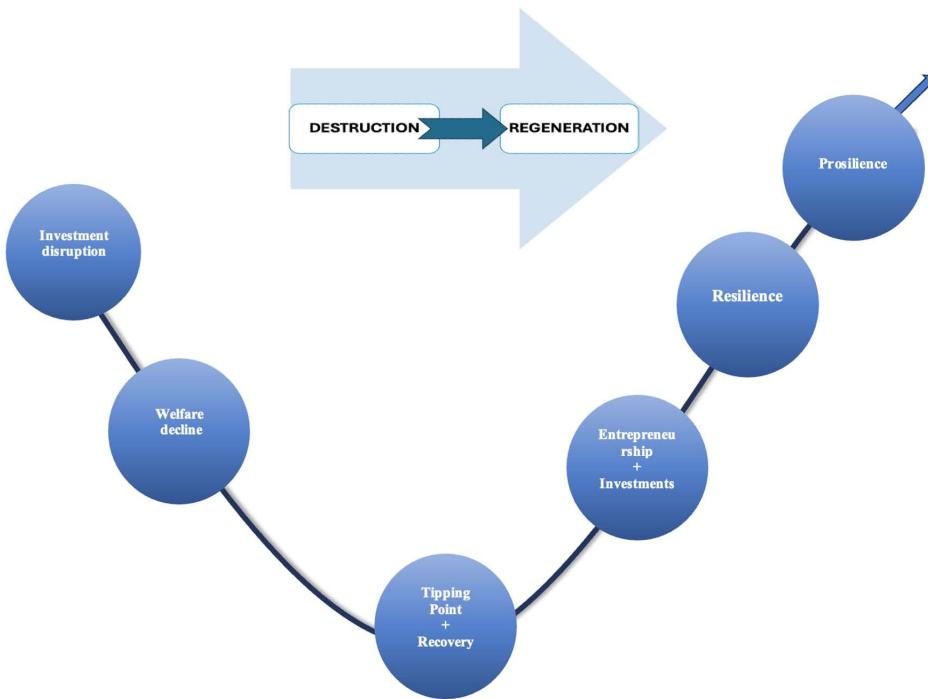
Source: Author's constuction

Identifying where each region stands along this trajectory allows for a targeted approach to economic rehabilitation, ensuring that investments are directed toward regions with the highest potential for recovery. A structured recovery strategy is necessary to address these disparities effectively. If the recovery strategy is more ambitious than a return to the initial situation, the BBB objective may be achieved by a supra-resilience strategy (often coined '*prosilience*') that seeks to significantly enhance the new outcome as compared to the original state of affairs.

Iraq's economy has experienced significant structural imbalances due to decades of political, economic, and security uncertainties and shocks, which have intensified the country's current vulnerability (see e.g., Alayseri, et al., 2024; Melnyk et al., 2023). Over all these years, Iraq has remained heavily reliant on oil. In 2019, oil comprised over 96% of its exports, 92% of government budget revenues, and 43% of GDP (International Monetary Fund [IMF], 2024). This economic dependency influences regional recovery patterns, as oil-producing regions exhibit different trajectories compared to diversified economies. The nation's economic health is closely tied to global oil prices. The limited expansion of non-oil sectors can be attributed to numerous security shocks and political instabilities, including regional conflicts and terrorist attacks. This overreliance on oil has hindered investments in

other critical industries and sectors. The private sector's potential for job creation has been hampered by an unfavourable business environment and persistent bureaucratic inefficiencies that discourage foreign and domestic investment. These factors contribute to variations in private sector development across governorates, affecting economic revitalization efforts.

Due to the large public sector and fixed wage structures, there is limited revenue available for public investments in infrastructure, culture, and human capital, which restricts the ability to respond to economic disruptions (Alnasrawi, 2002; Larkin & Rudolf, 2023). A structured investment framework is needed to ensure that financial resources are allocated efficiently to maximize socio-economic recovery. Even before the global COVID-19 pandemic, public discontent was growing due to inadequate service quality, pervasive corruption, and increasing unemployment and poverty rates (Transparency International, 2020). Investment priorities must be determined based on regions where these socio-economic issues are most pressing. Obstacles faced by the private sector include limited access to financial services and investment credits, complex registration and dissolution procedures for firms, a shortage of skilled workers, outdated legislation, and unfavourable regulations, all of which hinder business activities and expansion (Nasir et al., 2021). A systematic approach is necessary to account for these constraints, ensuring that economic revitalization strategies address both infrastructure rehabilitation and business environment reforms.

Starting a business in Iraq presents a challenge with numerous obstacles, including collapsing infrastructure, an unstable legal framework for consumer protection and laws, inadequate production standards, and a lack of incentives for investment (Gatti et al., 2014). The dominance of public and semi-public enterprises has weakened the private sector. Additionally, the education sector, particularly in areas liberated from IS, lacks a robust knowledge infrastructure (Alison, 2019). Regional educational deficiencies must be addressed to align workforce development initiatives with local economic needs. While the government has pledged to construct 1,000 new schools as part of its strategic initiatives to enhance the education system, this represents only a minor step. A broader education reform and workforce development initiative is required to support long-term economic diversification and innovation. Workforce investments should be prioritized based on the most critical needs across regions. However, limited investment in human capital continues to hinder Iraq's long-term economic recovery and growth (OCHA Iraq, 2015; UNDP Iraq, 2014; World Bank, 2016; World Bank, 2018; Ministry of Planning Iraq, 2018; NIC, 2019; Alison, 2019; Central Statistical Organization Iraq, 2019; Directorate of Transport and Communications Statistics, 2021).

Iraq's economy faces severe challenges due to widespread corruption and a lack of economic diversification (see also Gunter, 2021). Moreover, the economic performance has been significantly affected by the COVID-19 outbreak in recent

years. Since the 2003 conflict, infrastructure and human potential have remained underdeveloped, intensified by the IS takeover (Cordesman & Khazai, 2014). Security spending consumes a significant portion of the state budget, detracting resources from essential sectors like health, education, and the environment. The impact of security expenditure on economic recovery requires more efficient resource allocation strategies, from regional to local levels (Lyall, 2021). Violence has severely damaged social capital, trust, and social harmony. Government positions based on sectarian affiliations rather than professional qualifications have contributed to a further decline in effective governance. Addressing governance inefficiencies is crucial in ensuring that post-conflict investments are implemented effectively and equitably across regions. Strengthening institutional frameworks is essential for maximizing the effectiveness of investment strategies. Ongoing security and political uncertainties, as well as COVID-19 restrictions, hinder long-term planning and discourage foreign investments. An ineffective legal system and pervasive corruption worsen the country's economic challenges.

The root of Iraq's persistent development issues and the key to recovery lies in its governance system. The often-temporary nature of the Prime Minister's Cabinet results in structural inconsistency. Addressing corruption and improving access to water and power are top government priorities. Institutional stability is a key factor in determining the effectiveness of recovery investments, as regions with stronger governance structures may be better positioned to absorb and utilize funds efficiently. Targeted governance reforms are necessary to ensure investment efficiency and accountability (IMF, 2025). Effective governance would have to align with the current social situation and directly impact fiscal sustainability, employment growth, public services, private sector development, and other critical objectives for Iraq's medium- and long-term growth and stability. Rebuilding and rehabilitation should involve stronger governmental institutions and a new social contract grounded in accountability, participation, and inclusivity. Effective diplomacy among various political groups and sectarian identities, emphasizing broader national interests, is essential. Governance plays a crucial role in shaping social cohesion. Iraq's government's inability to achieve medium- and long-term goals is closely tied to its excessive dependence on revenues from international oil sales, often leading to implementation challenges due to funding constraints. Reducing fiscal dependency on oil revenues is necessary to enhance economic diversification and long-term stability.

Over several decades, economists have been drawn to the discussion surrounding large-scale redevelopment through public investment, with a particular focus on the distinction between social overhead capital (e.g., transportation infrastructure) and direct productive capital (e.g., factories) (Rodrik, 2007; Camagni & Capello, 2013). In recent years, many researchers have examined both the advantages and drawbacks of such substantial investments, as demonstrated by Flyvbjerg (2010)

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and Flyvbjerg et al. (2013). Balancing infrastructure investment with governance reforms is essential for ensuring sustainable recovery. Addressing governance gaps and ensuring financial transparency will be essential for the effectiveness of such efforts. This will be further refined and integrated into empirical experimentation within the scope of the present study. While progress has been made in some governance aspects, significant gaps remain that hinder Iraq's transition toward a resilient and self-sustaining economy. The challenge ahead is to build a governance structure that effectively integrates long-term economic strategies with short-term recovery measures, fostering an environment conducive to sustainable regional development (Despotakis et al., 1993). We will now present the research methodology adopted for the Iraqi case study.

4. Methodology and data for assessing regional regeneration potential in the Iraqi space-economy

In our exploration of Iraq's regional reconstruction, we adopt a stimulus-response approach. Drawing from the theoretical foundations outlined in Figure 1, we propose that after critical infrastructure disruptions and economic downturns, a region's regeneration potential can be evaluated by analyzing the relationship between various inputs (such as infrastructure and social sector expenditures) and their resulting outputs (e.g., economic recovery and growth potential). This approach is grounded in empirical research on the role of public infrastructure investment in economic recovery, which has been shown to significantly impact long-term growth trajectories (Aschauer, 1989; Barro, 1991; Chen & Rose, 2018). Moreover, post-conflict spatial disparities require targeted investment strategies that account for regional variations in economic potential (McCann, 2013; UNDP, 2021). This structured approach ensures that recovery strategies are tailored to each region's specific conditions while maintaining a coherent investment prioritization framework.

4.1. Data categorization and methodology

Our Iraq database includes input and output (or outcome) data on the success factors and performance outcomes of provinces (governorates), with a particular emphasis on transport infrastructure and investments. To ensure comparability, key indicators such as road quality, infrastructure investment, and social sector performance are systematically ranked. Recent studies emphasize the need for structured investment prioritization frameworks in post-conflict economies, where resources are constrained, and governance challenges persist (NDP, 2024). The prioritization model used in this study aligns with best practices for maximizing public investment efficiency in fragile contexts (Flyvbjerg, 2010; Flyvbjerg et al.,

2013). Table 1 outlines these indicators used in the analysis (see also Dawood & Zoghlami Shili, 2023). This study also compiles regional data focusing on transport infrastructure and investment needs, providing insights into the key success factors and performance metrics for Iraq's governorates. The role of transport infrastructure in economic recovery has been extensively studied, with studies indicating that accessibility and mobility improvements can accelerate regional regeneration (Banister & Berechman, 2001; Bertolini et al., 2005; Arbués et al., 2015). In post-conflict settings, strategic investment in transport networks is crucial for rebuilding economic connectivity and enabling trade (Berechman et al., 2006; World Bank, 2025). The cultural-ethnic diversity among Iraqi regions does not add to a balanced allocation of resources for infrastructure inputs, thus creating more socio-economic tensions and disparities. Levelling-up left behind places is, therefore, a major challenge (see e.g., Martin et al., 2021).

Table 1: Input and output categories at regional scale in Iraq

Selected Governorates	INPUTS				OUTPUTS				
	Road: SqKm	Quality Level Road Network	Infrastructure Needs (IQD billion, 5 yrs)	Sectoral Infrastructure (IQD billion, 5 yrs)	Per Capita Investment (IQD)	Health Care (IQD billion, yr 1)	Cultural Heritage & Tourism (IQD billion, yrs 2–5)	Education (IQD billion, 5 yrs)	Social Protection & Livelihood Support (IQD billion, 5 yrs)
Ninawa	37323	3	1,753.4	1,227.4	1400	480.7	565.3	1,447	3,162.5
Anbar	138501	3	1,590.6	1,113.4	800	183.6	285.9	1,458.9	1,102
Salah Al-Deen	24751	3	327.0	228.9	1200	67.6	22.8	272.1	1,200.9
Kirkuk	6679	2	464.1	324.9	900	202.8	54.7	925.5	511.2
Diyala	17685	1	186.6	130.6	900	73.7	45.7	323.8	369.1
Baghdad	4555	3	312.1	218.4	1400	20.5	100.5	768.2	892.4
Babel	5603	2	46.8	32.8	900	3.1	15.1	195.4	294.2

Source: Author's calculations based on World Bank (2016); World Bank (2018); Ministry of Planning Iraq (2018); National Investment Commission [NIC] (2019); U.S. Department of Defense, Measuring Stability and Measuring Stability and Security in Iraq (2009); NIC (2018); Directorate of Transport and Communications Statistics (2021) data

Given the incomplete and less reliable nature of some regional datasets, a hybrid assessment model should integrate quantitative data with qualitative evaluations to address inconsistencies and enhance analytical robustness (see also Nasir et al., 2021). This model ensures that only regions with rather complete, high-quality data are included in the analysis, narrowing the focus to seven key regions: Ninawa,

Anbar, Salah Al-Deen, Kirkuk, Diyala, Baghdad, and Babel. This choice brings some limitations, but the need to employ reasonably reliable data for the selected regions led us here. In any case, the most important regions are considered in our comparative study. The geographical position of these regions is depicted in Figure 2.

Figure 2: Map of the Iraqi governorates under study
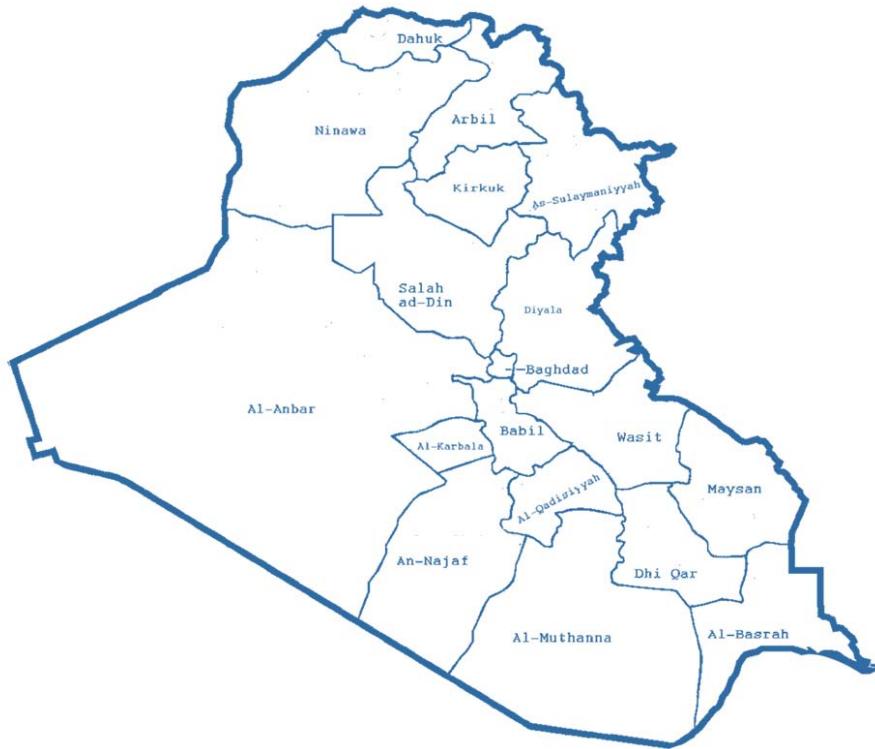
Source: Author's construction

Infrastructure is a primary driver of economic recovery, necessitating targeted revitalization strategies supported by financial, technological, and institutional frameworks. Regions with critical infrastructure deficiencies are prioritized in order to maximize stabilization and long-term development. The effectiveness of public infrastructure investments also depends on institutional quality and governance efficiency (Rodrik, 2007; Camagni & Capello, 2013), requiring an integrated evaluation framework to prevent misallocation of funds and ensure measurable recovery outcomes (Friesz et al., 2007). Infrastructure quality and investment needs are central to this selection, ensuring that the most critical deficiencies are addressed first to promote long-term recovery and stability.

4.2. Analytical framework

This study employs a combination of a qualitative Input-Output Analysis (IOA) and Multicriteria Decision Analysis (MCDA) to ensure data-driven, transparent, and strategic investment decisions for Iraq's post-conflict regional recovery. IOA evaluates how infrastructure, investment, and social infrastructure capacity contribute to economic recovery, providing a structured framework for balancing rehabilitation with broader development objectives (Haddad et al., 2010). By quantifying how inputs (e.g., infrastructure, healthcare, education) translate into outputs (e.g., economic growth, social stability), IOA helps rank regions by recovery potential, which, in turn, informs investment priorities. This ensures that the ranking of regions by recovery potential directly impacts the prioritization of investments. MCDA complements this by evaluating multiple factors simultaneously, ensuring a comprehensive assessment of regional priorities. The regional recovery assessment follows a structured approach, beginning with the normalization of input and output variables to standardize data for fair comparisons across regions. This is followed by the weighting of input variables, which assigns importance to the factors influencing the socio-economic recovery of regions. The next step involves calculating a composite score to measure recovery potential. An analysis of investment scenarios explores how different investment levels impact recovery. Finally, regions are ranked and prioritized for investment based on their scores, with this ranking directly informing regional investment allocation.

Step 1: Normalization of input and output variables

In this step, we identify and standardize the input and output variables used in the analysis. To ensure comparability, all variables are normalized on a 0–1 scale, where 1 represents the highest value in a category across all regions. This ensures that all data, regardless of its original scale, is measured consistently, allowing for an objective ranking of governorates based on a standardized assessment. The normalization formula is:

$$Normalized\ Value_{i,r} = \frac{X_{i,r}}{max(X_i)} \tag{1}$$

This prevents larger or well-funded regions from automatically ranking higher based on absolute investment values. Normalization ensures equitable comparisons across regions by adjusting for scale differences. In this analysis, inputs represent the resources and investment needs for recovery, while outputs capture the anticipated regional development outcomes resulting from those investments. Inputs reflect the current state of infrastructure and the required investment for post-conflict recovery. Key inputs include:

• *Road Area (SqKm)* – Represents total land covered by roads, indicating transportation infrastructure availability.

• *Quality Level of Road Network* – Assesses Road conditions (e.g., paved vs. unpaved, maintenance), which influence logistics efficiency and economic mobility.

• *Infrastructure Needs (IQD billion, 5 yrs)* – Measures the total investment required to restore essential infrastructure like water, energy, sanitation, and transport.

• *Sectoral Infrastructure Needs (IQD billion, 5 yrs)* – Captures specific investment needs in sectors such as communications, transport, and public utilities

These inputs are critical drivers of regional recovery, as economic development is highly dependent on infrastructure availability and investment levels. Outputs measure the anticipated benefits of infrastructure investment, helping identify regions that will generate the highest return on investment. Next, key outputs include:

• *Per Capita Investment (IQD)* – Indicates investment per person, highlighting resource distribution equity across regions.

• *Health Care (IQD billion, Yr 1)* – Reflects funding requirements for rebuilding healthcare facilities, staffing, and medical infrastructure.

• *Cultural Heritage & Tourism Investments (IQD billion, Yrs 2-5)* – Estimates investment needed to restore historical sites and develop tourism, fostering economic diversification.

• *Education Needs (IQD billion, 5 yrs)* – Identifies funding gaps in school reconstruction, teacher training, and education infrastructure.

• *Social Protection & Livelihood Support (IQD billion, 5 yrs)* – Covers support for vulnerable populations, including job creation, economic aid, and displaced persons assistance.

By normalizing both inputs and outputs, we ensure that rankings are not skewed by absolute investment values, preventing larger or well-funded regions from automatically ranking higher.

Step 2: Weighting of input variables

After normalization, each input variable is assigned a policy weight based on its relative importance in regional recovery. This ensures that factors with greater impact on regeneration receive higher priority, allowing for a more accurate assessment of growth potential and investment needs. The weighting process focuses only on input variables, ensuring comparability across regions (see Table 2). These weights are qualitatively derived from a range of public policy documents

and experts. They are indicative for policy priorities, but by no means precisely measurable. This information was collected by expert judgement from team members involved in the recovery program of Iraq (both Iraqi and foreign experts), supplemented with information from a wide range of statistical documents on policy choices and directions which were publicly available on the internet.

Table 2: Weighting of input variables

Criterion	Weight	Description
Road Area	0.10	Supports logistical connectivity but is less critical than infrastructure or social sectors. While essential for trade and mobility, roads alone cannot drive long-term recovery.
Quality of Road Network	0.20	Impacts transportation efficiency and trade, influencing regional economic mobility and accessibility. High-quality roads facilitate faster economic recovery.
Infrastructure Needs	0.40	Essential for restoring critical services such as water, energy, and sanitation. Given its direct effect on economic stability, it is the highest priority.
Sectoral Infrastructure Needs	0.30	Focuses on key sectors (e.g., communications, utilities, transportation) to support long-term, sustainable recovery.

Source: Author's calculations

By assigning higher weights to essential infrastructure needs, this approach prioritizes foundational recovery drivers over secondary improvements. This ensures that investment decisions reflect the varying impact of each factor on economic recovery, emphasizing the most critical dimensions for stability and growth. The higher the weight, the greater the factor's contribution to post-conflict regeneration. Infrastructure receives the highest weight, as it directly influences the ability of a region to function and grow. Road quality follows, as efficient transport networks accelerate trade and economic activity. By prioritizing these factors, resources can be allocated effectively, maximizing recovery efforts and promoting sustainable development.

Step 3: Composite score calculation

In Step 3, we calculate a composite score for each region by combining both normalized input values and normalized output values, adjusting them by their respective weights. The composite score serves as an overall measure of each region's potential for recovery, growth, and regeneration, and it guides investment prioritization. The simplified formula to calculate the composite score for each region is:

$$Composite\ Score_r = \quad_{i=1}^{I}(w_i \times NI_{i,r}) + \sum_{j=1}^{J}(NO_{j,r}) \qquad (2)$$

where:

- Normalized Input Value: The normalized value of an input variable (e.g., Road Area, Infrastructure Needs).
- Weight: The weight assigned to each input variable based on its importance for recovery and development.
- Normalized Output Value: The normalized value of an output variable (e.g., Health Care, Education Performance, etc.).

The resulting composite score represents the region's overall recovery potential, taking into account both the necessary inputs and the anticipated outputs. Regions with higher composite scores have greater regeneration potential and are thus prioritized for investment. Conversely, regions with lower composite scores may still need support, but they are not the immediate focus for large-scale funding. This composite score helps in ranking regions, which leads into Step 4 (where investment scenarios are applied) and ultimately aids initiatives in Step 5 (where decisions are made on how to allocate resources effectively).

Step 4: Investment scenarios

In Step 4, we apply different investment scenarios (high, moderate, and low impact) to evaluate how varying funding levels influence the growth potential and regenerative capacity of each region. Using the composite scores from Step 3, we adjust the scores under each investment scenario to reflect the impact of varying funding levels on the recovery variables, such as healthcare, education, and social protection. This helps identify regions with the highest recovery potential, ensuring that resources are allocated efficiently. The performance score for each region under each investment scenario is determined using the following formula:

$$Performance\ score_{r,s} = Composite\ Score_r \times Investment\ Factor_s \qquad (3)$$

where:

- Composite Score (region) is the region's baseline recovery potential calculated in Step 3, which combines both normalized input and output values with their respective weights.
- Investment Factor (scenario) is a qualitatively-based multiplier applied to adjust the performance score based on the different funding levels in each scenario:

  ◦ *High-Impact (H):* A multiplier greater than 1 (e.g., 1.2), prioritizing regions with the highest recovery needs and potential.

◦ *Moderate-Impact (M):* A multiplier approximately equal to 1, balancing resource distribution across multiple regions.

◦ *Low-Impact (L):* A multiplier less than 1 (e.g., 0.8), focusing on urgent, short-term recovery needs.

This analysis of investment scenarios directly influences regional rankings in Step 5, providing insight into how different funding levels will affect the regeneration capacity of each region. The output scores from Step 4 are then used to rank the regions and determine investment priorities, ensuring that the regions with the greatest recovery potential receive the necessary funding. By integrating structured ranking systems with scenario-based investment strategies, this framework ensures that recovery planning remains data-driven and outcome-focused. This prioritization strengthens the practical application of the study's findings, offering a clear roadmap for post-conflict economic recovery in Iraq.

Step 5: Regional ranking

In Step 5, regions are ranked based on their performance scores from Step 4, reflecting the impact of various investment scenarios. This ranking is crucial for determining investment priorities, identifying regions with the greatest potential for recovery based on projected outcomes. By prioritizing regions according to their post-investment recovery potential, resources can be allocated more strategically and effectively. The regions with the highest scores in Step 4, which indicate strong recovery potential under specific funding levels, are ranked at the top and should be prioritized for funding (see Table 3). This ensures that investments are directed toward areas with the greatest regeneration potential. Once performance scores from Step 4 are calculated, regions are ranked in descending order, with the highest-scoring regions receiving top priority for funding allocation.

Table 3: Investment prioritization categories

Investment Priority	Investment implication
High	Require immediate investment to maximize economic regeneration. These high-scoring regions demonstrate strong recovery potential and a high return on investment, warranting urgent funding.
Moderate	Need strategic funding to support long-term recovery. These regions have moderate growth potential, requiring targeted investment rather than immediate large-scale intervention.
Low	Not immediately urgent but require long-term planning before major investment. These regions will see a delayed or limited impact from funding. While they may need support in the future, they are not an immediate priority for recovery efforts.

Source: Author's construction

Ranking optimizes investment allocation, ensuring high-scoring regions receive the necessary funding to drive regeneration. Moderate-scoring regions need targeted investments to support growth, while low-scoring regions are not an immediate priority but should be considered for long-term strategic planning. This process ensures that investments are directed to regions with the greatest recovery potential, fostering long-term economic stability (Dawood & Zoghlami Shili, 2023).

This ranking system ensures that investments are directed toward regions with the highest potential for economic and social recovery. The evaluation process follows structured principles, incorporating data normalization, weighting assignments, and ranking procedures to maintain consistency and reliability in recovery planning. This approach minimizes inefficiencies and supports long-term economic resilience.

The framework outlined in this section thus provides a systematic method for assessing regional disparities and prioritizing investments. By integrating structured ranking systems with scenario-based investment strategies, it ensures that recovery planning remains data-driven and outcome-focused. This prioritization strengthens the practical application of the study's findings, offering a clear roadmap for post-conflict economic recovery in Iraq.

To establish a transparent and objective investment prioritization framework, the methodology combines qualitative Input-Output Analysis and Multicriteria Analysis (MCA). Normalization ensures fair comparisons across regions, while weighing priority to the most influential factors. Composite scoring ranks recovery potential, and investment scenarios help forecast the impact of different funding strategies. Finally, regional ranking ensures resources are allocated effectively. By enhancing transparency, accuracy, and strategic decision-making, this approach maximizes the effectiveness of post-conflict investments, promoting long-term recovery and economic stability.

5. Results: Assessment of regional regeneration potential

In this section, we apply the five steps outlined in Section 4 to the data for the 7 governorates under study of Iraq. Each step is analyzed and presented with tables where necessary to assess the regional regeneration potential of these areas. The following steps are carried out: normalization of input and output variables, assignment of weights to each variable, calculation of composite scores, evaluation under different investment scenarios, and regional ranking.

In *Step 1*, we standardize the input and output variables for each of the 7 relevant governorates in Iraq. Normalization is essential to ensure that all variables are on a common scale, making them comparable across different regions. All input and output variables are scaled between 0 and 1 based on the minimum and maximum values for each category (see Tables 4 and 5).

Table 4: Normalized input variables

Governorate	Road Area (SqKm)	Road Quality	Infrastructure Needs (IQD billion, 5 yrs)	Sectoral Infrastructure (IQD billion, 5 yrs)
Ninawa	0.1628	0.1765	0.374	0.375
Anbar	0.6051	0.1765	0.339	0.340
Salah Al-Deen	0.1081	0.1765	0.070	0.070
Kirkuk	0.0291	0.1176	0.099	0.099
Diyala	0.0772	0.0588	0.040	0.040
Baghdad	0.0199	0.1765	0.067	0.067
Babel	0.0245	0.1176	0.010	0.010

Source: Author's calculations

The normalized input variables in Table 4 show the distribution of key infrastructure factors across regions. Anbar appears to have the largest share of road area, with 60.51%, while Baghdad has the smallest at 1.99%. For road quality, regions like Ninawa, Anbar, and Baghdad each have the highest share of 17.65%. Ninawa has the highest infrastructure needs, representing 37.4% of the total, while Babel has the smallest share at 1%. Similarly, Ninawa also has the largest sectoral infrastructure needs at 37.5%, and Babel again has the smallest share at 1%. Normalization helps ensure fair comparisons by adjusting for differences in scale across regions.

Table 5: Normalized output variables

Governorate	Per Capita Investment (IQD)	Health Needs (IQD billion, Yr 1)	Cultural Heritage Needs (IQD billion, Yrs 2-5)	Education Needs (IQD billion, 5 yrs)	Social Protection Needs (IQD billion, 5 yrs)
Ninawa	0.1842	0.465	0.519	0.268	0.419
Anbar	0.1053	0.177	0.262	0.270	0.146
Salah Al-Deen	0.1579	0.065	0.021	0.050	0.159
Kirkuk	0.1184	0.196	0.050	0.171	0.068
Diyala	0.1184	0.071	0.042	0.060	0.049
Baghdad	0.1842	0.020	0.092	0.142	0.118
Babel	0.1184	0.003	0.014	0.036	0.039

Source: Author's calculations

The normalized output variables in Table 5 show the distribution of key recovery factors across regions. Ninawa has the highest per capita investment (0.1842) and appears to lead in health care (0.465) and cultural heritage needs (0.519).

In contrast, Babel has the lowest values across most categories, with minimal health (0.003) and cultural heritage needs (0.014). Anbar has moderate values for most outputs, while Salah Al-Deen and Kirkuk are in the middle range for most categories, except for health needs, where Salah Al-Deen has a low value (0.065). Normalization allows these values to be compared across regions on an equal scale.

In *Step 2*, we calculate the composite scores for each region using the normalized values and the weights. Based on the weights provided in Step 2 in Section 4, we apply them to the normalized input variables (see Table 6):

Table 6: Weighted inputs for each region

Governorate	Road Area (Weighted)	Road Quality (Weighted)	Infrastructure Needs (Weighted)	Sectoral Infrastructure (Weighted)
Ninawa	0.01628	0.0353	0.1496	0.1125
Anbar	0.06051	0.0353	0.1356	0.102
Salah Al-Deen	0.01081	0.0353	0.028	0.021
Kirkuk	0.00291	0.02352	0.0396	0.0297
Diyala	0.00772	0.01176	0.016	0.012
Baghdad	0.00199	0.0353	0.0268	0.0201
Babel	0.00245	0.02352	0.004	0.003

Source: Author's calculations

In Table 6, each region's input values (for road area, road quality, infrastructure needs, and sectoral infrastructure needs) have been multiplied by their respective weights. The weights were chosen to represent the relative importance of each factor in the recovery and growth process. For example, infrastructure needs are considered most important, so it has been assigned the highest weight of 0.40, while road area is given the lowest weight of 0.10. These weighted values will be used in the next step (Step 3) to calculate the composite scores for each region, allowing us to rank them based on their overall potential for recovery and investment.

Now that we have normalized input values and assigned weights to these inputs in Step 2, we can proceed to calculate the composite score for each region in Step 3. The composite score combines both input factors (road area, road quality, infrastructure needs, and sectoral infrastructure needs) weighted by their importance, along with the normalized output values (per capita investment, health needs, cultural heritage needs, education needs, and social protection needs) (see Table 7).

Table 7: Summary of composite scores

Governorate	Composite Score
Ninawa	2.16988
Anbar	1.39471
Salah Al-Deen	0.53215
Kirkuk	0.69913
Diyala	0.38888
Baghdad	0.64039
Babel	0.24337

Source: Author's calculations

The composite score represents each region's overall potential for recovery and growth. Regions with higher composite scores, such as Ninawa, are seen as having greater recovery potential and would likely be prioritized for investment. In comparison, regions like Babel, which have lower composite scores, may still need support but are not immediate priorities for large-scale funding. This score helps in directing investments effectively, as regions with the highest scores are better positioned to utilize resources for regeneration and growth.

In *Step 4*, we develop different investment scenarios to evaluate how varying funding levels can influence the growth potential and regenerative capacity of each region. Using the composite scores calculated in Step 3 (which combine input and output data with assigned weights), we adjust these scores under three distinct funding scenarios: High Impact, Moderate Impact, and Low Impact. The performance scores in this step represent the projected outcomes for each region under each funding scenario, based on their calculated composite scores from Step 3. The main task is to assess how different funding levels would affect recovery variables like healthcare, education, social protection, and infrastructure, and then prioritize regions for investment based on these assessments.

Implementing different investment scenarios allows us to evaluate how regions perform under varying funding conditions. The performance scores calculated under each scenario give us insight into how different funding levels affect the regeneration potential of each region. The regions with the highest performance scores under each scenario are those that should receive higher priority for funding. Below is the table summarizing the Performance Scores for each region under the three above-mentioned investment scenarios (High-Impact, Moderate-Impact, and Low-Impact).

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Table 8: Investment scenarios and performance score calculation

Governorate	High-Impact (H)	Moderate-Impact (M)	Low-Impact (L)
Ninawa	2.6039	2.1699	1.7359
Anbar	1.6737	1.3947	1.1158
Kirkuk	0.8390	0.6991	0.5593
Baghdad	0.7685	0.6404	0.5123
Salah Al-Deen	0.6384	0.5320	0.4256
Diyala	0.4667	0.3889	0.3111
Babel	0.2920	0.2434	0.1947

Source: Author's calculations

Table 8 summarizes how different funding scenarios influence the performance of each region, helping guide resource allocation for recovery and regeneration efforts. Ninawa and Anbar consistently rank at the top in all three scenarios, demonstrating that these regions have the highest recovery potential and should be prioritized for investment. This is reflected in their normalized input values (such as large road areas and high infrastructure needs) and normalized output values (including significant needs in health, education, and social protection). These factors contribute to their high composite scores, which reflect their overall recovery potential. As funding levels decrease, the performance scores of all regions decline, but Ninawa and Anbar maintain their high rankings, ensuring they continue to receive the most attention. Their composite scores, which combine input and output data, indicate they will yield the most meaningful recovery outcomes even under reduced funding. Regions such as Kirkuk, Baghdad, and Salah Al-Deen rank lower, showing how they may perform with more limited funding. These regions have smaller road areas, lower infrastructure needs, and less urgent recovery demands in key sectors (like health care, education, and social protection), which results in their lower composite scores.

Based on the output scores from Step 4, we now rank the regions in descending order to determine the priority for investment. The performance scores calculated under the three investment scenarios (High-Impact, Moderate-Impact, and Low-Impact) provide insight into the regeneration potential of each region. By ranking these regions according to their performance scores, we can identify the areas that would benefit most from targeted investment.

The regions with the highest performance scores under the High-Impact scenario are considered the highest priority for investment, as they have the greatest potential for recovery and growth. On the other hand, regions with the lowest performance scores should be considered for lower levels of investment, as their recovery potential may be less immediate or less significant.

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Table 9: Ranking of regions by investment priority

Governorate	High-Impact Rank	Moderate-Impact Rank	Low-Impact Rank
Ninawa	1	1	1
Anbar	2	2	2
Kirkuk	3	3	3
Baghdad	4	4	4
Salah Al-Deen	5	5	5
Diyala	6	6	6
Babel	7	7	7

Source: Author's calculations

Finally, Ninawa is classified as the highest priority, followed by Anbar, Kirkuk, Baghdad, Salah Al-Deen, Diyala, and Babel at the lowest priority. The ranking in Table 9 reflects the priority for investment in each region under the three different funding scenarios. Ninawa and Anbar consistently occupy the top ranks across all scenarios, indicating that they are the most viable regions for high-priority investments. In contrast, Babel consistently ranks at the bottom, suggesting that it requires lower levels of funding and intervention compared to other regions. Ninawa and Anbar rank the highest in all three scenarios, demonstrating their strong recovery potential. This is driven by their significant infrastructure needs, substantial output requirements in sectors such as health care, education, and social protection, and favorable input variables like road area. Kirkuk, Baghdad, and Salah Al-Deen occupy mid-range ranks. While these regions exhibit some recovery potential, they are not as critical as Ninawa and Anbar, meaning they will require moderate investment to address their recovery challenges effectively. Diyala and Babel consistently rank at the lower end of the scale, with Babel receiving the lowest priority across all scenarios. While these regions may still need some investment, their regeneration needs are less urgent, and therefore, lower funding levels can be allocated to them accordingly.

This ranking analysis ensures that investments are strategically directed towards the regions with the most pressing needs and highest recovery potential, thereby maximizing the impact of the available resources. It should be noted that the Iraqi situation is not unique in the world. Many countries exhibit significant spatial disparities which are not only due to physical geography, but also to cultural-ethnic tensions and weak institutional quality (see for an overview Cuadrado Roura et al., 2025).

In conclusion, the integration of input-output analysis and multicriteria analysis provides a data-driven framework for understanding regional needs and regenerative capacities. The final regional rankings, based on adjusted composite scores

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from Step 4, offer a clear method for decision-making in post-conflict investment, ensuring that resources are allocated effectively to maximize recovery and growth. By ranking regions according to their regenerative potential, this methodology enables the strategic allocation of resources to optimize long-term recovery.

6. Conclusion and policy recommendations

Iraq's post-conflict economy has a vulnerable structure caused by political and socio-structural discrepancies, a lack of a strongly coordinated governance system, and a weak international economic profile, hampering FDIs from scaling up the economy. Iraq's post-conflict recovery presents a complex challenge requiring a structured, evidence-based approach to ensure efficient resource allocation. This study applied Input-Output Analysis and Multicriteria Decision Analysis (MCDA) to assess Iraq's regional recovery potential, identifying priority areas for investment based on infrastructure quality, governance capacity, and socio-economic resilience.

The findings highlight the importance of strategic investment prioritization, as regions with stable governance structures can absorb funds effectively, whereas fragile regions require foundational reforms before economic investments can yield sustainable benefits. Sectoral needs also vary significantly, with some regions requiring urgent infrastructure rebuilding while others need investments in healthcare, education, and social services. A phased recovery strategy is necessary, starting with short-term stabilization efforts, followed by medium- and long-term development initiatives.

The study indicates that Ninawa and Anbar hold the highest recovery potential, whereas Diyala and Babel require long-term stabilization before large-scale investments can be effective. However, several critical challenges must be addressed. Weak institutional frameworks continue to hinder recovery, with corruption and governance inefficiencies limiting the effectiveness of investments. Iraq's overdependence on oil revenues makes economic diversification an urgent necessity. Infrastructure weaknesses, particularly in roads, power, healthcare, and education, require immediate strategic investment to support economic revitalization. Additionally, ongoing socio-political uncertainty and regional instability pose risks to sustained recovery. Addressing these challenges requires a phased, strategic recovery plan that integrates economic regeneration, governance reforms, and social development.

Investment should be prioritized based on recovery potential. High-priority regions such as Ninawa and Anbar should receive immediate and substantial infrastructure investments, particularly in transport, utilities, and education. Moderate-priority regions, including Kirkuk, Baghdad, and Salah Al-Deen, require targeted interventions to strengthen governance, healthcare, and the private sector. Low-priority

regions, such as Diyala and Babel, should focus on long-term, sustainable development strategies with phased investments over time.

Strengthening governance and institutional capacity is crucial for effective recovery. Establishing anti-corruption frameworks will ensure the transparent allocation of reconstruction funds, while the creation of regional development councils with clear mandates for economic planning will improve coordination. Institutionalizing data-driven decision-making, particularly using MCDA-based prioritization within national recovery plans, will enhance accountability and efficiency.

Economic diversification and private sector engagement must be prioritized to reduce Iraq's dependency on oil revenues. Encouraging investment in manufacturing, agriculture, and digital industries will foster economic resilience. Public-private partnerships (PPPs) should be leveraged to finance infrastructure and social projects, while investment incentives such as tax breaks and streamlined regulations can attract both local and foreign investors.

Infrastructure rehabilitation and strategic planning should focus on rebuilding transportation networks, including roads, bridges, and railways to improve connectivity and facilitate economic activities. Investments in renewable energy and decentralized power systems will enhance resilience and reduce reliance on state-controlled utilities. Strengthening digital infrastructure will also be essential to support innovation, trade, and remote education.

Social stabilization and human capital development are fundamental to long-term recovery. Expanding education and vocational training programs will help address labor market gaps and improve workforce capacity. Healthcare access must be improved by rebuilding hospitals and deploying mobile medical units to underserved areas. Additionally, strengthening social protection programs, including employment schemes and financial support for vulnerable populations, will be necessary to promote social stability and economic inclusion.

The present study has evidently various limitations. Not all Iraqi regions could be covered in detail, the databases used are not always up-to-date or mutually consistent, the development impacts of regional cultural-ethnic tensions are difficult to measure, and the role of public and private actors is sometimes diffuse. Clearly, in recent years, the statistical databases in Iraq have been improved. Important statistical sources on regional development are: the Central Bank of Iraq (including recent data on GDP and employment), the World Bank (including growth and investment data as well as trade data), Moody's Analytics (including economic development and unemployment data), and other open-access data platforms (e.g., Coface, Trading Economics). However, data on other indicators for all regions are so rare, that a more up-to-date analysis of the development potential of Iraqi regions is difficult to pursue.

Iraq's recovery demands a long-term commitment to strategic investment, governance reform, and economic diversification. A data-driven, phased, and regionally differentiated approach will maximize resilience and stability. If implemented with institutional integrity and consistent strategic planning, Iraq can transition from fragility to sustainable growth and long-term prosperity. But this 'battle uphill' will be a long-lasting and hopefully resilient process for the Iraqi regions.

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Neravnopravne teške bitke: regenerativne strategije iračkih regija nakon sukoba

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Sažetak

Infrastrukturna i ekonomska obnova zemlje nakon geopolitičkog sukoba zahtijeva uravnoteženu političku strategiju, ovdje ilustrirano na slučaju Iraka. Dugoročni oporavak ove zemlje nakon sukoba zahtijeva strateški pristup utemeljen na dokazima kako bi se optimizirala raspodjela regionalnih resursa i ubrzala regionalna regeneracija. U ovoj studiji primjenjuje se kvalitativna input-output analiza i multikriterijska analiza odlučivanja (MCDA) za procjenu razlika u infrastrukturi, upravljanju i ekonomskoj otpornosti među regijama, pružajući analitički i podatkovno utemeljen okvir za određivanje prioriteta regionalnih investicijskih strategija. Rangiranjem regija na temelju njihovog kapaciteta oporavka, studija istražuje kako omogućiti strategiju usmjerenu na stabilizaciju iračkog gospodarskog prostora i jačanje njegovih institucija upravljanja. Rezultati našeg empirijskog istraživanja ukazuju na kritičnu potrebu za dugoročnim ulaganjima kako bi uravnotežila trenutnu stabilizaciju s dugoročnom ekonomskom transformacijom. Međutim, fragmentacija upravljanja, korupcija i slabi institucionalni okviri ostaju značajne prepreke otpornosti, ograničavajući učinkovitost ulaganja i ometajući održivi gospodarski oporavak. Rješavanje ovih strukturnih problema – kroz reforme upravljanja, izgradnju institucionalnih kapaciteta i transparentnu raspodjelu resursa - ključno je za dugoročnu ekonomsku otpornost regija u Iraku. Ako se učinkovito provede, ova strategija može unaprijediti iračko svemirsko gospodarstvo od poslijeratne neizvjesnosti do održive stabilnosti i rasta.

Ključne riječi: *regenerativno djelovanje, oporavak, otpornost, postkonfliktni, multikriterijska analiza odlučivanja, regionalna ulaganja, institucionalni kapacitet*

JEL klasifikacija: *O18, H54, R11, O43, D70*

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Work motivation of Generation Z in the Czech Republic[*]

Petr Řehoř[1], Jaroslav Vrchota[2], Monika Maříková[3], Lukáš Klarner[4]

Abstract

Organizational managers face unique challenges associated with different generations working in an organization, each possessing specific values, motivations, skills, and communication styles. Currently, Generation Z, the youngest one, is entering the labour market. This paper evaluates the work motivation of Generation Z using data obtained from a questionnaire survey. The sample consists of 142 representatives of this generation, aged 18 to 25. The data were analysed using factor analysis, which identified six key motivational factors for Generation Z employees. These factors are: internal communication and work engagement; work control and evaluation; compensation and well-being work motivation and personal development; work stability and social security; and work autonomy and support. The results show that Generation Z is primarily motivated by good financial compensation, respect and recognition, clear opportunities for career growth, and benefits that provide flexibility and stability. Understanding the characteristics and preferences of Generation Z can help managers create a productive work environment and increase their satisfaction and performance.

Keywords: *management, Generation Z, motivation, HR strategies, communication*

JEL classification: *M12, J81*

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1. Introduction

The dynamics of the work environment change with each generation, and organizations must adapt their working conditions and benefits to reach and retain employees across different generations. Understanding generational differences is essential for creating productive and harmonious work teams. These teams consist of individuals from different age groups, each bringing different perspectives, experiences, work attitudes, and expectations. Management that can identify and respond to these differences can better motivate its employees and support their professional growth. Every generation has its own distinct priorities and values in the work environment. With the arrival of Generation Z, born between 1997 and 2012, into the labour market, new needs and expectations regarding working conditions and workplace relationships are emerging. This generation, which is just beginning its professional careers, has different demands compared to previous generations in terms of how they are managed, motivated, and how they perceive the value of their work.

Generation Z, being the youngest and most diverse, expects an inclusive environment where all identities and opinions are respected. Diversity and inclusion training helps managers understand and respond to the needs of all generations (Roberson, 2019; Shore et al., 2018). Generation Z prefers innovative approaches and a rapid work pace, so managers should be open to new technologies and work methods that motivate and engage these younger employees (Huang et al., 2019; Monje-Amor, 2024). The authors of this article aimed to assess the work motivation of Generation Z, which is crucial for understanding their approach to work and ensuring their satisfaction and productivity in the workplace. A key objective was to develop a strategy for managers to lead this generation effectively. Gentry et al. (2011) confirms that organizations that successfully manage different generations can increase innovation and productivity.

2. Literature review

A generation refers to a group of people born in a certain period (Dimock, 2019), shaped by the same time and influenced by the same social indicators – in other words, a cohort united by age and stage of life, living conditions, technology, events, and experiences (McCrindle, 2018). The theory of generations is essential for a whole range of fields. In economics, it plays a role, for example, in marketing or the study of work behaviour. Generations have different values and work motivations, which is key to working well with employees (Becton et al., 2014). In the Czech Republic, the distribution of generations is as follows: Generation X (24%), Baby Boomers (22.2%), Generation Y (19.4%), Generation Z (14.8%), Generation Alpha (13%), Silent Generation (6.5%) (CZSO, 2023).

Generation Z refers to individuals born between 1996 and 2010. In terms of generation size, it is the largest generation comprising approximately 2.5 billion people, which is almost a third of the total world population (McCrindle, 2018). In 2020, digital natives represented 40% of customers worldwide. They are referred to as digital natives because they were born into a digital world (Hovorková, 2021). Being the first generation to grow up in an integrated, globally connected world assisted by the Internet and other technologies, they are also called the Internet Generation (Mărgăriţoiu & Eftimie, 2021), Technological Generarion (Yaman & Çakin, 2021), or Zoomers (Talmon, 2019). They are also known as Generation R, with the "R" standing for responsibility (Csobanka, 2016). Generation Z can be divided into two distinct groups. The first group prioritizes a well-paid job and spending as little time as possible at work. The second group values work that provides them with a sense of meaning (Daňková & Maca, 2019).

Generation Z suffers from dependence on computer technologies; as a result, they are more isolated, and their self-image is distorted (Berkup, 2014; Pishchik, 2020). It is also a very tolerant and open generation, able to express their opinions (Carvalho et al., 2022). They are also very spontaneous and like to travel. They know how to express themselves and argue very well (Wiratno et al., 2020). They are creative, motivated, entrepreneurial, and technologically advanced (Wilson, 2021). Surveys say that members of Generation Z want to try things for themselves and prefer direct experience with things. They are very focused on a consumer lifestyle and do not have high life goals (Bláha et al., 2016). Their greatest characteristics are impatience, rashness, and self-centeredness. They lack the skills to solve problems, put things in context, analyse them, and then make decisions (Dangmei & Singh, 2016). They are highly ambitious, self-confident, realistic, and accept everything that is given (Benítez-Márquez et al., 2022). Merriman (2015) argues that they are self-aware, persistent, innovative, and self-reliant. At work, it is most important for them to have a good relationship with their supervisor, who can increase their motivation the most (Septiawan & Masrunik, 2020).

They need to constantly develop and desire career advancement and want to continually learn new things (Lewis, 2022). They also want to manage everything themselves because they are convinced that they have the best competence to complete the given task (Patel, 2017). They are motivated by the idea of doing something that will significantly change the future of society (Seemiller & Grace, 2018). According to Cartwright-Stroupe and Shinners (2021) Generation Z exhibits a strong social justice orientation. They are willing to work hard and prove to themselves that they can do it; on the other hand, they want to have a stable job. Bejtkovský (2016) claims that they cannot listen and lack the art of interpersonal communication. They demand a personal approach and the opportunity to significantly contribute to the success of employers (Gabrielova & Buchko, 2021).

This generation is innovative, preferring short-term employment to long-term employment (Sidorcuka & Chesnovicka, 2017). Grayson (2021) says they want to have fast career progression and are looking for less manual positions. Dependence on technology also results in these individuals not being able to work in a team (Berkup, 2014; Pishchik, 2020). In the work environment, they require more patience, understanding, and empathy (Bencsik et al., 2016). It is a generation full of ambitious and self-confident people who will change their jobs more often due to the search for security and important internal satisfaction (Benítez-Márquez et al., 2022; Gabrielova & Buchko, 2021). Seemiller and Grace (2018) identified four essential work values of this generation, which are financial security, life satisfaction, family, personal relationships, and meaningful work. According to Bejtkovský (2016), Generation Z prefers new work challenges, financial bonuses for work done, the possibility to propose and implement their ideas, work flexibility, and the possibility of internships abroad.

Generation Z employees have, according to Bencsik et al. (2016), the following traits: They are more comfortable in the online world, preferring to solve problems independently. They live in the present, react quickly to changes, and quickly access information. There are four basic aspects of this generation in terms of work preferences: They are characterized by their intensive use of online means of communication. They have a strong tendency to participate in company events, want to promote their ideas, and like to organize their work. They expect their employer to provide them with the possibility of further studies (Dömeová, 2018). They prefer employment in smaller companies or organizations, where they expect closer friendlier ties and a more pleasant working climate (Bennett et al., 2012). Here are the most important areas of their management: flexibility - Generation Z is looking for more freedom to create and inspire; career - Generation Z already knows from a young age what career they want to pursue; motivation - wages and working conditions are still the main motivation (Djafarova & Foots, 2022).

3. Methodology

This paper aims to analyse the motivational factors of Generation Z employees and identify key factors for creating HR strategies that will motivate, engage, and retain Generation Z in the organization. The research was carried out in 2023 and 2024. A questionnaire survey was chosen as the primary research method. Respondents aged 18 to 25 were interviewed. The questionnaire was distributed with the help of students from the Faculty of Economics of the University of South Bohemia in the Czech Republic. The research sample included 142 representatives of Generation Z.

A correlation matrix was used for statistical analysis. This provided a deeper insight into the relationships between individual factors. This understanding of the

interrelationships will make it possible to formulate more comprehensive strategies for improving the work environment and increasing employee satisfaction. Factor analysis was used for data processing, which helps to summarize the information contained in a larger number of variables into a smaller number of dimensions, facilitating data understanding. This analysis enabled a better understanding of the structure of employee motives. Managers can identify the key factors that most influence employee engagement, satisfaction, and performance in the organization. They can thus better adapt their employee benefits based on the identified dimensions and preferences of individual generations of employees. For this analysis, data from all respondents were used, and it worked with the 22 most frequently mentioned motivators. These factors were carefully selected based on the literature review and previous research that indicated their key role in shaping employees' decisions to change the work environment.

Before carrying out the actual factor analysis, it was necessary to assess the suitability of the examined variables for the analysis. This involved finding out if there was a correlation between the original variables. If the correlation between the variables is statistically insignificant, it indicates that there is no hidden structure in the data, making factor analysis unnecessary. To evaluate this, we used basic correlation matrices to highlight statistical significance, along with Bartlett's test of sphericity and the Kaiser-Mayer-Olkin index (KMO). Subsequently, based on the type of outputs, the parameters of the factor analysis were chosen, included the extraction of basic components and the setting of direct oblimin rotation with a zero delta value.

4. Empirical data and analysis

This chapter presents the results of the empirical survey focused on the work motivation, preferences, and behaviour of Generation Z in the labour market. It includes a description of respondent characteristics, an analysis of key motivational factors, preferred employee benefits, and the reasons that may lead this generation to change jobs. The aim of the chapter is to identify the specific needs of Generation Z and their relevance for human resource management.

4.1. Characteristics of Generation Z in the labour market

The average age of Generation Z respondents is 21 years. Ideally, this generation would like to work 38 hours per week and earn EUR 1,864 net. They are more open to frequent job changes and highly value their indispensability at work. Generation Z attaches the lowest importance to corporate meetings but is most involved in modern technologies and values the space for realizing their ideas. The factors listed in the table1 reflect various aspects that can motivate employees and thereby

influence their job satisfaction and engagement. Permanent employment provides a sense of security and stability, while respect for employees as individuals contributes to a positive working atmosphere. The possibility of advancement and the opportunity for self-development and doing interesting work can motivate personal development and the achievement of career goals. Awareness of what is happening in the organization contributes to greater employee involvement in company processes. Corporate social responsibility and a good organizational reputation can be important for some generations in terms of values and ethics.

4.2. Key motivational factors of Generation Z

Respondents rated 22 motivational factors on a scale from 1 (least) to 4 (most). The highest value in Table 1 (3.81) indicates that a good salary is the most important aspect of work for Generation Z.

Table 1: What motivates you? – Average values

Variable	Average
Good salary	3.81
Respect for me as a person	3.58
Chances of advancement	3.39
Praise from the boss when I do a good job	3.37
Get along well with others at work	3.35
To feel that your work is important	3.35
Good physical working conditions	3.33
An opportunity to do interesting work	3.33
An opportunity for self-development and improvement	3.30
A chance to do quality work	3.26
A high degree of freedom at work (the ability to work without direct or close supervision).	3.15
Adequate rest time or coffee breaks	3.09
Good company reputation	3.08
Getting a performance review	3.07
Permanent employment	3.06
Agreeing with the organization's goals	3.01
Pension and other security benefits	2.84
Know what is going on in the organization	2.76
Corporate social responsibility	2.71
Participation in staff meetings	2.68
Knowing that I will be punished if I do a bad job	2.32
Work under strict supervision	1.85

Source: Authors' calculations

Generation Z highly values financial stability and adequate financial compensation for their work. Employers who offer competitive salaries are very attractive to this generation and can more easily attract and retain young talent. The second highest value (3.58) shows that Generation Z places great emphasis on respect and recognition in the work environment. For Generation Z, it is important to be respected as individuals at work.

Employers should ensure that the company culture promotes mutual respect and recognition, contributing to their job satisfaction and loyalty. The third important aspect is the chance of advancement (3.39). Generation Z is looking for opportunities for career growth and professional development. Employers should offer clear and achievable career paths to motivate their young employees to stay with the company and develop their skills. The lowest value (1.85) indicates that working under strict supervision is the least attractive aspect of work for Generation Z. Generation Z values autonomy and freedom in fulfilling their work tasks. Strict supervision is demotivating for them and can lead to job dissatisfaction. Employers should encourage independence and confidence in their employees' abilities to increase employee satisfaction and productivity.

4.3. Preferred employee benefits

Although some benefits and rewards appeal to all generations, each generation has its own specific preferences and expectations regarding work benefits. Table 2 provides an overview of the benefits deemed most important by Generation Z. This generation has the highest number of sick days (3.50). Generation Z places great emphasis on flexibility and taking care of their health.

Table 2: Preferred benefits – Average values

Variable	Average
Sick Days	3.50
Extraordinary premiums	3.42
13th pay	3.42
An extra week of vacation	3.39
Work equipment (laptop, company car...)	3.19
Transport allowances (to work)	3.15
Financial contributions for leisure activities	2.97
Work from home	2.95
Free refreshments at the workplace during the day	2.94
Contribution for pension insurance	2.86
Meal vouchers	2.48
Gifts from the employer (e.g. for Christmas)	2.30
Company kindergarten	2.17

Source: Authors' calculations

The ability to take time off when needed, without unnecessary bureaucracy, is a key benefit for them. Employers who offer this type of time-off benefit can better attract and retain talent from this generation. In second place, they have extraordinary bonuses and a 13th salary (3.42). Financial rewards are an important motivator. Generation Z is motivated by performance bonuses and other forms of financial rewards that recognize their efforts and contributions to the company's success. Employers should consider regular bonuses and bonuses as part of their compensation strategies.

The additional financial benefit of a 13th salary is highly appealing to Generation Z. This extra income enhances employees' financial stability and plays a crucial role in their decision to either remain with their current employer or seek new job opportunities. Corporate day-care ranked last (2.17), likely reflecting their current lifestyle and priorities as many of them do not have children yet.

4.4. Factors influencing job change

Changing jobs can be motivated by a combination of several factors. Each generation has its priorities and values that influence its decision to leave a job. Employees can look for new opportunities in another company that offers not only higher financial rewards but also more meaningful work, less uncertainty in the work environment, and better relations with colleagues and superiors. A more prestigious company and a richer offer of employee benefits are also attractive factors that can motivate employees to switch to a new employer. Table 3 describes the motivators that could lead to changing jobs.

Table 3: What motivates a generation to change jobs? – Average values

Variable	Average
Amount of financial evaluation	3.52
Uncertainty in the given company	3.44
More meaningful work at another company	3.39
Conflict with other colleagues	3.38
Inadequate employee benefits	2.92
Another more prestigious company	2.74
Conflict with superior	2.73

Source: Authors' calculations

Generation Z places the highest emphasis on financial reward (3.52), which indicates that the amount of financial reward is an important factor for this generation. Generation Z is looking for better salary conditions and adequate financial rewards for their work. If they feel their current financial remuneration is insufficient, they are more inclined to look for new job opportunities that offer them a better salary.

The second-highest value (3.44) shows that uncertainty about job stability is a strong motivator to change jobs. Generation Z prefers job security and stability. If they feel that their current company is not stable or there is a threat of layoffs, they are more motivated to look for a more stable work environment. The third significant factor of change is more meaningful work at another company (3.39). Generation Z is looking for work that is not only financially beneficial but also meaningful. If their current job does not meet this need, they may be more inclined to change jobs to find more meaningful work. The lowest value in the table indicates that conflict with superiors is a relatively less important factor (2.73) compared to others. Although conflicts with superiors can be unpleasant and affect the work environment, they are not as important to Gen Z as financial rewards, company stability, and meaningful work. However, employers should still ensure good relations between employees and supervisors to minimize the negative effects of these conflicts.

5. Results and discussion

Based on the results of the questionnaire survey and statistical data processing, the following results were identified for Generation Z:

- Work team and career growth: Generation Z is looking for a pleasant work team, opportunities for career growth, and flexibility at work.

- Online job search: They look for work online and use modern technologies.

- Benefits: They value benefits that include working from home, sick days, and financial contributions for leisure activities.

- Self-development: They emphasize opportunities for self-development and participation in employee meetings.

Lewis (2022) also states that this generation needs continuous development and a desire for career advancement. Bejtkovský (2016) confirms that an important stimulus is the possibility of flexible work. Bennett et al. (2012) agree that they expect closer friendships in the workplace and a more pleasant work climate, and according to Sidorcuk and Chesnovick (2017), they also require flexibility.

The individual motivational factors examined were compared using a correlation matrix. Unfortunately, due to its extensive size, the table of these correlations could not be included in this article. Therefore, we present the strongest correlations here. The highest correlation is between participation in staff meetings and knowing what is happening in the organization (0.58). Participation in staff meetings is directly related to being informed about organizational events. Generation Z places a high value on transparency and open communication, which is essential for their

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engagement and motivation. Another high correlation is between the chance to do quality work and feeling that one's work is important (0.52). For Generation Z, it is crucial that their work has meaning and that they can perform quality work. The feeling that their work is important directly supports their effort to maintain high-quality performance. The correlation between working under strict supervision and knowing that one will be punished for bad work is also strong (0.52). Strict supervision is often associated with clearly defined rules and consequences for mistakes. Generation Z may perceive this structure as a form of security and predictability in the work environment. The fourth highest correlation was found between corporate social responsibility and a good company reputation (0.48). Generation Z evaluates companies not only based on their financial success but also on their ethics and social responsibility, which increases the attractiveness of such companies.

Furthermore, a factor analysis was carried out to identify key motives. KMO and Bartlett's tests were first performed on the appropriateness of using factor analysis for data from Generation Z. All conditions were met here, as the data in Table 4 show.

Table 4: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.803
Bartlett's Test of Sphericity	Approx. Chi-Square	905.373
	Df	231
	Sig.	0.000

Source: Authors' calculations

After the analysis, we identified six main factors that categorized a total of 22 motivational factors, which accounted for 58.5% (see Table 5). We only considered components with a percentage representation higher than 4.5% Including only those components with higher percentage increases the robustness and reliability of the analysis. In this way, the risk of the results being affected by random or minor factors is minimized, thereby increasing the credibility and accuracy of the conclusions drawn.

Table 5: Total number of variations above the 4.5% limit

Compo-nent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of variance	Cumu-lative %	Total	% of variance	Cumu-lative %	Total
1	5.711	25.957	25.957	5.711	25.957	25.957	3.331
2	2.149	9.768	35.726	2.149	9.768	35.726	3.182
3	1.493	6.787	42.513	1.493	6.787	42.513	2.517
4	1.260	5.727	48.241	1.260	5.727	48.241	4.089
5	1.218	5.536	53.776	1.218	5.536	53.776	1.401
6	1.051	4.776	58.552	1.051	4.776	58.552	1.164

Source: Authors' calculations

Figure 1 shows the influence of the number of components on the predictive value of the factor analysis. As more components are added, their contribution to explaining the total variance decreases. Specifically, it shows that the number of components starts to decrease very slowly from the second level. Thus, the figure visually supports the decision to include only components with a percentage representation higher than 4.5%, since additional components would only contribute minimally to the overall variance explanation.

Figure 1: Effect of the number of components on the predictive value of the factor analysis
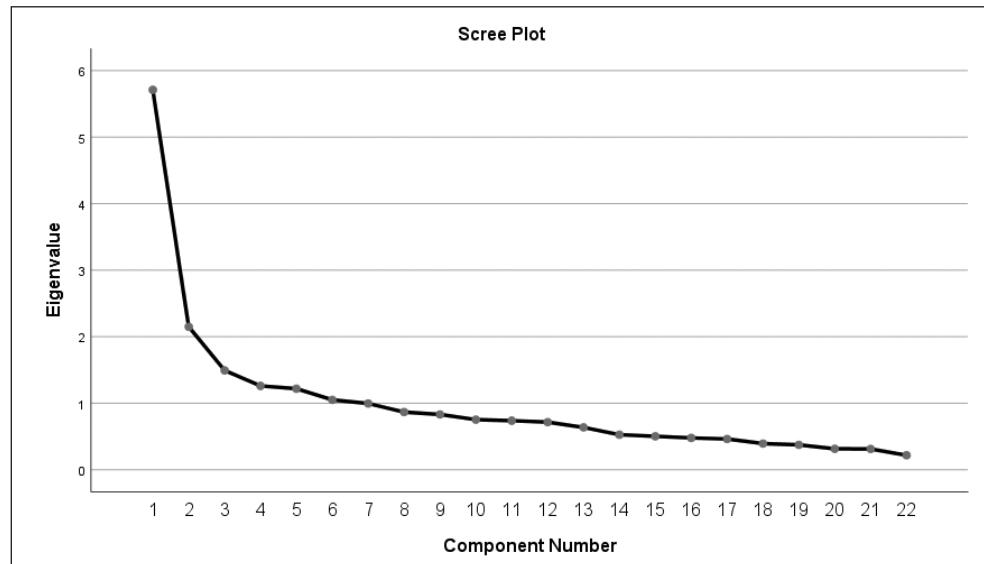
Source: Authors' representation

For Generation Z, which is known for its digital literacy, social engagement, and search for meaningful work, the following components, according to Table 6, could have a specific impact:

• Internal communication and work engagement: includes elements such as participation in staff meetings, awareness of what is going on in the organization, and agreement with the organization's goals. Generation Z appreciates transparent and open communication within the organization and employee engagement in the common goals and values of the company.

• Work control and evaluation: there are elements such as being aware of possible punishment for bad work, working under strict supervision, corporate social responsibility, getting performance reviews, good company reputation, and chances for promotion. This component reflects the balance between the control and evaluation of employees and their integration into the corporate environment, which positively affects work motivation and engagement. This generation may prefer a balanced approach to assessment and control. However, working under supervision could require flexibility and respect for individual work styles.

• Compensation and well-being: reflects elements such as good pay and provision of adequate rest periods or coffee breaks. Generation Z emphasizes financial rewards and work-life balance, which can contribute to their overall satisfaction and performance.

• Work motivation and personal development: these include elements such as the opportunity to do interesting work, the perception of one's work as important, the chance to do quality work, respect for the individual, opportunities for personal and self-development, and good relations with colleagues at work. These elements support overall job satisfaction, employee engagement, and personal and professional development in the work environment.

• Job stability and social security: it includes permanent employment, a large degree of freedom at work (the possibility to work without direct supervision), and the provision of pension and other social benefits. This component reflects the employee's needs for job stability, freedom at work, and security of social security, which contributes to his overall job satisfaction and well-being. Stable employment and the security of social security can be important to Gen Z, especially as they seek economic and job stability.

• Work autonomy and support: it covers elements such as a large degree of freedom at work, good physical working conditions, and recognition from the boss for quality work. A large degree of freedom at work and appreciation for quality work can be important to Generation Z, as this generation often appreciates the opportunity to work independently and to be recognized for their contribution.

Table 6 identified the main areas of concern or need of Generation Z employees, which can be useful for defining a strategy for human resource management and improving the work environment. Graczyk-Kucharska and Erickson (2020) state that HR departments should prepare to introduce or change values and culture in the workplace, rather than expecting Generation Z to adapt to society.

An article by Nguyen and Ha (2023) discusses how internal communication affects Gen Z engagement. It highlights the need for frequent, clear, and transparent communication to keep these employees informed and motivated, which in turn promotes a more engaged workforce. These conclusions are confirmed by the first component of internal communication and engagement.

Table 6: Distribution of individual variables into components

Variable	Components					
	1	2	3	4	5	6
Participation in staff meetings	.815					
Know what is going on in the organization	.674					
Pension and other security benefits					.304	
Agreeing with the organization's goals	.495					
Knowing that I will be punished if I do a bad job		.828				
Work under strict supervision		.800				
Corporate social responsibility		.540				
Getting a performance review		.313				
Good salary			.814			
Adequate rest time or coffee breaks			.611			
Good physical working conditions						.304
An opportunity to do interesting work				.777		
To feel that your work is important				.715		
A chance to do quality work				.642		
Respect for me as a person				.589		
An opportunity for self-development and improvement				.558		
Good company reputation		.408				
Get along well with others at work				.420		
Permanent employment					.868	
A high degree of freedom at work (the ability to work without direct or close supervision).					-.517	
Chances of advancement		.334				
Praise from the boss when I do a good job						-.518

Source: Authors' calculations

Managers should ensure open and transparent communication through regular staff meetings with management and internal newsletters. Furthermore, they should involve employees in the process of setting team goals so that they feel engaged and responsible for achieving the common values and goals of the company, and also involve them in decision-making processes and solving team projects. To fulfil this strategy, they can implement internal communication tools such as Slack, Microsoft Teams, or intranet platforms. Generation Z also has a different perspective on career ambitions than previous generations. They are often entrepreneurial and want to create their own identity in the labour market. Feedback also plays a much greater role with Generation Z. Young employees want to regularly receive information about their work performance and find out their weak and strong points. Constructive feedback or criticism helps them to improve their performance and to be more satisfied at work, as stated by Aggarwal et al. (2022), these factors are also part of the established second component of work control and evaluation. Company management should implement regular and constructive feedback with employees through 360-degree evaluations that take into account not only performance but also personal growth and contribution to teamwork. Furthermore, it should offer this generation a flexible work environment that respects individual work styles, but at the same time provides the necessary support and supervision when needed.

Proper compensation and benefits are among the main factors of employee satisfaction from Generation Z. The worker requires fair financial compensation for his effort, skills, and time, so salary is a key motivator. According to research conducted by Built-In in 2020, 60% of Gen Z respondents said that money is the foundation of success. This is also because this generation has experienced an economic recession and has a strong inclination towards money and financial security from an early age (Aggarwal et al., 2022). According to Csiszárik-Kocsír and Garia-Fodor (2018), the motivation factors for this cohort are advancement opportunities, higher salary, meaningful work, and a good team. This statement is confirmed by us in the third and fourth components related to work motivation and remuneration. Managers should offer competitive wages and bonuses that reflect employee performance and contribution. They should also implement policies promoting work-life balance, including flexible working hours and the option to work from home. Generation Z also wants a diverse range of programs and training aimed at personal and professional growth, such as workshops, online courses, mentoring, and coaching.

This generation is motivated by the search for a dream job and opportunities to expand their skills (Magano et al., 2020), which corresponds to the fourth component we identified. Bińczycki et al. (2023) show that Gen Z employees prioritize job stability and security, emphasizing the importance of stable employment, freedom at work, and comprehensive social security benefits to their motivation and satisfac-

tion. These variables are part of the fifth and sixth components. Management should allow this generation a high degree of autonomy in their work tasks and encourage innovative thinking and independence. Interns will also appreciate long-term employment contracts and clear opportunities for career growth. Managers should appreciate them and recognize the quality of employees' work, for example through recognition programs, bonuses, or public praise. It is also a necessary condition to ensure that the working environment is comfortable, safe, and equipped with the necessary tools and technologies that will facilitate the work of employees.

The findings of this study are generally consistent with the results of previous research on Generation Z motivation. As in studies by Bejtkovský (2016), Lewis (2022), and Csiszárik-Kocsír and Garia-Fodor (2018), financial remuneration, respect, and opportunities for career advancement were identified as the most significant motivational factors. This confirms that Generation Z places a high value on both material and developmental aspects of work. The emphasis on flexibility, autonomy, and self-development also aligns with findings by Bennett et al. (2012) and Sidorcuka and Chesnovicka (2017), who highlighted the importance of freedom and work-life balance for this generation.

However, certain results deviate from existing studies. The relatively low importance attached to corporate social responsibility and the frequency of staff meetings contrast with findings by Gabrielova and Buchko (2021) and Djafarova and Foots (2022), who highlighted a stronger orientation among Generation Z toward ethical and socially responsible employers. Similarly, the weaker impact of relationships with supervisors on motivation differs slightly from the conclusions drawn by Septiawan and Masrunik (2020). These discrepancies may stem from the young age of respondents and their limited professional experience, as younger employees tend to prioritise financial stability and career opportunities over relational and ethical aspects of work.

While most international studies (e.g., Bencsik et al., 2016; Csiszárik-Kocsír & Garia-Fodor, 2018) emphasise Generation Z's preference for flexibility, autonomy, and meaningful work over traditional financial motivators, our results suggest that financial remuneration remains the dominant motivator (mean = 3.81), even ahead of flexibility and meaningfulness. This finding indicates that in the Czech labour market, where many respondents are at the beginning of their careers, financial security and stability are still perceived as prerequisites for self-realisation. Similarly, our respondents valued permanent employment and job stability more than expected for this generation, which contrasts with studies suggesting their tendency towards short-term employment or frequent job changes (Sidorcuka & Chesnovicka, 2017; Gabrielova & Buchko, 2021).

Overall, the results were partly as expected and are consistent with the general motivational profile of Generation Z identified in international studies. At the

same time, they highlight the specific socio-economic conditions of young Czech employees, for whom financial stability and job security play a more prominent role than in most international contexts. This finding enriches the discussion on cross-cultural differences in motivational factors among Generation Z employees.

6. Conclusions

The questionnaire survey showed that Generation Z places the greatest emphasis on good financial remuneration, respect, and recognition as individuals and opportunities for career growth. These factors are key for them when evaluating the attractiveness of an employer. Gen Z prefers benefits that provide flexibility and financial rewards. He values paid sick days, extraordinary bonuses, and 13th salary the most. These benefits provide them not only financial stability but also flexibility and care for their health. Generation Z is most motivated to change jobs by higher financial rewards, job security, and meaningful work. Employers who want to retain their young talent should provide competitive salaries, a stable work environment, and offer meaningful work assignments. Correlations show that Generation Z places great emphasis on transparency, meaningful work, clear rules and consequences, corporate social responsibility, and interesting work content. A strategy for working with Generation Z should include these strongest correlations. In this way, managers can create a work environment that meets the needs and expectations of this generation, leading to higher employee satisfaction, motivation and loyalty.

The results of the factor analysis show that Generation Z emphasizes different aspects of working life and the work environment. This information will allow managers to better understand the needs and preferences of employees of each generation, which can lead to the creation of more effective and targeted leadership and human resource management strategies. Based on the identified motivation factors and preferences of Generation Z, employers' strategies should reflect the needs and expectations of this generation. Here are some key points that could be included in the strategy: improved internal communication and employee engagement, flexibility and autonomy at work, work-life balance, development opportunities, and career growth. Employers should support volunteer activities and involvement in social projects. The inclusion of these factors can lead to a better shaping of the work environment and benefits, which will contribute to the retention and motivation of Generation Z employees. The implementation of the recommended strategic areas can bring significant benefits not only to employees but also to the organizations themselves, which will be able to better utilize the potential of this young generation. Overall, this can lead to higher employee motivation, engagement, and loyalty, which in turn will positively affect the overall performance of the organization.

For Generation Z, which emphasizes digital literacy, social engagement, and meaningful work, a company's strategy should be designed to meet their specific needs and expectations. According to the research results, the company's strategy should include transparent communication and employee engagement, attractive financial rewards, and work-life balance, as well as support for personal and professional development. Providing stability and social security is also important, along with a high degree of work autonomy and recognition of quality work. This combination will contribute to the overall satisfaction, performance, and loyalty of Gen Z employees. This strategy should be regularly reviewed and adjusted based on feedback from Gen Z employees to ensure their continued satisfaction and engagement in the work environment.

The limits of the given article are the sample size (142 respondents) and the generalization of the results, the geographical limitation (only the Czech Republic), the use of only a questionnaire survey, and the limited number of variables (22 motivators). The selection of these variables was based on the literature review and previous research, but may not include all relevant aspects of Gen Z motivation. Other possible research directions could include conducting a more detailed analysis of generational differences in preferences for work environment and benefits, as well as an in-depth examination of the relationship between these factors and overall job performance and employee satisfaction. In addition, it would be interesting to investigate what strategies and initiatives employers can use to effectively engage and motivate employees of different generations, which could bring further insights into the field of human resource management and organizational behaviour. Future research should involve a larger and more diverse sample and combine quantitative and qualitative methods to yield more robust and contextually relevant results. It could also be extended to include the Visegrad Group (V4) countries, offering a broader Central European perspective and a more comprehensive understanding of generational motivation across different socio-economic and cultural settings. Although this paper provides valuable insights into the motivation of Generation Z, its findings should be interpreted with caution due to their limited generalisability. The conclusions reflect the specific cultural and economic context of the Czech Republic and may not be directly transferable to other national or organisational environments. Consequently, the results should be regarded as indicative rather than universally applicable, and further cross-cultural research is needed to confirm their wider validity.

Acknowledgment

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Motivacija za rad generacije Z u Republici Češkoj

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Sažetak

Organizacijski menadžeri suočavaju se s posebnim izazovima vezano za rad različitih generacija unutar radne organizacije, od kojih svaka posjeduje specifične vrijednosti, motivacije, vještine i komunikacijske stilove. Trenutno, generacija Z, najmlađa među njima, ulazi na tržište rada. U ovom radu procjenjuje se motivacija za rad generacije Z koristeći podatke dobivene anketnim istraživanjem. Uzorak se sastoji od 142 predstavnika ove generacije, u dobi od 18 do 25 godina. Podaci su analizirani primjenom faktorske analize kojom se identificiralo šest ključnih motivacijskih čimbenika za zaposlenike generacije Z. Ti čimbenici su: interna komunikacija i angažman na poslu; kontrola i evaluacija rada; naknada i dobrobit; motivacija za rad i osobni razvoj; stabilnost na radu i socijalna sigurnost; te autonomija i podrška na radu. Rezultati pokazuju da Generaciju Z prvenstveno motiviraju dobra financijska naknada, poštovanje i priznanje, jasne mogućnosti za napredovanje u karijeri te pogodnosti koje pružaju fleksibilnost i stabilnost. Razumijevanje osobina i preferencija generacije Z može pomoći menadžerima da stvore produktivnije radno okruženje povećavajući time njihovo zadovoljstvo i učinkovitost na radu.

Ključne riječi: *menadžment, generacija Z, motivacija, strategije ljudskih resursa, komunikacije, Republika Češka*

JEL klasifikacija: *M12, J81*

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Relationships Between the Beneish M-Score and Bankruptcy Models: Insights from Financial Models in Czech Manufacturing Firms[*]

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Abstract

Many well-known cases worldwide demonstrate that even if companies appear financially strong, their actual accounting reality may differ. Uncovering fraudulent behaviour is difficult, so auditors, financial authorities, stock exchanges, etc., must detect and eliminate it. This paper aims to determine the relationship between the Beneish M-score model and two bankruptcy models, Altman's Z-score and the Czech IN05 model. It verifies if there are significant differences in how these models classify firms, and whether the Beneish model aligns with them. The application part focuses on the 3,568 firms from the Czech manufacturing industry between 2015 and 2022, and uses the Bowker test for symmetry, working with paired data. The Beneish model showed that 34% of enterprises are at risk of fraud. The results of the analyses further confirmed the existence of systematic and statistically significant differences between the classifications of companies according to the Beneish model and the bankruptcy models Alman Z-Score and IN05. Therefore, if companies tend to go bankrupt, it is not possible to determine

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whether they will tend to manipulate statements or not. Similarly, a tendency to manipulate financial statements cannot be demonstrated in companies with good financial health.

1. Introduction

The definition of fraudulent financial reporting is more or less uniform. The International Standards on Auditing describe fraud as an intentional act committed by one or more members of management, persons charged with the governance of an entity, or by one or more employees or third parties, in which deception is used to obtain an unfair or unlawful advantage.

Fraudulent financial reporting involves intentional misstatements, including the failure to disclose amounts or figures that should have been disclosed in the financial statements with the aim of misleading users of the financial statements. It may be caused by management's efforts to manipulate profits to affect their perception of the entity's performance and profitability. Such manipulation of profits can begin with minor measures or inappropriate adjustments to assumptions and changes in management's judgments. Pressures and motives can lead to such a number of interventions increasing to such an extent that fraudulent financial reporting arises. Such a situation may arise where, due to pressure to meet market demands or to maximise its remuneration based on performance, management deliberately takes positions that lead to fraudulent financial reporting caused by material misstatements in the financial statements. In some entities, management may be incentivized to significantly reduce (material) profits to minimize tax liability or increase profits to secure financing from the bank.

The study applies the Beneish M-score, a metric that employs financial variables to discern instances of profit manipulation by companies, in conjunction with the bankruptcy models of Altman Z-score and the Czech model IN 05.

2. Literature review

According to International Auditing and Assurance Standards Board (IAASB, n.d.), fraudulent financial reporting is, for example, the manipulation of accounting records or documents based on which the financial statements were prepared, the incorrect presentation of events, transactions or material information in the financial statements, or the failure to disclose them, or the intentional misapplication of accounting principles relating to amounts, classification, presentation or method

of disclosure. In addition, Schilit (2002) also includes the misuse of accounting principles, the procedures used to measure, identify, report, and disclose business transactions in fraudulent financial reporting. According to Zhou and Kapoor (2011), fraudulent financial reporting has unfortunately become a common economic and social problem with a rapidly growing negative impact not only on investors, but also on the stability of domestic and global economies.

The meaning of the term *fraud* can vary depending on the situation and the person defining it. One main fact emerges from the diverse definitions of fraud, namely that, despite the obvious differences in the concept of fraud, fraud remains an act that is usually committed against a company or a person, by an individual or a group of individuals, for personal benefit or the benefit of their organization (Owusu et al., 2022). Wells (2013) divides fraudulent financial reporting into two subcategories, namely financial fraud and non-financial fraud, where the subcategory of financial fraud further includes overvaluation of assets or income in the form of accruals, fictitious income, concealment of liabilities and expenses, misdisclosure and mispricing of assets, and undervaluation of assets or income. Singleton and Singleton (2010) add that the most common type of fraud in financial statements is associated with the overestimation of revenues, where, in some cases, companies simply fabricate sales. Non-financial fraud is most often carried out through internal and external documents.

To prevent fraudulent conduct, it is essential to have an ethical corporate culture based on strong values, with management setting an example for employees through their own conduct. However, according to the results of the Brennan and McGrath (2007) investigation, in 71% of the cases examined, the CEO or chairman of the board was responsible for fraud. For this reason, the prevention of financial statement fraud must start at the top management level, according to the authors. The fact is also confirmed by Kasztelnik and Jermakowicz (2024), who state that the main perpetrators are CFOs and CEOs who aim to overestimate financial profitability and hide the actual theft.

Manipulation of financial statements, often associated with creative accounting, is a complex issue addressed in many professional articles. The topic of creative accounting has been monitored since the second half of the last century. Still, the boom of creative accounting is attributed to the period before the global financial crisis in 2007 (Savova, 2021). Creative accounting is generally perceived from a negative point of view, as the manipulation of financial statements to mislead the users of those statements, as reported by Murineanu (2024), Khaneja and Bhargava (2016), Khatri (2015), or Akpanuko and Umoren (2018). However, Strakova and Zvarikova (2021) concluded that creative accounting can also help in certain situations, such as avoiding bankruptcy by misleading users of financial statements. Iredele et al. (2022) also see a favourable aspect in creative accounting, namely that a company using creative accounting becomes more competitive in its operating

market. However, different geographies perceive creative accounting differently (Jones, 2021). It may be difficult, and sometimes impossible, for the parties involved to discern the reality and effect of accounting manipulation of financial statements, either due to insufficient knowledge and skills or an unwillingness to engage in detailed analysis. This assertion is supported by the findings of Brennan and McGrath (2007). The authors contend that identifying financial statement manipulation is challenging due to the numerous methods by which it can be executed.

The detection and manipulation of financial statements are complex processes involving various methods and models. These methods are tested on real cases, including modified accounting records to simulate creative accounting techniques or fraudulent behaviour (Kouřilová et al., 2018). The methods are often combined to increase efficiency in detecting manipulations in financial statements (Bína et al., 2023; Denich, 2021; Drábková, 2016; Durana et al., 2022; Blazek et al., 2020).

Detection of manipulation of financial statements is most often carried out using publicly available data from companies' financial statements, additionally, also through non-financial information from public sources using several tools, such as the use of analytical software, or mathematical and statistical methods in financial statements (Gee, 2014), or machine learning methods (Bolton & Hand, 2002). Detection models related to the detection of manipulation of financial information presented in financial statements are described by Yurt and Ergun (2015), Strakova (2020), and Bartov et al. (2000). Most of the detection models that make up the theory of accounting quality and earnings management focus on centre on accruals because accruals are easier to manage compared to earnings and cash flow (Yurt & Ergun, 2015; Strakova, 2020).

Techniques, goals, and motivations of creative accounting in the Czech Republic were investigated by, e.g., Honková and Myšková (2024). The results indicate that the predominant techniques employed are open accounting for additional sales, deferral of deliveries, recognition of revenues from partial deliveries, and a change in the value of inventories.

Common goals and motivations included reducing earnings volatility, supporting stock prices, increasing revenue or cash flow, and creating a consensus forecast for analysts' earnings.

Manipulative interference with the financial statements affects the financial health of the undertakings concerned to the benefit of the manipulator. In the standard evaluation of corporate financial health, there is a concerted effort to minimise subjectivity in selecting key indicators and their relative importance. In this context, specialised creditworthiness and bankruptcy models are employed. From this standpoint, it can be argued that creditworthiness and bankruptcy models

created by financial analysts on real data of specific companies in specific countries and times are more objective. It is posited that the models created can be used to predict whether the company is generating profit or whether it is on the verge of bankruptcy.

The first multivariate bankruptcy prediction model was developed by Altman in the late 1960s. The original Altman Z-Score model (based on Multiple Discriminant Analysis) has attracted the scientific community's attention since its inception. Its response to it has been to create countless competing models (Altman, 1968). Since then, Prof. Altman and his team have been intensively refining the original model through many modifications; for example, the ZETA® (Altman et al., 1977) or model utilized the non-financial indicators (Altman et al., 2016). Further, a great number of studies have focused on adapting or adjusting these models to the conditions and environment of the national economy. In addition to modifying the existing models, new models have been created. The first application of prediction models to the Czech environment was made by Neumaierová and Neumaier (2005), who determined four trustworthiness indices, i.e., IN95, IN99, IN01, and IN05.

3. Methodology and data

The paper aims to examine the interrelationship between the detection model of financial reporting manipulation and the evaluation of companies using bankruptcy models. The Albertina database, provided by Dun and Bradstreet (n.d.), was used for the selected analysis. In the time period 2015 to 2022, a field according to the NACE classification – section C, the manufacturing industry was chosen. This section includes the mechanical, physical, or chemical transformation of materials or components into new products (goods). The production process results in either finished products intended for use or consumption or semi-finished products intended for further processing (Český statistický úřad, n.d.). Financial statements were obtained from a stable sample of 3,568 enterprises (i.e., 24,976 records for the selected period). The theoretical basis consists of scientific publications and other sources listed in the list of sources.

The Beneish M-score was chosen as the selected model for detecting manipulation of financial reporting. It uses a set of financial variables to identify whether a company has manipulated its profits. The model was developed based on the assumption that there is a correlation between specific financial values and cases of financial fraud. This makes it possible to identify companies that engage in profit management practices. The initial model included five variables and was designed to evaluate the likelihood of profit manipulation between companies with a large discretionary temporal resolution (Beneish, 1997). Concerning the structure of the financial statements of Czech companies, where the type breakdown of the profit

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and loss account is primarily reported, the evaluation was carried out using a model with 5 indicators.

$$M\text{-}score = -6.065 + 0.823 \times DSRI + 0.906 \times GMI + \\ + 0.593 \times AQI + 0.717 \times SGI + 0.107 \times DEPI \tag{1}$$

where:

DSRI = days' sales in receivables index; GMI = gross margin index; AQI = asset quality index; SGI = sales growth index; DEPI = depreciation index.

The M-score threshold is -2.22. If the calculated M-score for a given company is lower than the stated limit value, it is unlikely that the company would be a manipulator of accounting data. Otherwise, if the calculated M-score is higher than the stated limit value, the company is likely engaged in purposeful manipulations in its financial statements.

Regarding the bankruptcy models under consideration, the Z-score model (1983 edition) has been selected for its established global recognition and utilisation in academic and professional contexts. Altman (1983) established cut-off points for the interpretation of this variant of the Z'score, which categorizes companies into three risk zones: the safe zone (Z'-score > 2.7), the grey zone (1.2 < the Z'-score < 2.7) and the distress zone (Z'-score < 1.2), in which companies with a Z-score of less than 1.2 are considered to be in financial distress and have a high probability of bankruptcy within the next two years.

IN 05 was chosen as a model presenting typical conditions for the Czech Republic (Neumaierová & Neumaier, 2005):

$$IN05 = 0.13 \times x_1 + 0.04 \times x_2 + 3.97 \times x_3 + 0.21 \times x_4 + 0.015 \times x_5 \tag{2}$$

where:

x_1 = assets / liabilities; x_2 = EBIT = interests; x_3 = EBIT / assets; x_4 = revenue / asset; x_5 = current assets / short-term liabilities and maximum value of variable x_2 is 9.

If the resulting value of the IN 05 index is higher than 1.6, then the company creates value, and if it is lower than 0.9, the company does not create value but destroys it. A grey zone is defined between the limit values. This model is presented with a full calculation methodology due to its specificity in the conditions of the Czech Republic. Companies that either create value or are loss-making were selected for the analysis. Companies classified in the *grey zone* were excluded from further analysis.

Numerous global cases have shown that even when companies appear financially strong; their accounting reality can be significantly different. This discrepancy is at the core of the conflict between owners and managers (Wells, 2013), which is

described in detail in the Agency Theory[1]. Within this theory, managers exhibit a strong motivation to manipulate financial statements in order to meet targets set in bonus plans, secure additional financing, or prevent a decline in the company's market value. For this reason, our primary research question is the theoretical and empirical connection between earnings manipulation detection models (Beneish M-score) and bankruptcy prediction models (Altman Z-score and IN 05), aiming to increase the predictive power and complexity of financial analysis.

For statistical testing, the following null hypotheses have been formulated:

• H01: The classification of enterprises according to the IN05 and Altman Z-score models is symmetrical, i.e., there are no systematic differences between the models in categorizing the companies.

• H02: The classification of enterprises according to the Beneish model and the IN05 model is symmetrical, i.e., there are no systematic differences in results between these models.

• H03: The classification of companies according to the Beneish model and the Altman model is symmetrical, i.e., there are no systematic inconsistencies in the classification of corporate risk.

The rejection of any of the hypotheses mentioned above will be interpreted as evidence of the existence of a systematic difference between the classifications of the respective models. For statistical comparison, the hypotheses were adapted according to a more detailed specification of the set of enterprises, based on the key indicators: turnover, total assets, and debt percentage. Each indicator was then divided into four quartiles, thus enabling the consideration of companies' varying size and risk profiles in the multidimensional analysis.

Table 1: Descriptive statistics on variables used for classification

Variable	Average	Minimum	Maximum	Standard deviation
Assets (in ths. CZK)	501 971,76	3	82 486 364	2 095 505,86
Turnover (in ths. CZK)	660 192,21	0	167 734 155	3 217 301,26
Debt (%)	0,54	-15,98	558,99	3,78

Source: Author's calculations based on Albertina database (2015-2022)

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[1] The basic idea comes from Smith's (1776) An inquiry into the nature and causes of the wealth of nations. W. Strahan and T. Cadell.

The Bowker symmetry test was selected to test the hypotheses, which is an extension of the McNemar test for paired data with more than two categories (Bowker, 1948). The test is suitable for paired categorical variables with the same set of values. It examines whether the transitions between categories in both models are symmetrical, i.e., whether the models do not systematically differ in how they are classified. In this study, the objective was to ascertain the existence of any potential interdependence between the outcomes of one model and those of another.

A chi-square test of independence was performed in addition to the Bowker test to compare the results of the Altman Z-score and IN05 models, which have the same category structure. This makes it possible to verify whether there is a statistically significant relationship between the classifications of farms according to these two models. At the same time, Cramer's V was calculated to evaluate the strength of this dependence. All calculations were performed in RStudio.

4. Results and discussion

When applying the standard M-score threshold (-2.22) to the studied sample of Czech companies, the model identified 34% of the monitored companies as likely financial reporting manipulators (i.e., companies with a high risk of fraud). The remaining 66% of the monitored companies were not identified by the model as suspected of manipulation and therefore fell into a low risk of fraud.

For a more detailed analysis of the relationship between the probability of accounting manipulation and the structural characteristics of firms, the firms were divided into quartiles according to the amount of debt, assets and turnover (quartile 1 depicts 25% of firms with the lowest values, quartile 4 depicts 25% of firms with the highest values). In each category, the frequency of observations classified as probable manipulators and unlikely manipulators according to the Beneish M-score was recorded. This situation is shown in Table 2.

Table 2: Categorization of M-score by company size

Quartile	Probability of manipulation		Probability of manipulation		Probability of manipulation	
	NO	YES	NO	YES	NO	YES
	Indebtedness		Assets		Turnover	
1	4 096 (66 %)	2 138 (34 %)	2 183 (35 %)	4 051 (65 %)	2 082 (33 %)	4 152 (67 %)
2	4 555 (73 %)	1 679 (27 %)	4 226 (68 %)	2 008 (32 %)	4 307 (69 %)	1 927 (31 %)
3	4 365 (70 %)	1 870 (30 %)	4 922 (79 %)	1 313 (21 %)	4 916 (79 %)	1 319 (21 %)
4	3 482 (56 %)	2 752 (44 %)	5 167 (83 %)	1 067 (17 %)	5 193 (83 %)	1 041 (17 %)

Source: Author's calculations based on Albertina database (2015-2022)

A 5-parameter model was used for the evaluation. Czech accounting standards primarily allow for the reporting of costs and revenues in the income statement according to type. Alternative purpose-based reporting is permitted. However, this approach requires internal classification of costs based on management accounting, which is then transferred to financial accounting for reporting purposes. This is reflected here in the SGAI indicator, which captures administrative costs. The current state of purpose-based reporting is, therefore, voluntary and is practiced by companies only in very exceptional cases. It can only be found in large companies that report according to IFRS. It is mandatory only for companies listed on public markets. A similar topic was also addressed by Dimitrijević and Danilović (2017), for example. The disparities in outcomes between the 5-parameter and 8-parameter models are addressed in the research by Durana et al. (2022) or Srebro et al. (2021). In this study, Durana's findings are evaluated concerning alternate perspectives, as outlined in the works of Wiszniowski (2020) and Timofte et al. (2021). The choice of a suitable model depends on several factors, such as time series, number of companies, sectors, but also the propensity of the environment to tax evasion.

Companies with the highest indebtedness are more likely to have accounting manipulation, though this is also true of companies with lower indebtedness. This could be due to management pressure on highly indebted companies to report better results, while low-debt companies might do better to obtain more bank loans. In companies classified by assets and turnover, the probability of accounting manipulation decreases with increasing size.

Although there are a number of models suitable for identifying creative accounting, the Beneish model is one of the most widely used worldwide. Its effectiveness is confirmed by a study by Shakouri et al. (2021), according to which it achieved a success rate of up to 73% in detecting fraudulent behaviour. The calculations performed in the study by Srebro et al. (2021) only exceptionally exceed the 40% threshold for the possibility of fraud. Švábová et al. (2020) adjusted the Beneish M-score and created their model for detecting fraudulent behaviour, with a success rate of 32.7% for identifying manipulative behaviour, while that of non-manipulative behaviour was 38.4%.

Consistent with the abovementioned papers, Bína et al. (2023) indicate a higher risk of using creative accounting methods for credit-burdened enterprises. The study, which relies on the outputs of the prevailing model, identifies that the manipulation of financial statements is predominantly observed in farms facing bank credit constraints. This group of enterprises may also be more inclined to engage in creative accounting practices. Concerning the tested bankruptcy models, they state that the IN05 and Z-score models primarily concern themselves with liquidity, debt, and profitability ratios. Enterprises with a high proportion of assets that are also indebted do not perform well in terms of liquidity and at the same time only achieve a low return on assets, which worsens the enterprise's overall performance.

4.1. Comparison of models for assessing financial health: Altman Z-Score and IN05

The course of the financial health of the analysed companies within the monitored period is shown in Figure 1. The individual boxes show the results achieved by the IN05 model and Altman Z-Score in the individual monitored years. The graph clearly shows differences in the values achieved, where IN 05 achieves larger ranges between the maximum and minimum values, while Z-Score is more consistent. When evaluating the mean values (in our case, it is the median), IN 05 shows more balanced results. In the Z-Score, it is possible to identify higher median values achieved in 2015 and 2016, corresponding to a higher proportion of enterprises classified as financially healthy. Overall, the most balanced values of bankruptcy models were reported in 2020, identically for both models used.

Figure 1: Financial health according to Altman Z-score and IN05
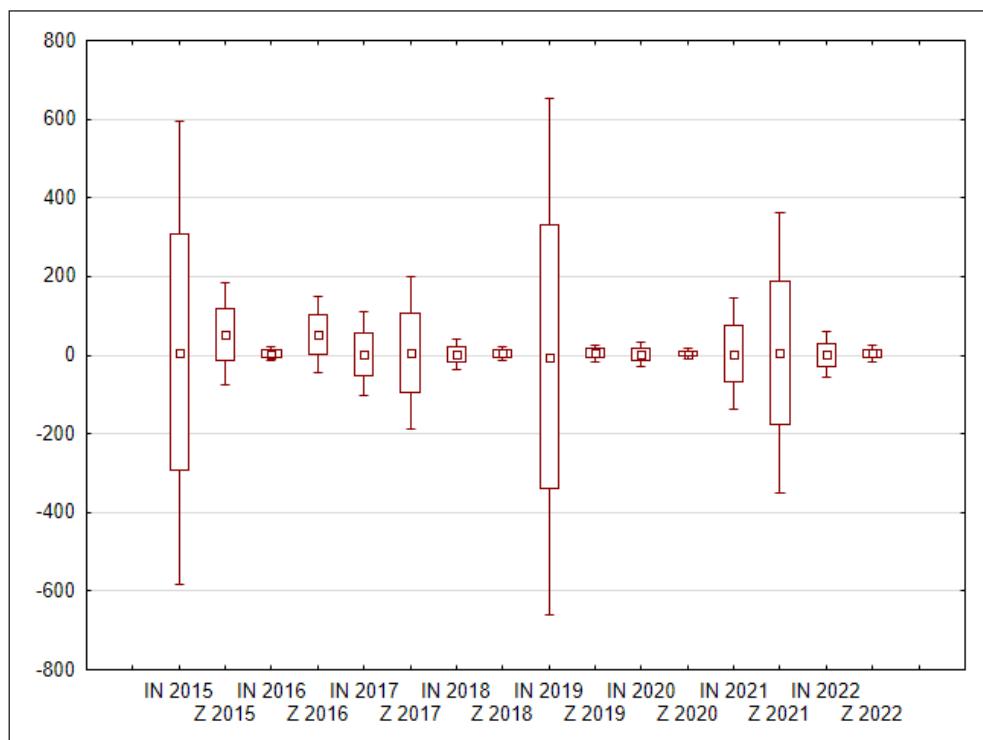
Source: Author's calculations based on Albertina database (2015-2022)

Furthermore, it was tested whether the classification of models according to Altman and IN05 is symmetrical, i.e., there are no systematic differences between these two models in classifying enterprises into individual categories. For a better overview, the division of companies in our group into individual categories is shown in Table 3.

Table 3: Categorization of companies according to Altman Z-score and IN05

Classification	Altman Z-Score		IN05	
Tendency to bankruptcy	1 621	6.5%	5 405	21.7%
No tendency to bankruptcy	16 475	66.1%	11 923	47.8%
Grey Zone	6 841	27.4%	7 609	30.5%
On the whole	24 937	100%	24 937	100%

Source: Own calculations based on Albertina database (2015-2022)

The chi-square of the independence test was used to determine the degree of agreement between the classifications of enterprises according to Altman Z-score and the Czech IN05 model. This test evaluated the data as a whole, comparing the aggregate values of individual classifications. A chi-square independence test was used to determine the agreement between enterprise classifications according to Altman Z-score and the Czech IN05 model. This test evaluated data as a whole, comparing the aggregate values of individual classifications. The results (test statistics (χ^2): 2808.42, degree of freedom [df]: 2, p-value: <0.001) rejected the hypothesis of no systematic differences between classifications, proving a connection between the IN05 model and Altman Z-score. Cramer's coefficient V = 0.237 indicates the relationship's weak to medium strength, showing models are not interchangeable.

The relationship between the IN05 and Altman Z-score models was also analysed through paired comparison. The results of the Bowker symmetry test (χ^2 test statistics = 784.907; degrees of freedom = 2; p-value < 0.001) led to the rejection of the H01 null hypothesis. This result points to statistically significant and systematic differences between the classifications of enterprises according to both models.

Both models operate within the ratio analysis framework, utilising sales and EBIT to total assets as key performance indicators. However, a distinguishing aspect of each model lies in the distinct variables employed to calculate liquidity and indebtedness. Another factor to consider is the width of the grey zone interval, while for the IN05 model, this interval is more than half as narrow. It is also necessary to consider the conditions under which the model was created. IN05 is directly applicable to the Czech economic and accounting requirements. Consequently, the result of this model should be accorded greater weight than Altman Z-score, which is a foreign product (Bína et al., 2023).

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4.2. Comparison of the Beneish model and IN05

An overview of the distribution of companies into individual categories was created in Table 4 to test another hypothesis. This hypothesis examined whether there are differences between the Beneish model and IN05.

Table 4: Categorization of companies according to IN05 and Beneish

Classification	Unlikely manipulation	Probable manipulation
Tendency to bankruptcy	2 044 (12%)	3 361 (19%)
No tendency to bankruptcy	4 097 (24%)	7 826 (45%)

Source: Author's calculations, Albertina database (2015-2022)

Based on the performed Bowker symmetry test for all enterprises (without their classification) according to the Beneish model and the IN05 model, excluding the grey zone, the following results were obtained: $X^2 = 72.63$, df = 1, $p < 0.001$. The p-value obtained is significantly lower than the commonly used significance levels, which means the H2 null hypothesis is rejected. This result suggests the existence of statistically significant and systematic differences between the classifications of enterprises according to the Beneish model and the IN05 model. Therefore, if companies tend to go bankrupt (31% of companies), it is impossible to determine whether they will tend to manipulate statements. Similarly, a tendency to manipulate financial statements cannot be demonstrated in companies with good financial health (69%).

Using all three selected classifications (i.e., assets, turnover, indebtedness), the resulting values were identical to the analysis of the unsorted set. Only the results for companies in the second quartile by turnover appeared to be interesting. It was revealed that the models do not show systematic differences in results (at a significance level of 1%). The resulting values in this case were: $X^2 = 5.69$, df = 1, $p = 0.017$.

4.3. Comparison of the Beneish model and Altman Z-score

The next step investigated whether there are systematic differences between the Beneish model and the Altman model. The results (test statistics $X^2 = 3,549.00$, df = 1, $p < 0.001$) rejected the null H3 hypothesis in favour of the alternative, i.e., that there are statistically significant and systematic differences between the classifications of enterprises according to the Beneish model and the Altman model. There are, therefore, consistent discrepancies in the classification of enterprises into risk categories. The division of companies into individual categories is shown in Table 5.

Table 5: Categorization of companies according to Altman Z-score and Beneish

Classification	Unlikely manipulation	Probable manipulation
Tendency to bankruptcy	834 (5%)	787 (4%)
No tendency to bankruptcy	5 509 (30%)	10 966 (61%)

Source: Author's calculations based on Albertina database (2015-2022)

The rejection of the H3 hypothesis suggests the presence of consistent discrepancies between the Beneish model and Altman Z-score model in classifying enterprises into risk categories. Consequently, it is not feasible to ascertain, based on financial health, whether a company will have a propensity to manipulate financial statements. Following the findings of this study, Agustia et al. (2020) suggest that there is an absence of a relationship between bankruptcy risk and profit-management behaviour when firms implement one of two business strategies involving cost management differentiation, thereby mitigating the risk of bankruptcy. However, it should be noted that the risk of bankruptcy is subject to change throughout a company's lifecycle (Khanh & Thu, 2019), and the manipulation of profits can be more significant during the initiation and decline phase (Hussain et al., 2020). In contrast, a study conducted in the V4 countries demonstrates that profit manipulation is prevalent in companies experiencing financial distress and in the grey zone (as defined by Altman Z score), where the financial future of a company is impossible to predict (Valášková et al., 2021).

The present study did not identify any correlation between companies experiencing financial distress and the presence of links. Valášková et al., 2021have stated that the Beneish M-score was combined with Altman Z-score in two models based on discrimination analysis. These models were applied to a sample of 11,105 business relationships, revealing significant relationships between these financial situations. It has been demonstrated that businesses confronted with financial challenges, or those operating within the so-called *grey zone*, tend to manipulate profit. Another similar analysis was conducted by Parikh (2024), who selected five Indian pharmaceutical companies as a sample. The results indicated minimal risk of financial manipulation in most companies, with one company showing sporadic high-risk years, which raises some concerns but does not significantly threaten its overall financial stability. In contrast, Rossi et al. (2020) found the opposite dependence. The findings from the case study indicate that financial instability is a predictor of bankruptcy. However, it is also a factor that hinders effective profit management.

5. Conclusion

The analysis of the detection of possible manipulation of financial statements was carried out in a sample of more than 3.5 thousand Czech industrial companies over

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a seven-year period. The Beneish model showed that the risk of fraud could be identified for 34% of the companies in the total set of enterprises. If the analysis was extended to include a more detailed classification of companies, then in terms of the amount of assets and turnover, the trend is such that the probability of manipulation with accounting data decreases with the company's increasing size. In the case of sorting by indebtedness, the companies with the highest indebtedness and the companies with the lowest indebtedness have the highest probability of manipulating accounting.

The Bowker symmetry test was used to evaluate the relationship between the Beneish model and the bankruptcy models (Altman Z-Score, IN05), which indicated the existence of statistically significant and systematic differences between the classifications of companies according to the Beneish model and the Altman Z-Score and IN05 models. Therefore, if companies tend to go bankrupt, it is impossible to determine whether they will tend to manipulate statements. Similarly, a tendency to manipulate financial statements cannot be demonstrated in companies with good financial health. Therefore, it is not possible to determine on the basis of financial health whether the company will tend to manipulate financial statements. The rejection of the hypotheses indicates consistent discrepancies between the IN05 and Altman Z-score models in classifying enterprises into risk categories. This discrepancy may be due to the different constructions and orientations of the two models – IN05 is a model developed for the Czech business environment, which emphasizes specific financial indicators relevant to the local market; The Altman Z-score is an internationally recognized model that uses a combination of several financial ratios to predict bankruptcy, but may have limited accuracy when applied to different economies or industries.

The present research adopts an innovative approach to examining the interrelationships between models. This approach facilitates the evaluation of agreement or the incompatibility of classifications at the individual companies' level. This is in contrast to other research based on data aggregations, which can create biases. The methodology employed in this study is the Bowker test, which functions with paired data, i.e., classifications of a specific company according to different models, while each unit is analysed separately in all periods.

The main limitation of our study is the use of the five-parameter Beneish model rather than the more comprehensive eight-parameter version. This choice was necessary to ensure the robustness and representativeness of the sample, as it allowed us to analyse a set of more than 3,500 companies, most of which are not publicly listed – an analysis that would not have been feasible using the eight-parameter model. Importantly, prior research has shown that the five-parameter model exhibits similar trends comparable to the eight-parameter model (see, e.g., Srebro et al., 2021; Durana et al., 2022). We also recognize that Beneish's model was originally developed within the US GAAP accounting environment.

Nevertheless, several previous studies have successfully applied it in other accounting systems, including the European environment. Although differences between US GAAP and Czech accounting regulations may affect the absolute values of individual indicators, they are unlikely to affect their mutual relationships, which are central to the objectives of this analysis.

One of the main directions for further research would be an international or cross-sector comparison of the results obtained using Beneish's model. Such a comparison would make it possible to assess the extent to which the model's informative value differs in different accounting, institutional, and sectoral conditions.

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Odnosi između Beneishovog M-rezultata i modela bankrota: Primjeri financijskih modela u češkim proizvodnim poduzećima

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Sažetak

Mnogo je poznatih slučajeva diljem svijeta koji pokazuju da čak i tvrtke koje izgledaju financijski jake, njihova računovodstvena stvarnost može biti drugačija. Teško je otkriti manipulativno ponašanje, pa ga revizori, financijske vlasti, burze itd. moraju detektirati i eliminirati. Ovaj rad ima za cilj utvrditi odnos između Beneishovog M-rezultata i dvaju modela stečaja, Altmanovog Z-rezultata i češkog IN05 modela. Provjerava se da li postoje značajne razlike u načinu na koji ovi modeli klasificiraju tvrtke i je li Beneishov model usklađen s njima. Aplikacijski dio fokusira se na 3568 tvrtki iz češke prerađivačke industrije između 2015. i 2022. godine te koristi Bowkerov test simetrije, radeći s uparenim podacima. Beneishev model pokazao je da je 34% poduzeća u riziku od prijevare. Rezultati analiza dodatno su potvrdili postojanje sustavnih i statistički značajnih razlika između klasifikacija tvrtki prema Beneishevom modelu i modelima stečaja Alman Z-Score i IN05. Stoga, ako tvrtke imaju tendenciju bankrota, nije moguće utvrditi hoće li biti sklone manipuliranju izvještajima ili ne. Slično tome, tendencija manipuliranja financijskim izvještajima ne može se pokazati u tvrtkama s dobrim financijskim zdravljem.

Ključne riječi: *kreativno računovodstvo, Beneishev model, Altmanov model, IN model, industrijska poduzeća.*

JEL klasifikacija: *G33, M41, M42*

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"The eyes are the windows to the brain": pupillometry and eye fixation patterns in smartphone product communications[*]

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Abstract

Monitoring eye movement has been proven crucial for understanding consumer behaviour, and pupillometry can indicate whether the stimuli cause much confusion in the brain. This research examined the impact that smartphone promotional messages have on the brain's cognitive demands and analysed the visual attention that those received. In the realm of neuromarketing, this study explored the smartphone industry and its advertising impact on Greek consumers, as well as its effect on their mental workload levels measured through pupil dilation. An eye tracking device with a comparative questionnaire were used to investigate these topics, with their results from a final sample of 31 people (17 female and 14 male) agreeing with a large body of the pre-existing literature, which suggests that, although men and women might have slightly different approaches to this product category, they mostly have similar biometric results. The stimuli included 10 images containing promotional content from five brands (Sony, Apple, Realme, Xiaomi, Samsung). After the detailed analysis of the eye

tracking results that included fixation and pupil metrics and their comparison with the correlated literature, the study concluded that the appearance of the smartphone is the element that attracts the customers' visual attention the most and that the tested material generally did not demand considerably high amounts of mental workload to be processed. Ultimately, it highlighted the importance of implementing a combination of implicit and explicit research methods to gain a comprehensive understanding of the impact of product advertising on visual attention and mental effort, having additional academic and practical implications.

1. Introduction

To provide a comprehensive foundation for the study, this introductory chapter outlines the broader context in which the research is situated and clarifies the key industry dynamics and methodological considerations that shape the analysis presented in the subsequent sections.

1.1. Smartphone industry and challenges

In Greece, there are more than 14 million mobile connections (corresponding to 135% of its population) (Kemp, 2021), but there are no known studies that have investigated consumer behaviour in the smartphone industry using neuromarketing methods. Within this extremely competitive field, companies are investing significant amounts of money in promotion to gain an advantage over their competitors (Jae, 2011). Hence, there is certainly a necessity for more extensive investigation into consumer behaviour, and the advertising impact on their decision-making using implicit methods, as high-tech brands have to compete in a precarious market (Msaed et al., 2017; Yang & Gabrielsson, 2017). The key question in this study was how smartphone brands can gain knowledge about attention and their ads by using eye-tracking methods.

1.2. Eye-tracking method and research query

Based on the review of current literature, it appears that this is one of the first studies to attempt the testing of promotional messages and images coming from brands of the smartphone industry in the Greek market, by using an eye tracking device; that is to say that it attempted something similar to what Bang and Wojdynski (2016) examined in their research, where they tested the product category of coffee shops and their venture of marketing in form of online banner ads, in which they observed, and recorded with an eye tracker, customers' division of attention and their reactions to the tasks of personalised versus non personalised ads and of different demands of

mental effort. In more detail, for the needs of this paper five of the most powerful technological brands (i.e., Apple, Realme, Samsung, Sony and Xiaomi) and certain of their latest smartphone models were examined, to investigate a form of their commercial efforts, in terms of the interest they gained and of the participant's brain response with the levels of mental workload that those evoked.

The eye-tracking method is preferred over other neuromarketing tools due to device mobility and its ability to provide a wide range of accurate data about visual attention. After all, people's eyesight is what captures the vast majority of the information coming from their surroundings and the extraneous sources (Hahn et al., 2016). Adding to that, another important reason is that it can profoundly detect biometric data that were completely inaccessible with traditional marketing (Mansor & Mohd Isa, 2018), especially about pupil dilation (a metric generally known as pupillometry) which is corroborated to be a reliable indicator of people's magnitude of mental efforts and of their implicit cognitive procedures (Diede & Bugg, 2017; Hahn et al., 2016; Sirois & Brisson, 2014).

In detail, the research query was divided into 4 different sub-questions as follows:

- RQ1: Do smartphone ads implicitly demand significant levels of mental effort provoking big amounts of cognitive load?

- RQ2: Which of the smartphone's elements are attracting important interest and attention?

- RQ3: Are there any differences in these results between men and women, and if yes, to what extent?

- RQ4: Do the implicit results of the eye tracker differ and/or contrast with the self-reported answers?

These four research questions were carefully developed to align with the study's overarching objectives: (1) to identify which ad elements most effectively attract attention among Generation Z consumers, and (2) to explore how smartphone advertisements engage cognitive resources through implicit neuromarketing metrics. By combining biometric data (eye-tracking and pupillometry) with self-reported responses, the study aims to provide a comprehensive understanding of both unconscious and conscious consumer reactions to smartphone advertising.

2. Literature review

Neuromarketing is an emerging field of research that combines experimental setups with neuroscientific methods in order to understand consumer behaviour, untangle their emotions and unconscious motivators of the decision-making (Özbeyaz, 2021;

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Nyoni & Bonga, 2017). The brain is connected with every vital function of the human body, and it is where any thought, emotion, feeling and attitude is generated, hence it is the main focus of neuromarketing and generally the most significant tool for uncovering and understanding the human behaviour (Davis et al., 2017).

More specifically, it is considered to be suitable for advertising or marketing research, as it provides unique biometric information and results (Rawnaque et al., 2020). Neuromarketing studies utilise tools and devices such as the functional magnetic resonance imaging (fMRI) a technique that measures brain activity by detecting changes in blood flow, the electroencephalography (EEG), the Magnetoencephalography (MeG), Galvanic Skin Response (GSR), eye-tracking devices and others to get real-time answers about the decision-making issues (Nyoni & Bonga, 2017). Its main purpose is not to replace the traditional marketing techniques (e.g., surveys), but to expand the knowledge of the consumers' buying decision with insights about their emotional and psychological state, using biometric data that traditionally were obscure under the self-reported answers (Aldayel et al., 2020; Hakim & Levy, 2018; Kumar et al., 2019; Tomkova et al., 2020; Venkatraman et al., 2015; Yadava et al., 2017); and thus Fortunato et al. (2014) claim that neuromarketing's significance is highlighted by its ability to fulfil that purpose to *fill the gaps left by traditional marketing research*.

2.1. Smartphone industry characteristics

In the smartphone industry, it is easy to assume that customers do not have to choose based solely on sensory preferences, such as taste or appearance, they must consider their needs more thoughtfully to find the most suitable high-tech product for themselves (Chen et al., 2016; Hie et al., 2017). As a result, brands are providing new smartphone models in a short period of time from each other, whilst they are trying to increase their market share in a very competitive marketplace (Wong et al., 2019). Consumers are attracted by specifications such as the speed of the processor, the camera's quality, or the battery's capacity (Rajasekaran et al., 2018), but in different regions and cultures, such factors that affect the brand-switching behaviour of smartphones users can vary in significance (Ling et al., 2018; Satriawan & Setiawan, 2020). Other researchers suggest that the appearance of the smartphone has a notable influence on creating customers' attitude towards it and on their overall satisfaction, but there are still some more complex motivators that form their buying decision (Kim et al., 2016; Wong et al., 2019). Accordingly, Yeh et al. (2016, p. 253) tried to uncover the factors that lead to brand loyalty for smartphone users and found that functional, emotional and social value are positively related with it, but Wong et al. (2019, p. 237) later supported that the functional value is less effective on preventing brand switching behaviours. Other papers claim that the convenience of use, the social communication and self-expression capabilities (including the device's look and its attractiveness) are features which can be very

significant for luring customers of high-tech products (Al-Kwifi, 2016; Lau et al., 2016; Lee et al., 2011).

Furthermore, the price of the smartphone is a determinant of the perceived quality and, thus, it is a decisive attribute of the customer's intention to buy (Bharat, 2021Satriawan & Setiawan, 2020; Zahid & Dastane, 2016). Simultaneously, the electronic word of mouth (eWOM) contributes significantly on the decision-making in favour of a smartphone purchase (Alrwashdeh et al., 2019). Contrariwise, there are studies that found eWOM to have no impact on the customer buying decision and then studies that although recognized eWOM as a positive contributor at the time of the purchase decision, they distinguished it from viral advertising which was considered to be much more important for enhancing the purchase intention (Sawaftah et al., 2020).

Consequently, with the continuous need for discovering and distinguishing the functions that really matter for the consumer (Kim, 2016), the question of how a marketing campaign can be effective and provoke the right emotions to the customer elicits (Baraybar-Fernández et al., 2017; Kun et al., 2017; Vallejo et al., 2019); whilst it is also known that companies spend great amounts of resources for promotion and advertisements (Golnar-Nik et al., 2019; Kumar et al., 2019; Yadava et al., 2017; Zahid & Dastane, 2016).

2.2. Research gaps and perceptual differences between males and females

Most of the existing literature about advertising in general is mainly based on the answers that customers give on self-reporting forms, in which they express their feelings and decisions in their own words; but eventually, many of their decisions are being taken unconsciously, and sometimes it is even difficult for them to understand and describe the exact emotion they are experiencing at any moment (Baraybar-Fernández et al., 2017). Thus, the smartphone market should be investigated in greater depth regarding advertising and its impact on the decision-making, in order to achieve and produce the best marketing mix possible (Zahid & Dastane, 2016).

Adding to that, at the present time there is still a general absence of understanding and reporting on the overall consumer behaviour as regards to the smartphone industry (Bharat, 2021), and notably most of the studies about it ignore the impact of advertising on their buying behaviour (Chine et al., 2019). For that reason, there have been some studies which call for further research about other reasons that could lead customers to switch their smartphones (Oh & Park, 2020), except from contributors such as convenience, brand name and social influence that can influence the customer's purchase intention (Golnar-Nik et al., 2019; Kaushal & Kumar, 2016).

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As regards the gender variable, according to Boscolo et al. (2020, p. 301), there have been many studies which have proven that between the two genders (males and females) there are variations both in the evaluation process of advertising and in the attitudes towards them. He et al. (2021, p. 1541) also highlighted that men and women show different preference in products and advertisements, which are often created separately from brands in order to address the needs of each gender respectively.

Duan et al. (2021, p. 5) did find some differences in the cognitive fluency between the two genders. Similarly, other studies mentioned variations between male and female results (Aymerich-Franch, 2014; Boscolo et al., 2020; Vecchiato et al., 2014), but at the same time there is need for more extensive research for advertising effects on the two genders (Aymerich-Franch, 2014; Baraybar-Fernández et al., 2017; Cartocci et al., 2016; Sawaftah et al., 2020;Stefko et al., 2021), especially with using and implementing neuromarketing approaches to capture their response to the marketing stimuli (Boscolo et al., 2020; Goodrich, 2014).

3. Methodology

This paper employed a methodology that transformed raw eye-tracking metrics into original interpretations, offering a fresh perspective on the field of studies about high-tech products and smartphone advertisements. This approach is sufficient to classify it as qualitative research (Sandelowski, 1995). With purposive sampling, it is expected that the selected sample will provide singular and plentiful individual information (Etikan et al., 2016). The nature of the study required participants with specific characteristics, and by using the number of subjects suggested in the literature, the results could be replicated and transferred to the typical population with similar traits (Gheondea-Eladi, 2014).

More specifically, smartphones are one of the most appealing high-tech products for the younger generations (Golnar-Nik et al., 2019), and especially for smartphone brands it is the Generation Z (people born from 1997 and after), which is associated with the use of social media since its born, that has an extreme importance as a consumer category (Mohammed, 2018). According to the academia, part of the Gen Z is considered to be people who were born after 1997, and who in fact are people very familiar with technology and social media usage, as they were born or grew inside a period of massive technological and web advancements (Cilliers, 2017; Prakash Yadav & Rai, 2017; Turner, 2015); thus, all the participants were adults born from 1997 to 2004.

A total of 35 participants voluntarily took part in the research, comprising 20 women and 15 men. However, due to corrupted data, only 31 recordings were used in the analysis. All 31 participants reported having normal or corrected-to-normal

vision, and they were all fluent in Greek. The group consisted of 17 females and 14 males, all aged between 18 and 25 years old.

3.1. Experimental setup and data processing

Before the experiment, each participant completed a standard 9-point calibration sequence using the Tobii Pro Studio software to ensure high spatial accuracy across the display area. During the main session, each stimulus was presented for 8 seconds, followed by a 2-second neutral gray screen to minimize carry-over effects between exposures. Participants were seated approximately 60–65 cm from the monitor, with the device operating at a 30 Hz sampling rate. The room lighting was kept constant to avoid external luminance effects on pupil diameter.

Raw gaze data were inspected and cleaned according to standard neuromarketing practice. Blinks and signal losses shorter than 100 milliseconds were interpolated, and any fixation lasting less than 80 milliseconds was removed. Approximately 4 % of the total data points were excluded due to blinks or calibration drift. Final metrics for analysis included Time to First Fixation (TTFF), Total Fixation Duration (TFD), Fixation Count (FC), and average pupil dilation per Area of Interest (AOI). These procedures ensured the reliability and replicability of the measurements across participants.

This study was conducted using eye-tracking technology (Tobii Pro X2-30). Participants viewed two online photos per brand, one with the actual device with hardware specifications, and one containing promotional messages. In total, the participants viewed 10 online photos each. Areas of Interest (AOIs) were selected for all 10 photos that included the smartphone model, technical specifications, customer reviews and promotional texts. The visuals were sourced directly from official promotional content and online listings of each smartphone brand. The first image for each brand showcased the product with a focus on its physical attributes—device shape, screen design, and hardware specifications—presented on a clean, neutral background. The second image for each brand was designed to simulate a promotional ad, including product-centred marketing phrases, logo placement, and design elements such as vibrant colours or stylized fonts. The content aimed to reflect realistic brand communication strategies found on social media, websites, or digital ads. All stimuli were static (non-animated) and presented in high resolution to maintain visual clarity and enable precise gaze tracking.

To clarify the theoretical foundations, we present a simplified conceptual model linking ad design, visual attention, and cognitive load (Figure 1). Based on the limited capacity model of motivated mediated message processing (Lang, 2000) and dual-process perspectives (Petty & Cacioppo, 2012), we propose that specific design aspects of an ad (e.g., layout balance, colour contrast, and imagery complexity) can determine the flow of visual attention. Attentional amplification, or

concentrated attention, in turn, modulates cognitive load, and, therefore the speed at which viewers process and retain message information. These relationships summarize the expected paths as represented in Figure 1 for the core variables investigated in this study.

Figure 1: Conceptual model of relationships between ad design, visual attention, and cognitive load
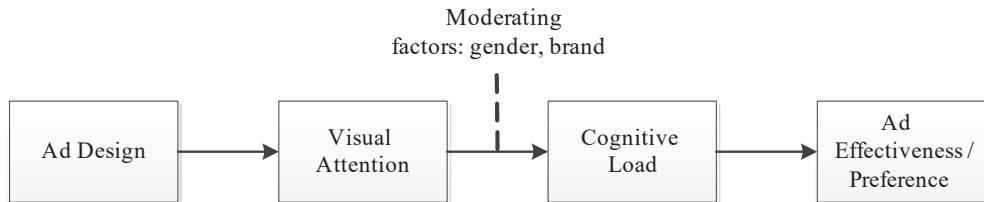
Source: Author's construction

3.2. Metrics and interpretation

The metrics analysed for each AOI were: time to first fixation (TTFF), meaning how fast participants fixated on an AOI (Bebko et al., 2014); total fixation duration (TFD), meaning how long participants fixated on a specific area (Tsai et al., 2012; Zhang & Yuan, 2018) combined with fixations count (FC) measuring how many times participants fixated on an AOI (Pfiffelmann et al., 2020); pupil dilation which measures changes in the size of the eye's pupil as it is widely accepted that the pupil of the eye dilates when a task demands more mental effort to be decoded (Alnaes et al., 2014;; Hosseini et al., 2017; Palinko & Kun, 2011). The five brands included in this study were: Apple, Samsung, Xiaomi, Sony and Realme. The brands were pretested to determine their level of popularity. All participants viewed the 10 photos in a randomized order. At the end of the test, they were asked for their explicit opinions about the stimuli, with the purpose of gaining comparative results between eye-tracking and the questionnaire.

4. Empirical data and analysis

This chapter presents the empirical findings derived from the eye-tracking and pupillometry measurements, together with the corresponding self-reported questionnaire responses. The following subsections systematically outline the results related to mental effort, visual attention, and cross-method comparisons, offering an integrated view of how participants processed and evaluated the smartphone advertisements.

4.1. Results of mental effort

When it comes to pupil dilation, all of the brands did a great job in making their promotional efforts understandable and somehow efficient without exaggerated and complex content. Participants' pupil dilation attested that they did not have to apply an increased amount of mental effort to decode and comprehend the stimuli (Table 1). It is noteworthy that there were no significant variations between male and female participants (Table 2), which somewhat contradicts previous, and stereotypical, evidence from similar studies about high-tech products (Kotzé et al., 2016).

Table 1: Overall results of pupil dilation

AOI	Mean of dilation times per participant	Occasions of pupil dilation
Specifications	1.323	41
Promotional texts	0.677	21

Source: Author's calculations

Table 2: Gender results on pupil dilation

Gender	Mean of dilation times per participant	Occasions of pupil dilation	Average % change
Female	1.029	35	2.426 %
Male	0.964	27	2.371 %

Source: Author's calculations

In fact, it is in agreement with the notion that over the last century the gender gap on the positivity of attitudes towards technology is becoming more and more marginally distinguishable (Cai et al., 2017).

4.2. Results of visual attention

The element that attracted significantly more attention, based on the TTFF (Table 3), TFD and FC (Table 4) metrics, was the appearance of the smartphone (the actual device). In this regard, the study refutes what Mao et al. (2020, p. 16) claimed in their article, where they supported that the smartphone's design has started decreasing in importance for the customer. As a matter of fact, it supports the allegations that the appearance is very important in the creating process of the customers' impressions and for their general psychological gratification (Kim, 2016; Wong et al., 2019).

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Table 3: AOI rank in terms of TTFF seconds

AOI	TTFF in seconds	Occasions that it was the first thing noticed
1. Model 1st display	2.712	56.744 %
2. Reviews	3.996	3.226 %
3. Specifications	4.256	40 %
4. Model 2nd display	4.924	21.963 %
5. Logos	7.615	4.516 %

Source: Author's calculations

Table 4: AOI rank in terms of TFD seconds and FC

AOI	TFD in seconds	Mean duration per participant in seconds	Fixations Count	Mean of total fixations per participant	Occasions with 0 fixations
1. Specifications	861.59	27.793	2,361	76	1.29 %
2. Models	425.064	13.712	1,663	54	11.29 %
3. Logos	97.974	3.161	366	12	37.419 %
4. Reviews	10.089	0.326	45	2	56.452 %

Source: Author's calculations

4.3. Eye-tracking results compared with questionnaire

Interestingly, eye tracking results on this specific point agreed with those of the questionnaire, where the appearance also received the highest score. This outcome was somewhat expected due to the prolonged exposure time that the photos had, allowing people to have enough time to process all information in the stimuli. If exposure was set to only a few seconds, implicit and explicit results would probably differ substantially.

A deeper analysis of self-reported answers revealed that there were important differences compared to eye tracking. More specifically, Realme came last by a large margin in visual focus according to self-reporting results, while it had the third best performance, very closely following the first two brands, in TFD (Table 5) and the second best in FC (Figure 2). Another significant discrepancy was about promotional messages' complexity, where Samsung was in first place and Apple was in last place in self-reporting, while the complete opposite positions were observed in eye tracking (Table 6).

Table 5: Brands' smartphones rank on the questionnaire and on eye tracking

Questionnaire Rank on Interest	Questionnaire Score on Interest	Eye-tracking Rank (TFD)	TFD in seconds
1. Apple	3.94	1. Apple	863.58
2. Samsung	3.58	2. Samsung	827.87
3. Xiaomi	3.58	3. Realme	822.83
4. Sony	2.74	4. Xiaomi	772.28
5. Realme	2.52	5. Sony	734

Source: Author's calculations

Figure 2: Fixation count of the 5 brands' smartphones
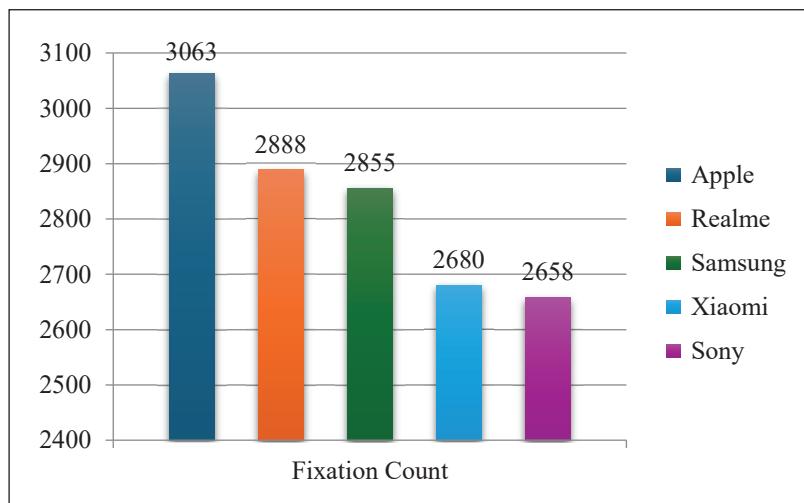
Source: Author's calculation

Table 6: Brands' smartphones ranking on questionnaire and eye tracking

Questionnaire Rank on the Complexity of the ads	Questionnaire Score on Complexity	Eye-tracking Rank	Participants with dilated pupils (at least once)
1. Samsung	3.26	1. Apple	13
2. Sony	3.23	2. Sony	12
3. Xiaomi	3.06	3. Realme Xiaomi	11
4. Realme	3.03		
5. Apple	2.84	4. Samsung	9

Source: Author's calculations

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The final remark of this comparison was the difference between male and female responses on the questionnaire, and their results were captured on the eye tracker. More distinctively, females reported a mean score of 2.89 about the complexity of the ads, while males reported a mean score 3.33. However, the results presented in Table 7 indicated the exact opposite, even by a very small margin.

Table 7: Gender results on pupil dilation

Gender	Mean of dilation times per participant	Occasions of pupil dilation	Average % change
Female	1.029	35	2.426 %
Male	0.964	27	2.371 %

Source: Author's calculations

Although this research used a relatively small sample to ensure the validity of the self-reported data, it is adequate enough for neuromarketing research and for the comparative section about self-reported versus biometric responses (Janić et al., 2022; Ćirović et al., 2022).

4.4. Supplementary comparisons across gender and brand groups

To ensure that the observed effects were not affected by demographic or brand-specific factors, exploratory comparisons were performed using the existing eye-tracking and pupillometry metrics. Descriptive checks across gender (male vs. female) and brand conditions revealed no notable differences in fixation or pupil-dilation measures. This suggests that the neurophysiological patterns observed in the study primarily reflect ad-design characteristics rather than participant demographics or brand familiarity.

5. Results and discussion

First of all, it was found that throughout the participants' interaction with the stimuli, the eye tracking device managed to detect dilated pupils for just about a few times per session. This practically implies that they did not have to put great amount of mental effort, in their attempt to decode and comprehend the promotional text of the smartphone and its characteristics. This evidence appears somewhat unanticipated, because previous research had definitely demonstrated that there are alterations in the consumer behaviour for familiar and unfamiliar brands, as regards to the attitudes towards the advertisement (Rhee & Jung, 2018), to the intensity of processing the analogous information (Martí-Parreño et al., 2017), and, finally,

to the brand itself under miscellaneous marketing channels (Junior Ladeira et al., 2022). The idea behind this observation was that Realme and Sony could be seen as unfamiliar brands for the Greek consumer, since their market share in Greece for 2021 had been below 10% cumulatively, and the others as familiar ones, inasmuch as they had conquered the majority of the Greek market (more than 60%) for the same timeline (Statcounter, 2022).

Furthermore, it can be concluded that the participants' brains, who are part of the Generation Z, did engage with the promotional messages from the smartphone brands, for the reason that for more than 80% the stimuli display did not evoke excessive amounts of cognitive load. In general, comprehensible advertising content lowers the demands of the customers' amounts of cognitive load that are disposable for such tasks, in a way that does not lead to their undesirable cognitive disengagement (Bang & Wojdynski, 2016; Jae, 2011; Wang & Duff, 2016). In its turn, customer's brain engagement with the ad is not just a simple proof of marketing's effectiveness, but it is actually one of its main purposes that can enhance brands' efforts to communicate their message to their audience (Wang, 2006), and thus to be able to allure their cognitive attention (Janić et al., 2022). Eventually, by having secured those, the brand with a better marketing communication is capable of inducing a greater feeling of connection to the customer with the product itself (Kim et al., 2017).

Finally, what this study uncovered for that specific matter, is equally useful for academics and practitioners. More accurately, it showed that the variable of brand familiarity might not be completely applicable to the smartphone industry and to young adults in Greece, regarding their unconscious brain and visual reactions towards their promotional messages. Simultaneously, it confirmed for managers that they were able to find the right balance on the difficulty and the amount of the information that they provided to the customer, acting as it was suggested for such high-tech brands in other regions (Msaed et al., 2017); whilst it filled some gaps left on the past in the smartphone consumer behavior, and extended the marketing analysis on this industry for the vital category of Gen Z audience (Aroean & Michaelidou, 2014; Mohammed, 2018).

Regarding the visual interest, the initial and most prominent finding was that the design of the smartphones was the element that attracted the participants' concentration for a very long period of time. Participants first noticed the smartphone model's design, faster than any other area of interest in the stimuli. This disclosure indicates that young adults are spending most of their available time gazing at the appearance of the smartphone before anything else during their interplay with a smartphone promotional message, no matter the brand. In alignment with past research on the topic, the smartphone's design manifested as one of its most significant and impressive parts for the customer (Ayodele & Ifeanyichukwu, 2016; Chen et al., 2016; Tan & Sie, 2014; Wong et al., 2019), but at the same time this came in complete

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contradiction with evidence by consumers from another continent who put it in the last places of their preferences that contribute to their buying decision (Rajasekaran et al., 2018); and also with a more recent research which stated that the design has been falling behind in matter of its significance (Mao et al., 2020).

Additionally, the study can be used alongside others, as it was suggested, for the sake of comparisons among different countries and continents about the customer's incentives and behaviour in the smartphone market (Kim et al., 2016). Finally, the biometric results combined with those on paper claim that the design of the smartphone, and subsequently the camera features with battery capacity, are those that attracted the customer's concern and those that need to be projected the most. It is known that features of the smartphone are those that are of the utmost importance for the consumer's purchase decision (Lay-Yee et al., 2013). Hence, these results are also answering to the request for a deeper investigation on the marketing mix of smartphone brands in their attempt to understand and produce the most suitable one (Zahid & Dastane, 2016).

One of the main variables of this paper, and the only that was responsible for the participants split in two smaller groups, was the gender variable. Generally, it is proven that this variable is of great significance for such brain studies (Palmiero & Piccardi, 2017), as it has been categorically reported that females and males do have various reactions in many categories when shown the same product or ad (He et al., 2021; Janić et al., 2022). This concept is crucial and needs to be kept monitored (Stefko et al., 2021), and on a first interpretation, it can be said that the results only added to the debate of already disunited written works and opinions on this aspect.

In consonance with a major part of past research (Baraybar-Fernández et al., 2017; Boscolo et al., 2020; Kim, 2016;), either with or without deploying neuroscientific methodology, the outcome of pupillometry and the rest of the eye tracking metrics indicate that there are no noteworthy differences for men and women. More specifically, the slight dissimilarities in their perceptual ability, and the dispersion of their visual attention, are simply appended to the view that in the technological context those are mostly a stereotypical issue of concern (Kim, 2016). In fact, both male and female participants showed similar implicit attitudes toward the five brands and their respective advertisements. There were only a few minor statistical variances, which is consistent with findings from other neuromarketing studies. (Baraybar-Fernández et al., 2017; Boscolo et al., 2020). These variations may be attributed to the sample including three more women than men. On the contrary, the inquiry fundamentally disagrees with the literature that employs traditional methodological approaches, which suggest conclusions different from what has just been described (Aymerich-Franch, 2014; Cai et al., 2017). Additionally, it further objects to neuroscientific ones that examined participants' reactions to some TV commercials based on their gender (Vecchiato et al., 2014), but also to other non-

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neuro studies that had tested the gender influence on products or advertisements under the scope of the online and technological environment and mentioned differences among them (Kotzé et al., 2016).

Nevertheless, this research provides some practical insights for professionals aiming to stay competent in the Greek smartphone market, while also addressing some gaps in academic literature. First, it can be concluded that the results of the smartphone advertisement tested here were largely similar for both males and females in terms of perceptual fluency. Secondly, it can be noted that females showed slightly more interest in the design of the smartphone model than males, as indicated by the average duration and number of fixations. Thirdly, it addresses the need for further exploration of how advertising affects both genders, particularly through neuroscientific methods (Cartocci et al., 2016; Goodrich, 2014); and ultimately, it delves deeper into the human cognitive system separated by gender, in which there are huge promises and opportunities for enlarging the quality and the quantity of the literature about the consumer behaviour topic (Meyers-Levy & Loken, 2015).

For the scope of this study, the questionnaire employed here was indeed effective in contributing to the discussion regarding the traditional qualitative or quantitative methods compared to the neuromarketing approach. In any respect, it is well acknowledged that questionnaires alongside with focus groups and interviews are almost costless, but the ideal questionnaire with zero imperfections is practically impossible and in many cases the bias in direct communication is unavoidable (Aldayel et al., 2020; Fortunato et al., 2014,; Gountas et al., 2019; Hakim & Levy, 2018; Hakim et al., 2021); thus, the questionnaire was meant to be used as supplementary proof or comparative evidence on the eye tracking results.

The comparison revealed that, in many cases, the eye tracking results did not align with participants' responses on the questionnaire, particularly regarding questions assessing the perceived difficulty of each brand's advertising messages. The brand that was reported to have the most complex ad (i.e., Samsung) was actually the one that had provoked pupil dilation to the fewest number of participants, added to some serious deviations of their declared interest on the smartphone models from the division of their visual interest in those (e.g., the Realme model was by far last at participants' interest on paper but one of the best in eye tracking).

Accordingly, this paper accomplished to confirm the notion that respondents' answers in a questionnaire, as well as in traditional research tools, may not always be driven by rationality. Instead, they are often influenced by the respondents' subjective beliefs and preferences (Tomkova et al., 2020). Additionally, it reinforced the notion that traditional methodologies often fail to detect the unconscious attitudes of the customer, which in turn will result in deteriorated information, especially about advertising effects (Agarwal & Dutta, 2015; Kumar et al., 2019).

More importantly, it provides concrete evidence of how eye-tracking systems can be utilized and the opportunities they offer marketers within the broader context of neuromarketing's theoretical framework (Mansor & Mohd Isa, 2018).

6. Conclusions

To recapitulate, this study addresses theoretical gaps in understanding online promotion within the smartphone market. It highlighted the significance of utilizing neuromarketing methods to assess the effectiveness of advertising and marketing efforts. The research involved testing promotional messages and images from the smartphone industry using an eye-tracking device. At the same time, defining the content and elements of an ad that connects the brand message with the smartphone's specifications and their functional usefulness for consumers is challenging. (Al-Kwifi, 2016; Msaed et al., 2017). What the data analysis of the participants' eye tracking sessions revealed about this issue, in assistance with their questionnaire answers, is summarised as follows: The design of the smartphone model was found to be the most significant visual point of interest, as participants had large duration and big numbers of eye fixations on the area that had actual images of the smartphone's appearance. The specific type of promotional messages that were examined did not provoke significant cognitive load, as indicated by changes in pupil size. Hence, the smartphone brands communicated their message in a smooth way that did not confuse the participants with excessively complex content, which in turn did not encourage them to disengage with the ads.

Men and women did not show significant differences that would pinpoint the gender variable as a notable factor. However, using more representative or larger samples could provide different insights. The responses to the questionnaire partially failed to align with the actual intuitive eye-movement results of the eye tracking system, indicating obvious contradictions in participants' visual attention and interest.

Despite the disagreements observed in both the self-reported questionnaires and participants' eye-tracking data, it is worth pinpointing those explicit self-reported answers, whether in questionnaire form or through other traditional qualitative and quantitative methods, are irreplaceable. They offer a more comprehensive understanding of a subject.

In summary, this study addressed theoretical gaps in the smartphone industry and highlighted the need for effective advertising and marketing efforts. It also extended previous works and reported its findings by using the eye-tracking methodology. The eye-tracking method combined with a more traditional self-reporting questionnaire achieved the study's main objective to a satisfactory level, which was to uncover participants' visual interest and attention in smartphone ads and the potential mental demand that those ads impose. In conclusion, this research has

accomplished some valuable insights for practitioners and managers of smartphone brands in the Greek market. It also examined some underexplored theoretical areas of consumer behaviour in this industry. Additionally, the study provided some distinct directions and suggestions for further research in these areas for academics to pursue in the future.

When considering the limitations of this study, several points should be highlighted. Firstly, the sample size was relatively small and focused solely on young adults in Greece, which means the findings may not fully represent broader or more diverse populations. However, it is worth noting that the sample size is in line with established norms in neuroscience and neuromarketing research, where the use of biometric tools often involves smaller, highly controlled groups. While including more participants in future studies could enhance generalizability, the current sample was sufficient to yield meaningful and reliable insights. Secondly, cultural influences, such as local attitudes toward advertising and brand familiarity, may also have subtly shaped participants' responses. Additionally, we relied solely on static images, without incorporating dynamic formats like video ads, which are increasingly relevant in real-world digital marketing. Exposure time to each stimulus was brief, and we did not assess behavioural follow-up, such as purchase intent or engagement. These are all valuable paths for future research, which could expand on this work with more diverse samples, immersive ad formats, and real-world behavioural measures to deepen our understanding of how attention and mental effort influence consumer decisions.

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„Oči su prozori mozga“: pupilometrija i obrasci fiksacije oka u komunikaciji putem pametnih telefona

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Sažetak

Praćenje pokreta očiju pokazalo se ključnim za razumijevanje ponašanja potrošača, a pupilometrija može ukazati uzrokoju li podražaji veliku zbunjenost u mozgu. Ovim istraživanjem ispitao se utjecaj promotivnih poruka putem pametnih telefona na kognitivne zahtjeve mozga i analizirala vizualna pozornost korisnika.U području neuromarketinga, ovaj rad istražuje industriju pametnih telefona i njezin utjecaj oglašavanja na grčke potrošače, kao i njezin utjecaj na razinu mentalnog opterećenja mjerenog širenjem zjenica. Za ovo istraživanje, uz komparativni upitnik, koristio se uređaj za praćenje oka, a rezultati konačnog uzorka od 31 osobe (17 žena i 14 muškaraca) u skladu su s velikim dijelom postojeće literature, što sugerira da, iako muškarci i žene mogu imati neznatno drugačiji pristup ovoj kategoriji proizvoda, u većini slučajeva imaju slične biometrijske rezultate. Podražaji su uključivali 10 slika s promotivnim sadržajem 5 brendova (Sony, Apple, Realme, Xiaomi, Samsung). Nakon detaljne analize rezultata praćenja očiju koja je uključivala fiksaciju i metriku zjenica te njihove usporedbe s povezanom literaturom, u radu se dolazi do zaključka da je izgled pametnog telefona element koji najviše privlači vizualnu pažnju korisnika te da općenito, testirani materijal nije zahtijevao veliko mentalno opterećenje korisnika za procesuiranje.Konačno, istaknuta je važnost primjene kombinacije implicitnih i eksplicitnih istraživačkih metoda kako bi se dobilo sveobuhvatno razumijevanje utjecaja oglašavanja proizvoda na vizualnu pažnju i mentalni napor, što ima dodatne akademske i praktične implikacije.

Ključne riječi: *oglašavanje proizvoda, praćenje pogleda oka, mentalni napor, vizualna pažnja, širenje zjenica*

JEL klasifikacija: *M31, M37, D12, D87*

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Clickbait and Influencers: How peripheral cues affect the reach of native ads[*]

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Abstract

Native advertising refers to a paid advertisement that mimics editorial content, aiming to prompt a profitable action. Authors of native ads employ various tactics to attract attention and raise awareness of a brand, product, or service, ultimately seeking to drive the reader toward conversion. These tactics may include selecting headlines that guide the reader's interpretation of the message, choosing credible sources of information, and incorporating (graphic) design elements. This paper investigates how peripheral cues – specifically clickbait headlines, sources of information, and visual components – affect the reach of native advertisements, framed within the Elaboration Likelihood Model (ELM). According to the ELM, when audiences lack sufficient motivation or cognitive resources for in-depth analysis, they predominantly rely on the peripheral route of information processing. Consequently, the use of attention-grabbing yet often superficial elements is essential for capturing initial attention and maximizing overall reach. A study based on a sample of 543 native ads from the most widely read Croatian internet portals found that headlines emphasizing uncertainty or using vague pronouns consistently achieved the highest reach among various clickbait techniques. Additionally, uncertainty emerged as the most prevalent strategy used. Even though such headlines can spark curiosity, non-clickbait headlines often match or outperform them, especially when they rely on ambiguous language, uncertainty cues, or numeric indicators. Moreover, the findings indicate that ads

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featuring influencers as sources of information achieve significantly greater reach than those relying on other types of sources. These results underscore the crucial role of peripheral cues in the creation of effective native advertisements and open avenues for future research that might explore the depth of processing and attitude change among consumers.

Keywords: *native advertising, clickbait headlines, influencers, online portals, audience engagement*

JEL classification: *M30, M37, L86, D83*

1. Introduction

The concentration of so-called hybrid forms of media content in the contemporary online environment is becoming increasingly intense (Balasubramanian, 1994; Macnamara, 2014; Taiminen et al., 2015). The lack of a clear theoretical and practical distinction between sponsored content (Tutaj & Reijmersdal, 2012), content marketing (Pulizzi, 2014; Pulizzi & Piper, 2023), brand journalism (Cole and Greer, 2013), and native advertising (Verčič & Tkalac Verčič, 2016) often results in confusion among readers, who are finding it increasingly difficult to recognize the commercial nature of the content being presented to them. For most researchers, native advertising serves as an umbrella term intended to simplify the classification of hybrid forms, as native advertising is, by definition, a paid advertisement designed to resemble editorial content. Its purpose is to attract a target audience with useful content while simultaneously promoting a brand, its values, and its products (Cole & Greer, 2013; Howe & Teufel, 2014; Wojdynski & Evans, 2016). On the other hand, research by Taiminen et al. (2015) revealed that most public relations and marketing professionals prefer to use the term content marketing when referring to commercial hybrid forms of online content.

In addition to the obvious terminological confusion, three other problematic areas of native advertising need to be addressed:

1. Application area: Is native advertising a public relations technique, a marketing tool, or a tactic indistinguishable from traditional advertising?

2. Authorship of native ads: Who is the creative author and who bears responsibility for the content?

3. Legal and ethical framework: How is native advertising legally defined, and what is the practice of media outlets in labelling such advertisements? (Trbušić et al., 2024)

According to the *Interactive Advertising Bureau* (IAB), there are three fundamental forms of native advertising: *In-Feed/In-Content native advertising*, *Content Recommendation Ads*, and *Branded/native content*. The latter refers to "paid content by a

brand that is published in the same format as full-fledged editorial content on the publisher's website, usually in collaboration with the publisher's own teams" (IAB, 2019). This form of native advertising (branded/native content) will be the focus of the research component of this paper because it is the only type among the mentioned forms of native advertising that allows for a structured analytical approach.

The fact that native ads closely resemble editorial content in both appearance and format on online news portals implies that such ads incorporate essential elements of journalistic texts, such as headlines, visual elements (graphics and infographics, photo, video, branded visual content), and sources of information, which may include quoted statements or comments from common people or influential figures and representatives of organizations. Therefore, the main objective of this paper is to analyse which types of headlines, visual elements, and sources of information are most used in native ads. Furthermore, the study aims to determine, based on the Elaboration Likelihood Model (ELM), whether these elements belong to the central or peripheral route of persuasion. Finally, the paper seeks to identify differences in the effectiveness of ads based on these elements, enhancing understanding of the key factors that influence the success of native advertising.

In line with the research objectives, the following hypotheses are proposed:

H1: Native ads employing clickbait headlines will be more efficient than ads with neutral headlines.

H1a: There is a significant association between industry type and the type of headline used; specifically, industries with a pronounced consumer focus (e.g., healthcare, financial) employ emotional or uncertainty-based clickbait headlines more frequently than industries with less consumer focus.

H2: Native ads with rich visual elements will be most efficient compared to those with minimal visual components.

H3: Native ads featuring influencers as sources of information will achieve highest reach, thanks to the influencers' reputation and appeal.

H3a: There is a significant association between industry type and the information source used in advertisements. Specifically, ads in industries that depend on personal preferences and trends (e.g., lifestyle, travel) will more frequently engage influencers as sources of information, whereas ads in professional and technical sectors (e.g., financial, ICT, healthcare) will more often rely on expert authorities or official institutions as sources.

In the following chapters, the paper elaborates on the theoretical framework, further develops the proposed hypotheses, describes the methodology and analytical design, and concludes with an interpretation of the results, conclusions, and limitations of the research.

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2. Literature review and hypothesis development

This section is structured and divided into two parts. The first part provides an overview of the theoretical framework of the study, while the second part explains and contextualizes the variables to be analysed in the research segment in accordance with the theoretical foundation.

2.1. Elaboration likelihood model (ELM)

The Elaboration Likelihood Model (ELM) provides a comprehensive framework for organizing, categorizing, and interpreting the fundamental processes that underlie the effectiveness of persuasive communication (Petty & Cacioppo, 1986). As such, it is a model applicable to various areas of theory and practice, including psychotherapy and counselling (Petty et al., 1984a; Cacioppo et al., 1985) as well as mass media advertising, selling and marketing communications (Petty et al., 1984b; Cacioppo & Petty, 1985; Kemeter & Bušljeta Banks, 2013; El Hedhli & Zourrig, 2022).

At its core, the Elaboration Likelihood Model (ELM) explains how persuasive communication can influence attitude change. It posits two distinct routes through which individuals process persuasive messages: the central and peripheral routes to persuasion (Petty & Cacioppo, 1986). The central route suggests that individuals are sometimes motivated to pay attention to the content of a message and accept it when the arguments presented are sufficiently persuasive. In such situations, individuals engage in a thorough evaluation of the message and process its content in depth. Conversely, under different circumstances, individuals may lack the motivation to carefully assess information and instead focus on superficial and external cues. This approach is referred to as the peripheral route to persuasion, as it relies on elements that are secondary to the message itself (Petty et al., 2003; Aronson et al., 2013).

Given that the Elaboration Likelihood Model (ELM) explains how individuals process persuasive messages through the central and peripheral routes of persuasion, examining the language and communicative features of marketing communication becomes essential for understanding the mechanisms underlying its effectiveness. One of the key factors in marketing success is the application of an appropriate linguistic style, which serves as a powerful persuasive tool (Blankenship & Craig, 2011). Moreover, the way a message is formulated often plays a more significant role than its actual content, as it can influence the perception and interpretation of information (Brennan & Williams, 1995). In this regard, linguistic style not only facilitates the comprehension and processing of a message but also shapes the perception of the message sender (Areni & Sparks, 2005).

In the context of native advertising, where persuasive messages are integrated into journalistic-style content, the analysis of linguistic style becomes even more crucial. If we assume that linguistic style encompasses not just verbal expressions but also that structural and visual elements influence how the audience perceives the message, we can argue that headlines, visual design, and source attribution play a pivotal role in shaping the persuasive effect of an advertisement. These elements can function as peripheral cues, influencing how recipients process and interpret advertising messages, particularly in situations where deep cognitive analysis of content is absent. Therefore, considering the applicability of ELM (Elaboration Likelihood Model) to advertising and marketing communication, it is justified to investigate how various aspects of linguistic style, including headlines, visual design, and source attribution, influence the effectiveness of native advertisements.

Previous research on persuasive communication within the Elaboration Likelihood Model (ELM) framework highlights key factors influencing attitude change. Petty et al. (1981) found that personal relevance determines whether individuals process messages via the central route (focusing on argument strength) or the peripheral route (relying on cues like speaker prestige). Cacioppo et al. (1996) further demonstrated that individual differences in need for cognition (NFC) affect message processing, with high-NFC individuals engaging in deeper analysis. Petty and Brock (1981) showed that distractions and cognitive load lead individuals to rely more on peripheral cues. Chaiken (1980) and Petty et al. (1995) found that attitudes formed via the central route are more stable and resistant to change, whereas those shaped by the peripheral route are more susceptible to persuasion over time. When it comes to native advertising, research is related to the analysis of readers' cognitive perception of native ads and their persuasive elements (Wojdynski & Evans, 2016), analysis of communication strategies in native ads (Wang & Li, 2017), perception of the organization or the sponsor of native ads and its socially responsible activities (Jung & Heo, 2018; Krouwer et al., 2020; Beckert et al., 2020; Wu & Overton, 2021), perception of the credibility of online portals that publish native ads (Howe & Teufel, 2014), and analysis of the basic features of native ads based on the most-read selected Croatian online portals (Trbušić et al., 2024).

2.2. Review of key variables

This section reviews three critical variables: clickbait headlines, visual elements, and information sources, that shape the effectiveness of native advertising, and introduces corresponding hypotheses suggesting that attention-grabbing headlines, strong visual design, and reputable or influential sources function as powerful peripheral cues to drive higher audience engagement.

2.2.1. Clickbaits

A headline is an integral component of a media text, yet its distinct positioning makes it the first, and often the only, element that the audience encounters (Kanižaj et al., 2022). Headlines are crafted to attract readers (Silić, 2006; Hudeček & Mihaljević, 2009), and since capturing their attention is challenging, publishers frequently resort to clickbait techniques. Clickbait occurs when a publisher posts a link with a headline that entices people to click to see more, without providing substantial information about what they will find (El-Arini & Tang, 2014). When readers realize that they have landed on irrelevant or misleading content, they often experience disappointment (Kanižaj et al., 2022). However, clickbait can sometimes be identified in advance, as it frequently follows stereotypical sensationalist constructions and linguistic patterns (Chen et al., 2015). Thus, clickbait headlines can be recognized through the following patterns, which will serve as a framework for the typology of native advertisement headlines in this research:

1. Uncertainty
2. Multiple combinations
3. Use of numbers
4. Emphasis on emotions
5. Use of vague pronouns
6. Reverse narrative style

Accordingly, the following hypothesis has been formulated:

H1: Native ads employing clickbait headlines will be more efficient than ads with neutral headlines, as such headlines more strongly arouse curiosity and act as a peripheral cue.

H1a: There is a significant association between industry type and the type of headline used; specifically, industries with a pronounced consumer focus (e.g., healthcare, financial) employ emotional or uncertainty-based clickbait headlines more frequently than industries with less consumer focus.

2.2.2. Visual elements

It is well-documented that modern digital environments increasingly prioritize visual content (Paska, 2019), a development that has consequently shaped the online media sphere. A substantial body of research has demonstrated the superiority of pictorial elements over verbal ones (Childers & Houston, 1984; Mitchell, 1986; Obermiller & Sawyer, 2011; Wedel & Pieters, 2000). The notion of visual equip-

ment also encompasses video formats, particularly shorter videos (from just a few seconds to a couple of minutes), which rank among the most popular forms of video content in the information era (Wang, 2020; Xiao et al., 2023). Recently, an increasing number of businesses have allocated resources to promoting their products via short-form video advertising (Meng et al., 2024).

Therefore, we have formulated a second hypothesis that will be subject to empirical testing:

H2: Native ads with rich visual elements will be most efficient compared to those with minimal visual components, because appealing design and visual content provide powerful peripheral cues that quickly capture attention.

2.2.3. Information sources

According to their most fundamental definition, sources encompass any individuals or platforms from which, or on which, information about relevant facts can be obtained (Bobić, 1987). Such sources may be diverse, including other individuals, government agencies, other media organizations, and non-governmental organizations (Malović, 2005). In an advertising context, they can also include employees within an organization, product or service users, and others. In recent years, influencer marketing has evolved into a key component of digital marketing strategies, serving as a critical touchpoint for reaching target audiences (Kim & Kim, 2021). At its core, influencer marketing is a type of endorsement marketing that employs influencers' product recommendations to boost sales; however, its objectives extend beyond mere revenue generation, aiming to capture the attention of potential customers, stimulate word-of-mouth effects, and foster customer engagement with a brand or product (Brown & Hayes, 2008).

Hence, the following hypotheses have been formulated:

H3: Native ads featuring influencers as sources of information will achieve the highest reach, thanks to the influencers' reputation and appeal, which serve as a strong peripheral cue for the audience.

H3a: There is a significant association between industry type and the information source used in advertisements. Specifically, ads in industries that depend on personal preferences and trends (e.g., lifestyle, travel) will more frequently engage influencers as sources of information, whereas ads in professional and technical sectors (e.g., financial, ICT, healthcare) will more often rely on expert authorities or official institutions as sources.

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3. Methodology and analytical design

In this section, we detail the selection and analysis of 543 native advertisements published over six months on six major Croatian news portals, focusing on how different headline types (standard vs. clickbait), visual elements (photos, videos, graphics), and information sources (e.g., influencers) were identified and measured. We then discuss how these variables were correlated with ad reach to assess the impact of peripheral cues across different industries.

3.1. Sample selection and data collection

The sample for the study consists of native advertisements published over six months (December 2021 – May 2022) on the six most-read Croatian internet news portals (index.hr, jutarnji.hr, vecernji.hr, 24sata.hr, telegram.hr, slobodnadalmacija. hr), which were identified as the most influential online news media in the Croatian digital space based on visitor criteria (Peruško, 2023). Following a machine-based pre-analysis that included all posts on Croatian internet portals during the observed period, totalling over 1.5 million posts on 5.104 web pages, a representative sample was selected based on visit frequency, specifically from the largest Croatian internet portals. A machine search was conducted using keywords and phrases in the content or headlines. The keywords used to identify native content included phrases such as *paid content*, *sponsored content*, *native*, *content provided by*, *content created by*, *powered by* and *tnative*, as native content should be clearly identified as such in the media. After selecting all articles published during the six-month period that included these keywords, a total of 811 articles were identified, from which non-native articles, primarily sponsored or PR content, and other irrelevant material were manually excluded. The final sample for the study consisted of 543 native advertisements across the six internet portals, noted for their influence and readership in Croatia. Before determining the research sample, it was confirmed that all analysed internet portals offer native advertising services through a review of their publicly available marketing, advertising, and public relations pricing lists.

3.2. Analytical framework and variables

Of the total sample of 543 native advertisements, 177 posts, or 32.6%, were from the portal jutarnji.hr, 103 posts or 18.97% from vecernji.hr, and 99 posts or 18.23% from telegram.hr. The portal 24sata.hr accounted for 88 analysed articles or 16.21%, index.hr for 62 or 11.42%, and slobodnadalmacija.hr for 14 native articles or 2.58%. The research on a sample of 543 native advertisements published between December 1, 2021, and May 30, 2022, on the six selected Croatian internet portals, was conducted using content analysis methodology. An analytical matrix was applied, containing five general categories (general identification elements,

content emphasis, headline characteristics, content characteristics, audience engagement), within which 19 variables were observed for each of the 543 ads. The researchers independently read and analysed all identified ads and then compared results, achieving full agreement across all variables.

For the purposes of this study, three main categories were examined: headline characteristics, visual content characteristics, and types of information sources. In analysing headlines, the focus was on classifying different headline types, distinguishing between standard and clickbait headlines. When examining visual content, particular attention was given to identifying specific elements, such as photographs, video content, graphics, or infographics, as well as any combinations thereof. Additionally, different information sources were investigated, including representatives from the organization/company, brand ambassadors, influencers/celebrities, direct users of the product or service, and multiple sources. All these variables were then correlated with the reach of each ad to illustrate how various peripheral cues affect the effectiveness of native advertisements. Finally, an industry-specific analysis was conducted to determine whether certain headline types or types of information sources were more prevalent or characteristic of industries, and how these variables related to the ads' reach.

4. Results and discussion

In this chapter, we analyse how various peripheral cues, such as clickbait headlines, visual elements, and information sources, shape the reach and effectiveness of native advertisements. We also examine industry-specific patterns to reveal how different sectors strategically employ these cues to engage audiences and improve ad performance.

4.1. The effectiveness of clickbait headlines as peripheral cues

The data indicate that as many as 79.01% of the observed native advertisements employed clickbait headlines, with the most prevalent techniques being those based on uncertainty (44.38%) and combinations of multiple clickbait elements (13.81%). Meanwhile, neutral headlines accounted for 20.99%, and other identified styles (e.g., emotional appeals, reverse narrative) were comparatively infrequent and less effective. In terms of reach, the data suggest that headlines containing clickbait features, particularly those emphasizing uncertainty or combining multiple styles, attract greater audience attention and encourage interaction.

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Table 1: Prevalence and reach of clickbait headline characteristics in the analysed native ads (n=543)

Clickbait Type	Count	%	Mean Reach	Median Reach	Min Reach	Max Reach	Total Reach	Std. Deviation
Uncertainty	241	44.38	11,202.71	10,051	963	142,818	2,699,855	10,441
Not a clickbait headline	114	20.99	8,990.41	8,400	963	32,270	1,024,907	5,974.08
Multiple combinations	75	13.81	12,504.33	10,891	963	80,240	937,825	9,946.85
Use of numbers	51	9.39	10,610.37	10,418	2,129	18,790	541,129	3,985.18
Emphasis on emotions	32	5.89	7,367.21	6,125	1,531	19,962	235,751	5,062.08
Use of vague pronouns	27	4.97	11,954.88	10,701	5,688	24,296	322,782	4,770.36
Reverse narrative style	3	0.55	6,861.66	5,688	5,688	9,209	20,585	2,032.85

Source: Author's calculations

These findings provide empirical evidence supporting H1: *Native ads employing clickbait headlines will achieve greater reach than ads with neutral headlines, as such headlines more strongly arouse curiosity and act as a peripheral cue*, indicating that ads featuring clickbait headlines achieve higher reach than their neutral counterparts by eliciting stronger curiosity and functioning as a peripheral cue. For illustrative purposes, we provide a select few of the analysed advertisement headlines: *Do you eat fish at least twice a week? Here's why you should* (Index.hr, 2022a); *Is it possible to win at an online casino, or is everything rigged?* (Index. hr, 2021); *How can we pull children away from their mobile phones and guide them toward more beneficial activities? A teacher offers an excellent suggestion* (Marinović, 2021); *What is the secret of fortunate individuals? Experts say they do these four things differently* (Index.hr, 2022b).

Table 2: Wilcoxon rank sum (pairwise) tests comparing audience reach for clickbait vs. non-clickbait headlines

Not a clickbait headline versus:	Test Statistic	p value	Bonferroni adjusted p value
Use of vague pronouns	2,091.5	0.0019	0.0114
Uncertainty	16,359.5	0.0018	0.0110
Reverse narrative style	139.0	0.7124	1.0000
Emphasis on emotions	1,533.0	0.9160	1.0000
Use of numbers	3,681.5	0.0031	0.0190
Multiple combinations	5,453.0	0.0006	0.0041

Source: Author's calculations

Since the Shapiro-Wilk test for normality of audience reach data (W = 0.9763, p < 0.001) indicated a significant deviation from normal distribution, the non-parametric Kruskal-Wallis test was used to assess differences in audience reach. The significant Kruskal-Wallis result (χ^2 = 28.45, p < 0.001) suggested that at least one of the groups differed from the others. To investigate whether native ads using clickbait headlines achieve greater reach than non-clickbait ads, Wilcoxon rank-sum (Mann-Whitney) tests were conducted with the null hypothesis (H$_0$) that *Not a clickbait headline* does not surpass each of the six clickbait headline categories. After applying a Bonferroni correction to adjust for multiple comparisons, the results indicated that *Not a clickbait headline* reached significantly larger audiences than *Use of vague pronouns* (adjusted p = 0.0114), *Uncertainty* (adjusted p = 0.0110), *Use of numbers* (adjusted p = 0.0190), and *Multiple combinations* (adjusted p = 0.0041). In contrast, there was no significant difference in reach for *Reverse narrative style* (adjusted p = 1.0000) or *Emphasis on emotions* (adjusted p = 1.0000). Thus, while non-clickbait headlines appear to outperform several clickbait styles, they perform comparably to reverse narrative and emotion-focused headlines under these tests.

The Figure 1 illustrates the prevalence of various clickbait headline techniques across a range of industries. The chart visually represents how different sectors employ specific strategies to attract audience engagement, with colour intensity indicating the percentage of ads that utilize each technique within each industry. A chi-square test of independence was performed, revealing a significant association between industries and clickbait characteristics (χ^2 = 264.45, p < 0.001), which suggests that different industries favour specific information sources in their ads and employ distinct clickbait strategies. The respective data therefore aligns with H1a: *There is a significant association between industry type and the type of headline used; specifically, industries with a pronounced consumer focus (e.g., healthcare, financial) employ emotional or uncertainty-based clickbait headlines more frequently than industries with less consumer focus*, suggesting that industries with a pronounced consumer focus are indeed more inclined to employ emotionally charged or uncertainty-based clickbait techniques. A particularly telling example comes from the healthcare industry, where native advertisements prominently feature two central themes: on the one hand, narratives centred on illnesses, disorders, and diagnoses, and on the other, successful solutions and preventive measures aimed at mitigating health risks (Trbušić et al., 2024). By emphasizing fear and urgency, such ads tap into consumers' emotional responses, fostering a heightened need for products and services that promise relief or protection. Interestingly, the real estate sector in Croatia also capitalizes on uncertainty, which is particularly evident given current market volatility and rising housing costs.

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Figure 1: Distribution of different clickbait types across various industries
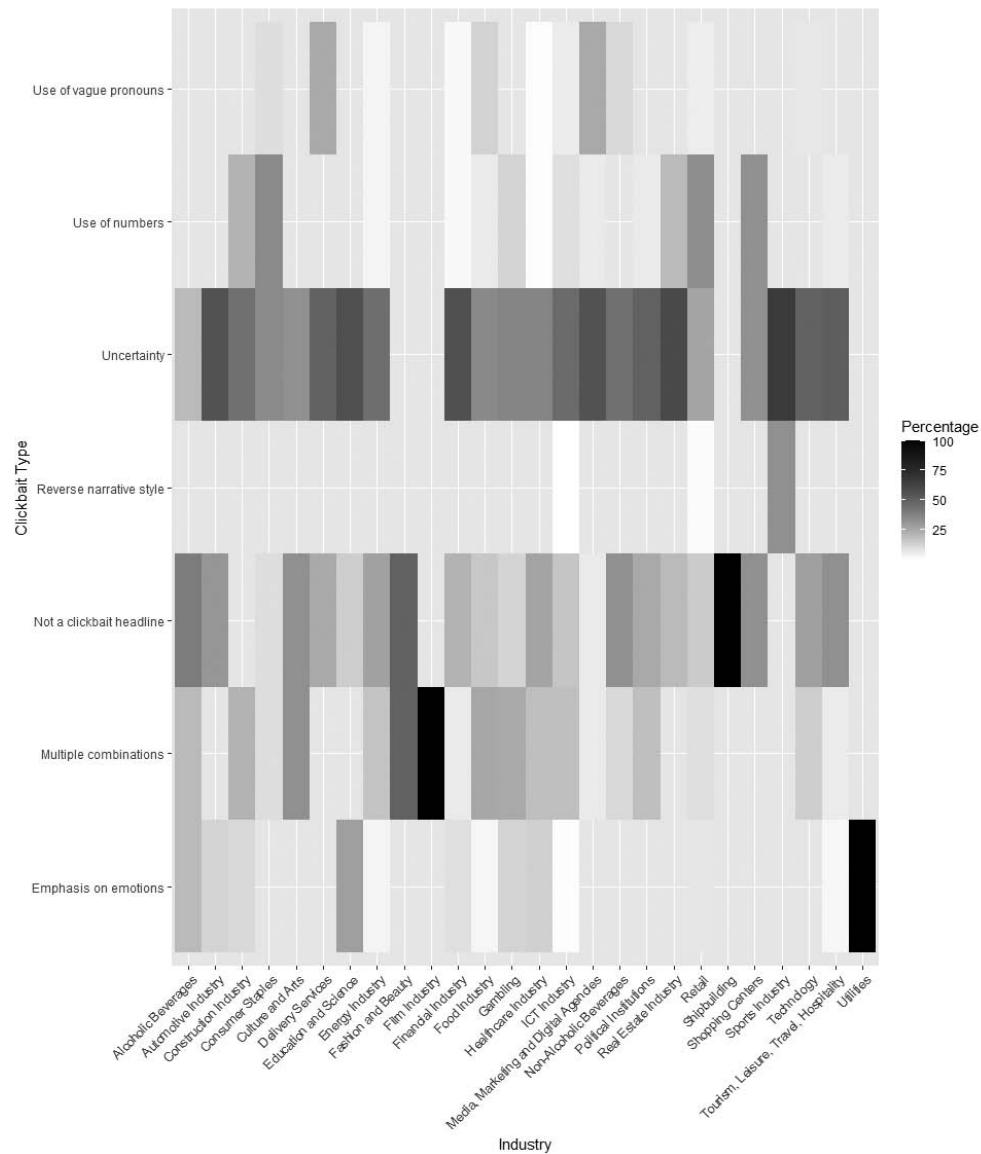
Source: Author's calculations

According to recent data from the Croatian Bureau of Statistics (2025), real estate prices have experienced a steady increase over the past few years, intensifying concerns about affordability and accessibility among prospective buyers. This heightened sense of urgency provides a fertile ground for uncertainty-based advertising strategies. Below, we present only a few of the clickbait headlines

from the analysed advertisements that convey a sense of uncertainty: *Nearly 500,000 people in Croatia suffer from the same digestive problems. Even those under 35 should be cautious* (Telegram.hr, 2022a); *This vitamin helps combat winter depression – here's how to recognize and treat it* (Index, 2022c); *A well-known Zagreb restaurateur reveals his biggest financial mistakes – I keep making them over and over again* (Marinović, 2022); *Applications for the APN program are opening soon; here's everything you need to know if you're buying an apartment with a subsidized housing loan* (Telegram, 2022b); *Will the current surge in inflation impact car insurance prices as well? An expert reveals what we can expect* (Telegram, 2022c); *While renovating his house, Željko from Zagreb encountered a problem many people face. I found the perfect solution.* (Jutarnji list, 2022).

In contrast, more technically oriented or B2B-driven industries, such as shipbuilding, tend to favor straightforward, non-clickbait approaches, reflecting the highly specialized nature of their content and more narrowly defined consumer base.

4.2. The effectiveness of visual elements as peripheral cues

The research findings indicate that all analyzed native advertisements include some form of visual element (photograph, video content, infographic, or a combination of these). Photographs are the most frequently used, appearing in 400 ads, while the combinations of photographs and graphics, as well as photographs and video content, appear 65 and 60 times, respectively. However, further analysis did not reveal any statistically significant differences in reach across the different types of visual elements. Consequently, we are unable to either confirm or refute H2 that *Native ads with rich visual elements will be most efficient compared to those with minimal visual components, because appealing design and visual content provide powerful peripheral cues that quickly capture attention.*

4.3. Information sources as peripheral cues

Table 3: Representation of different types of sources in the statements and reach (n=543)

Source type	Count	%	Mean Reach	Median Reach	Min Reach	Max Reach	Total Reach	Std. Deviation
No source / statement	257	47.33	10,025.14	9,396.0	963	33,929	2,576,463	5,281.73
Source from the organization / company	107	19.71	9,940.28	8,580.0	1,107	80,240	1,063,610	8,622.92
Source unrelated to the product or service	56	10.31	12,504.33	10,891	963	80,240	937,825	7,276.38
Multiple sources	41	7.55	17,113.12	12,781.0	3,211	142,818	701,638	21,412.84
Direct user of the product or service	37	6.81	9,844.32	10,051.0	2,088	18,962	364,240	3,873.95
Brand ambassador	26	4.79	10,057.19	9,719.0	1,558	31,308	261,487	7,743.89
Influencer / celebrity	19	3.5	14,645.78	14,797.0	9,975	21,300	278,270	3,371.75

Source: Author's calculations

A comparison of the analytical results with the proposed hypotheses H3: *Native ads featuring influencers as sources of information will achieve highest reach, thanks to the influencers' reputation and appeal, which serve as a strong peripheral cue for the audience*, and H3a: *Ads in industries that depend on personal preferences and trends (e.g., tourism, travel) will more often engage influencers as sources of information, whereas ads in professional and technical sectors (e.g., financial industry, ICT, healthcare industry) will prefer expert authorities or official institutions as sources, due to a stronger emphasis on credibility and technical accuracy*, reveals a clear alignment. Specifically, H3 posits that native advertisements featuring influencers as sources of information will achieve the highest reach, primarily due to the influencers' recognizability and appeal to audiences. This is corroborated by the finding of the highest mean reach (14,645.78) precisely in the category of ads featuring influencers/celebrities, a figure considerably greater than that of other source types. These results also align with previous research on the positive effects of involving influencers in marketing communication (Djafarova & Rushworth, 2017; Evans et al., 2017; Boerman, 2020). A significant difference in audience reach was also confirmed concerning

the type of sources used in the ads ($\chi2$=33.34, p<0.001). This result suggests that different types of sources, such as direct user testimonials or organizational representatives, have a measurable impact on the success of the article.

To examine whether using an influencer/celebrity category differs from other source types, Wilcoxon rank-sum (Mann-Whitney) tests were conducted with the null hypothesis (H_0) that the influencer/celebrity category does not surpass each of the six other categories. Following a Bonferroni correction for multiple test comparisons, the results revealed that influencer/celebrity sources reached significantly different outcomes compared to a direct user of the product/service (adjusted p = 0.000247) and an unrelated source (adjusted p = 0.002883). In contrast, there was no significant difference between influencer/celebrity and any of the remaining source types, namely, no source/statement, source from the organization/company, brand ambassador, or multiple sources, as their adjusted p-values all exceeded 0.05. Thus, while influencers/celebrities stand apart from direct users and unrelated sources, they perform comparably to the other categories examined in this context.

Table 4: Wilcoxon rank sum (pairwise) tests comparing audience reach for influencer/celebrity vs. other types of sources

Influencer / celebrity versus:	Test Statistic	p value	Bonferroni adjusted p value
No source / statement	1,075.0	1.0000	1.0000
Source from the organization / company	407.0	1.0000	1.000
Multiple sources	448.0	1.0000	1.000
Source unrelated to the product or service	803.5	0.0000	0.0028
Direct user of the product or service	579.5	0.0000	0.0002
Brand ambassador	130.0	1.0000	1.0000

Source: Author's calculations

Figure 2: Distribution of different source types across various industries
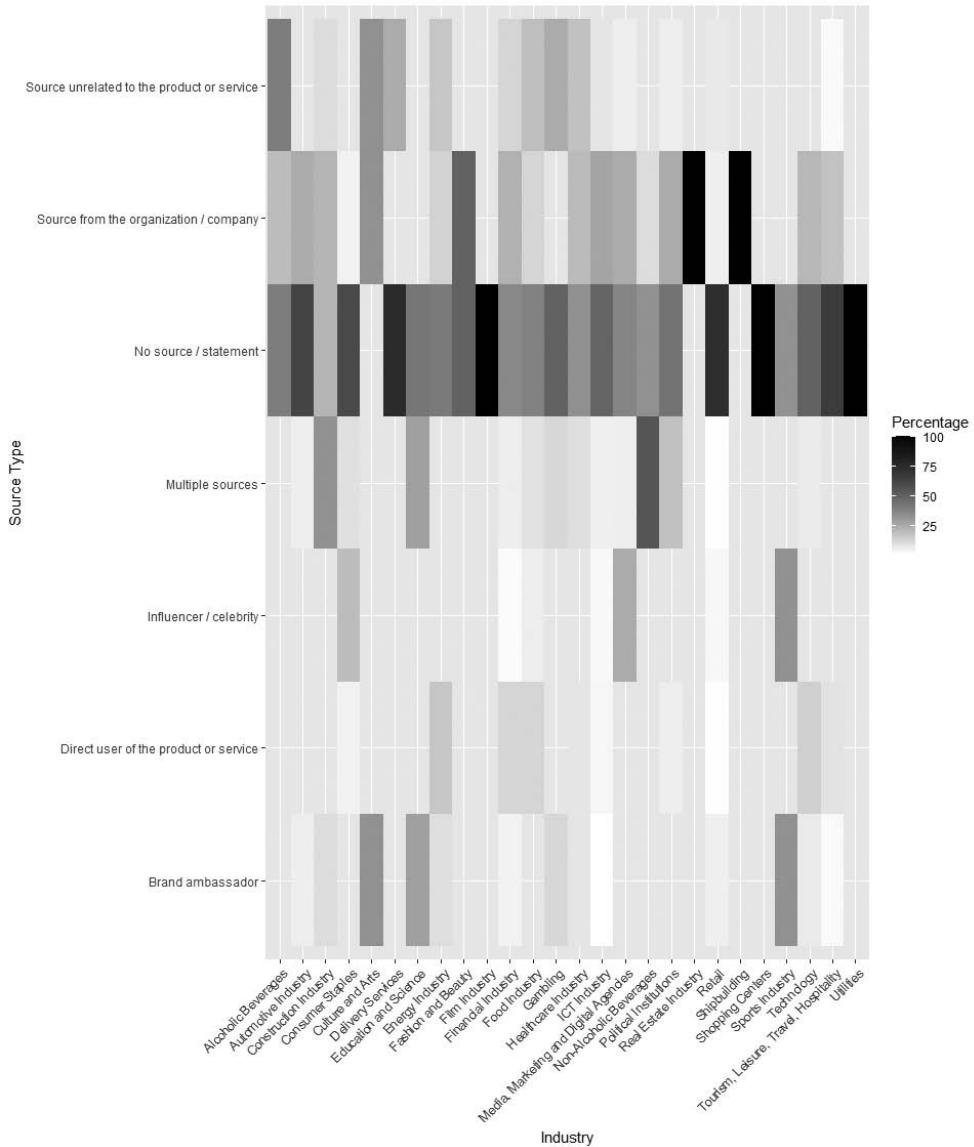
Source: Author's calculations

Additionally, a Pearson's chi-squared test of independence was conducted to examine the association between industries and information sources (H3a), which yielded a significant result ($\chi^2 = 254.72$, p = 0.000). These findings indicate that different industries favour specific information sources in their ads and employ distinct clickbait strategies. Furthermore, H3a assumes that industries oriented

toward personal preferences and trends (e.g., tourism, fashion, travel) are more likely to employ influencers as sources, while professional and technical sectors (e.g., finance, ICT, healthcare) will rely more heavily on expert authorities or official institutions, owing to an emphasis on credibility and technical accuracy. The data substantiates this claim: the sports sector, as well as industries aiming to capture broad consumer attention (e.g., media, marketing agencies, etc.), prominently utilize influencers/celebrities. In contrast, advertisements in industries such as shipbuilding, real estate, and science and education more frequently feature multiple sources and/or in-house experts and official institutions.

To conclude, the results of this study reveal both consistencies and divergences from previous findings in the literature. For instance, Rony et al. (2017) report that clickbait posts generally reach broader audiences, yet our analysis shows that neutral headlines, in certain cases, achieved greater reach than clickbait ones. Conversely, the finding that native advertisements featuring influencers as information sources attain the highest reach aligns with expectations and prior research. A recent meta-analysis by Pan et al. (2025) further demonstrates that influencer marketing significantly affects user behavior and engagement, which is clearly reflected in our results.

Some results, such as the strong effect of influencers, were expected based on theory and earlier studies, while others, such as the limited effectiveness of clickbait elements, were unexpected and open new questions for further inquiry. According to the 'knowledge gap' hypothesis, one might assume that curiosity-driven, attention-grabbing headlines increase reach, but our findings suggest that this is not always the case. Such discrepancies may be attributed to factors such as audience saturation over time or decreasing trust in overly sensational headlines, consistent with research showing that clickbait can erode reader credibility and trust.

5. Conclusion

The findings of this study confirm the crucial role of peripheral cues in attracting initial audience attention in native advertising, in line with the Elaboration Likelihood Model (ELM). While reach alone does not provide direct insights into the depth of message processing, higher reach can be seen as an indication that a certain percentage of users was at least minimally motivated to click and read further. According to ELM, this suggests that native ads leveraging strong peripheral cues, such as influencers, clickbait headlines, and rich visual elements, effectively generate initial audience engagement.

This study initially found that clickbait headlines, particularly those based on uncertainty, vague pronouns, and the use of multiple clickbait techniques, can attract attention by triggering curiosity and addressing emotional or informational gaps.

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However, the statistical tests revealed a more complex picture. Specifically, the non-parametric analyses showed that non-clickbait headlines reached significantly larger audiences than clickbait variants using vague pronouns, uncertainty cues, numeric indicators, and multiple combinations. Notably, there was no significant difference between non-clickbait headlines and those employing reverse narrative styles or an emphasis on emotions. This suggests that although certain clickbait strategies may effectively capture immediate attention, their overall impact is not uniformly superior, and some traditional headline styles can perform just as well or even better in terms of reach. Finally, while clickbait headlines can be effective in capturing attention, their long-term impact and potential negative effects on brand perception remain open questions, as they may lead to user disappointment if the content does not meet expectations.

When examining the role of visual elements as a variable in native advertising, it emerged that every analyzed advertisement included some form of visual component. Consequently, we were unable to compare them with ads lacking any visuals, meaning we cannot definitively conclude whether visual elements, regardless of their sophistication, do or do not generate higher reach. Future studies incorporating advertisements without visual components would be necessary to isolate the precise impact of visual cues on ad performance.

Furthermore, the results confirm that native ads featuring influencers as sources of information achieve the highest reach, reinforcing the idea that an influencer's reputation and recognizability serve as strong peripheral cues. However, reach alone does not reveal whether users engaged in deeper processing of the message. Assessing whether users read and processed the content would require additional behavioural metrics, such as time spent on the page, scroll depth, and conversion rates. This distinction is essential, as ELM differentiates initial attention capture via the peripheral route from deeper message processing via the central route. Thus, while influencer-driven ads attract attention primarily due to the influencer's identity and reputation, further analysis would be needed to determine whether some users transition to central processing, which is more likely if the influencer is perceived as a credible expert in the respective field.

Industry-specific trends support the hypothesis that different sectors adopt distinct advertising strategies. Industries driven by personal preferences and trends (e.g., tourism, fashion, media) are more likely to use influencers to attract attention and foster audience engagement. In contrast, professional and technical sectors (e.g., finance, ICT, healthcare) tend to rely on expert authorities and official institutions, as credibility and technical precision play a crucial role in audience persuasion. This finding aligns with the Two-Step Flow of Communication Theory (Katz & Lazarsfeld, 1955), which suggests that influencers may serve as initial motivators for engagement, while a subset of users, especially those with a personal interest in the topic, may transition to deeper message processing if the influencer is perceived as an expert.

Several limitations of this study should be noted. First, the sample consists of 543 native advertisements published over a six-month period on several leading Croatian online portals, which restricts the generalizability of the findings to other contexts or longer time frames. Second, since all analysed ads included visual elements, we lacked a control group of ads without visuals, making it impossible to isolate the effect of visual components on reach. Lastly, categories such as 'clickbait headline' or 'influencer' were defined according to our coding criteria and may overlook nuances, such as varying levels of influencer popularity.

Finally, this study provides strong empirical support for the effectiveness of peripheral cues in increasing the reach of native advertisements. However, future research should examine their impact on deeper message processing and attitude change. Further studies could incorporate behavioural analytics (e.g., A/B testing, engagement time tracking) to explore how different audience segments interact with native ads beyond initial attention capture. From a practical perspective, advertisers should recognize the effectiveness of combining engaging headlines, compelling visual elements, and influential sources of information to maximize message visibility. However, to enhance message retention and persuasion, they should also consider strategies that encourage deeper cognitive processing, particularly when targeting audiences in sectors where credibility and expertise are crucial factors in decision-making.

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Clickbait naslovi i influenceri: Kako periferni poticaji utječu na doseg nativnih oglasa

Davor Trbušić[1], *Luka Šikić*[2], *Dražen Maleš*[3]

Sažetak

Nativno oglašavanje plaćeni je oglas koji nalikuje uredničkom sadržaju, s ciljem poticanja profitabilne akcije. Autori nativnih oglasa posežu za brojnim taktikama kojima nastoje privući pažnju i podići svijest o brendu, proizvodu ili usluzi ne bi li naposljetku doveli kupca (čitača) do konverzije. Neke od taktika su odabir naslova koji usmjerava primateljevo čitanje poruke, odabir izvora informacija te (grafičke) opreme oglasa. Ovaj rad ispituje utjecaj perifernih poticaja – clickbait naslova, izvora informacija i vizualne opreme – na doseg nativnih oglasa u kontekstu Modela vjerodostojnosti elaboracije (eng. Elaboration Likelihood Model – ELM). Prema ELM-u, u situacijama kada publika nije posebno motivirana ili nema dovoljno kognitivnih resursa za dubinsku analizu, dominantno se oslanja na perifernu rutu obrade informacija. Stoga je za povećanje inicijalne pozornosti i dosega neophodno korištenje privlačnih, ali često površinskih elemenata. Istraživanje na uzorku od 543 nativna oglasa na najčitanijim hrvatskim internetskim portalima pokazalo je da neizvjesnost kao tip clickbaita ima najveći doseg u usporedbi s ostalim oblicima clickbait naslova. Osim toga, rezultati su pokazali da oglasi u kojima su influenceri izvori informacija ostvaruju znatno veći doseg od oglasa koji se oslanjaju na druge vrste izvora. Nalazi istraživanja potvrđuju važnu ulogu perifernih poticaja u kreiranju učinkovitih nativnih oglasa te otvaraju prostor za buduće studije koje bi se bavila dubinom obrade i promjenom stavova kod korisnika. U praktičnom smislu, rezultati sugeriraju da oglašivači, kombinirajući atraktivne naslove i influencere kao izvore informacija, mogu uspješno povećati vidljivost marketinških poruka.

Ključne riječi: *nativno oglašavanje, clickbait naslovi, influenceri, internetski portali, angažman publike*

JEL: *M30, M37, L86, D83*

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The Editorial Board receives all manuscripts. After reviewing and accepting the manuscripts, Editor-in-Chief subjects them to the members of the Editorial Board for the assessment process, and in case of the specific content of the text, to external experts as well. After evaluation, Editor-in-Chief proposes Editorial decisions for further action including: (a) which manuscript, if necessary, should be returned to the author with suggestions, comments and recommendations for improvement, primarily methodological presentation of research materials, (b) which manuscripts could be sent to peer-review process, (c) which manuscripts should be rejected because of the reasons as follows:

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Book reviews, reviews on doctoral dissertations, as well as reviews on international conferences and seminars are not submitted to extramural reviews. They are accepted or rejected by the Editor and co-editors.

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d. Introduction – defines the problem and the subject matter of the research referring to recent bibliography and findings. However, these can more specifically be dealt with in the second section *Literature review*. The last part of the introduction is reserved for setting the hypothesis of the research that will be later on analyzed at the beginning of the conclusions. Finally, Introduction ends up by giving clues of the organization of the text.

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---------- (1994) "Exploiting cross Section Variation for Unit Root Inference in Dynamic Data", *Economics Letters*, Vol. 44, No. 1-2, pp. 9–19.

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g. Empirijski podaci i analiza – sadržavaju dokumentacijsku podlogu i rezultate empirijske analize. Potrebno je opisati i prikazati uzorak podataka korišten u analizi te prezentirati i objasniti statistička te ekonometrijska obilježja dobivenih rezultata uz tumačenje njihova ekonomskog sadržaja.

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---------- (1996a) "Empirics for Economic Growth and Convergence", *European Economic Review*, Vol. 40, No. 6, pp. 951–958.

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