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CONTENTS

| | |
|--|-----|
| <i>Aysenur Tarakcioglu Altinay, Mesut Dogan, Bilge Leyli Demirel Ergun, Sevdie Alshiqi</i> – The Fama-French Five-Factor Asset Pricing Model: A Research on Borsa Istanbul | 3 |
| <i>Sarbjit Singh Oberoi, Sayan Banerjee</i> – Bankruptcy Prediction of Indian Banks Using Advanced Analytics | 22 |
| <i>Le Hoang Vinh, Ngo Van Toan, Pham Le Quang</i> – Non-Linear Impact of ICT on Profitability of Commercial Banks in Vietnam | 42 |
| <i>Alexei O. Verenikin, Anna Y. Verenikina, John T. Finley, Khanifa V. Tyrkba, Maria V. Melanina</i> – Human Capital for Sustainable Regional Development | 54 |
| <i>Arben Fetoshi, Remzie Shahini-Hoxhaj</i> – Internal Communication in Organizations: The Case of the Post of Kosovo | 70 |
| <i>Anel Ussenova, Nurlan Sailaubekov, Shynara Sarkambayeva, Magbat Spanov, Sadylbek Ussenov</i> – A New Approach for Measuring Human Capital and Business Activity at the Enterprises of Chemical and Petrochemical Industry | 88 |
| <i>Ejup Fejza, Alban Fejza</i> – Analysis of the Effects of the Service Quality on Client Satisfaction in the Tourism Sector in Kosovo | 103 |
| <i>Nikolay Sterev, Kostadin Kostadinov, Daniel Yordanov, Tsvetelina Yorgova</i> – Open Entrepreneurial Academic Centres | 116 |
| <i>Dochka Velkova, Yana Kirilova</i> – The Discount Rate in the Assessment of EU Funded Investment Projects | 135 |
| <i>Larysa Cherchyk, Nina Khumarova, Anna Burda</i> – Forestry Enterprises Diagnostic Audit of Compliance with the Social Responsibility Principles | 149 |
| <i>Ibrahim L. Awad</i> – A Comparative Study of Seigniorage: Egypt and Qatar | 172 |
| Summaries | 191 |

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THE FAMA-FRENCH FIVE-FACTOR ASSET PRICING MODEL: A RESEARCH ON BORSA ISTANBUL⁵

This study aims to test the validity of the Fama-French Five-Factor Model (FF5F) for Turkey. Within the scope of the study, throughout 468 weeks between September 2009 and August 2018, the returns over the risk-free interest rate of 18 different intersection portfolios are used based on value, profitability, and investment factors. A total of 8424 portfolios (18 portfolios x 468 weeks) are generated in the study. As a result of the analyses, it is determined that the Five-Factor Asset Pricing Model is valid for Borsa Istanbul. Subsequently, it is concluded that the Fama-French Five-Factor Model has a higher explanatory power in describing the stock returns of the portfolios formed with stocks of small-scale companies compared to the portfolios formed with stocks of large-scale companies. The findings are consistent with the literature.

Keywords: CAPM; Fama-French Five Factors Model (FF5F); Stock Returns; Borsa Istanbul

JEL: E44; G11; G12

1. Introduction

In the late 1950s, the soaring prestige of natural sciences, which attempted to explain natural events with the obtained data by applying to empirical instruments, encouraged the belief that it would be possible to mitigate problems pertinent to decision-making and equity allocation with the widespread use of optimization models and mathematical techniques (Dempsey, 2013).

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In this context, Markowitz's (1952) "Portfolio Selection" and the modern corporate finance theory developed by Modigliani and Miller (1958; 1963) have contributed to the formation of normative literature on issues related to the functioning of financial institutions and the financial system. In the study of Markowitz (1952) on portfolio selection, the relationship between risk and return in securities investment is considered a turning point for modern finance and investment theories. "Modern Portfolio Theory", for which Markowitz was awarded a Nobel Prize in 1990, brought a new perspective to finance literature and rendered the traditional portfolio approach controversial. There are various models based on modern portfolio theory which develop by adding to this model. The best-known and most studied among these models is the Capital Asset Pricing Model (CAPM).

The Capital Assets Pricing Model (CAPM) argues that the risk premium expected from security should be proportional to the expected risk premium pertaining to the market. The model has been widely utilized in performance assessments, estimation of capital cost, portfolio selection, and measurement of abnormal returns. The CAPM has been considered an important turning point in modern finance theory since it was developed by Sharpe (1964), Lintner (1965), Mossin (1966), and Black (1972). The market model of William Sharpe (1964) was formulated as follows:

$$R_{it} = \alpha_i + \beta_i * R_{Mt} + e_{it}$$

The variables in the formula are as follows:

R_{it} = The return of stock i in period t

α_i = The expected return of security i

β_i = The sensitivity of stock i to market movements

R_{Mt} = The return on the market in period t

e_{it} = The risky return of security i (defines the error term with statistically a zero mean and constant variance (σ_e^2)).

The equation in this model explains the return on assets through the return on the stock market index. The β value in the equation denotes a risk indicator stemming from the relationship between market return and stock return. Following the model, the equilibrium model was developed. The difference between the market model and the equilibrium model emerges due to the relationship between excessive market returns and return on assets rather than market returns. The general formulation of the equilibrium model developed by Sharpe, Lintner, and Mossin is called the Capital Asset Pricing Model. The Asset Pricing Model is formulated as follows:

$$R_{it} = R_f + \beta_i * (R_{Mt} - R_f) + e_{it}$$

R_{it} = Return of the stock i in period t

R_f = Risk – free interest rate

R_{Mt} = Return on the market in period t

e_{it} = The risky return of security i (defines the error term with statistically a zero mean and constant variance (σ_e^2)).

In the new Capital Asset Pricing Model developed by Black (1972), unlike the previous model developed by Sharpe, Lintner, and Mossin; the assumption of risk-free borrowing and lending was included. Basu (1977) considered different time-series models and explained that the returns were positive and linear by associating them with the β coefficient. The equation of this model is as follows:

$$R_{it} - R_f = \alpha_i + \beta_i * (R_{Mt} - R_f) + e_{it}$$

Although the Capital Asset Pricing Model is still accepted as a widely used model in bond pricing, contradictory findings are being observed in empirical studies (Chiah et al. (2016). Therefore, the researchers studied more advanced models by including more descriptive variables in the model of stock return behaviour.

When investors select among the securities representing the ownership of their companies' activities, they assume that they pay reasonable prices considering what is known about the company (Fama, 1976). The foundation of modern finance theory is based upon such a generally accepted view in capital markets. The paradigm underlying this view argues that financial capital circulation is based on achieving the most attractive rates of return for its investors (Dempsey, 2013). This principle coincides with the assumption of the rational expectations hypothesis in economics that economic decision-making units would have all the information related to the variable. However, decision-making units do not have all the information related to the variable since another assumption of the hypothesis claims the existence of a certain level of cost to be incurred to gather information, it would not be possible to acquire a consistent return upon acting according to the assumption that merely partial information is accessible.

Insufficient disclosure of the expected returns of financial assets due to some deficiencies in the CAPM assumptions led to studies conducted on multi-factor models in determining stock returns. The first of these models was the "Three-Factor Model" developed by Eugene F. Fama and Kenneth R. French in 1993.

In this model, two new factors such as the company size (size) and the Book Equity / Market Equity ratio (value) were included in the CAPM which tests the relationship between the expected rate of return of any risky investment instrument or any portfolio and the rate of return of the market portfolio. Fama and French (1993) concluded that stocks of companies with market equities of less than \$ 1 billion and stocks of companies with high book equities tend to yield higher returns than expected through the CAPM (Fama and French, 2015).

The equation for the Fama-French Three-Factor Model is as follows:

$$R_{it} - R_f = a_i + (R_{Mt} - R_{ft}) + s_iSMB_t + h_iHML_t + e_{it}$$

The variable previously denoted as α_i in the model is expressed as a_i in Chiah et al. (2016). There are no changes here except for the difference in notation.

The Size Factor (SMB-Small Size Minus Big Size) is the difference in return between portfolios with a low market value and portfolios with a large market value.

$$SMB = \frac{(SH + SN + SL) - (BH + BN + BL)}{3}$$

The Value Factor (HML-High Value Minus Low Value) is obtained by subtracting low-value stocks from high-value stocks.

$$HML = \frac{(SH + BH) - (SL + BL)}{2}$$

With the Fama-French Three-Factor Model, the β coefficient pertaining to the market sensitivity in the CAPM was excluded from the model and replaced by the size and the value factors based on the assumption that they would better handle the cross-sectional change. Fama and French developed the existing model in 2015 by including the investment and profitability factors in the Three-Factor Model since the Three-Factor model was not sufficient in explaining the cross-sectional changes having certain anomalies in expected returns related to investment and profitability. The new model has entered the literature as the Fama-French Five-Factor Model (Kubota and Takehara, 2018). The Fama-French Five-Factor Model, developed due to the failure of the Three-Factor Model in explaining the expected return, was formulated in the following form (Jan and Ayub, 2019);

$$R_{it} - R_{ft} = a_i + (R_{Mt} - R_{ft}) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + e_{it}$$

The Investment Factor (CMA-Conservative Minus Aggressive) is obtained by subtracting high-risk (aggressive) stocks from low-risk (conservative) stocks.

$$CMA = \frac{(SC + BC) - (SC + BA)}{2}$$

The Profitability Factor (RMW-Robust Minus Weak) is the t-time difference in return between portfolios with high profitability ratios and portfolios with weak profitability ratios.

$$RMW = \frac{(SR + BR) - (SW + BR)}{2}$$

Table 1. Selected Portfolio Groups that Constitute the Fama-French Factors

| | | |
|-------|-----------------------------------|-------------------|
| SMALL | Book Equity/Market Equity (S-B/M) | High (SH) |
| | | Neutral (SN) |
| | | Low (SL) |
| | Profitability (SP) | Robust (SR) |
| | | Medium (SM-) |
| | | Weak (SW) |
| | Investment (S-INV) | Conservative (SC) |
| | | Medium (SM) |
| | | Aggressive (SA) |
| BIG | Book Equity/Market Equity (B-B/M) | High (BH) |
| | | Neutral (BN) |
| | | Low (BL) |
| | Profitability (BP) | Robust (BR) |
| | | Medium (BM-) |
| | | Weak (BW) |
| | Investment (B-INV) | Conservative (BC) |
| | | Medium (BM) |
| | | Aggressive (BA) |

2. Literature Review

In the 1950s, the process of detecting stock price movements and determining the factors affecting this process became an interesting issue for researchers. In this process, many models have been developed pertaining to the issue. The first model of the field, as mentioned in the introduction part of the study, was Markowitz's (1952) modern portfolio theory. The process continued with the capital assets pricing model (CAPM) developed with the contributions of Sharpe (1964), Lintner (1965), and Black (1972). Following these studies, Fama and French (1993) developed a new three-factor model in which the criticism toward the CAPM was eliminated in the related field. In 2015, Fama and French designed a five-factor model by adding two more factors to the previous model developed in 1993. A large number of studies have been conducted in the domestic and foreign literature regarding the Fama-French Three-Factor Model. Nonetheless, upon examining the literature, it is apparent that there are merely a limited number of studies conducted on the validity of the Fama-French Five-Factor Model.

Chiah et al. (2016) made strong suggestions for the international capital markets which were excluded from the sample by testing the validity of the Fama-French Five-Factor Model in explaining the stock returns on the Australian Stock Exchange throughout 1982-2013. The study, in which the multi-factor model was found to be suitable for the Australian capital markets, emphasized the model's suitability also for the American capital market.

Fama ve French (2017), in which the Fama-French Five-Factor Asset Pricing Model was tested in the North American, European, Japanese, and Asian Pacific Stock Markets, detected that investments were negatively related to the returns whereas the increase in both the Book Equity / Market Equity ratio and profitability boosted the average returns in North America, Europe, and the Asia Pacific. In the study, it was determined that there was a positive and strong relationship between the average returns and the Book Equity / Market Equity ratio for Japan, however, it was concluded that the average returns were weakly related to profitability and investment factors.

Lin (2017), which the applicability of the Fama-French Five-Factor Asset Pricing Model was tested in the Shanghai and Shenzhen Stock Exchanges between 1997-2015, concluded that the Fama-French Five-Factor Model was far more successful than the Fama-French Three-Factor Asset Pricing model in explaining the returns in the Shanghai and Shenzhen Stock Exchange Markets. However, unlike the results obtained in Fama-French (2015), the study stated that the investment factor had no contribution in explaining the average returns.

Foye (2018) determined that the Five-Factor Model was more successful in explaining stock returns than the Three-Factor Model for Eastern Europe and Latin America by testing the applicability of the Fama-French Five-Factor Asset Pricing Model for the stock markets in Asia (China, India, Indonesia, Malaysia, Philippines, South Korea, Taiwan, and Thailand), Eastern Europe (Czech Republic, Hungary, Russia, Poland, and Turkey), and Latin America (Argentina, Brazil, Chile, Colombia, and Mexico) throughout 1996-2016.

Nevertheless, it was stated that the variables of profitability and investment are not explanatory for Asian countries, therefore, the Fama-French Five-Factor Asset Pricing Model failed to explain the returns for the Asian Region.

Huang (2018) tested the applicability of the Fama-French Five-Factor Asset Pricing Model in the Chinese Stock Exchange throughout 1994-2016. It was determined that the Fama-French Five-Factor Model for the Chinese Stock Exchange was more successful than other traditional asset pricing models in explaining stock returns.

Kubota ve Takehara (2018), who tested the stock returns of the Tokyo Stock Exchange throughout 1978-2014 with the Fama-French Five-Factor Asset Pricing Model, concluded that the profitability and investment factors were not statistically significant in explaining the stock returns.

Olive et al. (2018), this study analyses FAMA French Three Factor model and Capital asset pricing model in the Indian stock market. To maximize share price, the financial manager must learn to assess two key determinants viz., risk and return. Each financial decision presents certain risk and returns characteristics, and the unique combination of these characteristics has an impact on the share price. The risk and return of a single decision were discussed using CAPM and FAMA French Three-factor model. The objectives of the study included, measuring and analyzing the performance of the stock using FAMA French three-factor model and capital asset pricing model. This study was done for the Indian Stock market by choosing the first leading stock market Bombay Stock Exchange as the sample. The index selected for the study was S&P BSE 200, and only 120 companies were selected as the sample for conducting the study. CAPM being a single-factor model gave only 7.5 percent significant result to the single asset. This showed that market return alone cannot determine the risk and return of the company stock. The predictability of the variables of FAMA French Three Factor model namely market return, size (SMB), and value (HML) factors are also tested in this study. The result showed that about 58.3 percent of company stocks showed significant results towards SMB and 52.5 percent of company stocks are showing significant results towards HML. Hence, the findings were generally supportive of the FAMA French model applied to Indian equities.

Cox ve Britten (2019), by comparing the Fama-French Three-Factor Model and the Fama-French Five-Factor Model in terms of explaining the stock returns on the Johannesburg Stock Exchange between 1991 and 2017, concluded that the former model had higher explanatory power than the latter pertaining to the time-series of the size-value and size-profitability variables. The Fama-French Five-Factor Model was identified as the best model to explain revenue in general. It was concluded that the model is sufficient to reveal and explain the negative relationship of the size, beta and coefficient with the return.

Senarathne (2019) emphasized that the findings were insufficient in normal market conditions in his study where the applicability of the Fama-French Five-Factor Asset Pricing Model was tested for the stock market in Europe, Japan, Asia Pacific (Japan), and North America throughout 1990-2019. It is asserted that the reaction of investors to portfolios with common risks in the European and Japanese markets during the crisis depended on the opinion regarding the size of capital stocks, the size of the investment, the level of profitability, and Book Equity/Market Equity.

Zhao et al. (2019) concluded that the Fama-French Five-Factor Model was more successful in mitigating asymmetric information in their study where the Fama-French Five-Factor Model was compared with the Bayesian Approach throughout 2000-2017. Li et al. (2019)

stated that the Fama-French Five-Factor Model was partially successful in explaining the stock returns of the Chinese Stock Market as a result of their study covering the period of 2005-2016, and the most important underlying reason was the fact that the Chinese stock market being rather fragile compared to the stock markets of developed economies.

Rugwiro and Choi (2019) tested the applicability of the Fama-French Three-Factor Asset Pricing Model for the Korean Stock Exchange throughout 1998-2016 and concluded that the Fama-French Three-Factor Model was insufficient to explain the liquidity factor compared to the Fama-French Five-Factor. Racicot et al. (2019) evaluated the sample consisting of 12 sector portfolio returns and market risk factors in terms of the applicability of the Fama-French Five-Factor Model for the S&P 500 throughout 1968-2016 and concluded that the model could be more sufficient to explain the returns upon inclusion of the estimators of the financial crisis and economic fluctuations into the model. Gonzalez and Jareno (2019), in their studies comparing the Fama-French Three-Factor and Five-Factor Models throughout 1989-2014, concluded that it could perform significantly better for low theta values during stagnation periods in explaining the sectoral returns on the US stock markets.

Ahmed et al. (2019) compare major factor models and find that the Stambaugh and Yuan (2016) 4-factor model is the overall winner in the time-series domain. The Hou, Xue, and Zhang (2015) q-factor model takes second place and the Fama and French (2015) 5-factor model and the Barillas and Shanken (2018) 6-factor model jointly take third place. The pairwise cross-sectional R-2 and the multiple model comparison tests show that the Hou et al. (2015) q-factor model, the Fama and French (2015) 5-factor and 4-factor models, and the Barillas and Shanken (2018) 6-factor model take equal first place in the horse race.

Pandey and Sehgal (2019), in this paper, authors experiment with the construction of alternative investor sentiment indices. Further, the authors evaluate the role of the sentiment-based factor in asset pricing to explain prominent equity market anomalies such as size, value, and price momentum for India. Based on the findings, the authors confirm that our Composite Sentiment index leads other sentiment indices currently in vogue in investment literature. The asset pricing models, including the more recent Fama French 5-factor model, are not fully able to explain the small firm effect which is captured by our sentiment-based factor which seems to proxy for the price over-reactions.

Pepenkov (2019), stock returns are generally difficult to explain, as they are comprised of many discrete channels of risk. Empirical asset pricing models (EAPM), such as the Fama-French five-factor model (FF5), have been used to partition these channels across a series of systematic risk factors, such as company size (total market equity), value (book-to-market ratio), investment, and operating profitability. Prior EAPMs only accounted for how such factors contributed to risk at the market level, ignoring any potential variation across the sectors. This study developed a sector-heterogeneous model (SHM) which directly accounts for this variation by generalizing the Fama-French methodology to sector subsets of stocks. The results demonstrated that risk is meaning heterogeneous across sectors for each of the factors in the FF5, with different subgroups of factors being statistically significant within each sector. In a direct comparison of explanatory power, the SHM outperformed the FF5 and improved adjusted R-2 by an average of 5% for stocks across all sectors. Several applications of sector heterogeneity were then demonstrated for stock-picking purposes, including a high-beta portfolio strategy using the SHM-beta which outperformed the S&P

500 in backtesting. This study concludes that meaninsector heterogeneityneity exists in market risk. This information is materially useful to investors.

Chakraborty et al. (2019), This paper shows that asset prices are linear polynomials of various underlying explanatory factors, and asset returns being ratios of these polynomials, are rational functions that do not add linearly when averaging. Hence, average returns should be modelled based on stock prices. However, continuous returns may be treated as approximately linear across time and modelled directly. Our new Rational Function (RF) models, empirically outperform the traditional asset pricing models like the Capital Asset Pricing Model (CAPM) and the Fama-French three and five-factor models for both average and continuous returns. Moreover, the RF theory also provides a model to estimate asset volumes. The average change in asset volumes together with average returns provide the estimates for the average change in market values of assets. Thus, the RF model approach can be used to select assets that provide either the highest returns for profit maximization or the highest change in market values for wealth maximization for given levels of risk.

Ielasi, F., & Rossolini (2019), the aim of the paper is to compare the risk-adjusted performance of sustainability-themed funds with other categories of mutual funds: sustainable and responsible mutual funds that implement different approaches in portfolio selection and management, and thematic funds not committed to responsible investments. The study analyses a sample of about 1000 European mutual open-end funds where 302 are sustainability-themed funds, 358 are other responsible funds, and 341 are other thematic funds. Risk-adjusted performance is analyzed for the period 2007-2017 using different methodologies: a single-factor Capital Asset Pricing Model (CAPM), a Fama and French (1993) 3-factor model, and a Fama and French (2015) 5-factor model. Our main findings demonstrate that the risk-adjusted performance of ST funds is more closely related to their responsible nature than to their thematic approach. Sustainability-themed mutual funds are more similar to other socially responsible funds than to other thematic funds, as confirmed by performance analysis over time. They are also better than other thematic funds in overcoming financially turbulent periods and currently benefit from SRI regulation and disclosure.

Ait-Sahalia et al. (2020) authors use all traded stocks from NYSE, AMEX, and NASDAQ stock markets for 1996-2017 to construct the five Fama-French factors and the momentum factor at the 5-minute frequency. Second, the authors document the key empirical properties across all the stocks and the new factors and apply the nonparametric time series regression model with the new high-frequency Fama-French factors. Authors find that this factor model is effective in explaining the systematic component of the risk of individual stocks. In addition, the authors provide evidence that idiosyncratic jumps are related to idiosyncratic events such as earnings disappointments.

Liammukta et al. (2020), in this paper, authors have developed a Fama – French five-factor model (FF5 model) from Fama & French (2015) by using the concept the of time-varying coefficient. For a data set, the authors have used monthly data from Kenneth R. French's home page, it includes Japan portfolios (classified by using size and book-to-market) and 5 factors from July 1990 to April 2020. In the first analysis, the authors used the Augmented Dickey-Fuller test (ADF test) for the stationary test, from the result, all Japan portfolios and

5 factors are stationary. Next analysis, the authors estimated a coefficient the of the five-factor model by using a generalized additive model with a thin-plate spline to create the time-varying coefficient Fafive-factor five-factor model (TV-FF5 model). The benefit of the study is TV-FF5 model which can capture a different effect at different times of 5 factors but the traditional FF5 model can't do it. From the result, authors can show a time-varying coefficient in all factors and in all portfolios, for time-varying coefficients of $R_m - R_f$, SMB, and HML are significant for all Japan portfolios, time-varying coefficients of RMW are positively significant for SM, and SH portfolio and time-varying coefficients of CMA are significant for SM, SH, and BM portfolio.

Foye and Valentinčič (2020), and Fama and French (2015) recently proposed a five-factor model which adds investment and profitability terms to their seminal three-factor model. Motivated by the accounting-based nature of the new factors, the authors' test of variants of the models in Indonesia a country previous researchers have characterized by an idiosyncratic financial reporting environment and low earnings quality. Although multi-factor spanning tests imply these factors contribute to the explanation of average returns, tests using sets of LHS portfolios reveal all competing models produce large intercepts and the five-factor model offers at best only a trivial improvement to the description of average LHS returns.

Douagi et al. (2021), the novel contribution of this paper is to test if the Fama-French five- and six-factor models can explain the portfolio returns in the Regional Stock Exchange of Ivory Coast Securities (BRVM) between January 2007 and December 2018. For the Fama-French five-factor model, the results show that the only useful factors for describing the portfolio excess return are the market, value, and profitability when the OLS and the GARCH techniques are used. For the augmented Fama French six-factor model, the results report that only the market, value, profitability and illiquidity factors played an eminent role in explaining the portfolio's excess return. Moreover, using the OLS technique, it is found that the Fama-French five-factor model and the augmented Fama-French six-factor model can capture the portfolio returns. However, when the GARCH technique is used, the findings show that these models can fully explain the portfolio returns. The results found can help portfolio managers to identify extensive factors that have an impact on equity returns and to estimate the required return on the stock. Moreover, traders can employ these factor models to control investment risk.

Calice and Lin (2021), In this study, a comprehensive set of risk premia of country equity returns for 45 countries over the sample period 2002 – 2018 in both a single and a multiple-factor setting. Using a new three-pass estimation method for factor risk premia by Giglio and Xiu (2021), authors find that several factors, including default risk, are also priced in country equity excess returns, controlled by the Fama-French 5-factor and Carhart models. Moreover, the authors apply a novel approach to investigate the multi-factor impact on country equity returns. Authors find that the multi-factor information, constructed from the first principal component of the statistically significant single factors, provides a consistent and stronger prediction of anomalies in country equity returns.

Zhu et al. (2021), this paper tests a multi-factor asset pricing model that does not assume that the return's beta coefficients are constants. This is done by estimating the generalized arbitrage pricing theory (GAPT) using price differences. An implication of the GAPT is that when using price differences instead of returns, the beta coefficients are constant. Authors

employ the adaptive multi-factor (AMF) model to test the GAPT utilizing a Groupwise Interpretable Basis Selection (GIBS) algorithm to identify the relevant factors from among all traded exchange-traded funds. The authors compare the performance of the AMF model with the Fama-French 5-factor (FF5) model. For nearly all time periods less than six years, the beta coefficients are time-invariant for the AMF model, but not for the FF5 model. This implies that the AMF model with a rolling window (such as five years) is more consistent with realized asset returns than is the FF5 model.

Cao et al. (2021), using a direct measure of investor attention generated from the Securities and Exchange Commission's EDGAR (Electronic Data Gathering, Analysis, and Retrieval) log files, the authors revisit the stock return predictability of the divergence of opinions in the presence of a varying degree of investor attention and information acquisition. They document a positive relationship between the divergence of opinions and future stock returns, consistent with the risk hypothesis, as opposed to the overvaluation hypothesis. More importantly, the authors find that the predictive power of divergence of opinions is more pronounced in stocks with lower investor attention. They further document the construction and profitability of divergence of opinions portfolios augmented with investor attention. A portfolio that goes long on stocks with low investor attention and the highest divergence of opinions and short on stocks with low attention and the lowest divergence of opinions generates a Fama-French 5-factor monthly alpha of 1.14%.

Platanakis (2021), for various organizational reasons, large investors typically split their portfolio decision into two stages – asset allocation and stock selection. In this study hypothesize that mean-variance models are superior to equal weighting for asset allocation, while the reverse applies for stock selection, as estimation errors are less of a problem for mean-variance models when used for asset allocation than for stock selection. This study confirms this hypothesis for US data using Bayes-Stein with no short sales and variance-based constraints. Robustness checks with four other types of mean-variance models, and a wide range of parameter settings support our conclusions. Authors also replicate our core results using Japanese data, with additional replications using the Fama-French 5, 10, 12 and 17 industry portfolios and equities from seven countries. In contrast to previous results, but consistent with our empirical results, authors show analytically that the superiority of mean-variance over $1/N$ is increased when the assets have a lower cross-sectional idiosyncratic volatility, which authors also confirm in a simulation analysis calibrated to US data.

Khoa and Huynh (2022), this study applied a machine-learning technique to compare the performance of the Fama-French 5-factor model (FF5). Two approaches are employed in the Fama-French model: Long Short Term Memory Recurrent Neural Network (LSTM-RNN) and Maximum Likelihood Estimation (MLE). From January 1, 2010, through March 3, 2022, the stock market in Ho Chi Minh City was experimentally researched. The rolling window approach is used in combination with the Root Mean Square Error (RMSE), and the results of the FF5 model with the LSTM-RNN algorithm are more efficient in prediction error than the MLE methodology. This contribution encourages investors and hedge fund managers to use the LSTM-RNN algorithm to boost forecasting efficiency.

Meng and Zhang (2022), this paper aims at analyzing the impact of corporate environmental information disclosure from the perspective of investors. To that end, the authors have

collected environmental information disclosure data of all Chinese listed companies from 2004 to 2020 and controlled the impacts of annual reports on investor response. Authors apply the Fama-French five-factor model to calculate the accumulative abnormal returns of stocks during the event window. The study's results suggest that environmental information disclosure can have a significant negative response among investors when authors take the impacts of annual reports into consideration. Moreover, the authors find that heavy-polluting companies and companies with high institutional shareholding are more likely to have negative reactions from investors. Notably, the negative response is found significant after the Ambient Air Quality Standard was revised in 2012. Furthermore, high environmental expenditure and strict environmental regulation will result in negative investor responses, while the political connection can alleviate the negative impacts of environmental information disclosure. The results remain robust in different ways. The findings suggest that listed companies may lack the incentive to engage in environmental management and are reluctant to disclose environmental information. Consequently, the government should formulate a mandatory disclosure policy and provide administrative support to environmental-friendly companies. Besides, companies should introduce innovative technologies to cut down environmental costs. Meanwhile, investors should be aware of the importance of corporate environmental behaviours and realize the long-term benefits of environmental management of listed companies.

3. Methodology

In this study, it is aimed to test the validity of the Fama-French Five-Factor Model for Borsa Istanbul. Within the scope of the study, the weekly data of the returns of 18 different intersection portfolios in excess of the risk-free interest rate are utilized throughout September 2009 – August 2018 (468 weeks) based on value, profitability, and investment factors. In the study, a total of 8424 portfolios (18 portfolios * 468 weeks) are formed. In the study, it is investigated which of the Fama-French Three, Four, and Five-Factor Models best explains the stock returns for Borsa Istanbul by developing estimators separately. In the Fama-French Five-Factor Model, besides the stock returns, the systematic risk premium $\beta_i(r_m - r_f)$ of stocks, market factor, size factor (SMB), value factor (HML), profitability factor (RMW) and investment factor (CMA) variables are used. In the study, companies in the financial sector, with equity capital and insufficient information are excluded from the analysis. The risk-free interest rate data used in the study are obtained from the official website of the Prime Ministry Undersecretariat of Treasury, and other data are obtained via the Finnet software. As the risk-free interest rate, the 1-month US Treasury bond interest rate is taken. In the study, a bias-adjusted robust estimator and the GRS-F test according to the Newey-West method are used.

The portfolios used in the study are presented in Table 2. After the companies are divided into 2 groups, big and small, while creating portfolios; portfolios are divided into 3 groups such as "Book Equity / Market Equity", "Investment" and "Profitability". Two portfolios, namely "Small-S" and "Big-B", are identified for the size effect. For the value effect, 3 portfolios such as "High (Big-B)", "Neutral (Neutral-N)" and "Low (Low-L)" are selected in accordance with the Book Equity/Market Equity. Later on, the 6 (2x3) value-weighted

portfolio intersections according to Size and Book Equity / Market Equity are formed (Fama and French, 1995).

Table 2. Portfolios Used in the Study

| Portfolio | Company Size | Value Effect | |
|-----------------|--------------|--------------|-----------------------------|
| SL ⁶ | Small | Low | Book Equity / Market Equity |
| SN | Small | Neutral | |
| SH | Small | High | |
| BL | Big | Low | |
| BN | Big | Neutral | |
| BH | Big | High | |
| SC | Small | Conservative | Investment |
| SM | Small | Medium | |
| SA | Small | Aggressive | |
| BC | Big | Conservative | |
| BM | Big | Medium | |
| BA | Big | Aggressive | |
| SW | Small | Weak | Profitability |
| SM- | Small | Medium | |
| SR | Small | Robust | |
| BW | Big | Weak | |
| BM- | Big | Medium | |
| BR | Big | Robust | |

Stocks are divided into 3 groups (from smallest to largest). Then, regardless of this process, they are divided into 3 groups according to the DD/PD ratio. With the intersection of these two groups, the Firm Size DD/PD portfolio is created. In the model, the weighted average residual return ($R_{it} - R_{ft}$) of the confluence of Firm Size-DD/PD, Firm Size Profitability and Firm Size-Investment portfolios is used as the dependent variable, as well as the residual returns of portfolios consisting of different combinations of these factors by dividing each factor into more percentages. Firms are ranked according to their profitability and divided into 3 percentiles. Bills in the 30th percentile and below are called "(Weak)", those in the 70th percentile and above (Strong), and the bills in the middle segment are called "(Medium)". Fama and French (2015, 2017) stated that in the profitability portfolios that they divided into three according to their profitability, the profitability portfolios with the highest third achieved higher returns. After the investment is calculated, the stocks are ranked according to the investment value and divided into 3 percentiles. Bills in the 30th percentile and below are called "(Conservative)", those in the 70th percentile and above are called "(Aggressive)" and the bills in the middle segment are called "(Medium)".

Within the scope of the study, the following models are developed to cover the aim of the study and the created portfolios:

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + \varepsilon_{it}$$

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i(SMB_t) + h_i(HML_t) + \varepsilon_{it}$$

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i(SMB_t) + h_i(HML_t) + r_i(RMW_t) + \varepsilon_{it}$$

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i(SMB_t) + h_i(HML_t) + r_i(RMW_t) + c_i(CMA_t) + \varepsilon_{it}$$

⁶ It refers to the return on a portfolio of stocks with small company size and low Book Equity / Market Equity ratio.

In this context, the hypotheses of the GRS-F test are as follows (Gibbons, Ross & Shanken, 1989):

H_0 : All alpha coefficients obtained from the CAPM, the Fama-French Three, Four, and Five-Factor models are equal to zero ($\alpha_i = 0$).

H_1 : All alpha coefficients obtained from the CAPM, the Fama-French Three, Four, and Five-Factor models are not equal to zero ($\alpha_i \neq 0$).

Table 3. Descriptive Statistics of the Intersection Portfolios in Excess of the Risk-Free Interest Rates

| | N (Week) | Mean | Std. Deviation |
|-----|----------|-------|----------------|
| SL | 468 | .0027 | .03264 |
| SN | 468 | .0037 | .02982 |
| SH | 468 | .0024 | .02925 |
| BL | 468 | .0031 | .02504 |
| BN | 468 | .0039 | .02413 |
| BH | 468 | .0023 | .02623 |
| SC | 468 | .0038 | .03068 |
| SM | 468 | .0032 | .02964 |
| SA | 468 | .0018 | .03006 |
| BC | 468 | .0033 | .02698 |
| BM | 468 | .0033 | .02535 |
| BA | 468 | .0035 | .02786 |
| SW | 468 | .0015 | .02953 |
| SM- | 468 | .0030 | .02846 |
| SR | 468 | .0051 | .03206 |
| BW | 468 | .0004 | .02846 |
| BM- | 468 | .0034 | .02467 |
| BR | 468 | .0042 | .02346 |

Descriptive statistics regarding the created portfolios created in the study are given in Table 3. The highest average, the value-weighted weekly return is the SR portfolio, which consists of stocks with small and robust profitability ratios in terms of the company size. The most profitable portfolios are SR, BR, and BN, respectively.

Table 4. Correlation Analysis Results regarding the Factor Premiums

| | RM-RF | SMB | HML | CMA | RMW |
|-------|-------|--------|--------|-------|-----|
| RM-RF | 1 | | | | |
| SMB | 0.096 | 1 | | | |
| HML | 0.063 | -0.223 | 1 | | |
| CMA | 0.116 | .018 | 0.166 | 1 | |
| RMW | -.005 | 0.133 | -0.064 | -.010 | 1 |

Correlation analysis results regarding the factor premiums are given in Table 4. There is a negative relationship between SMB and HML factors, whereas a positive and weak relationship between CMA and HML factors. It is seen that there is a very low correlation among the independent variables used in the study. It can be claimed that this situation can

prevent multicollinearity problems and spurious regression results that may occur in the model.

Table 5. Unit Root Test Results

| Variables | LLC Test | | PP Fisher Test | |
|-----------|----------|----------------|----------------|-----------------|
| | T-test | Probability(p) | Statistic | Probability (p) |
| SL | -5.76 | 0.000 | 37.21 | 0.000 |
| SN | -17.27 | 0.000 | 87.86 | 0.000 |
| SH | -28.50 | 0.000 | 56.33 | 0.000 |
| BL | -4.99 | 0.000 | 42.58 | 0.000 |
| BN | -17.31 | 0.000 | 72.84 | 0.000 |
| BH | -22.91 | 0.000 | 69.21 | 0.000 |
| SC | -25.40 | 0.000 | 72.54 | 0.000 |
| SM | -29.61 | 0.000 | 117.70 | 0.000 |
| SA | -28.04 | 0.000 | 77.87 | 0.000 |
| BC | -24.22 | 0.000 | 70.68 | 0.000 |
| BM | -9.69 | 0.000 | 45.39 | 0.000 |
| BA | -14.73 | 0.000 | 36.73 | 0.000 |
| SW | -7.76 | 0.000 | 36.79 | 0.000 |
| SM- | -7.17 | 0.000 | 40.73 | 0.000 |
| SR | -9.46 | 0.000 | 43.99 | 0.000 |
| BW | -20.06 | 0.000 | 61.21 | 0.000 |
| BM- | -8.22 | 0.000 | 43.97 | 0.000 |
| BR | -21.21 | 0.000 | 76.54 | 0.000 |
| Rm-Rf | -26.40 | 0.000 | 76.45 | 0.000 |
| SMB | -8.77 | 0.000 | 45.22 | 0.000 |
| HML | -7.54 | 0.000 | 76.55 | 0.000 |
| CMA | -12.45 | 0.000 | 44.80 | 0.000 |
| RMW | -15.60 | 0.000 | 66.40 | 0.000 |

The hypotheses for unit root tests of the variables are as follows:

H_0 : The series contains a common unit root ($H_0: p_i = p = 1$).

H_1 : The series contains no common unit root ($H_1: p_i = p < 1$).

Series must be stationary in order to obtain econometrically significant relationships among the variables. If the time series of the variables contain a trend, the relationship reflects the spurious (bogus) regression (Sevinç, 2013, pp. 235-236). Table 5 presents the unit root test results indicating the stationarity of the variables. In this study, the Fisher ADF Root Test is used. Also, the LLC and the PP Fisher tests are performed. Both root test results indicate that the series is stationary. In other words, the null hypothesis (H_0), which claims that the variables contain unit roots due to the stationarity of the series, is statistically rejected.

4. Findings

In this part of the study, the validity of the Fama-French Five-Factors Asset Pricing Model (FF5F) is tested for Turkey.

Table 6. Regression Results

| Ri – Rf | a | β | s | h | r | c | Grs-f | dw | f-statistic | Adjusted R ² |
|------------------------------------|------------------|--------------------|-------------------|-----------------|------------------|------------------|----------------|-------|------------------|-------------------------|
| CAPM | 0.003 (0.285) | 0.254 (2.564)** | - | - | - | - | 1.55 (0.15) | 1.986 | 35.78 (0.000) | 0.384 |
| Fama-French Three Factor (Model 1) | 0.003 (0.285) | 0.254 (2.564)** | 1.023 (5.754)* | .121 (1.032) | - | - | 1.32 (0.23) | 1.986 | 35.78 (0.000) | 0.447 |
| Fama-French Four Factor (Model 2) | 0.004 (0.292) | 0.261 (2.631)** | 1.135 (5.954)* | .143 (1.195) | .656 (4.034)* | - | 1.13 (0.38) | 1.867 | 38.25 (0.000) | 0.448 |
| Fama-French Five Factor (Model 3) | 0.011 (0.322) | 0.282 (2.945)** | 1.265 (6.551)* | .160 (1.280) | .756 (4.344)* | -.234 (1.001) | 1.02 (0.41) | 1.982 | 42.91 (0.000) | 0.455 |

The CAPM, Fama-French Three-Four, and Five-Factor regression results are presented in Table 6. Upon examining the analysis results, it is understood that 4 models constituted with 18 portfolios are significant and there is no autocorrelation. The R² values of the CAPM, the Fama-French Three-Factor, the Fama-French Three-Factor, the Fama-French Four Factor, and the Fama-French Five-Factor Models are 38.4%; 44.7%; 44.8%, and 45.5%, respectively. This obtained result indicates the Fama-French Five-Factor Model as the model with the highest explanatory power in explaining stock returns. However, it is seen that alpha coefficients are equal to zero and there is no pricing error in the developed models. Moreover, the market factor β coefficients in models are positive and significant. The value factor “h” coefficient is not statistically significant in the Fama-French Three-Four and Five-Factor regression models. On the other hand, in the Fama-French Four and Five-Factor regression models, the profitability factor “r” coefficient is positive and significant. Furthermore, the investment factor “c” coefficient is not determined to be statistically significant in the Fama-French Four and Five-Factor regression models.

Consequently, the H_1 hypothesis is accepted for the CAPM, the Fama-French Three, Four, and Five-Factor Models after performing the GRS-F test. In other words, the CAPM, the Fama-French Three, Four, and Five-Factor Models are determined to be valid for Borsa İstanbul, since there is no pricing error in the models.

Table 7 indicates the regression results of the CAPM, the Fama-French Three, Four, and Five-Factor Models in terms of portfolios formed with stocks of large-scale companies. Upon examining the analysis results, it is understood that all 4 models generated with 9 portfolios are significant and there is no autocorrelation. R² values of the CAPM, the Fama-French Three-Factor, Four Factor, and Five-Factor Models are 34.2%; 42%; 42.1%, and 43%, respectively. This result obtained reveals that the model with the highest explanatory power in explaining the stock returns of large-scale companies is the Fama-French Five-Factor Model.

Table 7. Regression Results regarding the Portfolios Formed with Stocks of Large-Scale Companies

| Ri – Rf | α | β | s | h | r | c | Grs-f | dw | f-statistic | Adjusted R ² |
|--------------------------|------------------|--------------------|-------------------|-----------------|------------------|------------------|----------------|-------|------------------|-------------------------|
| CAPM | 0.003 (0.202) | 0.182 (1.973)** | - | - | - | - | 1.43 (0.13) | 1.871 | 28.12 (0.000) | 0.342 |
| Fama-French Three Factor | 0.004 (0.221) | 0.202 (2.021)** | 1.129 (5.239)* | .132 (1.190) | - | - | 1.29 (0.26) | 1.922 | 31.20 (0.000) | 0.420 |
| Fama-French Four Factor | 0.002 (0.234) | 0.245 (2.230)** | 1.344 (5.722)* | .143 (1.216) | .643 (4.228)* | - | 1.16 (0.36) | 1.791 | 32.11 (0.000) | 0.421 |
| Fama-French Five Factor | 0.002 (0.304) | 0.265 (2.642)** | 1.342 (5.986)* | .132 (1.322) | .698 (4.328)* | -.264 (1.121) | 1.04 (0.39) | 1.885 | 34.23 (0.000) | 0.430 |

Table 8. Regression Results regarding the Portfolios Formed with Stocks of Small-Scale Companies

| Ri – Rf | α | β | s | h | r | c | Grs-f | dw | f-statistic | Adjusted R ² |
|--------------------------|------------------|--------------------|-------------------|-----------------|------------------|------------------|----------------|-------|------------------|-------------------------|
| CAPM | 0.002 (0.242) | 0.198 (2.091)** | - | - | - | - | 1.39 (0.15) | 1.745 | 43.33 (0.000) | 0.453 |
| Fama-French Three Factor | 0.002 (0.286) | 0.289 (2.783)** | 1.253 (5.854)* | .146 (1.243) | - | - | 1.33 (0.23) | 2.025 | 58.15 (0.000) | 0.547 |
| Fama-French Four Factor | 0.002 (0.296) | 0.291 (2.801)** | 1.543 (5.987)* | .165 (1.440) | .598 (4.108)* | - | 1.10 (0.38) | 1.991 | 59.01 (0.000) | 0.548 |
| Fama-French Five Factor | 0.001 (0.312) | 0.310 (3.019)** | 1.353 (6.294)* | .147 (1.270) | .676 (4.245)* | -.264 (1.087) | 1.01 (0.46) | 1.980 | 62.20 (0.000) | 0.554 |

Table 8 indicates the results of the CAPM, the Fama-French Three, Four, and Five-Factor regression results in terms of portfolios formed with stocks of small-scale companies. Upon examining the analysis results, it is understood that all 4 models generated with 9 portfolios are significant and there is no autocorrelation. R² values of the CAPM, the Fama-French Three-Factor, Four Factor, and Five-Factor Models are 45,3%; 54.7%; 54.8%, and 55.4%, respectively. This obtained result reveals that the model with the highest explanatory power in explaining the stock returns of small-scale companies is the Fama-French Five-Factor Model.

5. Conclusion

Accurate calculation of the expected returns of the stocks is one of the issues that has been in dispute since the 1950s and there is still no consensus in the literature on the issue. Many models have been developed concerning the concept. Distinctive models are still being created. The common point in the generated models is that they are all based on the CAPM. In models developed with respect to the CAPM and the most recent studies, the aim is to calculate the stock returns more accurately. For this purpose, many models have been developed in which new explanatory factors, which are thought to influence calculations, are included. The Fama-French Five-Factor (2015) model is one of the models developed for this purpose.

In this study, the validity of the Fama-French Five-Factor Model for Borsa İstanbul is tested. Within the scope of the study, based on value, profitability, and investment factors, the weekly data of the returns of 18 different intersection portfolios in excess of the risk-free interest rate are utilized between September 2009 and August 2018 (468 weeks). In the study, a bias-adjusted robust estimator and the GRS-F test according to the Newey-West method is used. As a result of the analysis, R^2 values of the CAPM, and the Fama-French Three, Four, and Five-Factor Models are determined as 38.4%; 44.7%; 44.8%, and 45.5%, respectively. This result singles out the Fama-French Five-Factor Model as the model with the highest explanatory power in explaining stock returns. Also, as a result of the GRS-F test, the H_0 hypothesis is accepted for the CAPM, the Fama-French Three, Four, and Five-Factor Models. In other words, the CAPM, the Fama-French Three, Four, and Five-Factor Models are determined to be valid for Borsa İstanbul, since there is no pricing error in the models.

In the study, the regression results of the CAPM, the Fama-French Three, Four, and Five-Factor Models are analyzed in terms of portfolios formed with stocks of large- and small-scale companies. According to the analysis results, the R^2 values of the CAPM, the Fama-French Three-Factor, Four, and Five-Factor Models are 34.2%; 42%; 42.1% and 43%, respectively; in terms of portfolios formed with stocks of large-scale companies.

On the other hand, R^2 values are 45.3, 54.7%, 54.8%, and 55.4%, respectively; in terms of the portfolios formed with the stocks of small-scale companies. In other words, the Fama-French Five-Factor Model has higher explanatory power to explain the portfolios formed with the stocks of small-scale companies compared to the portfolios formed with the stocks of large-scale companies. This situation can be justified by the fact that small-scale companies have higher risks and higher returns. The findings obtained within the scope of the study are compatible with certain studies in the literature such as Fama and French (1993) which concluded that companies with a Market Equity of less than \$ 1 billion and stocks of companies with high book equities tended to yield higher returns than estimated through the CAPM, and Kubota and Takehara (2018) which explained the reason of that situation as a common risk factor.

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BANKRUPTCY PREDICTION OF INDIAN BANKS USING ADVANCED ANALYTICS³

The banking sector in India plays a crucial role in economic growth. A bank provides an opportunity for investments to encourage economic growth and the potential to yield higher returns. In this study, we develop a bankruptcy prediction model by using machine learning (ML) techniques, namely logistic regression, random forest, and AdaBoost, and compare these models with those developed using deep learning (DL) techniques, namely the artificial neural network (ANN). ANN results in the highest accuracy and the most favourable prediction model for bankruptcy. Data used in this study are collected from survived and failed private and public sector banks from India from March 2001 to March 2018. For bankruptcy prediction, we use the bank's macroeconomic and market structure-related features. The feature selection technique 'Relief algorithm' is used to select useful features for the bankruptcy prediction model. Because failed banks in comparison with survived were less in the dataset, the issue of imbalanced cases may have arisen, in which case most ML and DL techniques do not perform well. Thus, we convert the dataset into a balanced form by using the synthetic minority oversampling technique (SMOTE). The results of this study can help in performing financial analyses of banks and thus have significant implications for their stakeholders.

Keywords: Bankruptcy; Imbalanced Data; SMOTE; Relief Algorithm; Deep Learning; Artificial Neural Network

JEL: G21; G28; G34

1. Introduction

Being a central player within a nation's economy, banks control the supply of money in circulation and stimulus. The banking sector in India is sufficiently capitalized and well-regulated by the Reserve Bank of India (RBI), which is India's central banking agency⁴. In recent times, the banking sector in India has introduced innovative models such as payments banks and small finance banks. Banking institutions worldwide have been undergoing dynamic changes where their survival depends on the quality of services they offer to their customers. These financial organizations are encountering stifling competition because of

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⁴ The RBI is India's central bank that controls the flow and supply of the Indian rupee.

increasing consumer demands, rapid growth in technological infrastructure, and continual changes in banking regulations and policies. The success of these financial organizations largely depends on how they leverage resources such as technological infrastructure, the quality of services they offer to their customers, and governing policies.

Bankruptcy forecasting is a crucial concern in the financial sector and has attracted increasing attention from both academic researchers and industry practitioners. Because of the burgeoning development in the power of computing, researchers have even attempted to use machine learning (ML) and deep learning to forecast the plaguing challenge of ‘bankruptcy’ (Altman, et al., 2020). Most banks and financial organisations still prefer using a traditional technique to evaluate their performance (Qu, et al., 2019; Altman et al., 2020). However, the methodological limitations of these techniques and approaches should be considered (Qu, et al., 2019).

Bankruptcy prediction has been in vogue in the research community for approximately five decades now (Makinen, Solanko, 2018). Bankruptcy prediction remains a vital factor because it helps measure the financial health of a firm before it becomes bankrupt. Studies have widely used statistical (SL) and ML techniques to build bankruptcy prediction models (Appiah, 2015). To develop unbiased and generalised bankruptcy prediction models, specific features that can effectively describe the status of a bank should be selected (Liang et al. 2016). We attempt to build an efficient bankruptcy prediction model that can solve the issue of ‘imbalanced classes’.

We initially assume that one of the following conditions triggers the failure of a bank: dissolution, negative total assets, state intervention, and merger and acquisition (Pappas, et al., 2017). We collect data from 58 Indian public and private sector banks that have been categorized as ‘failed’ or ‘survived’ as per conditions indicated by Pappas et al. (2017). Because of an imbalanced dataset, we use the synthetic minority oversampling technique (SMOTE) method to transform data in the balanced form (Fernández, et al., 2018). Moreover, a relief algorithm is used to select crucial features for bankruptcy prediction. These selected features are then fed into different ML and DL techniques to develop the most efficient and generalised bankruptcy prediction model. We randomly divide the whole dataset into training and test datasets, accounting for 80% and 20% of the data, respectively. A different bankruptcy prediction model is developed using ML techniques, such as logistic regression, random forest, and Adaboost, and DL techniques. Finally, all these results are compared based on the model accuracy to derive the best-generalized bankruptcy prediction models.

The remaining study is organized as follows. Section 2 provides the literature review. Section 3 describes the data, descriptive statistics, and methodology used to build the model. Section 4 explains empirical results. Section 5 provides implications of the research study.

2. Literature Review

This study focuses on bankruptcy forecasting which has been a trending topic in recent times. Statistical techniques have been mainly used for bankruptcy forecasting (Qu, et al., 2019). Both academia and industry practitioners have been using advanced techniques such as ML

ad DL algorithms to formulate a bankruptcy prediction model (Nwogugu, 2006; Nwogugu, 2008; Dellepiane, et al., 2015; Kadioglu, et al., 2017; Barboza, et al., 2017; Sujud, Hashem, 2017; Kou, et al., 2019; Devi, Radhika, 2018; Qu, et al., 2019). This literature review focused on two topics: ML and DL approaches.

2.1 ML Approaches

Park and Han (2000) were one of the first researchers who developed a bankruptcy prediction model by using the k-nearest neighbour. Furthermore, Min and Lee (2005) are the first to use a support vector machine (SVM) with various kernels for building a bankruptcy prediction model. Boyacioglu et al. (2009) developed a bankruptcy prediction model for 65 Turkish banks by using SVM and multivariate statistical methods. The accuracy of the prediction model developed using SVM is superior to those of other models. A study built nine bankruptcy prediction models by using ML techniques, such as logistic regression (LR), SVM, K-nearest neighbour, and linear discriminant analysis, for US banks during the financial crisis and found that the accuracy of the model developed using SVM was higher than that of models developed using other ML techniques (Serrano-Cinca and Gutiérrez-Nieto, 2013). Chiaramonte et al. (2015) formulated bankruptcy prediction models for 3242 European banks and showed that the neural network yielded more favourable results than did other techniques. The findings of the aforementioned studies indicated that SVM is the most suitable ML technique for developing bankruptcy prediction models (Bell, 1997; Olmeda, Fernández, 1997; Ahn, et al., 2000; Boyacioglu et al., 2009; Serrano, Gutiérrez, 2013; Chiaramonte et al., 2015; Le, Viviani, 2018; Uthayakumar, et al., 2018; Alaka, 2018). Recently, researchers have used the SMOTE method to transform data in a balanced form for developing the most suitable prediction model and devised a technique to quantify the financial stress of firms under some constraints (Shrivastav, Ramudu, 2020; Shrivastava et al., 2020).

2.2 DL Approaches

Although DL emerged almost two decades ago, it is now widely used in both academic research and industrial applications because of its ability to manage highly nonlinear data. DL has extensive applications in image recognition (Pak, Kim, 2017; Traore et al., 2018) voice recognition (Satt, et al., 2017; Khalil et al., 2019; Zhao, et al., 2019), and natural language processing (Deng, Liu, 2018; Kamath, et al., 2019). Some researchers have even used DL to solve issues encountered in the fields of finance and management science.

ANN and recurrent neural networks (RNN) are the two most common DL methods used for predicting stock price fluctuations (Fischer, Krauss, 2018). Convolutional neural network (CNN) is another crucial DL technique; however, this method has not been used for developing a bankruptcy prediction model (Qu, et al., 2019). Hosaka (2019) used CNN for the first time to analyze the bankruptcy of firms, the financial statement, and financial ratios of Japanese listed companies and convert the result into grayscale images. A theoretical framework for bankruptcy prediction was suggested by Hosaka (2019), and this framework

has dominated other predictive models including those developed using advanced ML techniques (Qu, et al., 2019).

DL models for bankruptcy prediction were introduced by Mai et al. (2019), particularly the neural network in which the model has more than one hidden layer. Mai et al. (2019) selected crucial features from the textual data of more than 9000 US public companies for bankruptcy prediction. The textual data collected from public news and the annual reports of these companies combined with the classical financial information of companies, such as financial ratios, yielded more suitable and efficient predictive models compared with those developed using standalone data. These findings and insights provide newer outlooks and motivations for research in this area. Some studies on bankruptcy prediction have even been conducted in the Indian context (Dhakar, et al., 2020; Smiti, Soui, 2020; Alexandropoulos, et al., 2019).

Most studies on bankruptcy prediction have primarily focused on countries that have a large number of bankrupt firms, especially banks. However, in a country such as India, surviving banks have far outnumbered failed banks, resulting in the issue of imbalanced classes. No study on this topic has yet used DL methods (Altman, 1968; Sinkey, 1975; Martin, 1977; Ohlson, 1980; Altman et al., 1994; Ahn et al., 2000; Wang et al., 2014; Chiaramonte et al., 2015; Le, Viviani, 2018; Uthayakumar et al., 2018; Shrivastav, 2019 and many more). In this study, we use an analytics-based methodological approach wherein we initially extract the most significant bankruptcy-related features, transform data from an imbalanced to a balanced form, choose suitable DL and ML techniques, and use them to develop the best predictive model.

3. Data Description, Descriptive Statistics, and Methodology

We collect data for both failed and survived public⁵ and private sector banks⁶ in India from January 2000 to December 2018. We consider a bank to be a ‘failure’ when it meets one of the following conditions: merger or acquisition, bankruptcy, dissolution, and negative assets (Shrivastava, Ramudu, 2020). These conditions for failed or survived banks were verified by Altman (Altman, 1968; Altman, et al., 2017).

Data are collected for a total of 59 banks, of which 17 and 42 are failed and surviving banks, respectively. The target feature in the dataset has two classes, namely survival, and failure, and the proportion of classes is 0.97. The dataset has 618 instances with 26 financial and nonfinancial features depicted in table 1 below. Because collected data contains a mix of crucial and redundant features, we use a well-known feature selection technique called ‘Relief’ to formulate the bankruptcy model. ‘Relief’ is a nonparametric technique widely used for feature selection because of its simplicity and prevents the overfitting of the prediction model (Subsection 3.1.).

⁵ Public Sector Banks (PSBs) are a major type of bank in India where a majority stake (i.e., more than 50%) is held by a government.

⁶ India has banks where the majority of shares or equity are not held by the government but private shareholders.

Table 1. Features and their descriptions

| Features | Description of Features |
|--------------------------|---|
| Status | Binary representation: 1 for failed banks and 0 for surviving banks |
| Total Assets | Current assets + advances + investment + fixed assets + others |
| Equity | Total capital – reserves and surplus |
| Total Liabilities | Net loans – reserves for impaired loans. |
| Deposits | Demand + saving + term deposits |
| Profit after tax | Operating profits + other incomes |
| Total Capital | Equity + reserves and surplus |
| Reserves and Funds | The reserve fund is a savings account or other highly liquid asset set apart by banks to meet any future costs |
| Return on assets | Net profit/total assets |
| Net Income | Posttax profit |
| Net Interest Revenue | Gross interest and dividend income minus total interest expense |
| Other Operating Income | Any other sustainable income that is related to a company's core business |
| Overheads | Personnel expenses and other operating expenses |
| Z-score | $(\text{Return on assets (ROA)} + \text{equity/asset})/\sigma$ (return on assets) |
| Loan Loss Reserves/Loans | Signifies how much funds have been put apart for potential losses. |
| Equity/Assets | Evaluates the amount of security the bank enjoys by its equity |
| Equity/Net Loans | Measures the equity insulation available to take up losses on the loan manuscript |
| Equity/Deposits | Estimates the amount of everlasting funding relative to undersized funding. |
| Equity/Liabilities | Identified as the capitalisation ratio and is the inverse of the leverage ratio. |
| Net Interest Margin | Net interest income expressed as a percentage of earning assets |
| Cost/Income | Estimates the costs of managing the bank, the main element of salaries, as a proportion of income produced before provisions. |
| Net Loans/Assets | Proportion of resources coupled up in loans |
| Growth of Real GDP | Gross domestic product at market price |
| Inflation | Logarithmic change of the GDP deflator year wise |
| C3/All | Percentage of total assets held by the big three banks of total assets of the banking industry |
| C5/All | Percentage of total assets held by the big five banks of total assets of the banking industry |

In this study, extreme values (outliers) are winsorized upon 1% and 99% for surviving banks, whereas failed banks may represent some financial stress in the case of extreme values. The target feature in this study is the bank's status, namely survived or failed. The status of banks is used as a categorical variable where 0 represents surviving banks and 1 represents failed banks. Furthermore, significant features used for bankruptcy prediction are the statement, balance sheet, financial ratios, and country-specific variables. The dataset used in this study includes approximately 92% of Indian banks.

The descriptive statistics of all features included in the dataset are listed in Table 2. All the features in the dataset except those presented as a percentage or ratio are in millions. As shown in Table 3, the standard deviation values of most of the features are high, indicating a large variation in the bank's financial profile. The basic statistical measure of financial profiles for survived and failed banks are listed in Table 3. The t-test values for mean differences in the different features of banks with different profiles are provided in Table 3.

Table 2. Descriptive statistics for private and public sector Indian banks over the period 2000-2017

| Bank-specific variables | | Mean | Max | Min | Std. Dev. | N |
|-------------------------|---|-----------|------------|---------|-----------|-----|
| Status | Survived (0) or failed (1) | 0.03 | 1 | 0 | 0.16 | 838 |
| Size | Total Assets | 0.62 | 1 | 0 | 0.49 | 825 |
| Bank type | Public sector banks as 1 and private sector banks as 0 | 0.64 | 1 | 0 | 0.48 | 838 |
| Profit after tax | Operating profits \pm other incomes | 8268 | 145,496 | -60,892 | 19,077 | 823 |
| Total assets | Current assets+ advances + investment + fixed assets + others | 1,185,955 | 27,059,663 | 0.5 | 2,239,587 | 823 |
| Total capital | Equity + reserves and surplus | 4371 | 45,739 | 0.5 | 5646.94 | 822 |
| Deposits | Demand + saving + term deposits | 952,140 | 20,447,514 | 866 | 1,725,551 | 814 |
| Loans and advances | Loans and advances | 705,731 | 15,710,784 | 763 | 1,381,711 | 821 |
| Return on assets | Net profit/total assets | 0.85 | 4.46 | -6.5 | 0.81 | 794 |

Table 3. Descriptive analytics of the dataset

| Feature | Minimum | Median | Mean | Maximum | Standard Deviation |
|--------------------------|----------|----------|-----------|------------|--------------------|
| Total Assets | 0.0 | 472732.0 | 1184797.0 | 27059700.0 | 2238500.0 |
| Equity | -9900.0 | 26900.0 | 78300.0 | 1883000.0 | 160050.0 |
| Total Liabilities | 700.0 | 401700.0 | 952200.0 | 20448000.0 | 1715000.0 |
| Deposits | 866.0 | 401609.0 | 952140.0 | 20447514.0 | 1725551.0 |
| Profit after tax | -60892.1 | 3349.9 | 8269.0 | 145496.4 | 19065.0 |
| Total Capital | 0.0 | 472726.0 | 1184516.0 | 27059663.0 | 2238607.0 |
| Reserves and Funds | -34971.0 | 23374.0 | 73863.0 | 1874887.0 | 158809.0 |
| Return on assets | -6.5 | 0.9 | 0.9 | 4.5 | 0.8 |
| Net Income | 0.0 | 54039.0 | 132996.0 | 2700874.0 | 245053.0 |
| Net Interest Revenue | -14064.0 | 11839.0 | 29703.0 | 625481.0 | 58665.0 |
| Other Operating Income | 79.5 | 40600.3 | 103652.6 | 2075392.8 | 187286.0 |
| Growth Overheads | 34.3 | 23469.5 | 61682.3 | 1139568.9 | 105937.0 |
| Z-score | -3.3 | 2.0 | 2.3 | 11.5 | 2.1 |
| Loan Loss Reserves/Loans | 0.0 | 0.0 | 0.0 | 0.5 | 0.04 |
| Equity/Assets | -50.6 | 0.1 | 0.0 | 1.0 | 1.8 |
| Equity/Net Loans | -0.1 | 0.1 | 0.2 | 11.4 | 0.5 |
| Equity/Deposits | -0.1 | 0.1 | 0.1 | 11.7 | 0.43 |
| Equity/Liabilities | -1.0 | 0.1 | 0.1 | 19.9 | 0.8 |
| Net Interest Margin | 0.0 | 0.0 | 0.0 | 0.7 | 0.0 |
| Cost/Income | 0.9 | 1.6 | 1.6 | 22.8 | 0.8 |
| Net Loans/Assets | 0.0 | 0.6 | 0.5 | 0.7 | 0.1 |
| GDP growth | 0.0 | 0.1 | 0.1 | 0.2 | 0.0 |
| Inflation CPI | 2.2 | 6.3 | 6.9 | 15.0 | 3.2 |
| C3/All | 0.0 | 0.3 | 0.3 | 0.3 | 0.1 |
| C5/All | 0.0 | 0.4 | 0.3 | 0.4 | 0.1 |

Table 4. The t-test values for mean differences in different features

| Features | Survived Banks | Failed Banks |
|--------------------------|----------------|--------------|
| Profit After Tax | 10020 | 2100*** |
| Total Assets | 1435000 | 300500** |
| Return on Net worth | 0.89 | 0.57*** |
| Equity | 95800 | 15900*** |
| Total Liabilities | 1339750 | 284550*** |
| Total Provision | 35392 | 6790*** |
| Loans | 935100 | 246900*** |
| Net Interest Revenue | 35900 | 8000 *** |
| Other operating income | 125050 | 27887*** |
| Growth overheads | 74300 | 17260*** |
| Loan Loss Reserves/Loans | 0.04 | 0.03 |
| Equity/Assets | -0.02 | 0.07 |
| Equity/ Net loans | 0.14 | 0.22 |
| Equity/Deposits | 0.08 | 0.15 |
| Equity/Liabilities | 0.1 | 0.12 |
| Net Loans/Assets | 0.51 | 0.5 |
| Net Interest Margin | 0.04 | 0.04 |
| Cost/Income | 1.58 | 1.69 |
| Z-score | 2.25 | 2.13** |
| Inflation CPI | 7 | 6.6 |
| C3 All | 0.27 | 0.23*** |
| C5 All | 0.26 | 0.20*** |
| GDP growth | 0.11 | 0.13 |

***, **, and * represents statistical significance at 1%, 5%, and 10%, respectively.

The financial profiles of surviving and failed banks are presented in column I and column II in Table 3. As shown in columns I and II, surviving banks are financially healthier than failed banks. The net income and equity are 10020 and 95800, respectively, for surviving banks and 2100 and 15900, respectively, for failed banks. The equity/assets for surviving banks are 0.07, whereas those for failed banks are -0.01. Overall, the financial health of surviving banks is superior to that of failed banks.

3.1 Two-Step Feature Selection

Kira and Rendall (1992) formulated an instance-based feature selection method called 'Relief'. This technique preserves the balance between the computational complexity and accuracy of ML and DL methods. The Relief technique allocates weights to independent features that indicate the significance of this feature with regard to target features. The maximum and minimum values of weights allocated to independent variables by the Relief algorithm are +1 and -1, where +1 shows the most crucial variables and -1 represents the most redundant variables.

The Relief algorithm is a nonparametric technique for feature selection and indicates the significance of features based on the contribution of other features. The Relief algorithm does not possess any assumptions regarding the distribution of independent variables or the size of the sample. The features that have positive weights are considered to be significant,

whereas those with negative weights are considered to be redundant and thus discarded from the model.

Computer pseudo-codes for the “Relief” technique are indicated below:

Initial Requirement: First, we use features of each record where ‘0’ represents the class for surviving banks and ‘1’ represents the class for failed banks. ‘R’ coding is used to implement the Relief algorithm in this study, where ‘I’ represents the number of records in the training dataset, ‘V’ denotes the number of features in each record of the training dataset, and ‘T’ represents randomly selected training records from the ‘I’ records of the training dataset. ‘A’ represents the randomly selected feature for randomly selected training records.

The dummy code for the ‘Relief’ technique is indicated as follows:

Assume that the weight of each feature is zero, $W[A] = 0$.

For $i = 1$ to T do

Select a random target instance, e.g. L_i

For this randomly selected instance, check the closest hit ‘H’ and closest miss ‘I’.

For $A = 1$ to V do

Weight $[A] = \text{Weight}[A] - \text{diff}[A, L_i, H]/T + \text{diff}[A, L_i, I]/T$

Finish (second loop)


Finish (First loop)

Return ($W[A]$).

The algorithm chooses records from training data (e.g. ‘ L_i ’) without replacement. For chosen instances from the training dataset, the weights of all variables are updated based on differences observed between target and neighbour instances. This process continues, and in each round, the distance of the ‘target’ instances from all other instances is calculated. Furthermore, this method selects the two closest neighbour instances from the same class (0 or 1), termed as the closest hit (‘H’), and the closest neighbour with a different class, termed as the closest miss (‘M’). The weights in each round are updated based on the closest hit or miss.


If it is the closest hit or features differ for the same class (0 or 1), then the weight decreases by $1/N$, and if it is a closed miss ‘M’, then the weight increases by $1/N$. This process continues until all the features of all instances are finished by the loop. An example of the ‘Relief’ technique is as follows:

| | | |
|---------------------------|----------------|---|
| Target Instance (L_i) | PQPQPQPQPQPQPQ | 0 |
| Closest Hit (H) | PQPQPQPQPQPQPQ | 0 |



In this example, because of the mismatch of a feature where the instances are from the same class (red colour), a weight $-1/T$ is assigned to the feature.

| | | |
|----------------------|----------------|---|
| Target Instance (Li) | PQPQPQPQPQPQPQ | 0 |
| Closest Hit (H) | PQPQPQPPQPQPQ | 1 |



In this example, because of the mismatch of features where instances are from different classes (red colour), a weight $1/N$ is allocated to the feature. This process follows the last instances, and this method for estimating weights is valid for discrete features only.

The diff. function computes the difference in the value of feature 'A' with two instances I_1 and I_2 , where $I_1 = L_i$ and I_2 is either 'H' or 'M' during weight updates. The diff. function of a discrete feature is as follows:

$$\text{diff.}(A, I_1, I_2) = \begin{cases} 0 & \text{if } \text{value}(A, I_1) = \text{Value}(A, I_2) \\ 1 & \text{otherwise} \end{cases}$$

The diff. function of a continuous feature is as follows:

$$\text{diff.}(A, I_1, I_2) = \frac{|\text{value}(A, I_1) - \text{value}(A, I_2)|}{\max(A) - \min(A)}$$

The weights for feature 'A' are calculated for all instances. The weights are normalized so that their value is between 0 and 1. The weights calculated using the 'Relief' algorithm are then fed into various ML and DL methods for developing bankruptcy prediction models.

3.2 Imbalanced Class and SMOTE

Imbalanced data are a crucial issue in ML and DL in which one class contains more instances than the other class. Undersampling, oversampling, and SMOTE are prominent techniques used to solve the problem of imbalanced data (Chawla et al., 2002). Both undersampling and oversampling replicate minority classes for balancing them in data, whereas SMOTE overcomes the imbalances of classes by creating dummy instances. SMOTE is a powerful and widely used method that generates dummy instances from minority instances. SMOTE generates a new minority class instance by interpolation of the nearest minority class instance randomly as a pictorial representation shown in figure 1.

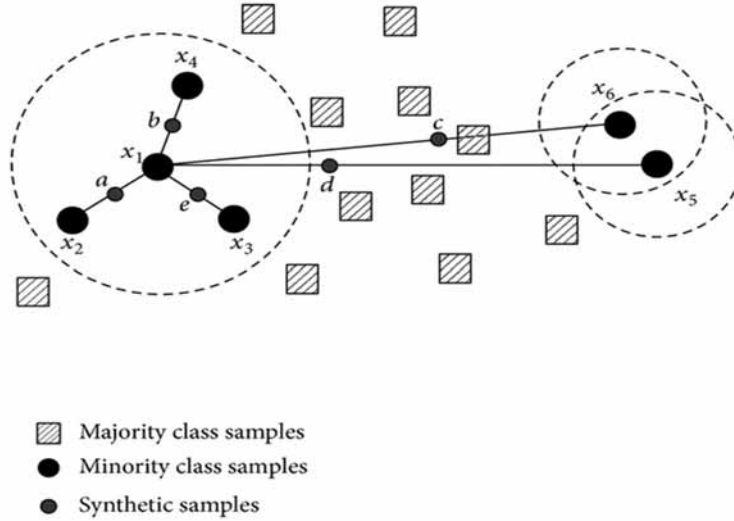
First, for each minority class instance \mathcal{X} , one gets its k-nearest neighbours from other minority class instance. Second, select one minority class instance $\bar{\mathcal{X}}$ among neighbours.

Finally, create a synthetic instance \mathcal{X}_{new} by interpolating from \mathcal{X} and $\bar{\mathcal{X}}$ as follows:

$$x_{\text{new}} = x + \text{rand}(0,1) \times (\bar{x} - x) \quad (1)$$

Here, $\text{rand}(0, 1)$ creates a random number lying between 0 and 1.

Figure 1. Synthetic data generation method using SMOTE



SMOTE interpolates a new minority class instance from two minority class instances.

3.3 Logistic regression

Logistic regression (Kumar, U.D., 2017) is a supervised ML algorithm used to predict classes from an input feature. It provides the probability of a class by using the logit function. The logistics regression model is given below:

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n \quad (2)$$

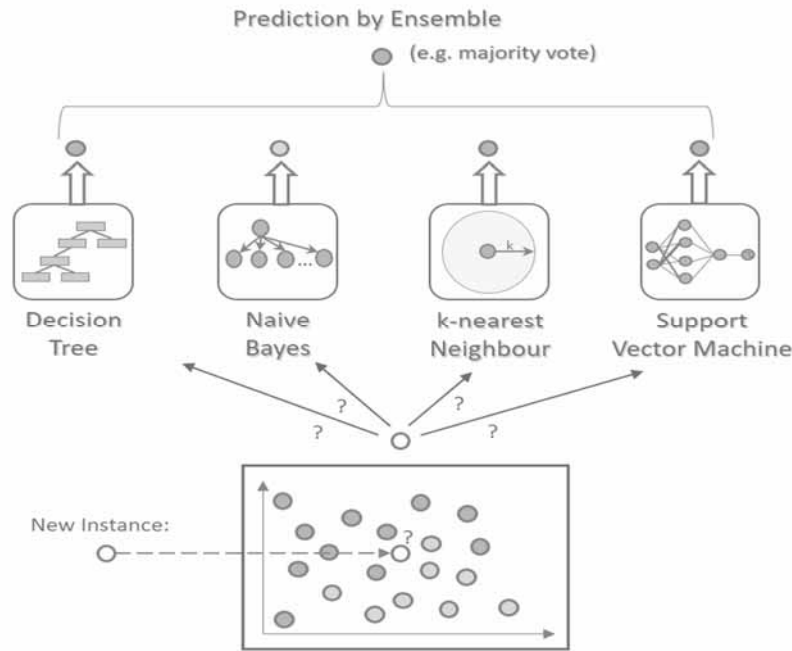
If p denotes the likelihood of success, then $1 - p$ would be the likelihood of failure, especially in the case of binary class instances (failure and nonfailure). The x_0, x_1, \dots, x_n are the features of a logistics model and $\beta_0, \beta_1, \dots, \beta_n$ are the coefficient estimates of features.

3.4 Ensemble Learning

Ensemble learning is a powerful method to increase the performance of a predictive model. Ensemble learning is a group learning method that provides higher accuracy and model

stability. This technique uses various ML algorithms to predict an accurate class. Classification is performed through majority voting, whereas regression is performed using the averaging method as depicted in figure-2.

Figure 2. Ensemble Learning method

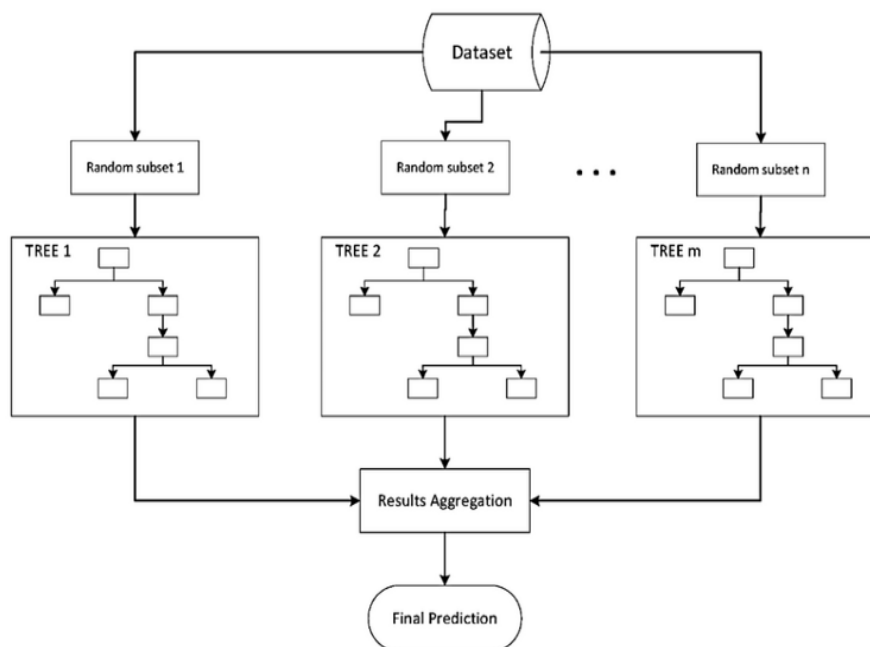


The two types of ensemble methods are bagging and boosting. Variance and overfitting can be reduced using ensemble techniques, thus reducing the bias of the predictive model.

3.4.1. Bagging Technique: Random forest

Bagging is an ensemble technique used to improve the accuracy and stability of a model. In the bagging approach, the same learning algorithm is trained with the subsets of a dataset that are randomly picked from the training dataset. We select the subsets of the training dataset into bags randomly and then train the learning model of each bag (Figini et al., 2016). The final prediction is performed by combining the results of all model results. In this study, we use the random forest, a widely used bagging technique based on decision tree models. Random forest is particularly robust and allows for the presence of outliers and noise in the training set (Yeh et al., 2014) and the pictorial representation of the ensemble technique is given in Figure 3.

Figure 3. Bagging procedure for algorithm learning



The steps of a random forest algorithm (Yeh et al., 2014) are as follows:

1. Create random subsets of the parent dataset that are composed of an arbitrary number of observations and different features.
2. Each subset from step 1 produces a decision tree.
3. For each observation, the forest uses a large number of votes. The class with the most votes is chosen as the preferred classification of the element.

The random forest identifies the importance of each variable in classification results; therefore, it provides not only the classification of observations but also information regarding the significance of features for the separation of classes (Maione et al., 2016).

3.4.2. Boosting Technique: Adaboost

Boosting is another ensemble method that combines weak learners to create a strong learner to make more accurate predictions. Boosting begins with a weak classifier that is prepared using training data. A classifier learning algorithm is considered to be weak when small changes in data induce large changes in the predictive model. In the next iteration, the new classifier focuses on or places more weight on those cases that were incorrectly classified in the last round.

AdaBoost is a successful and efficient method for classification (Kim, Upneja, 2014). Initially, Adaboost assigns weights to all k observations $1/k$. Thus, the first sample is uniformly generated from initial observations. After the training set X_i is extracted from X , a classifier Y_i is trained on X_i . The error rate is calculated considering the number of observations of the training set. The new weight for each observation is based on the effectiveness of the classifier Y_i . If the error rate is higher than a random guess, then the test set is discarded, and another set is generated using original weights (initially $1/k$). If the error rate is satisfactory, the weights of the observation are updated according to the importance of the classifier. These new weights are then used to generate another sample from initial observations. The boosting technique involves the following steps (Heo, Yang, 2014):

1. The distribution of weights $w_1(i) = 1/k$ is created, where $i = 1, 2, \dots, k$, and w_t is the iterative weighting ($t = 1, \dots, T$),

$$w_{t+1}(i) = \frac{w_t(i) e^{\alpha_t(2I(y_i \neq h_t) - 1)}}{\sum_{i=1}^k w_t(i) e^{\alpha_t(2I(y_i \neq h_t))}}, \text{ where } h_t = \arg \max |0.5 - \epsilon_t| \text{ is the error such that}$$

$\epsilon_t = \sum_{i=1}^k w^t(i) |I(y_i \neq h_t(x_i))|$, $I = 1$ when the measure is accurately computed; otherwise, it is 0.

2. In each cycle, $\alpha_t = \frac{1}{2} \ln \left(\frac{1 - \epsilon_t}{\epsilon_t} \right)$ is recalculated. The process completes when $|0.5 - \epsilon_t| \neq \delta$, where δ is constant.

3. $Y(x)$ is evaluated for the complete boost by $Y(x) = \text{sign} \sum_{t=1}^T \alpha_t h_t(x)$.

3.5 DL approach (ANN)

ANN is a deep learning technique that can be used to determine the pattern of nonlinear data. ANN is based on input variables that communicate to one or more hidden layers with a combination of neurons and predict the output class (survival of failed banks in this case). The idea behind the ANN method is to simulate the human brain where neurons communicate with others with the help of signals (layers) (Shanmuganathan, 2016). The output of the ANN is based on input, weights, and bias term b_i as follows:

$$h_i = f^{(i)} \left(b_i^{(i)} + \sum_{j=1}^n w_{ij} x_j \right)$$

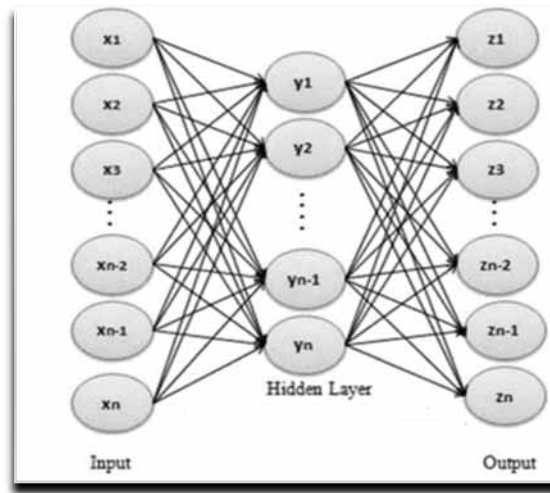
Here, x_i represents input data and w_{ij} is the weight of layers from the j^{th} input neuron to the i^{th} hidden neuron. In the ANN model, the first layer is the input layer that is equal to the number of input features in the model represented by x_i , $i=1, \dots, n$. Each input has different

weights w based on its relationship with the output class (survival and failure). The output of the neuron is calculated using the following formula:

$$z_i = f^{(2)} \left(b_i^{(2)} + \sum_{j=1}^{n_k} v_{ij} h_j \right)$$

where n_k is the number of hidden neurons, and v_{ij} denotes the weight connecting the hidden neuron i to the output neuron j . At the start, networks are initialized using random weights. Subsequently, the values of weights are iteratively adjusted to reduce the loss function. ANN has been criticized for its black-box nature and lengthy training process in the development of an optimal model. The raw structure of ANN is shown in Figure 4.

Figure 4. Basic structure of the ANN model



4. Empirical Results

The data used in this study has 618 instances in which the class proportions (survival and failure) are 2.4% and 97.6%, respectively. The parent dataset is separated into two portions, called train and test, accounting for 80% and 20% of data, respectively. First, we formulate the logistics prediction model for bankruptcy by using the training dataset and validate it by using the test dataset. The predictive model provides a precision of 0/0 with 0.5 as the threshold value. The prediction model has a high number of false negatives with a low recall value. The F value of the prediction model is undefined at 0/0, and the overall precision and accuracy of the model are low. The low accuracy of the model can be attributed to the model being biased for the majority class, thus being unable to understand the pattern for the minority class. Therefore, transforming the dataset into a balanced form is essential before formulating the prediction model. The SMOTE technique is used to transform the dataset into a balanced form. In this case, after using the SMOTE technique, the ratios of minority

and majority classes become nearly equal with 1180 instances and 26 features (Table 1). Next, the Relief technique is applied to the dataset for significant variables related to the failure of the bank. The feature whose weights are more than 0 (Table 5), as indicated by the Relief algorithm, are considered to be significant features and fed into a different ML and DL model to formulate the bankruptcy prediction model. The weights calculated using the Relief algorithm are given in Table 4.

Table 5. List of features and their weight estimated using the Relief algorithm

| Features Name | Relief Score |
|--------------------------|--------------|
| Total Assets | 00 |
| Equity | -0.09 |
| Total Liabilities | 0.08 |
| Deposits | -0.012 |
| Profit after tax | 0.14 |
| Total Capital | 0.02 |
| Reserves and Funds | 0.09 |
| Return on assets | 0.15 |
| Net Income | 00 |
| Net Interest Revenue | -0.12 |
| Other Operating Income | 0.09 |
| Overheads | -0.1 |
| Z-score | 0.23 |
| Loan Loss Reserves/Loans | -0.1 |
| Equity/Assets | 0.10 |
| Equity/Net Loans | 0.12 |
| Equity/Deposits | -0.1 |
| Equity/Liabilities | 0.12 |
| Net Interest Margin | 00 |
| Cost/Income | 0.1 |
| Net Loans/Assets | 0.02 |
| Growth of Real GDP | 00 |
| Inflation | 00 |
| C3/All | 0.08 |
| C5/All | 0.09 |

The balanced data are divided into training and testing datasets, accounting for 80% and 20% of data, respectively. Because of the use of the SMOTE algorithm, the risk of bias and the overfitting of the model is high. To prevent these issues, random forest and Aaboost algorithms are used. Notably, the models can make wrong predictions when it is validated using the test dataset. The bankruptcy prediction model can predict a bank to be failing or surviving when the true status of banks may differ. A total of 4 conditions may occur as given in table 5 below:

1. Failed banks are falsely classified as surviving, whereas failed banks are correctly classified as failing.
2. Surviving banks are rightly classified as surviving, whereas surviving banks are falsely classified as failing.

Table 6. Confusion Matrix: True versus Forecasted Results

| Forecasted Results | | True Results | |
|--------------------|----------|----------------|----------------|
| | | Positive | Negative |
| | Positive | True Positive | False Positive |
| | Negative | False Negative | True Negative |

$$\text{Sensitivity}(1 - \text{Type II error}) = \frac{\text{true positives}}{\text{true positives} + \text{false negatives}}$$

&

$$\text{Specificity}(1 - \text{Type I error}) = \frac{\text{true negatives}}{\text{true negatives} + \text{false positives}}.$$

As discussed above, in two cases, errors occur. The first case is when failed banks are classified as surviving, and the second case is when surviving banks are classified as failing. These two types of wrong classification of banks are related to Type I and Type II errors.

Forecasting accuracy and Type I or II errors are calculated using the test dataset to compare various predictive models in this study (Lin et al., 2012). However, the total accuracy of the model is not an appropriate measure to compare various predictive models because the Type II error is more sensitive compared with Type I error in this study. The Type I error indicates the number of surviving banks that have been incorrectly classified as failed banks. By contrast, the Type II error indicates the number of failed banks that the model incorrectly classified as surviving banks. The Type II error is more acute for banks because if the predictive model makes wrong decisions that are highly likely for bankruptcy, it creates a challenging problem for banks as time passes. Overall, a prediction model with low Type II error and high accuracy is considered the best prediction model in this study. Therefore, the prediction model that can provide the highest accuracy and lowest Type II error rate can be regarded as the best predictive model. We use ML and DL techniques such as logistic regression, random forest, AdaBoost, and ANN to formulate bankruptcy predictive models and validate them using training and testing datasets, respectively.

The Type II error is 64.34%, and the accuracy is 68.65% in the bankruptcy prediction model developed using logistic regression as given in Table 7.

Table 7. True vs Forecasted

| Forecasted | | True | |
|------------|---|------|-----|
| | | 1 | 0 |
| | 1 | 41 | 5 |
| | 0 | 74 | 132 |

The type II error is 71.8% and the accuracy is 58.26% for the bankruptcy prediction model developed using the random forest as given in Table 8.

Table 8. True vs Forecasted

| | | True | |
|------------|---|------|-----|
| | | 1 | 0 |
| Forecasted | 1 | 48 | 4 |
| | 0 | 67 | 133 |

The Type II error is 1.73% and the accuracy is 98.8% for the bankruptcy prediction model developed using AdaBoost as given in table-9 below:

Table 9. True vs Forecasted

| | | True | |
|------------|---|------|-----|
| | | 1 | 0 |
| Forecasted | 1 | 113 | 1 |
| | 0 | 2 | 136 |

The Type II error is 0.86% and the accuracy is 99% for the bankruptcy prediction model developed using ANN as given in table-10 below:

Table 10. True vs Forecasted – Artificial Neural Network

| | | True | |
|------------|---|------|-----|
| | | 1 | 0 |
| Forecasted | 1 | 115 | 1 |
| | 0 | 1 | 135 |

Table 11. Error of the model on the test dataset

| Techniques | Type-II error |
|---------------------------|---------------|
| Logistics Regression | 64.34% |
| Random Forest | 58.25% |
| AdaBoost | 1.74% |
| Artificial Neural Network | .87% |

The high accuracy and low Type-II error rate are statistical measures used to compare ML or DL models. The accuracy and Type-II error rates of all bankruptcy prediction models in Table 11 indicate that ANN is the most favourable bankruptcy prediction model, although none of the formulated bankruptcy models in the study has a 0 Type-II error. One of the likely reasons may be that some banks are financially healthy but acquisitions or mergers occurred due to government policies or to reduce the operational cost. The second reason can be that feature selection techniques have eliminated some of the financial features of firms from modelling even if they may be important for bankruptcy. For example, SBI Commercial and Intl. Bank has been forecasted as a surviving bank, although we consider it as a failed bank in the original dataset. This bank was merged with the SBI by the government to minimize operational costs and not due to the financial crisis. Typically, these are some scenarios that result in Type-II errors in models. Therefore, based on the trade-off among complexity, accuracy, and Type II error of the bankruptcy prediction model, ANN has the highest accuracy and is the most favourable model.

5. Conclusions and Implications of the Study

In this study, a systematic framework is developed for analyzing a bank's financial stress and to formulate an efficient and generalized bankruptcy model. In this study, data are collected from the Prowess Database, a publically available dataset for Indian banks that contains data from 2000 to 2018 with several missing values. We develop bankruptcy prediction models by using logistics, random forest, AdaBoost, and ANN and perform a comparison based on their accuracy. Finally, based on Type-I error and the accuracy of the model, ANN is found to be the most favourable prediction model. The possible reason is that ANN can identify a highly nonlinear pattern in the dataset compared with other techniques. The proposed method provides a holistic approach, starting from selecting a list of significant features for bankruptcy prediction by using the 'Relief' algorithm, transforming the dataset into a balanced form through SMOTE, and selecting appropriate ML techniques that can predict bank failures. This model can be useful for decision-makers who can obtain a future warning regarding firms before they undergo insolvency.

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NON-LINEAR IMPACT OF ICT ON PROFITABILITY OF COMMERCIAL BANKS IN VIETNAM⁴

The aim of this article is to evaluate the nonlinear impact of ICT on the profitability of commercial banks in Vietnam and determine the ICT threshold for banks to gain additional profits from this investment. The research sample was selected by purposive sampling method, including 25 commercial banks in the period 2010-2020. The estimation results according to the 2-step system GMM indicate that ICT has a U-shaped nonlinear effect on profitability, and profitability will be lowest when the readiness index for ICT development and application reaches 0.6052 according to the derivative method, if this level is exceeded, ICT will have a positive impact on profitability and vice versa.

Keywords: Commercial Banks; ICT; Nonlinear impact; Profitability

JEL: G20; G21; G32

1. Introduction

The Ministry of Information and Communications of Vietnam (2020) said that Vietnam actively implements digital transformation and takes advantage of the Industrial Revolution 4.0 to create a driving force to promote economic growth, solve difficult problems from a national level to ministries, branches and localities; accordingly, the banking system in Vietnam is no exception. In early December 2021, the Governor of the State Bank of Vietnam signed Decision No. 1977/QĐ-NHNN on the establishment of the Steering Committee and Working Group on the digital transformation of the banking sector. In this decision, one of the objectives and tasks was determined to promote the process of digital transformation at credit institutions.

Begenau et al. (2018) and Fuster et al. (2019) all argued that the application of information and communication technology (ICT) in the banking sector has become stronger in recent

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years. Wiredu et al. (2020) recommended that commercial banks increase the application of advanced technologies to survive in the competitive wave of the industry. Aggreh et al. (2020) emphasized that the ICT application strategy is the premise for banks to ensure their competitiveness not only domestically but also globally. Jakšič & Marinč (2019) asserted that the stability of the banking system is influenced by the level of development and application of ICT. Chen et al. (2019) concluded that the technology can contribute to increasing the efficiency of financial services by saving transaction costs, being more convenient and safer. Deng et al. (2021) have suggested that the risk management efficiency of commercial banks is improved thanks to the technology factor. It is the result of applying technology to help banks reduce information collection costs, speed up information access and quality, or improve information security. Meanwhile, Aggreh et al. (2020) provided evidence that commercial banks investing in ICT will have a negative impact on financial performance represented by return on assets in the same year; and the positive effect only occurs after 1 year, and the magnitude becomes stronger 2 years later; then a positive relationship at year 3 or a negative relationship at year 4 does not guarantee statistical significance. However, from the case of commercial banks in Nigeria, Aggreh et al (2020) provided evidence that the investment in ICT will have a negative impact on financial performance represented by return on assets in the same year; then the impact will be positive in the next year and this positive effect will continue after 2 years with a stronger degree; and then the positive relationship in the 3rd year or the opposite in the 4th year does not guarantee statistical significance.

The above reviews showed that the increase in ICT investment can have a positive or negative impact on the financial performance of commercial banks, in which the majority of cases have a positive relationship, and the opposite effect may be due to the fact that ICT has not been properly invested. Following the inevitable trend of applying ICT in the banking sector, Aggreh et al. (2020) believed that on a global scale, the investment in ICT of commercial banks has grown rapidly, and many institutions are racing to incorporate new technologies to deliver financial services to customers, including cloud computing, artificial intelligence, and voice recognition.

Thus, the question is: "*What the level of investment in ICT is appropriate to ensure the best profitability for commercial banks?*". Accordingly, the authors will evaluate the nonlinear impact of ICT on the profitability of commercial banks in Vietnam. The research results are expected to provide useful information for commercial banks in choosing ICT investment policies. The findings are also a reference for the central bank and other entities to make relevant decisions.

The next content of the article is structured as follows. Section 2 reviews the theoretical basis and empirical evidence, and then we discuss research gaps and develop research hypotheses. Section 3 presents the methodology of this paper, including the research model, data and estimation methods. Section 4 analyzes and discusses the research results. Finally, Section 5 presents the conclusion and recommendation.

2. Literature Reviews and Hypothesis Development

2.1. Theoretical Reviews

According to Van Horne & Wachowicz (2008), companies have 3 main financial decisions: investment, financing and asset management, in which the fixed assets are formed from investment decisions, and they are the foundation on which to conduct operating activities with the expectation of generating firms' profitability. Enterprises investing more in fixed assets will increase operating capacity, thereby meeting more needs of customers and creating opportunities to increase income for themselves (Ngo et al., 2021). Thus, commercial banks that expand investment in ICT and apply more modern technology will increase their advantages in providing financial services to customers. This not only contributes to the generation of more income, but it can also save operating costs, and resulting in an increase in their profitability. Besides, in order to explain the nature of the impact relationship of ICT on firm performance, the researchers often relied on the transaction cost theory initiated by Coase (1937) and developed further by Williamson (1979), and the Resource-based view (also known as Resource-advantage theory) according to the research by Barney (1991).

The transaction cost theory explains the existence of firms in a market economy. According to Coase (1937), companies are considered efficient if transaction costs are minimized, including the cost of determining a fair price, and the cost of negotiating and concluding a contract. Thus, commercial banks develop and apply ICT to provide financial services to customers, and the related costs will be reflected in the price of each transaction. Accordingly, if the increase in the level of ICT investment or the modernization of application technology can contribute to an increase in the service delivery capacity of commercial banks, the additional transaction costs will increase and the bank profitability can be increased. However, the increase in transaction size is large enough and reaches a certain level, so that commercial banks can save costs thanks to the advantages of scale and can increase the bank's profitability.

The competitiveness of enterprises should be based on resources that are valuable, rare, difficult to imitate or replaced by other resources. Through the development and application of ICT, commercial banks can create differentiation and competitive advantage for products. This increases the value of benefits for customers and is also an opportunity to increase income for commercial banks. Dabwor et al. (2017) argued that, for commercial banks, the application of ICT plays a central role in providing financial services to customers, through which the core problems of commercial banks will be solved, including meeting customer expectations, reducing operating costs and managing the competition.

2.2. Empirical Reviews

Many empirical studies concluded that the development and application of ICT have provided the opportunity to increase efficiency in various aspects. Koyuncu et al (2017) found reliable evidence that the penetration of ICT contributes to improving the efficiency of financial intermediation and controlling factors that reduce the efficiency of commercial banks. Binuyo & Aregbeshola (2014) confirmed that ICT has a positive impact on the

financial performance of the commercial banking system. Dabbous (2020) affirmed that the increasing investment in the application of ICT contributes to improving the performance of commercial banks. In addition, Binuyo & Aregbeshola (2014) further pointed out that most of the contribution to the performance of commercial banks comes from the ICT cost-effectiveness compared to the level of investment in ICT. Accordingly, they recommended that commercial banks should focus on policies to increase the rational use of ICT equipment rather than additional investment. Al-Azzawi & Altmimi (2015) used the Cobb-Douglas production function to evaluate the impact of the investment of ICT on the profitability of commercial banks in Jordan, the authors found a positive relationship.

Adebola (2018) assessed the impact of ICT on the performance of commercial banks by analyzing the results of a survey of 25 people in the ICT department and 25 people holding senior positions in other departments, and this author showed that the technological innovation has a positive effect on operational efficiency. This study has shown that the introduction of ICT affects customer satisfaction, reduces management costs and contributes to increasing the profitability for commercial banks. In addition, the author also concluded that ICT has contributed to improving the work efficiency of the staff, it has contributed to ensuring the accuracy and speed of processing transactions, and the use of ICT has reduced the stress in banking operations.

Mahboub (2018) analyzed the influence of ICT investment on the performance of commercial banks. This author argued that commercial banks invest heavily in new technologies to take advantage of new digital and information technology solutions to make their operating activities more efficient, comply with requirements from regulatory authorities and enhance the interaction with their customers for the purpose of maintaining and increasing competitiveness. However, the research results proved that the influence of ICT investment on the performance of commercial banks depends on specific cases. The applications associated with automated teller machines, online banking, telephone banking, and point-of-sale terminals do not significantly affect bank performance, while the applications for debit cards, credit cards, and mobile banking have a significant positive effect on banks' performance. Therefore, commercial banks are advised not to spend too much to invest in ICT.

Al-Busaidi & Al-Muharrami (2021) used the longitudinal quantitative analysis and provided reliable evidence on the impact of ICT investment on financial indicators. Accordingly, commercial banks increase their investment in ICT, which increases operating costs, net operating income and profitability, but the relationship between ICT and these financial ratios does not guarantee statistical significance. In addition, these authors also used the Delphi qualitative research method and argued that the top value from ICT investment is related to customer relationship perspective, namely improving service quality and ensuring customer privacy, being customer retention and increasing customer loyalty. Considering the financial aspect, Al-Busaidi & Al-Muharrami (2021) asserted that the benefits of the ICT investment are the improvement in revenue, the profitability of assets and other business performance indicators.

Agbolade (2011) found the existence of a positive relationship between ICT and the profitability of commercial banks. The author determined that the scale of earnings would have been negligible without the advent of ICT, and this implied that the small change in ICT

investment and application will lead to a corresponding increase in profits. Adesola (2013) confirmed that the application of ICT contributes significantly to improving labour efficiency, ensuring service delivery efficiency and improving profitability for commercial banks. Not only that, the relationship between commercial banks with customers becomes better thanks to the application of ICT, because the customers can access their accounts during the week and the outside business hours without going to the commercial bank's headquarters, and this will result in higher customer satisfaction.

Westerfeld & Zimmermann (2008) tested the hypothesis that for commercial banks with innovative e-business solutions, the traditional lending business can transform into proactive credit risk management. Their research results showed three types of tools including pricing platforms, rating tools and trading platforms. This suggested that ICT leads to a restructuring of the traditional lending business model. In addition, the authors pointed out that ICT affects not only the origin of customer loans but also the customer credit risk management. Accordingly, the impact of ICT on the lending business is sustainable, irreversible and is gradually changing the operating activities of commercial banks.

2.3. Research Gap and Hypothesis Development

According to the overview in section 2.2, empirical studies evaluated the impact of ICT on the performance of commercial banks in many different aspects. They can be generalized to include 3 approaches. The first is the impact of ICT on financial performance, which focuses on profitability indicators (Al-Busaidi, Al-Muharrami, 2021; Dabbous, 2020; Adebola, 2018; Mahboub, 2018; Koyuncu et al., 2017; Al-Azzawi, Altmimi, 2015; Binuyo, Aregbeshola, 2014; Adesola, 2013; Agbolade, 2011). The second is the impact of ICT on the effectiveness of the service delivery to customers (Al-Busaidi, Al-Muharrami, 2021; Adebola, 2018; Adesola, 2013). The third is the impact of ICT on the work performance of the workforce (Adebola, 2018; Adesola, 2013; Westerfeld, Zimmermann, 2008). Regarding the analytical results, the studies tested the linear effect and confirmed the positive relationship.

To answer the question and realize the research objective, the authors used secondary data (Dabbous, 2020; Mahboub, 2018; Koyuncu et al., 2017; Al-Azzawi, Altmimi, 2015; Binuyo, Aregbeshola, 2014), or the primary data through surveys and questionnaires (Agbolade, 2011; Adesola, 2013; Adebola, 2018), or a combination of the two (Al-Busaidi, Al-Muharrami, 2021). Next, the studies used different models and methods, namely the combined approach with the longitudinal quantitative analysis and the Delphi qualitative analysis (Al-Busaidi, Al-Muharrami, 2021), the Cobb-Douglas production function (Al-Azzawi, Altmimi, 2015), the generalized method of moments (GMM) estimation and the robustness test by residual cointegration regression analysis according to the approach of Pedroni and Kao (Binuyo, Aregbeshola, 2014), the least squares method and the statistical analysis (Agbolade, 2011; Adesola, 2013; Mahboub, 2018; Adebola, 2018).

Thus, the theoretical overview and empirical evidence confirmed the pivotal and indispensable role of ICT in the banking and finance sectors. It is a fundamental factor that has a decisive meaning on the performance of commercial banks. Based on the nature of the ICT investment associated with the profitability goal, the managers of commercial banks

need to determine the appropriate and large enough investment in ICT. The transaction cost theory implies the U-shaped nonlinear impact of ICT on the performance of commercial banks. However, this relationship has not been verified by empirical studies, this is a research gap. Accordingly, the authors will test the research hypothesis “ICT has a U-shaped nonlinear effect on the profitability of commercial banks in Vietnam” by using GMM based on secondary data.

3. Methodology

3.1. Research Model and Data

To achieve the research objective, the authors set up a research model with the dependent variable of profitability according to the perspective of financial management (PROF), and it is represented by return on equity (Al-Busaidi, Al-Muharrami, 2021; Al-Azzawi, Altmimi, 2015). The independent variable, ICT, is structured in the form of a quadratic function, and it is represented by the readiness index for the development and application of ICT of commercial banks as announced by the Ministry of Information and Communications. In addition, the model also has control variables (CONTROL), including credit risk represented by the credit risk provision ratio, loan growth represented by the rate of increase (decrease) of outstanding loans to customers during the year, bank size represented by the base 10 logarithms of total assets, and operating expenses expressed as a ratio of operating expenses to total assets. The specific regression equation is as follows:

$$PROF_{i,t} = \sigma + \beta_1 ICT_{i,t} + \beta_2 ICT_{i,t}^2 + \beta_j CONTROL_{j,i,t} + \varepsilon_{i,t} \quad (1)$$

where:

σ is a constant;

ε is the error;

β_1 and β_2 are the regression coefficients of the independent variable;

j represents the order of each control variable;

i and t represent each commercial bank and each year, respectively.

The authors used the purposive sampling method to determine the research sample with 25 commercial banks in the period 2010-2020. The research data was collected from two sources, including the audited financial statements of commercial banks and the Vietnam ICT index report of the Ministry of Information and Communications. Table 1 presents the measurements and data sources of the variables.

Table 1. Measurement Methods and Source of Data

| Variable | Symbol | Measurement | Source of data |
|----------------|--------|--|---------------------------------|
| Profitability | PROF | $\frac{\text{Earnings after taxes}}{\text{Average equity}}$ | Balance sheet, Income statement |
| ICT | ICT | ICT index, including technical infrastructure, human resources, internal banking applications and online banking services. | Vietnam ICT Index Report |
| Credit risk | RISK | $\frac{\text{Loan loss provision}}{\text{Total balance of loans to customers}}$ | Balance sheet |
| Loan growth | LGR | $\frac{\text{Increase/ (Decrease) in loans to customers}}{\text{Customer loan balance at the beginning of the year}}$ | Balance sheet |
| Operating cost | OC | $\frac{\text{Total operating costs}}{\text{Total assets}}$ | Balance sheet, Income statement |
| Bank size | SIZE | Logarithm base 10 of total assets | Balance sheet |

Source: Compiled by the authors.

3.2. Estimation Method

Our research results were determined by the quantitative research method with the support of Stata 15 software. We used the Two-step System GMM estimation method to control the endogeneity problem, because the ICT not only affects banks' profitability but also vice versa. The bank's profitability is the basis for capital accumulation, and accordingly, it can affect the level of ICT development and application. In order to confirm the validity of the instrumental variable, the endogenous phenomenon was considered by the Hansen test, and the AR(2) test was used to consider the second-order series correlation phenomenon. If the results of these tests accept hypothesis H_0 , the GMM estimation is sure to be robust and accurate.

From the confirmed U-shaped nonlinear relationship, the authors used the derivative method to determine the threshold of ICT leading to the reversal of the impact of ICT on bank profitability. According to the regression equation above, the derivative of PROF with respect to ICT is $\beta_1 + 2\beta_2 \cdot \text{ICT}$; therefore, PROF is lowest when ICT is equal to $-\beta_1/2\beta_2$.

4. Findings and Discussion

4.1. Descriptive Statistics and Correlation Coefficients Matrix

Table 2 presents the results of descriptive statistics of the variables according to the number of observations, mean, standard deviation, maximum and minimum values.

According to Table 3, the data of variables from the financial statements consists of 275 observations, while the ICT variable has only 192 observations. It showed that we used the unbalanced panel data. The mean value of PROF was 10.53%, and this variable ranged from a low of -56.33% to a high of 29.57%. Thus, in general, commercial banks ensured that their income exceeds their costs, and they had a positive after-tax profit during the period 2010-2020. This is the basis to ensure the financial responsibility of commercial banks for the owners. Regarding the ICT variable, the average was 0.5226 and ranged from the lowest

level of 0.2527 to the highest level of 0.8114. The readiness index for the ICT development and application of the Joint Stock Commercial Bank for Investment and Development of Vietnam has always been the highest over the years. In addition, the descriptive statistical results of the control variables indicated that commercial banks had the provision for credit risk of VND 1.29 per VND 100 of outstanding customer loans, the trend of loan expansion, liquid asset accounts for 18.23% of total assets, operating expenses are VND 1.82 per 100 VND of total assets, the total asset value representing the bank's size with a value ranging from VND 8,225 billions to VND 1,517 trillion.

Table 2. Descriptive Statistics

| Variables | Observations | Mean | Std. Dev. | Minimum | Maximum |
|-----------|--------------|--------|-----------|---------|---------|
| PROF | 275 | 0.1053 | 0.0840 | -0.5633 | 0.2957 |
| ICT | 192 | 0.5226 | 0.1211 | 0.2527 | 0.8114 |
| RISK | 275 | 0.0129 | 0.0044 | 0.0066 | 0.0315 |
| LGR | 275 | 0.2360 | 0.3192 | -0.7038 | 4.2447 |
| LIQ | 275 | 0.1823 | 0.0873 | 0.0450 | 0.6104 |
| OC | 275 | 0.0182 | 0.0056 | 0.0075 | 0.0565 |
| SIZE | 275 | 8.0079 | 0.5042 | 6.7618 | 9.1771 |

Source: The authors' process.

Table 4 represents the matrix of correlation coefficients among the variables. The correlation coefficient between PROF and ICT is 0.247. It explained that the volatility of the readiness for ICT development and application is positively related to the volatility of banks' profitability. In addition, the positive correlation coefficient was also found between PROF and RISK, LGR, OC and SIZE, while the correlation relationship between PROF and LIQ is negative.

Table 4. Correlation Coefficients Matrix

| | PROF | RISK | ICT | LGR | LIQ | OC | SIZE |
|------|--------|--------|--------|--------|--------|--------|-------|
| PROF | 1.000 | | | | | | |
| RISK | 0.149 | 1.000 | | | | | |
| ICT | 0.247 | 0.282 | 1.000 | | | | |
| LGR | 0.105 | -0.124 | 0.149 | 1.000 | | | |
| LIQ | -0.068 | 0.139 | 0.075 | 0.078 | 1.000 | | |
| OC | 0.241 | 0.014 | -0.143 | 0.042 | -0.311 | 1.000 | |
| SIZE | 0.493 | 0.284 | 0.315 | -0.231 | -0.229 | -0.152 | 1.000 |

Source: The authors' process.

Considering the correlation coefficients among the explanatory variables according to Table 4, the positive value ranges from 0.014 to 0.315 and the negative value ranges from 0.124 to 0.311. These results indicated that the correlation relationship of the volatility among these variables is not strong. And we concluded that the multicollinearity is not a serious problem, because the absolute value of all these correlation coefficients is less than 0.8 (Hair et al., 2006; Gujarati, 2008).

4.2. Estimation Results

The outcomes of the Two-step system GMM regression are shown in Table 5. Our model does not have second-order autocorrelation, it is indicated by the P-value of 0.224 from the AR(2) test, which is greater than 0.05. In addition, the P-value from the Hansen test is 0.421, which is higher than 0.05; this result demonstrated that the instrumental variable is suitable. According to the regression coefficient of the variable ICT, the 1st order is -0.305 and the 2nd order is 0.252; they are accepted at the significance level of 0.01, and we found that the ICT has a nonlinear U-shaped effect on commercial banks' profitability.

Table 5. Estimation Results according to the Two-step System GMM

| Variable | Coefficient | Standard Error | P-value |
|------------------|-------------|----------------|---------|
| ICT | -0.305*** | 0.085 | 0.000 |
| ICT ² | 0.252*** | 0.083 | 0.002 |
| RISK | -1.139*** | 0.206 | 0.000 |
| LGR | 0.015** | 0.007 | 0.045 |
| LIQ | 0.174*** | 0.011 | 0.000 |
| OC | 5.107*** | 0.333 | 0.000 |
| SIZE | 0.133*** | 0.013 | 0.000 |
| Observations | 147 | | |
| Number of code | 25 | | |
| AR (2) Test | 0.224 | | |
| Hansen Test | 0.421 | | |

, * Significant at 0.05 and 0.01, respectively; ^{ns} denotes not significant
Source: The authors' process.

To check the robustness of the results according to the Two-step system GMM regression in Table 5, the authors estimated according to the IV-FE method, and the results are summarized in Table 6. The regression coefficients of the variable ICT and the variable ICT² are -2.407 and 2.267, respectively. They are accepted at the significance level of 0.1, demonstrating that these findings are robust and reliable.

Table 6. Estimation Results according to the IV-FE model

| Variable | Coefficient | Standard Error | P-value |
|------------------|----------------------|----------------|---------|
| ICT | -2.407* | 1.376 | 0.080 |
| ICT ² | 2.267* | 1.278 | 0.076 |
| RISK | -2.106 ^{ns} | 1.721 | 0.221 |
| LGR | -0.008 ^{ns} | 0.038 | 0.835 |
| LIQ | 0.478*** | 0.142 | 0.001 |
| OC | 5.930*** | 1.981 | 0.003 |
| SIZE | 0.160*** | 0.033 | 0.000 |
| cons | -0.755** | 0.362 | 0.037 |
| Observations | 147 | | |
| Number of code | 25 | | |
| Hansen Test | 0.358 | | |

*, **, *** Significant at 0.1, 0.05 and 0.01, respectively; ^{ns} denotes not significant
Source: The authors' process.

The nonlinear U-shaped impact of ICT on the profitability of commercial banks in Vietnam is confirmed above. Accordingly, in Table 7, the authors found that the bank profitability may be lowest if the readiness index for ICT development and application is 0.6052. If the ICT index is below this level, ICT has a negative impact on banks' profitability, and vice versa.

Table 7. The threshold of ICT

| Variable | β | Derivative of PROF with respect to ICT | Threshold of ICT |
|------------------|---------|---|------------------|
| ICT | -0.305 | $\frac{d(\text{PROF})}{d(\text{ICT})} = -0.305 + 0.504 \text{ ICT}$ | 0.6052 |
| ICT ² | 0.252 | | |

Source: The authors' process.

4.3. Discussion

The GMM estimation results indicated the U-shaped nonlinear effect of ICT on the profitability of commercial banks in Vietnam. Accordingly, the research hypothesis is accepted, and this result supports the transaction cost theory. This also affirmed that the application and development of ICT is the foundation and means for commercial banks to provide financial services to their customers. Sapkota et al. (2018) argued that the banking industry has grown tremendously thanks to the advent of ICT. Commercial banks can meet customer expectations, reduce operating costs and ensure competitiveness through the development and application of ICT. However, in order to achieve the goals of ICT application and development, commercial banks need to make large enough investments in them. According to Omotoso et al. (2012), the application of ICT in the banking and financial sector poses many challenges in terms of insecurity, cybercrime and fraud that can cause concerns to customers when transacting. Thus, the U-shaped relationship is appropriate. Commercial banks develop and apply ICT at a low level, the ICT index according to the Ministry of Information and Communication's assessment has not reached 0.6052, the commercial banks' ability to respond to challenges will not be good, and leading to the fact that the added benefits tend to outweigh the added costs, and the bank profitability will be reduced. The profitability of commercial banks will increase with the ICT development and application when their ICT index is superior to 0.6052.

In addition, the GMM estimated results also showed that the profitability of commercial banks in Vietnam is negatively affected by credit risk and positively affected by loan growth, liquidity, operating expenses and bank size. These results can be explained by (i) the credit risk management in the lending activities that have not met the expected profitability, (ii) the loan to customers is a profitable asset item of commercial banks, (iii) the liquidity of commercial banks will help them attract more customers to provide financial services and gain additional benefits, (iv) commercial banks need to be able to control that the change in operating costs is lower than the change in operating income, and (v) commercial banks have more advantages in operating activities thanks to their larger scale.

5. Conclusion and Recommendation

The development and application of ICT are expected to increase the performance of commercial banks in various aspects. Based on the data analysis of 25 commercial banks in Vietnam in the period 2010-2020 through the 2-step system GMM estimation, we found that ICT has a U-shaped nonlinear impact on the profitability of commercial banks. If the readiness index for ICT development and application of commercial banks is higher than 0.6052, ICT will have a positive impact of ICT on bank profitability, and vice versa. Accordingly, the research results recommended that commercial banks in Vietnam need to implement investment planning in ICT with a level of investment that is large enough and is suitable with the ability to meet the budget and human resources. This will generate additional net benefits from the development and application of ICT.

From the theoretical overview and empirical evidence, the article has pointed out the research gap and proposed the hypothesis along with the research model, and then the research results have been determined based on the reliable estimation method. Accordingly, the article provided the managers of commercial banks and other stakeholders with useful information about the development strategy and application of ICT in the banking and finance sector. Not only that, the article has also contributed to supplementing the theoretical framework on the relationship of the nonlinear impact of ICT on banks' profitability. Commercial banks need to determine the level of investment large enough to exploit and create added value. However, in order to have specific orientations for the investment decision in ICT of commercial banks, further studies can assess the impact of each component of the ICT index on banks' profitability, including: technical infrastructure, human resources, internal banking applications and online banking services; or the studies can examine the moderating role of ICT on the relationship between financial decisions and the profitability of commercial banks.

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HUMAN CAPITAL FOR SUSTAINABLE REGIONAL DEVELOPMENT⁶

The research aimed at the construction of the ranking of the human capital index in the regions of the Russian Federation based on the available data on the significant factors of sustainable development. Based on the premise that the components of the Human Capital Index calculated by the World Bank coincide with the Sustainable Development Goals from Agenda 2030 "Transforming our world", the authors construct a Regional Rating of Human Capital Development in Russia using measurable indicators for 85 Russian regions for Targets 3 and 4 from National Sustainable Development Goals Indicator Set. The indicators were grouped into three pillars (subsets): Health, Education and Living standard, each pillar consisting of 2-4 sub-pillars and 2-6 indicators. All data for the indicator's calculation is taken from official statistics. No expert assessment is used. The research methodology is based on generalized modified principal component analysis (GMPCA), verified by the authors' previous research. The study reflects an integrated approach to assessing the efforts of Russian regional authorities in human capital development. The research lays the foundation for regular analysis of the rating and dynamics of its components in the Russian regions, which will allow for an assessment of the current state and potential of human capital development in Russian regions and can serve to improve regional socio-economic policy.

Keywords: principal components analysis; human capital; rating of regions

JEL: C38; E24; Q01; R11

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1. Introduction

Human beings, their knowledge and competences, in today's knowledge economy are becoming the main factor for successful economic development. Therefore, human capital development is not only a task for employees and employers, but primarily a task for the government.

Despite the fact that human capital is one of the main drivers of economic growth, it is not easy to make a convincing case for investing in it. As early as Alfred Marshall pointed to the relationship between the “illiquidity” of individual assets and their limited investment potential: “The worker sells his work, but he himself remains his own property: those who bear the expenses of rearing and educating him to receive but very little of the price for his services in later years. Consequently the investment of capital in him is limited by the means, the forethought, and the unselfishness of the parents” (Marshall, 1993, p. 466). Although this statement seems somewhat exaggerated in today's context of countries' huge investments in human capital, it captures the essence of the problem (Verenikin, 2005).

According to G. Becker, “human capital is formed by investments in people, among which we can name education, production training, health care costs, migration and the search for information on prices and income” (Becker, 2003, p. 39). A large share of these investments in our country, and in other countries of the world, falls on the shoulders of the state.

Investment in human capital is becoming increasingly important as the characteristics of labour are changing under the influence of rapid technological progress. The World Bank's “The Changing Nature of Work” report states that the labour market increasingly values workers with better socio-behavioural skills such as “aptitude for teamwork, empathy, conflict resolution, and relationship management” (World Bank, 2019, p. 50). In this report, experts revise the issue of measuring human capital by focusing on outcomes rather than inputs, i.e. costs, and propose the construction of a human capital index (HCI) to assess the role of health and education in the productivity of the next generation of workers (World Bank, 2019, p. 56).

The HCI measures the amount of human capital, “child born in 2018 can expect to attain by age 18, taking into account the risks of poor health and poor education that prevail in the country in which the child was born during that same year” (World Bank, 2019, p. 12). This means that children born in a particular year will have certain educational opportunities and face certain health risks as they grow up and that higher levels of education and better health will ultimately affect the productivity of the next generation of workers.

The HCI has three components:

1. Child survival from birth to school age (measured using under-5 mortality data);
2. Educational attainment (measured by the expected number of years of schooling, taking into account the quality of that schooling).⁷

⁷ In order to compare children's learning, the World Bank is developing a new comprehensive database of test scores from international student assessment programmes covering some 160 countries.

3. Health level (measured through adult survival rate and prevalence of stunting among children under 5 years of age).

We will not elaborate further on the HCI, since not all indicators have been calculated for Russia (in particular, official statistics of the Russian Federation do not collect data on stunting, which probably had a negative impact on the final result of Russia), we note only that the Russian Federation ranks 34th, the first five places are taken by Singapore, Republic of Korea, Japan, Hong Kong and Finland, the last – the poorest countries of Africa.

According to the World Bank, human capital is one of the most important factors of sustainable economic growth. Sustainable economic growth is a crucial point for sustainable development, a concept developed and promoted by the World Bank.

More than thirty years ago, the concept of sustainable development proclaimed meeting “the needs of the present generation without compromising the ability of the future generations to meet their own needs” (Brundtland, 1987). Over time, specific goals, targets and indicators have been formulated. The UN resolution of 25 September 2015 “Transforming our world: The 2030 Agenda for Sustainable Development” presented 17 Sustainable Development Goals and 169 targets that define the vector of development: social, economic and environmental priorities.

The components of the Human Capital Index (survival rate, schooling, and health) are directly linked to at least three global goals to be achieved by the countries of the world by 2030.

Although the principles of sustainable development have been included in a number of official documents of the Russian Federation for more than 20 years, they are not yet widely applied in practical political decisions.

However, some very concrete steps in this direction have already been taken. For example, in July 2020, the first “Voluntary National Review of the 2030 Agenda for Sustainable Development” was launched at a high-level political forum under the auspices of the UN Economic and Social Council (ECOSOC). Non-governmental Ecological Vernadsky Foundation took part in the preparation of the Review. Rosstat is actively monitoring the SDG indicators and the information is available on the Rosstat web portal in the section “Sustainable Development Goals”.

It is easy to see that the three components of the HCI (survival rate of children under 5, quantity and quality of education, and health status of adults) are linked to the achievement of Goal 3, “Good Health and Well-Being”, and Goal 4, “Quality Education”, because, according to the report developers, “achievement of quality education lays the foundation for improving people's living conditions and for sustainable development” (Sustainable Development Goals in the Russian Federation, 2020).

Thus, in constructing the ranking we will try to calculate the human capital index in the regions of the Russian Federation based on the available data on the significant factors of sustainable development.

In addition, we will further compare our rating with the results obtained in the “Human Development Index in Russia for 2019” calculated by the Analytical Center for the

Government of the Russian Federation (Human Development Index in Russia: Regional Disparities, 2021). In calculating this index, the Analytical Center for the Government of RF applied the methodology of the UN Development Programme “Human Development Index” (Human Development Indices and Indicators, 2018): for each Russian region, the gross regional product (GRP) is adjusted for the non-distributable part of the country’s GDP, and the GRP is adjusted for price differences. By comparing two indexes we try to estimate the difference of our index and HDI calculated on the basis of official UN methodology.

2. Data and Methodology

From the National SDG Indicator Set, we selected measurable regional indicators for 2019, representing data for Targets 3 and 4. We have presented these targets as indicators of the Russian regions' human capital development rankings. We have also added indicators for the population's living standards. The indicators are grouped into three subsets (pillars): health, education and living standard, each section consisting of subsections comprising from 2 to 6 indicators (see Table 1). The calculations were based on open official statistics, mainly from the official website of the Federal State Statistics Service (Rosstat). The principal component loadings are calculated for 85 regions.

The research methodology is based on principal component analysis (PCA), which is widely used in multivariate statistics, including regional studies (see, for example, Doukas et al, 2012; Petrişor et al, 2012; Tan, Lu, 2015; Gavrilets et al., 2019).

The methodology is constructed on an integral indicator. An integral indicator is an indicator that aggregates a group of indicators of alternatives or sub-indices based on these indicators. The advantages of the integral indicator are that it allows aggregating of multi-dimensional information about alternatives and allows one to see the overall picture of the alternative, with the integral indicator it is easier to capture the attention of the public (Saltelli et al., 2006). A single integral indicator is preferable to searching for trends in several indicators at once.

There are approaches to compiling integral indicators based on weighting initial indicators (Poledníková, Melecký, 2017; Aivazyan, 2006; Yang, Ou, Hsu, 2019), ranking indicators (Aleskerov, 2013), and calculating performance (Lissitsa, 2003). Singh et al. (2008) provide a synthesis of approaches to measuring sustainability based on indicator weighting. The article summarizes the experience of measuring the sustainability of companies, cities, regions, countries, and economic activities. The approaches for each stage of compiling an integral indicator are highlighted.

Table 1. Indicators for calculating the Regional Rating of Human Capital Development in Russia

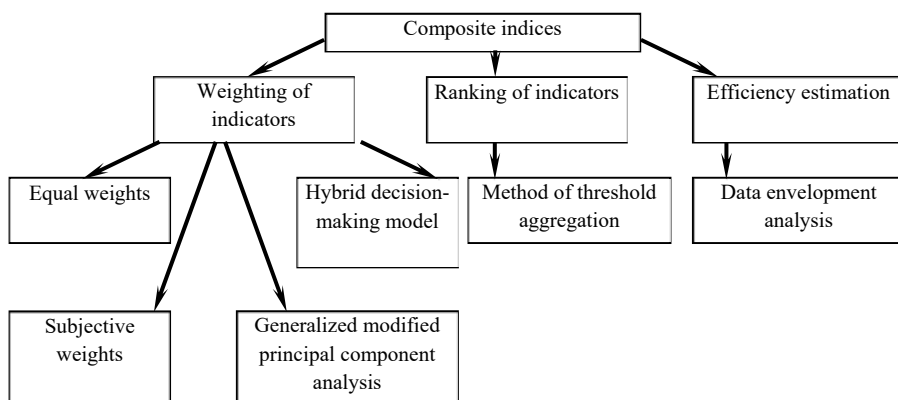
| Pillar | Sub-pillar | Indicators | Weight*, % |
|--------------------|--|---|------------|
| A. Health care | A1. Infant mortality | A1.1 Mortality of children aged 0 – 4 years (per 1,000 live births) | 3.90 |
| | | A1.2 Infant mortality (per 1,000 born alive) | 3.92 |
| | A2. Survivability. Health | A2.1 Mortality from blood circulatory system diseases (per 100,000 population) | 3.87 |
| | | A2.2 Mortality from neoplasms, including malignant neoplasms (per 100,000 population) | 3.87 |
| | | A2.3 Morbidity with a first-time diagnosis of drug abuse (per 100,000 population) | 3.99 |
| | | A2.4 Morbidity with a first-time diagnosis of alcoholism and alcoholic psychosis (per 100,000 population) | 3.99 |
| | | A2.5 Number of fatalities in road accidents, persons (per 100,000 population) | 4.00 |
| | | A2.6 Number of settlements with a population of more than 100 up to 2,000 that are beyond the reach of a healthcare provider or its structural subdivision providing primary healthcare | 3.99 |
| | A3. Survivability. Sanitation | A3.1 Sanitary status of drinking water supply, number of samples (from distribution network) not meeting hygienic standards as a percentage of the total number of samples analyzed | 4.00 |
| | | A3.2 Sanitary condition of urban atmospheric air, number of samples that do not meet hygienic standards as a percentage of the total number of samples tested | 3.98 |
| | | A3.3 Sanitary condition of the soil, number of samples that do not meet hygienic standards as a percentage of the total number of samples tested | 4.00 |
| | A4. Survivability. Preventive care | A4.1 Coverage of citizens by preventive health examinations | 3.99 |
| | | A4.2 Proportion of the population who are systematically involved in physical education and sport | 3.99 |
| | | A4.3 Healthy life expectancy | 4.01 |
| B. Education | B1. Education. Accessibility | B1.1 Net enrolment of children under 3 years of age in pre-primary education | 4.00 |
| | | B1.2 Gross enrolment ratio in secondary vocational education programmes as a % of the population aged 15-19 years | 3.98 |
| | | B1.3 Gross enrolment ratio in higher education – Bachelor's, Specialist's and Master's degree programmes, as a percentage of the population aged 17-25 years | 3.99 |
| | B2. Education. Effectiveness | B2.1 Proportion of pupils in general education institutions aged 10 and over who are under the basic level of training in accordance with the Federal Standards for Education | 4.00 |
| | | B2.2 Index of change in the educational attainment of pupils in general education institutions in basic general education programmes | 4.00 |
| C. Living standard | C1. Welfare | C1.1 GRP at PPP, million roubles (GRP multiplied by the ratio of regional subsistence minimum to federal subsistence minimum) | 3.97 |
| | | C1.2 GRP per capita, RUB | 3.97 |
| | | C1.3 Average cash income per capita, roubles | 3.91 |
| | | C1.4 Proportion of the population with cash incomes below the minimum subsistence level (% of the total population of RF region) | 3.97 |
| | C2. Regional expenditures on human capital | C2.1 Human capital development expenditures, % of GRP | 4.00 |
| | | C2.2 Increase in human capital development expenditures, % of GRP | 4.00 |

* weights are calculated by generalized modified principal component analysis in Gretl⁸.

Source: compiled by the authors on the basis of the National SDG Indicator Set – <https://rosstat.gov.ru/sdg/national>.

⁸ Gretl is an abbreviation of GNU Regression, Econometrics and Time-series Library (statistics and econometrics software package).

Figure 1. Approaches to construction of composite indices



Source: Verenikin, Makhankova, Verenikina, 2021.

Poledníková and Melecký (2017) distinguish three approaches to determining weights: equal weights for criteria, a subjective determination of weights and a determination of weights based on statistical approaches.

Subjective weighting means that weights are determined on the basis of expert opinion, opinion polls or an analytic hierarchy process (AHP) (Singh et al., 2008). The advantage of subjective scales is that they are transparent and easy to understand. The disadvantage of subjective weights is that they reflect the preferences of a certain group of individuals, but users of the integral indicator can change and for them, the ratio of indicators may be irrelevant.

Statistical or objective methods of weighting include approaches that are based on mathematical calculations. Poledníková and Melecký (2017) include methods based on performance boundary analysis, the shortest distance to the target, conjoint analysis and factor or regression analysis. Singh et al. (2008) highlight the principal component method and regression analysis, noting that equal or expert weights are more commonly used.

When considering methods for comparing alternatives, it is important to note the approach called data envelopment analysis (DEA). This method assesses the technical effectiveness of certain decision-making units (DMUs) and ranks them according to their effectiveness. First, a number of input and output parameters are selected for each alternative (DMU). Generally, inputs refer to the resources used and outputs refer to the goods and services produced. Measurement of technical efficiency consists of comparing the actual output to the maximum possible output for a given amount of resources (Lissitsa, 2003).

The different approaches used to compare alternatives (Figure 1) have both advantages and disadvantages. The diversity of existing approaches is due to the fact that each of them meets the requirements of researchers in its own way. In our opinion, to measure the sustainable development of companies, it is necessary to exclude approaches that use expert or subjective assessments of company indicators, the approach should be automated, mathematically and

economically justified. Approaches that use equal or subjective weights lose because they are not sufficiently convincing for an external user. The threshold aggregation method of compiling an integral indicator requires the ranking of indicators into three gradations, which cannot be done for sustainable development indicators without expert judgement. The performance-based approach requires a strict division of indicators into inputs and outputs (inputs and outputs), a division that is debatable.

An alternative, quite a common approach in multivariate statistical analysis, tested in many studies, which avoids subjective estimates in comparing a variety of parameters and factors, is the principal components method.

Suppose that each j -th region ($j=1, \dots, m$) is characterized by a number of parameters $\{x_i\}_{i=1}^n$. In general, we are dealing with a matrix of input data $X = \begin{pmatrix} x_{11} & \dots & x_{1m} \\ \vdots & \ddots & \vdots \\ x_{n1} & \dots & x_{nm} \end{pmatrix}$, in which vector columns correspond to information about particular regions. Denote the corresponding covariance matrix by $\Sigma = \begin{pmatrix} \sigma_{11} & \dots & \sigma_{1n} \\ \vdots & \ddots & \vdots \\ \sigma_{n1} & \dots & \sigma_{nn} \end{pmatrix}$.

The key question is how to select appropriate weighting factors for the specific indicators of the region x_i so as not to rely on subjective judgements.

Using principal components analysis one can transform the input data matrix X into a new set of artificially uncorrelated variables: $Z = \begin{pmatrix} Z_1 \\ \vdots \\ Z_n \end{pmatrix} = \begin{pmatrix} z_{11} & \dots & z_{1m} \\ \vdots & \ddots & \vdots \\ z_{n1} & \dots & z_{nm} \end{pmatrix} = LX$, where Z_1, \dots, Z_m – are vectors of the principal components, $L = \begin{pmatrix} l_{11} & \dots & l_{1n} \\ \vdots & \ddots & \vdots \\ l_{n1} & \dots & l_{nn} \end{pmatrix}$ is the linear orthogonal transformation matrix.

The fraction of total variation of initial data explained by the k -th principal component can be calculated as the ratio of the corresponding characteristic root of the matrix Σ and the sum of its eigenvalues: $\rho_k = \frac{\lambda_k}{\sum_{k=1}^n \lambda_k}$.

Using the modified principal components approach (Aivazyan, 2006) one can consider the weighted sum $y_{1j} = \sum_{i=1}^n l_{1i}^2 x_{ij}$ instead of commonly used z_{1j} as an aggregate indicator of economic activity. This avoids negative estimates of the principal components as constituent elements of the composite index.

In order to retain the information content of initial data we propose to use a generalized modified principal components approach (Verenikin, 2018) verified in our previous studies (See, e.g., Verenikina, Verenikin, 2019; Verenikin et al, 2021) so as to calculate the aggregate indicator of regional human capital development as a weighted sum of values y_{kj} , that correspond to every principal component ($k = 1, \dots, l$):

$$I_j = \sum_{k=1}^l \rho_k y_{kj} = \sum_{k=1}^l \rho_k \sum_{i=1}^n l_{ki}^2 x_{ij} = \frac{\sum_{k=1}^l (\lambda_k \sum_{i=1}^n l_{ki}^2 x_{ij})}{\sum_{k=1}^l \lambda_k} = \sum_{i=1}^n \frac{\sum_{k=1}^l \lambda_k l_{ki}^2}{\sum_{k=1}^l \lambda_k} x_{ij} = \sum_{i=1}^n \sigma_i x_{ij},$$

where $\sigma_i = \frac{\sum_{k=1}^l \lambda_k l_{ki}^2}{\sum_{k=1}^l \lambda_k}$ is the weight of the i -th indicator that characterizes regional human capital development within the aggregate index calculated using the generalized modified principal components analysis.

The modified principal components y_{kj} are weighed here by the fractions of variation in initial data explained by the corresponding principal components ρ_k . Thus we avoid any loss of data variance. The explaining capability of the proposed index extends to the total variance of initial variables. A distinctive feature of the proposed composite indicator is that it is not sensitive to subjective preferences regarding the relative importance of specific factors of regional human capital development. In contrast to the weighting coefficients, which are based on subjective judgments of experts and are obtained a priori, prior to data analysis, the objective weights σ_i (see Table 1) are posteriorly estimates, since they are calculated on the basis of the analysis of initial data.

We use the aggregate indicators calculated via generalized modified principal component analysis to arrange the regional rating of human capital development (Table 2).

It is necessary to normalize initial indicators within the range from one to ten in order to obtain a uniform increasing influence of all factors under consideration on the level of the resulting aggregate index.

We scale indicators to a ranking gradation from 1 to 10 according to the following idea. The sample contains both negative and positive impact indicators. Thus, all mortality and morbidity indicators of Section A (subsections A1 and A2), all indicators related to the sanitary condition of water, land and air (subsection A3), as well as indicator B2.1 (proportion of underskilled pupils) and indicator C1.4 (share of the population with income below the subsistence minimum) are negative, and the condition "the less, the better" applies to them. The remaining indicators are positive and are subject to the "more is better" condition. If the indicator corresponds to the "the more, the better" case, we fit it to the 1-10 ranking scale in the same way as before: $x_{ij}^n = 1 + 9 \left(\frac{x_{ij} - x_{ij}^{\min}}{x_{ij}^{\max} - x_{ij}^{\min}} \right)$, where x_{ij}^n is the normalised variable, x_{ij}^{\max} and x_{ij}^{\min} – are the "best" and "worst" values of the original indicator respectively. If the indicator corresponds to the "the less, the better" case, the following normalisation transformation is applied: $x_{ij}^n = 1 + 9 \left(\frac{x_{ij} - x_{ij}^{\max}}{x_{ij}^{\min} - x_{ij}^{\max}} \right)$, where x_{ij}^n is the normalised variable, x_{ij}^{\max} and x_{ij}^{\min} are the "worse" and "better" values of the original indicator respectively.

The rating is a linear combination of the entire set of modified principal components. Thus, it can be seen as a composite of partial indices that summarize the weighted modified estimates of the principal components for each data pillar, i.e. for each section. These sub-indices form the region's ranking for each section and provide insights into the factors affecting the level of human capital development and the potential for improvement.

3. Results

The results are presented in Table 2. Moscow leads, followed by St. Petersburg, Yamalo-Nenets, Nenets and Khanty-Mansi Autonomous Area, Belgorod Region and the Republic of Tatarstan. Outsiders include the Pskov and Amur regions, the Karachay-Cherkessia Republic, the Transbaikal Territory and the Jewish Autonomous Area.

Table 2. Regional Rating of Human Capital Development in Russia

| RF region | Integral indicator value | Place in the ranking |
|---|--------------------------|----------------------|
| Moscow city | 7,11233 | 1 |
| Saint Petersburg city | 6,72552 | 2 |
| Yamal-Nenets Autonomous Area | 6,69358 | 3 |
| Nenets Autonomous Area | 6,67086 | 4 |
| Belgorod region | 6,42850 | 5 |
| Republic of Tatarstan | 6,41691 | 6 |
| Khanty-Mansi Autonomous Area – Ugra | 6,37279 | 7 |
| Astrakhan region | 6,28132 | 8 |
| Samara region | 6,25874 | 9 |
| Krasnoyarsk region | 6,15772 | 10 |
| Komi Republic | 6,08431 | 11 |
| Lipetsk region | 6,08015 | 12 |
| Magadan region | 6,05642 | 13 |
| Sakhalin region | 6,03877 | 14 |
| Udmurtian Republic | 6,03555 | 15 |
| Vologda region | 6,00496 | 16 |
| Krasnodar region | 5,98669 | 17 |
| Moscow region | 5,98021 | 18 |
| Tyumen region (without Autonomous Area) | 5,95391 | 19 |
| Chechen Republic | 5,92608 | 20 |
| ~~~~~ | | |
| Ivanovo region | 5,75031 | 76 |
| Republic of Tuva | 4,59766 | 77 |
| Republic of Altay | 5,54130 | 78 |
| Kurgan region | 4,72529 | 79 |
| Altai region | 5,48321 | 80 |
| Pskov region | 5,25058 | 81 |
| Amur region | 5,92608 | 82 |
| Karachayevo-Chircassian Republic | 5,69154 | 83 |
| Trans-Baikal territory | 4,46106 | 84 |
| Jewish Autonomous region | 4,83791 | 85 |

Source: composed by the authors.

By grouping the results by federal districts, we obtained an aggregated regional ranking in terms of human capital development (see Table 3), with the Central Federal District in the lead.

Having decomposed the integral ranking, we calculated sub-indices that summarized the weighted modified loadings of the principal components for each data pillar. These sub-indices form the region's ranking for each pillar and provide insights into the factors affecting human capital development and the potential for improvement (see Table 4).

Table 3. Aggregated regional rating of human capital development by federal districts

| <i>Federal District of the Russian Federation</i> | <i>Integral indicator value</i> | <i>Place in the rating</i> |
|---|---------------------------------|----------------------------|
| Central | 105,251 | 1 |
| Volga | 80,264 | 2 |
| Northwestern | 74,054 | 3 |
| Far Eastern | 57,896 | 4 |
| Siberian | 54,183 | 5 |
| Southern | 45,739 | 6 |
| North Caucasus | 39,539 | 7 |
| Ural | 35,263 | 8 |

Source: composed by the authors.

Table 4. Leaders and outsiders in the sub-indices of Regional Rating of Human Capital Development in Russia

| Pillar A. Health | | | |
|----------------------------------|-------------------------------|----|------------------------------|
| 1 | Republic of Tatarstan | 76 | Amur region |
| 2 | Moscow city | 77 | Irkutsk region |
| 3 | Belgorod region | 78 | Oryol region |
| 4 | Yamalo-Nenets Autonomous Area | 79 | Krasnoyarsk Territory |
| 5 | Nenets Autonomous Area | 80 | Novgorod region |
| 6 | Khanty-Mansi Autonomous Area | 81 | Pskov region |
| 7 | Republic of Ingushetia | 82 | Jewish Autonomous Region |
| 8 | Astrakhan Region | 83 | Primorye Territory |
| 9 | Republic of Udmurtia | 84 | Trans-Baikal Territory |
| 10 | Chechen Republic | 85 | Chukotka Autonomous Area |
| Pillar B. Education | | | |
| 1 | Saint-Petersburg city | 76 | Jewish Autonomous Region |
| 2 | Moscow city | 77 | Republic of Buryatia |
| 3 | Tyumen region | 78 | Chukotka Autonomous Area |
| 4 | Tomsk region | 79 | Kabardino-Balkarian Republic |
| 5 | Samara region | 80 | Republic of Altai |
| 6 | Novosibirsk Region | 81 | Trans-Baikal Territory |
| 7 | Republic of Tatarstan | 82 | Republic of Tuva |
| 8 | Nizhny Novgorod Region | 83 | Republic of Daghestan |
| 9 | Vladimir region | 84 | Chechen Republic |
| 10 | Oryol region | 85 | Republic of Ingushetia |
| Pillar C. Living standard | | | |
| 1 | Moscow city | 76 | Astrakhan region |
| 2 | Yamal-Nenets Autonomous Area | 77 | Jewish Autonomous Region |
| 3 | Nenets Autonomous Area | 78 | Republic of Kalmykia |
| 4 | Chukotka Autonomous Area | 79 | Chelyabinsk region |
| 5 | Sakhalin region | 80 | Smolensk region |
| 6 | Khanty-Mansi Autonomous Area | 81 | Republic of Mari El |
| 7 | Trans-Baikal Territory | 82 | Kabardino-Balkarian Republic |
| 8 | Magadan Region | 83 | Republic of Ingushetia |
| 9 | Saint Petersburg city | 84 | Republic of Mordovia |
| 10 | Moscow region | 85 | Republic of Khakassia |

Source: composed by the authors

Among the leaders in subindex A. "Health": Tatarstan, Moscow and Belgorod Region; for subindex B. "Education": the federal cities of St. Petersburg and Moscow and Tyumen,

Tomsk and Samara regions; for sub-index C. "Living standard": Moscow, Yamalo-Nenets, Nenets and Chukotka Autonomous Areas, Sakhalin Region.

Among the outsiders in subindex A. "Health": Pskov Region, Primorsky Region, Trans-Baikal Territory, Jewish and Chukotka Autonomous Area; for sub-index B. "Education": Trans-Baikal territory, Republics of Tuva, Dagestan, Chechnya and Ingushetia; by sub-index C. "Living standard": Republics of Mari El, Kabardino-Balkaria, Ingushetia, Mordovia and Khakassia.

4. Discussion

Let us compare our rating "Regional Rating of Human Capital Development in Russia" with the "Human Development Index in Russia: regional disparities" which has been composed by the Analytical Centre for the Government of the Russian Federation since 2015. Let us take the latest calculation data, for 2019 (see Table 5).

Table 5. Comparative table of the positions of RF regions in the human development ratings (the first 15 and the last 10)

| Regions of the Russian Federation | Position in the Regional Rating of Human Capital Development in Russia | Position in the Human Development Index in Russia: regional disparities | Deviation |
|-----------------------------------|--|---|-----------|
| Moscow city | 1 | 1 | 0 |
| Saint Petersburg city | 2 | 2 | 0 |
| Yamalo-Nenets Autonomous Area | 3 | 4 | +1 |
| Nenets Autonomous Area | 4 | 5 | +1 |
| Belgorod region | 5 | 10 | +5 |
| Republic of Tatarstan | 6 | 6 | 0 |
| Khanty-Mansi Autonomous Area | 7 | 11 | +4 |
| Astrakhan region | 8 | 3 | -5 |
| Samara region | 9 | 16 | +7 |
| Krasnoyarsk region | 10 | 12 | +2 |
| Komi Republic | 11 | 17 | +6 |
| Lipetsk region | 12 | 19 | +7 |
| Magadan region | 13 | 14 | +1 |
| Sakhalin region | 14 | 8 | -6 |
| Republic of Udmurtia | 15 | 22 | +7 |
| ~~~~~ | | | |
| Ivanovo region | 76 | 77 | +1 |
| Republic of Tuva | 77 | 85 | +8 |
| Republic of Altai | 78 | 82 | +4 |
| Kurgan region | 79 | 74 | -5 |
| Altai region | 80 | 73 | -7 |
| Pskov region | 81 | 76 | -5 |
| Amur region | 82 | 71 | -11 |
| Karachayevo-Chircassian Republic | 83 | 79 | -4 |
| Trans-Baikal Territory | 84 | 81 | -3 |
| Jewish Autonomous Region | 85 | 84 | -1 |

Source: Regional Rating of Human Capital Development in Russia calculated by the authors, Human Development Index in Russia: regional disparities created by the Analytical Centre for the Russian Government (see Human Development Index in Russia, 2021, pp. 10-13)

As we can see from Table 5, there is little divergence in most positions (13 positions for 0-4 positions in the ranking, 11 positions for 5-8 positions). At the same time, the Amur Region diverges by 11 places, the region ranks 82 in our ranking, and 71 in the Human Development Index. The reason for this divergence is the relatively high position of the region in the Living standard pillar (43rd place), which is determined by an average share of the population with incomes below the subsistence level (15.7%, with a maximum of 34.1% among all regions and a minimum of 5.6%), and increase in human capital expenditures (1.14% of GRP, with a maximum of 1.8% and a minimum of 0.9% among all regions).

To investigate the relationship between regional human capital rankings, we compared them using Kendall and Spearman rank correlation coefficients (Table 6).

Table 6. Rank correlation coefficients for the ratings of human capital development

| | |
|--|-------|
| Kendall's rank correlation coefficient | 0,38 |
| P-value | 0,14 |
| Spearman rank correlation coefficient | 0,524 |
| P-value | 0,21 |

Source: calculated by the authors based on *Regional Rating of Human Capital Development in Russia and Human Development Index in Russia: regional disparities*.

Kendall's rank correlation coefficient is defined as the difference in rank probabilities of matching and inversion and is calculated according to the formula: $\tau_K = (P - Q)/(P + Q)$, where P is the number of matches, Q is the number of inversions⁹ (Kendall M. et al. 1975).

The Spearman rank correlation coefficient that takes into account the difference in ranks is calculated according to the formula: $\tau_S = 1 - \frac{6 \sum_{i=1}^n (u_i - v_i)^2}{n(n^2 - 1)}$, where $(u_i - v_i)$ – is the rank difference of the i-th observation, n – is the number of observations.

Observations in our study refer to RF regions that have rank-places in the respective rankings. A single value of Kendall and Spearman coefficients means complete coincidence between the two rankings, a value of zero means no correlation between the ranks, a value equal to -1 means a complete inversion of the rankings.

A pairwise comparison across the sample of regions simultaneously in the compared rankings yields Spearman and Kendall rank correlation coefficient values of 0.38 and 0.52, respectively (Table 6). Since the coefficient values more than P-value in each case – we reject the null hypothesis. Thus, the rank correlation coefficient is statistically significant and the rank correlation relationship between the two ratings of human capital development is significant.

⁹ Coincidence refers to the simultaneous excess of the ranks of the i-th observations over the ranks of the j-th observations, and inversion refers to the case where the rank of the i-th observation of the first ordering is greater than the rank of the j-th observation, and the rank of the i-th observation of the second ordering is lower than the rank of the j-th observation.

In order to understand what the ranking positions are related to, it is important to pay attention to the structure of the generated integral indicator, in particular the weights that were picked up by the generalized modified principal component analysis (see Table 1).

The indicators with the highest weight are: A4.3. Healthy life expectancy, 4.01%, A2.5 Number of fatalities in road accidents (4.00%), A3.1. Sanitary status of drinking water supply, 4%, A3.3 Sanitary condition of the soil, 4%, B1.1. Net enrolment of children under 3 years of age in pre-primary education, 4%, B2.1. The proportion of pupils who are under the basic level of training (4%), B2.2. Index of change in educational attainment, 4%, C2.1. Human capital development expenditures (4.00%) and C2.2. Increase in human capital development expenditures, 4%.

The indicators with the lowest weighting are: A2.1. Mortality from blood circulatory system diseases, 3.87%, A2.2. Mortality from neoplasms, including malignant neoplasms, 3.87%, A1.1. Mortality of children aged 0 – 4 years, 3.90%, C1.3. Average cash income per capita, 3.91%, A1.2. Infant mortality, 3.92%.

Though the indicators with the highest weights can be treated as more important factors for human capital quality, the weights of indicators are very close to each other, so we can't make the conclusion, that only crucial factors for human capital development should be taken into account in regional policy.

Poses and cons for regional human capital development can be evaluated by analyzing the structure of the integral indicator of each region, where we can explore the contribution of each indicator to the integral value of the rating and compare the position of each indicator with the average for the sample. Based on the comparison, it is possible to identify indicators that are drivers of growth, to provide recommendations for improving performance in those areas where the relevant potential is present.

For instance, there are 3 neighbouring regions in the Northern-East of the Central district: Ivanovo, Kostroma and Yaroslavl, historically closely linked regions, which political centres are within 100 km of each other.

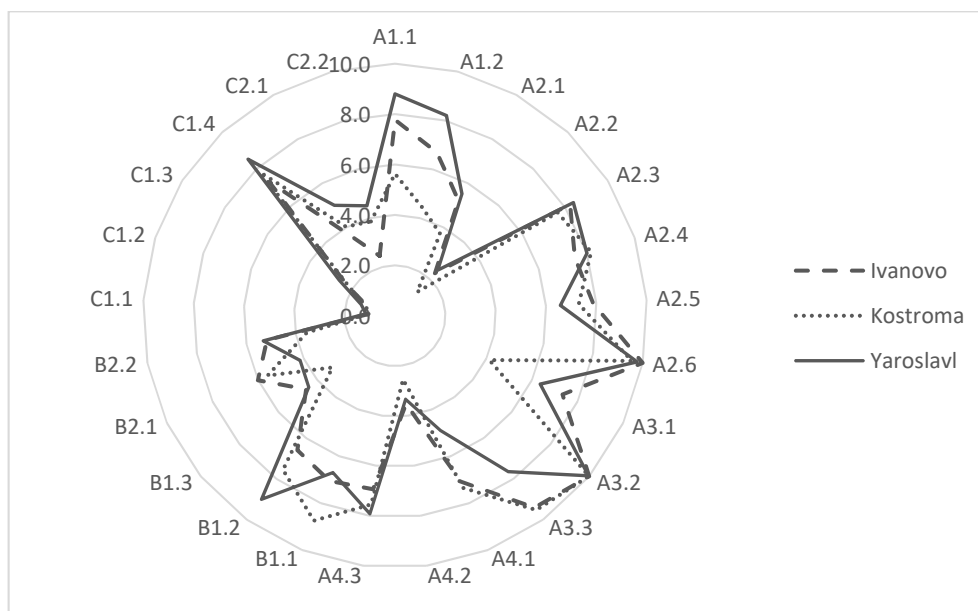
Table 7. Indices and sub-indices of Regional Rating of Human Capital Development in Russia for selected regions

| Region | Position in the Regional Rating of Human Capital Development in Russia | Pillar A. Health | Pillar B. Education | Pillar C. Living standard |
|------------------|--|------------------|---------------------|---------------------------|
| Ivanovo region | 76 | 33 | 21 | 69 |
| Kostroma region | 66 | 74 | 29 | 44 |
| Yaroslavl region | 26 | 44 | 20 | 34 |

Source: composed by the authors on the basis of Regional Rating of Human Capital Development in Russia.

Yaroslavl ranks significantly higher than its nearest neighbours. What is the reason for its failure? If we look at the values of sub-indices, we see that Kostroma lags behind in Pillar A. «Health» and Ivanovo in Pillar C. «Living Standards». Further decomposition of the integral index requires analysis of indicator values, for which the region is lagging and identification of reasons for this situation (see Figure 2).

Figure 2. Decomposition of integral indicator of Regional Rating of Human Capital Development in Russia for Ivanovo, Kostroma and Yaroslavl regions



Source: composed by the authors on the basis of Regional Rating of Human Capital Development in Russia.

So, these are specific issues that are the responsibility of regional authorities. For example, Kostroma is seriously lagging by indicator A1.1. Mortality of children aged 0 – 4 years and indicator A3.1. Sanitary status of drinking water supply. Obviously, the solution to these problems lies in the development of the health care system in the regions (including in the frames of the national project Demography), and in a renewal of the central water supply system due to its significant deterioration. Ivanovo region, in its turn, is lagging behind by human capital development expenditures (indicators C2.1. and C2.2.), so public administrations should ensure that the region's investment in human capital will increase.

5. Conclusion

Thus, our rating methodology reflects a comprehensive approach to assessing individual aspects of regional development. The rating provides an integrated assessment of the current state of human capital development in Russian regions. We used only official statistical data published by federal agencies, so there are some shortcomings associated with the lack of sufficient statistical information. The research base needs to be expanded in the future. Nevertheless, we do not use expert estimates, which require complex and costly research, making the calculations much simpler and more objective.

In fact, our survey lays the foundation for regular (e.g. once a year) analysis of the level of human capital development in the Russian regions. The study of factors determining the regions' positions in the ranking can be used to improve socio-economic policy in Russian regions. Obviously, in order to improve the level of human capital development, more attention and investment should be directed towards healthcare and education projects.

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INTERNAL COMMUNICATION IN ORGANIZATIONS: THE CASE OF THE POST OF KOSOVO³

Effective and transparent communication among publicly owned organizations is considered crucial for enhancing the staff's performance and accomplishing strategic priorities. The paper examines the Post of Kosovo, as a major public enterprise and looks at internal communication and its impact on employees' efficiency. Drawing on survey analysis and interviews, we find that the Post of Kosovo, as a public enterprise applied a closed type of hierarchical management, with no formal structure of communication in the organizational scheme. Our findings indicate that communication in the Post of Kosovo is characterized by a lack of transparency, control and manipulation, and centralized decision-making structures. It also indicates that communication has a direct impact on employee motivation and overall organizational performance. Thus, the findings of the study contribute to the existing literature on public enterprise management in transition societies and provide valuable insights into how internal communication can be used as an important tool for organizational success.

Keywords: public enterprise; internal communication; efficiency; the Post of Kosovo

JEL: L32; M12; M14; P31

1. Introduction

In transitional societies, public enterprises are caught between two important processes. On the one hand, they are exposed to the pressure to modernize, transform and adopt to the market economy and the competition which comes from the private sector. On the other hand, the democratization of states also demands adjustment of the management style, norms, and principles which govern public enterprises. In other words, they are expected to operate based on the principle of good governance, transparency, and efficiency to justify their role as a national assets and market competitor. However, meeting such expectations is not an easy task. Public enterprises are not immune to political interference as well as internal management flaws. Yet, research shows that if public organizations, such as those governing

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the sector of energy, communication, transport, and other public services, can develop effective internal communication strategies coupled with internal good management are more likely to survive the market economy and retain their strategic and vital role in the transition from one political system to another one.

Existing literature shows that effective communication is an essential aspect of work relations among employees, at the professional or social level. This also allows the organization and its workers more transparency and greater alignment of daily expectations with strategic priorities (Smith, 2018). In this regard, the attention to the psychological aspects and social needs of the employees has emerged as a central feature, turning communication into a crucial factor for the productivity of an organization. Yet, as Anthony Giddens notes, in modern societies the majority of organizations tend to be more elastic. In other words, bureaucratic and organizational systems are more elastic than Max Weber thought they were, and their domination is challenged by less hierarchical types of groups and associations (Giddens 2004, p. 291). Existing studies on Kosovo's economic transition, especially those concerning public organizations, show that there is a lack of adaptability, transparency, and politicization of steering committees in public enterprises (KDI, 2014). As a result, low performance is identified as a characteristic of a significant number of public enterprises in Kosovo. This is a negative phenomenon, considering the fact that the public sector makes up a large portion of Kosovo's economy. Even during the Covid-19 pandemic, the Government of Kosovo supported public enterprises financially by providing interest-free lending, in order to ensure short-term liquidity (Aliu et al., 2022). However, no one has researched so far internal communication efficiency as an impacting factor on the performance of this enterprise.

The paper focuses on exploring the organizational communication efficiency of the Post of Kosovo. This case is of special interest for the Kosovo⁴ context, not only due to the lack of studies in this field, but it also may serve as an exploratory approach that highlights the importance of communication for organizational efficiency and good performance. We argue that looking at the case of the Post of Kosovo offers us valuable insights into how organizational communication takes place and impacts its performance, especially in a context where there have been rapid socio-economic development and significant change on the political culture of the country. In particular, we are interested to test two main questions. First, we want to explore whether the more closed and ineffective the communication in a company is, the lower the motivation of employees is, and as a result the weaker efficiency of the enterprise. Second, we want to explore whether a communication strategy, which empowers participatory management, has crucial importance in the performance of a company.

This case of the Post of Kosovo, as a public enterprise, is crucial as it helps understand the organizational dynamics in a country which has undergone multiple transitions in the past three decades. Namely, the transition from communism to democracy, the transition from war to peace and the transition from international administration to independent statehood

⁴ Kosovo is one of the six Western Balkan countries that declared its independence on February 17th 2008. However, it is still not recognized as a sovereign and independent state by five Member States of the European Union (EU) and continues to be opposed by Russia and China at the UN Security Council.

(Freedom House, 2021). These internal dynamics provide sufficient grounds to raise a number of important questions on the management model and the conditions which dictate its performance, productivity and realization of strategic goals. Namely, what is the quality of organizational communication in this enterprise? Does the Post of Kosovo have a communication strategy? What are the effects of internal communication on its efficiency? The research design of this study is qualitative and is based on semi-structured interviews with key personnel of the Post of Kosovo. Through interviews, we aim to explore the internal communication strategies, their effectiveness and their impact on the performance of the company. The interviews also aim to explore what are the main challenges and opportunities for the Post of Kosovo and how internal communication contributes to their success. The research will draw upon existing studies on organizational communication and public enterprise management in transition economies and will analyse the data collected from the interviews in order to identify the main trends in communication within the Post of Kosovo.

This paper finds that although the internal communication in the Post of Kosovo has improved over the years, this public enterprise has applied a closed type of hierarchical management, with no formal structure of communication in the organizational scheme. The internal communication in the Post of Kosovo appears to be characterized by a lack of transparency, tendencies for control and manipulation, and centralized decision-making. We also find that communication appears to have had a direct impact on employee motivation and overall business performance. Therefore, we argue that is important for the management of the Post of Kosovo to improve their communication structures and processes to ensure effective communication and maximize the potential of the enterprise. We hope that the findings of the study contribute to the existing literature on public enterprise management in transition societies and provide valuable insights into how internal communication can be used as an important tool for organizational success.

2. Literature Review

This section aims to offer a conceptual discussion and highlight the main theoretical contributions and perspectives on effective communication within organizations. All organizations need to find ways to successfully manage a fundamental paradox: they need to coordinate the actions of their members if they want to survive (Conrad, Poole, 2005, p. 20). George Mead considered communication as the main matrix of human society (Mead, 2012; Habermas, 1984). Within organizations, the approach towards communication has changed in accordance with the dynamic of the historical development of the concerned society. Scholars view it as a complex and multidimensional process through which organizational development is made possible. Performance in organizations entails satisfactory completion of tasks and duties set by the management. It is often measured in relation to the completion of contractual duties, as well as other everyday tasks, mid-term targets, and strategic goals. In turn, productivity and efficiency are understood as crucial hallmarks for measuring performance and outputs or outcomes. In other words, performance is the quality of work undertaken, whereas productivity is the quantity of the completed work within a certain time frame and expected outcomes. What glues together performance, productivity, and efficiency is effective communication (see Agboke, 2018). While effective communication increases

productivity due to encouraged motivation and improved relations among employees and employers, non-effective communication might result in insecurity, fear and dissatisfaction, which inevitably will result in a decrease of productivity (Mukelabai, Phiri, 2021).

Since in this paper, we explore the internal communication in the Post of Kosovo in the context of its performance and employee motivation, it is crucial to delve into the relevant literature on effective communication within public organizations. Scholars consider that effective communication is crucial for motivating the staff to perform better and enhance the overall efficiency of the organization (Robbins et al., 2013, p. 156). Two main theories of motivation are important to explore here: Herzberg's *Hygiene and Motivation Factors* and Vroom's *Expectations Theory*. According to Herzberg, managers who eliminate factors that cause dissatisfaction may bring peace (and order) to the workplace but not necessarily motivation. When these factors are appropriate, people will not be dissatisfied, but they will not be satisfied either. To motivate people in their work, Herzberg suggested a number of factors that increase job satisfaction (Blagoev et al., 2022). According to Herzberg, if an organization wants its employees to do a good job, it has to give them a good job to do (Giancola, 2010). Namely, the job description and the scope of tasks should be appropriate for the capacity and qualification of the concerned staff member. But, Lawler (1970) has a different point of view on the relationship between satisfaction and performance. The same maintains that it is not possible to increase the motivation of all employees by giving them a good job to do, because there are not so many "good jobs" in the organization to satisfy everybody (Blagoev et al., 2022).

On the other hand, the Vroom's expectancy theory (1964) considers the individual's motivation as based on their goodwill for achieving certain goals and their belief that the motivation will lead to expected performance. This theory considers the following relationships:

- a) *Effort-performance relationships* – the probability that an extra effort of the employee will lead to higher performance;
- b) *Performance-reward relationship* – the extra efforts will lead to the desired outcome; and
- c) *Reward-personal goal relationship* – the importance that the employee gives to the result or reward that can be achieved through work.

The motivation theories underline the values and long-term goals set by employers as the main motivating factors. However, if we consider the differences between the public and the private sector, the assumptions of the above-mentioned theories should be contextualized in the function of the scope and purpose of this study. As El Mar notes (2021), continuous changes in management processes together with factors such as government ownership and the equal treatment of all employees regardless of their distinct qualities, make managerial efficiency in public enterprises more difficult.

In general, organizational communication serves four major functions: *control, motivation, emotional expression and information* (Robbins et al., p. 157). Completion of tasks by employees, encouraging them to perform better, their social needs and information about what should or should not be done, are possible through communication in organizations. For communication to occur, the message must exist and a certain meaning must be transferred

from the sender to the receiver. The message is encoded using symbols and through a medium (channel) passes to the receiver, who decodes it. Then the feedback returns through a channel to the receiver and the transfer of meaning from one person to another is realized. The communication process includes the sender, the message, the encoder, the channel, the decoder, the receiver and the feedback, but we should always consider the noise that can be caused by internal or external factors, and which can hinder the communication process. (Robbins et al., p. 159). The process of communication is based on four elements: transmitter, receiver, channel, and message. All these elements must exist in effective and appropriate communication and are equally important (Pirjol, Radomir, 2017). Communication enables the performance of an organization and the way in which objectives and its potential are obtained depends on its quality. Within every organization, there is an exchange of information between departments, employees, customers and between the organization's environment and the environment outside it (Moldovan, 2010, p. 7). In short, efficient and continuous communication between employees is a precondition for the assessment of an organization's current situation (Valkanova, 2019).

Beyond the function of communication, it is important to account for the type of communication too. The two basic types of communication that matter to managers in organizations are: *interpersonal communication* – communication between two or more people, and *organizational communication* – the patterns, networks and systems of communication within an organization. For interpersonal communication, managers have a wide variety of channels including face-to-face communication, telephone, group meetings, formal presentations, memos, publications, email, videoconferences, etc. The development of Internet and Communication Technologies (ICTs) has further expanded the range of channels that can be used in internal communication, such as social media or internal blogs. Although using multiple channels to communicate a message decreases the potential for distortion, the type of channel chosen will affect the extent to which accurate emotional expression can be communicated. In the framework of interpersonal communication, it is important to emphasize non-verbal communication, especially body language and paralinguistic, which are important for the efficiency of communication. Some of the most meaningful communications are neither spoken nor written, body language can communicate emotions or temperaments, and every oral communication also has a nonverbal message (Robbins et al., p. 161).

Next, what matters is the mode of communication in an organization, namely whether it is *formal* and *informal*. Formal communication refers to communication that follows the official chain of command or is part of the communication required to do one's job, whereas informal communication is communication that is not defined by the organization's structural hierarchy. The role of this type of communication is to talk about things that do not necessarily have to deal with activity and these networks are based more on emotional criteria, common interests having less strict communication rules (Pirjol, Radomir, 2017). The informal communication system fulfils two purposes in organizations: a) it permits employees to satisfy their need for social interaction; and b) it can improve an organization's performance by creating alternative, and frequently faster and more efficient channels of communication (Robbins et al., p. 166). According to Moldovan (2010, p. 8), formal communication takes place through terms and rules imposed by the organization. The proper

development of this type of communication is followed by a set of rules concerning the content, responsibility, shape and moment, but also the destination of messages.

Meanwhile, regarding the flow of information, there are four types of internal communication: *downward, upward, lateral and diagonal communication*. Downward communication entails any communication that flows from managers to employees is a downward communication. This type of communication is used to inform, direct, coordinate, and evaluate employees. Managers are also using downward communication when providing employees with job descriptions, informing them of organizational policies and procedures, pointing out problems that need attention, or evaluating and giving feedback on their performance. Upward communication entails any communication that flows from employees to managers is upward communication. Reports are given to managers to inform them of progress toward goals and any current problems. Upward communication keeps managers aware of how employees feel about their jobs, their co-workers, and the organization in general. Managers also rely on it for ideas on how things can be improved. Lateral communication entails communication that takes place among employees on the same organizational level is called lateral communication. In today's often chaotic and rapidly changing environment, lateral communication is frequently needed to save time and facilitate coordination. Finally, diagonal communication entails communication between employees of different levels and departments of the organization is diagonal. In the interest of efficiency and speed, diagonal communication can be beneficial.

Regarding the flow of information, researchers have modelled the *types of networks* based on the centralization of communication and the structure of channels. Two types of communication networks that have been derived from Leavitt, Bavelas and Barrett's laboratory experiments (1995, p. 121) are: *restrictive networks* and *flexible networks*. As Moldovan notes, the restrictive network has a different degree of centralization and the access of participation of people in the discussion is unequal. The central person has power over information and in this way, she can control the access to information of other participants. Otherwise, the flexible network is decentralized by the fact that all people have the same right and access to information. Thus, this network proves to be more effective by the appropriate encouragement of employees (Moldovan, 2010, pp. 7-8).

Another division of networks based on the channel structure includes the *chain* network, the *wheel* network and the *all-channel* network. In the chain network, communication flows according to the formal chain of command, both downward and upward. The wheel network represents communication flowing between a clearly identifiable and strong leader and others in a work group or team. The leader serves as the hub through whom all communication passes. Finally, in the all-channel network, communication flows freely among all members of a work team. According to them, no single network is best for all situations. If you are concerned with high member satisfaction, the all-channel network is best, if having a strong and identifiable leader is important, the wheel facilitates this, and if accuracy is most important, the chain and wheel networks work best (Robbins et al., p. 168). Organizations with a centralized management model are characterized by less effective communication. "If an organization is highly centralized, the messages will be exchanged, interpreted and changed many times until they reach the decision-makers at the top of the organization, just like the decisions that are taken – policies and procedures – shall be exchanged, interpreted

and changed many times until they reach the people at the bottom of the organization, who are to implement them” (Conrad and Pool, 2005, p. 75).

But, in order for the communication to be effective, as the traditional perspective sets out, two conditions must be met: a) the processes of giving and receiving messages should be exact and credible and b) the receiver of the message should understand and respond to the message in accordance with the aim of the sender of the message (Papa et al., 2008, p. 8). Among the types of communication networks, the *grapevine* network is also important, which exists in the informal communication of almost all organizations. This is important because a large part of internal communication takes place at the level of rumours or common conversations between employees, therefore it represents an important source of information that can be used by managers to increase the effectiveness of organizations.

The discussion in this section shows that effective communication is essential for good organizational performance and productivity. In general, communication processes are based on four elements: transmitter, receiver, channel, and message. Communication networks can be grouped into restrictive, flexible, chain, wheel, and all-channel networks. In order for the communication to be effective, two conditions must be met: a) the processes of giving and receiving messages should be exact and credible, and b) the receiver of the message should understand and respond to the message in accordance with the aim of the sender of the message. The informal communication network, such as the grapevine network, is also important, since a large part of internal communication takes place at the level of rumours or common conversations between employees, therefore it represents an important source of information that can be used by managers to increase the effectiveness of organizations.

3. Research Approach and Methods

So far in this paper, we have ascertained that effective communication is crucial for better performance of organizations. This section outlines the research approach and methods used to explore this puzzling question in the context of the Post of Kosovo, as a case study of a public enterprise or organization in Kosovo. Notably, the lack of studies in the field of organizational communication in Kosovo and the aim for serious research that studies the communication interaction with the efficiency of a company, besides being quite challenging in the scientific aspect, also imposes special attention on the methodological issues. Scholars suggest the use of several methods for data collection, the selection of which depends on the aim and access to resources (Kumar, 2012, p. 140). Therefore, having in mind the aim of this research, we have used various methods such as surveys, interviews, data analysis and desk research. The sample selection was made based on geographical representation, which includes the seven regions of Kosovo. Since the Post of Kosovo is currently operating with 120 active post offices, two employees from each office were surveyed, namely, 260 officials, comprising 27.8% of 938 total number of employees in this enterprise (ZKA, 2021). The survey included low-level employees in order to have a clear overview of the state of communication, and through their responses to identify the types and channels used in the internal communication of the Post of Kosovo. The respondents have been classified into the three following age groups: 18 to 35 years old (17.2% of total respondents), 36 to 50 years

old (49.2% of total respondents) and 51 to 65 years old (33.6% of total respondents). Thus, considering the number of respondents and their age, the sample is representative.

Since the main aim of this research is to explore the current state of communication in the Post of Kosovo and to identify whether there are any changes over time, the comparative analysis of the results was done using the same sample in 2016 and 2021. So, for a comparison of results with regards to the dynamic of change, the surveying of the same level employees with the same sample (systematic sample) was implemented twice within a 5-year interval, in 2016 and 2021. We raised the research question: what is the structure of internal communication in the Post of Kosovo and what are the effects of communication on its performance? The questionnaire was designed in such a way as to provide data on the types of communication and channels that are used the most, for their involvement in decision-making processes, forms of conflict resolution, their advancements or degradations during the time they work in this enterprise, as well as their relations with colleagues and superiors. Meanwhile, for qualitative data regarding the managerial approach toward internal communication, we have conducted *standardized interviews* with high-level managers of the enterprise. The interviews were conducted in the same time interval (2016 and 2021) and the same questions were used, except added questions in 2021 regarding the impact of the Covid-19 pandemic on the performance of the Post of Kosovo. The interview was designed in such a way as to explore the approach, model, and importance of internal communication from the managerial perspective, based on their duties and responsibilities (Post of Kosovo, 2017). As primary data for this research, we also used the basic documents such as the Law on Postal Services, the statute, internal regulations, and annual reports of the Post of Kosovo. The analysis of the interview data was done using qualitative techniques, while the survey data were analysed using statistical methods. These methods offer us an opportunity to present the data a descriptive way. Overall, the use of different methods of data collection, with a focus on the sample selection, provided us with reliable data and useful insights into the field of organizational communication. In line with the overall purpose of this study, which is to explore internal communication and its impact on the performance of the Post of Kosovo, we aim to investigate two research questions: 1) what is the structure of internal communication in the Post of Kosovo; and 2) and what are the effects of communication on its performance?

4. The Organizational Structure and Communication of the Post of Kosovo

This section explores the organizational structure and communication of the Post of Kosovo. The Post of Kosovo as a public enterprise was established by Kosovo's Government (decision No.16/53, 21.12.2011), and approved by Kosovo's Parliament (01.08.2012), following the demerger from 'Post Telecom of Kosovo' (PTK) L.L.C.. Postal services in Kosovo date back to the communist era of the 1950s when the Post, Telephone, and Telegraph of Kosovo (PTT) was founded and later operated as the Post and Telecom of Kosovo (PTK).⁵ A major implication emerging from this legacy is that this new public

⁵ The Kosovo Post Office (KPO) was well established and developed, until the 1980s after Kosovo's Autonomous status was abolished and KPO's employees were expelled from work in 1989. However, from 1990 until the end of the war (1999), the so-called Serb 'violent measures' came into power, which

enterprise was built on the old managerial socialist legacy of a centralized economy and has not yet achieved full transformation for the market economy conditions. Based on the Law for Postal Services (No.03/ L-173), the scope of work of the Post of Kosovo includes public postal services as a primary activity and other services that are related to its premises within the limits specified by its statute (Law No.03/L-173, Article 5). The vision and mission of this enterprise, as stated in its official documents, is to be a successful business and to provide continuous care for its customers as the leader in offering quality, fast, and safe postal services (Post of Kosovo, 2012). Moreover, the Post of Kosovo has engaged in cooperation agreements with various institutions and companies in the country, as well as in memorandums with international organizations. Membership in the Universal Postal Union (UPU) continues to hinder the development of the Post of Kosovo. Also, the impact of the Covid-19 pandemic and the non-coverage of expenses by the government for the Universal Postal Service are reported to be the biggest challenges of 2021 (Post of Kosovo, 2021, p. 4).

The organizational scheme of the Post of Kosovo does not contain a formal *communication structure*. The Department for Marketing and Promotions (according to the organizational chart 2015), which was changed to the level of Directorate for Sales and Marketing in the organizational chart of 2016, includes three departments: sales, marketing and consumer support. This directorate does not have internal communication in its scope of work nor a public relations department (Regulation 2017, pp. 76-82). Although job descriptions have been specified for some positions within this directorate (e.g. '*ensuring continuous two-way communication between the client and the work team*'), which could be linked with public relations, they are reduced only to the function of sales officials and do not concern themselves with the general image or performance of the enterprise.

On the other hand, the managing structure of this enterprise is mostly hierarchical, with the Board of Directors at the top of the pyramid as the supervising body of the executive, making sure the development policies are implemented, with the high management that consists of Chief Executive, Vice-Chief Executive, Chief Financial Officer and the Secretary of the corporate, as well as the middle management organized horizontally with eight directorates branched in the level of regions and municipalities throughout Kosovo (Organizational chart, 2016). Therefore, the lack of a formal mechanism that would be in charge of managing the internal and external communication processes, makes effective communication impossible. This in turn has caused distrust in supervisor-subordinate relations, which continues to be almost the same in the last measurement in 2021. This is verified also by the responses from the interviews done in the research period, with the Human Resources Director and the Director of the Post Inspectors.

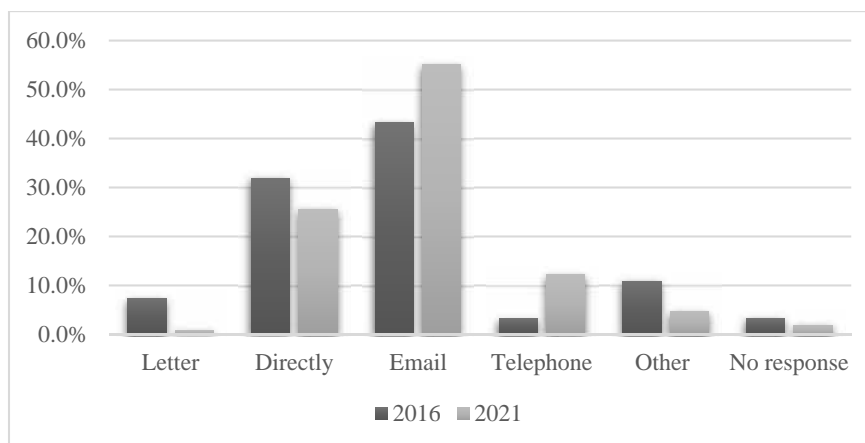
meant that every other government enterprise and institution was seized by the regime. During the war in Kosovo, KPO was in ruins. Just after the war, the enterprise's employees got back to their former workplace and the International Independent Post of Kosovo and the International Exchange Office of Kosovo LC/AO and CP started operating on May 31st 2000, which fulfilled the required criteria by the Universal Postal Union (UPU) for the exchange of postal shipments with the rest of the world.

5. Main Results

This section presents the main findings of this study. We find that the main factor which explains the change in the internal communication approach concerns the advancement of digital technological tools which are applied by the majority of organizations and institutions. The results of the survey with the employees of the organizational low-level show that within the five-year interval the forms of receiving tasks continue to be in favour of email and direct communication, from 43.3% to 55.1% for the former and from 31.9% to 25.4% for the latter. The use of telephone has also shown an increase in usage, from 3.5% to 5.2%, which could be explained by the increase in work dynamics and the impact of digital technologies. While task receiving through communication by letter has shown a decrease, from 7.4% to only 0.8%, as well as other forms which have shown a significant decrease, from 10.5% to only 4.7%. The respondents were instructed to use the option *other* if they receive the tasks in a combined manner (sometimes through email, and sometimes through telephone or directly).

In short, the results of the survey reveal that email and direct communication remain the primary forms of receiving tasks within the organization, while the telephone is becoming increasingly popular as a form of communication. Yet, Figure 1 shows a relatively low level of supervisor-subordinate communication and the transfer of information mainly through specific channels (e-mail), which makes the communication in this enterprise close to Likert's system 2 Benevolent Authoritative. The Director of Post Inspectors responded the same as in 2016 with regards to the forms of communication, by specifying verbal communication, letter communication and email as the main ones, while stating that he has noticed significant progress in *horizontal* as well as *vertical* communication within this time interval.⁶

Figure 1. In what way do you receive tasks from your supervisor?



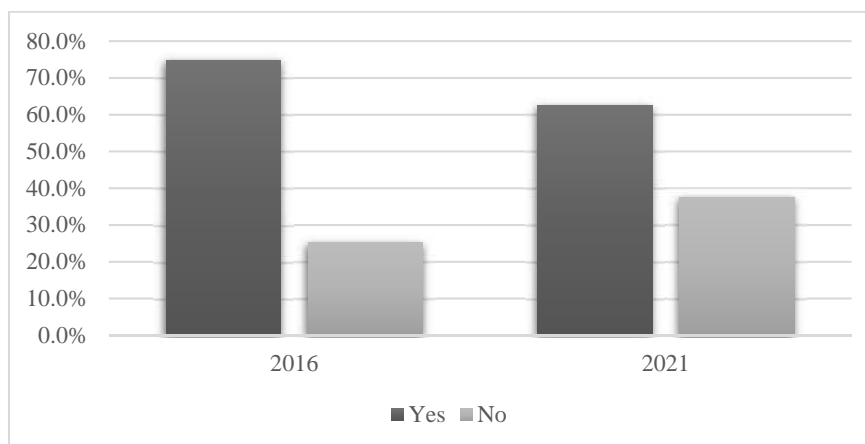
Source: Survey conducted for this research.

⁶ Interview with the Head of Inspection Department, The Post of Kosovo, 2016.

The results demonstrate that the use of letter communication is becoming increasingly uncommon as digital forms of communication are being prioritized. Therefore, the *formal* communication is based on the perspective of channels, because the management continues to take care of the communication from the top-down, while the communication bottom-up is more limited and mainly as a reporting of directorates that manage the operative level.⁷ Moreover, these findings point out that the Post of Kosovo does not have an effective communication structure that would enable it to communicate efficiently with its public. As a result, the image of the enterprise is not properly managed, and the supervisor-subordinate relations remain distrustful. Due to this, our interviewees within the Post of Kosovo considered the lack of an adequate communication structure the main problem of the enterprise, while the development of a communication strategy and a program for public relations is necessary, in order to increase communication efficacy in the future. To address this issue, a formal communication structure would be required for managing the internal and external communication processes of the enterprise. Additionally, these findings point out that the organization should consider revising the job descriptions of its employees in order to include communication responsibilities in order to promote a more open and trusting relationship between management and staff.

Nevertheless, the involvement of employees in working groups has marked a slight increase during these five years, although the suggestions and decisions of this form are not taken into account as much as they should. Figure 2 shows an increase of 12.5% of respondents, who reported they participated in working groups, which signalizes a positive change in the management's attitude towards the participatory model.

Figure 2. Have you been part of any working group?



Source: Survey conducted for this research.

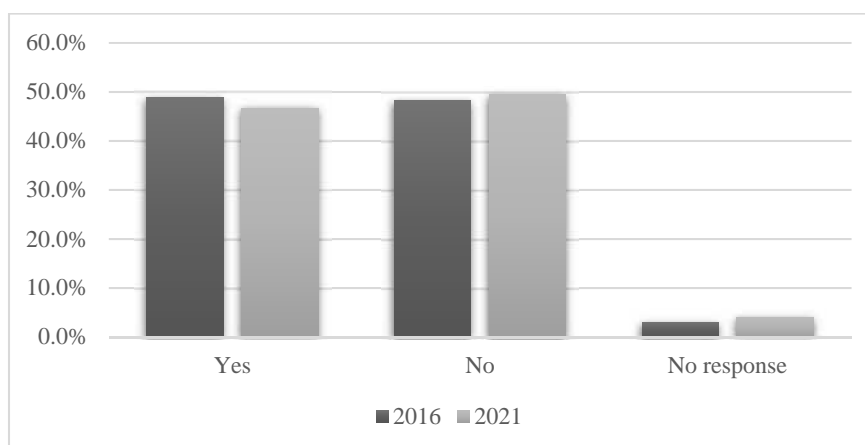
Based on McGregor's theory, the management approach results close to Theory X, according to which "a significant part of managers believe that employees don't like the work and try

⁷ Interview with the Head of Human Resources Department, The Post of Kosovo, 2016.

to avoid it, don't like responsibility, want someone else to lead them and value their safety at work above everything else" (Lawter et al., 2015, p. 86). This means that the communication in this enterprise continues to be non-effective and is still characterized by a lack of trust in the superior-subordinate relations. The Director of Post Inspectors in 2016 mentioned as an example the entering into force of the Code of Conduct, while in the last interview, he stated there was no such case. "On August 1st 2014, the new Code of Conduct for Employees (No. 01-263/14) entered into force, while we as directors were notified by mid-October 2014 through unofficial channels"⁸ (These findings point out that the management should provide the staff with the necessary resources and support, while the managers should foster a creative and stimulating environment, where employees can express their ideas and opinions. This type of environment is necessary in order to increase employee engagement, foster a sense of trust between the employees and the management and ensure better collaboration between the departments.

This management approach is corroborated also by the results of the survey, as outlined in Figure 3, where 46.7% of respondents stated they have been victims of injustice during their time of work in this enterprise, although this percentage was higher in the survey done 5 years ago. Employees continue, to a large extent, to be victims of injustice (48.9% in 2016 and 46.7% in 2021), although the results show a positive trend with regard to the number of cases. Despite the increase in employees' participation in working groups (37.7% in 2021 compared to 25.2% in 2016), most of them state that proposed decisions and solutions are not taken into account (70.5%), implying a very slow pace towards participatory management. Therefore, the employees' satisfaction at work continues to be low and has a negative impact on their motivation. Numerous studies have shown a great impact of satisfaction on the employees' motivation, while the level of motivation has an inevitable impact on the business performance of an organization (Aziri, 2011, pp. 77-86).

Figure 3. Did you have any injustice during the period of work in this enterprise?



Source: Survey conducted for this research.

⁸ Interview with the Head of Inspection Department, The Post of Kosovo, 2016.

The lower percentage, in this case, may be explained by the more inclusive approach of the management, although since April 2020 the board and management of the Post of Kosovo has been changed three times (Post of Kosovo, 2021). With the changes of government in Kosovo in 2020 and 2021⁹, two previous managements were discharged, while an acting chief executive holds his current position. This managerial instability defined the continuation of a constant financial crisis, although the 2021 report shows a slight decrease in losses of 26% less than in 2020¹⁰ (Post of Kosovo, 2021). Therefore, the measures for overcoming the crisis consist of also a slight improvement of the climate and the collegial relations in this enterprise. This seems to have had an impact also in the non-formal staff relations. The respondents' responses on the collegial relations show they are good and correct (98%), while with regards to the eventual disputes, the percentage of cases reported to the supervisors has increased, showing that there is a slight increase in the trust of superior-subordinate relation.

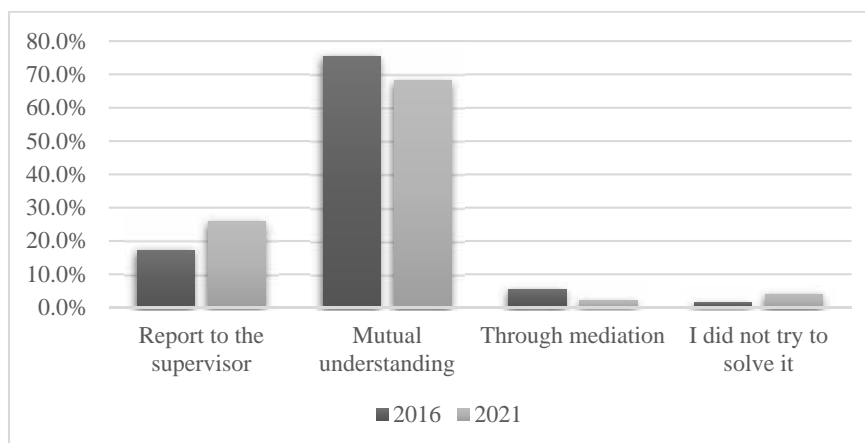
In this respect, these findings point out that the management of the Post of Kosovo had more scope to focus on creating a more inclusive working environment and to ensure that all staff members are treated equally and in line with the enterprise's regulations. This can be achieved by means of improved communication between the management and staff and by providing a safe and comfortable workplace with the necessary support and resources for the staff to perform their work successfully. Additionally, the findings show that there was scope for the management to continue to focus on increasing the trust between the staff and the management, by promoting a culture of openness and transparency.

Finally, the findings show that the 17.3% of cases reported to the supervisor, has increased to 25.7%, although overcoming their differences through mutual understanding remains the most preferred solution with 75.5% in 2016, namely 68% in the last measurement. The increase in cases where employees don't try to solve disputes which are proportional to the increase of cases reported to the supervisor, displays the improving trend of trust and a better general climate in the Post of Kosovo. Furthermore, as concluded by various reports of civil society organizations, the politicization of public enterprises expressed through the appointing of political persons in steering bodies remains one of the main causes for their low performance (KDI, 2021). Another analysis of the functioning of public enterprises concluded that "central public enterprises were the most suitable places for systemizing party militants" (KDI, 2014).

⁹ Government Kurti 1, formed after the elections in November 2019 discharged the board and chief executive. However only five months later it was overthrown by a no-confidence motion during COVID-19 Pandemics of 2020 and Government Hoti established by a wide coalition of opposition parties in June of 2020. The Hoti Government appointed the new board and management, who were also discharged again with the coming into power of Government Kurti 2, following the elections of February 2021.

¹⁰ We must note that almost all business have gone through financial difficulties in 2020. Therefore, the Covid-19 pandemic was the main cause of this phenomenon.

Figure 4. In case of collegial dispute, how do you solve it?



Source: Survey conducted for this research.

As a result, it seems that the Post of Kosovo has been making efforts to improve the general climate and trust in the enterprise, by implementing various measures such as training on conflict resolution and mediation, creating a grievance procedure, and introducing disciplinary measures in case of misconduct. However, as in other Western Balkan countries, it seems that the situation does not differ much when it comes to internal organizational communication. A study done in 2015 found that the employees in Albania have a relatively low level of satisfaction at work and feel unworthy in their organizations (Furxhi and Osmani, 2014). Other studies show that in the economy of Montenegro, which is dominated by the tourism industry, there is a slightly better level of satisfaction at work as a result of organizational culture (Simovic et al., 2020). In North Macedonia, the reports suggest there is a need for a change of management approach towards the motivation and inclusion of employees in the function of productivity increase (Mitrevic et al., 2018). According to a study with regards to the communication and job satisfaction, employees in Serbia are more satisfied with internal communication as well as with the job they do – communication satisfaction and work satisfaction scores range between 4.7 and 3.7, respectively, on a scale from 1 to 5 (Djordjevic et al., 2021).

Meanwhile, by the end of the research period (2020-2021), the Post of Kosovo, just like the entire global economy, was affected by the negative impact of the Covid-19 pandemic. According to the Director of Postal Inspectors, the Post of Kosovo has meticulously implemented all the measures and recommendations of the competent institutions such as working with essential staff, social distancing, disinfection tools, and isolation of contact persons, but dealing with this crisis has resulted in a decrease of financial and non-financial performance of the enterprise.¹¹ As for internal communication, the Covid-19 pandemic has increased the use of electronic channels such as email and telephone, but not other platforms made possible by Internet-based and digital technology, such as social media. Although the

¹¹ Interview with the Director of Postal Inspectors, Post of Kosovo, 2022.

restrictions during the pandemic have imposed online meetings, the Post of Kosovo has continued to hold the meetings with a physical presence in the framework of the Emergency Team. Meanwhile, downward communication in the form of decisions, announcements, requests and orders, was carried out via email communication.

6. Concluding Discussion

This study has examined the internal communication in the Post of Kosovo and has highlighted the importance of enhanced communication strategies for improving the efficiency of the enterprise. The results of the survey with the employees of the Post of Kosovo show that there is a slight improvement in the management approach in the past five years and that the communication between the employees and the superiors is gradually becoming more effective, while the trust between them is also increasing. Such improvements are mostly attributable to the availability and advancement of new digital technologies for organizational communication.

Although, the hierarchical style (top-down approach) and politicization of public enterprises such as the Post of Kosovo appear to also influence their performance. Senior management in organizations often assumes that power is preserved through controlling the flow of knowledge and information. This way of internal communication in Kosovo is especially present in public enterprises (Gap Institute, 2015). As shown in this study, the Post of Kosovo suffers from a lack of transparency and information flow from the top-down hierarchy. The Post of Kosovo is a central public enterprise with closed-type hierarchical management and no formal structure of communication in its organizational structure. As a result, the communication in this enterprise continues to be largely ineffective and is characterized by the insufficiency of information to the staff. Thus, based on the results of the survey on employee relations with superiors and considering the data on the weak performance of the Kosovo Post, communication appears to play an important role in shaping the productivity of the enterprise.

Yet, communication is not the only problem. Manipulation and control are also important. This is especially evident in societies with high unemployment levels and political interventions in the public sector, such as the case of Kosovo, where control and manipulation comprise the main engagement of high managers. In the case of the Post of Kosovo, this was expressed by various pressures towards those who did not express loyalty to management, while the opposite was for the reliable ones and those who have political support. Despite all improvements with regards to the general climate and trust in the supervisor-subordinate relation, the research results show that the information flow remains mainly in the vertical line from top-down, while the main forms of communication include email and direct communication, which in the 5-year interval have shown 11.8% increase, respectively 6.5% decrease. The increase of the use of email in the disfavour of direct communication is explained by the increase in work dynamics with the impact of new digital technology. However, in the five-year period, Post of Kosovo has not developed capacities for internal communication and as confirmed through interviews, there is no formal structure that would develop effective communication.

Thus, the findings in this research confirm our overall claim on the effects of internal communication on the performance of the company, in the sense of the consequences produced by the lack of adequate mechanisms, closed communication and centralized management. Along with other factors such as politicization, market competition and the global effects of technological development that might have had an impact on the business of the Post of Kosovo, organizational communication is also one of the main factors regarding the poor performance of this company. Therefore, the effects found in this longitudinal research with regards to the increased participation and decreased employee dissatisfaction should encourage the management to quicker changes towards a participatory model and an open communication structure, paying due attention to employees' motivation and self-actualization. However, this research study has its limitations. They are mainly related to management-level research due to their reluctance to answer challenging questions about employee motivation, lack of capacity and poor quality of internal communication, and lack of strategies for more effective adaptation to technological changes. Therefore, in order to generalize the results of the research, future research on this topic should be aimed at including a larger number of public enterprises in Kosovo. This paper can be useful as an attempt to explore the current situation and trend of changes regarding internal communication and its importance for organizational improvements in Kosovo. Despite the obvious limitations, this paper is believed to be contributing to the domestic literature in this field, since this topic has not been paid sufficient attention to so far.

Although this research suggests that the Post of Kosovo is making progress in terms of internal organizational communication and that the management approach is slowly becoming more inclusive, it is crucial that the management works on creating a more trusting and collaborative working environment which would ensure that all staff members are treated equally and in line with right-based frameworks and other bylaws. There is scope for the Post of Kosovo to devise appropriate communication strategies, such as open and transparent communication, to encourage employee effective participation and collaboration. Additionally, senior management should ensure that their employees are well-informed and aware of the company's goals and objectives, to ensure the efficiency of their work and to contribute to the organization's success. In sum, there is a need for the organization to focus on developing an effective communication structure in order to facilitate the exchange of information between departments and to better manage its public image.

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A NEW APPROACH TO MEASURING HUMAN CAPITAL AND BUSINESS PERFORMANCE IN CHEMICAL AND PETROCHEMICAL ENTERPRISES⁴

The paper proposes a new approach to measuring the quality of human capital in chemical (petrochemical) industry enterprises. At present, various qualitative and quantitative methods are presented in academic literature. However, measuring human capital quality in the case under consideration is complicated due to certain industry-specific features including difficulties in obtaining statistics.

The methodology presented in this research is an assessment of human capital based on the weighted factors that have the strongest impact on the formation of enterprise personnel according to the authors and further comparison of final indicators with the quality rating table. Thus, the given technique has a comparative nature and can be applied to rank enterprises that operate in the industry analyzed in the study. In general, the theoretical part of the methodology may include n factors.

Thus, to test the methodology, the factors mostly affecting human capital formation as well as available in terms of collecting the statistical data are considered. Those factors include: the share of internal R&D expenditures, the share of personnel who attended advanced training, the share of personnel with higher education, and the share of personnel with secondary vocational education.

Keywords: human capital; R&D (research and development); qualification; higher and secondary vocational education; assessment; rating; weighting factors

JEL: M12; M50; M52

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1. Introduction

The problem addressed in this paper covers the issues related to the development of the methodology for measuring the quality of human capital in the chemical (petrochemical) industry's enterprises. One of the priority industries in the Kazakhstani economy is the chemical (petrochemical) industry. That's why the mentioned industry was chosen for the study. The study proposes a comprehensive framework that assesses the human capital quality and identifies the enterprise personnel weaknesses, on the one hand, and has a comparative character and allows to rank enterprises within the industry, on the other.

The quality of human capital has the most direct impact on the enterprise's efficiency. Indeed, this is the personnel resources quality that determines the perspective performance indicators of an enterprise. This, in turn, justifies the need to develop a methodology that allows for a comprehensive assessment of enterprise personnel using an integrated approach based on a single index that adequately assesses the level of human capital quality in an enterprise.

2. Literature Review of Methods for Measuring Human Capital Quality

The traditional work in the basics of human capital research includes the scientific work of the 1992 Nobel Prize winner in Economic Science G. Becker (Human Capital, 1964) and the 1979 Nobel Prize winner in Economic Science T. Schultz (Investment in Human Capital: The Role of Education and of Research, 1971; Human Capital: Policy Issues and Research Opportunities, 1972).

Further, learning costs along with the direct costs (tuition fee, dormitory expenses, etc.) include "foregone earnings" as a major element, which are earnings students forego over the years of study. In essence, foregone earnings measure the value of a student's time spent on the learning and can be viewed as opportunity costs of its use. At the same time, T. Schultz promotes the idea of educational capital, an offshoot of the concept of human capital, relating to the investment made in education (Schultz, 1971).

According to Schultz, education makes people more productive, and good healthcare saves investment in education and provides opportunities to produce. The economist's most important contribution to science is *The Theory of Human Capital*, which in the 1980s initiated intense activity in motivating the investment in vocational and technical education from Breton-Woods international financial institutions, such as the IMF and World Bank.

Ogundari and Awokuse believed that human capital covers all investments aimed at improving human skills, including education, healthcare and vocational training/experience. Good education and improved health can lead to high labour productivity, as well as a decrease in inequality will be facilitated by the introduction of technologies into production and an improvement in the demographic situation (Ogundari, Awokuse, 2018).

Human capital is defined by the Organization for Economic Cooperation and Development (OECD) as "knowledge, skills, competencies and attributes embodied in the individual" that facilitate the creation of personal, social and economic well-being (OECD, 2001).

Laroche, Meret and Ruggieri (1999) further expanded the concept of human capital. They stated it should include the innate abilities of the man himself (Laroche et al, 1999).

S. Marginson described human capital as education, through which a person acquires knowledge and skills. This knowledge and skills can increase its productivity in the workplace. This increased productivity will bring higher wages to the individual, since a person's wages in an ideal labour market are determined by a person's productivity. Therefore, people will invest in education to a point where the private benefits of education are equal to the private costs. Considering this set of assumptions, the logic of the theory of human capital becomes clear in that education and training increase the quality of human capital and this leads to increased productivity, which in turn leads to an increase in the salary of the person himself (Marginson, 1992).

Human capital is very difficult to measure. Most studies use formal education to assess the impact of human capital on economic growth. This stems from a general understanding that education is essential to sustainable economic growth. Lucas argued that there were two main components formulating the country's human capital: education and learning. Employees devote part of their time to work and the rest to on-the-job training (Lucas, 1988).

G. Becker was the first to carry out a statistically correct calculation of the economic effectiveness of education: "Training costs should be included in any study of the relationship between wages and productivity." (Becker, 1964, p. 13).

Thus, human capital includes investments such as education, empirical learning, and vocational training that enhance a person's skills. This is much broader than just the level of education. It also includes an important component, like health.

To determine the income from higher education, for example, the lifetime earnings of those who did not go beyond high school were deducted from the lifetime earnings of those who graduated from college. Costs of education, along with direct costs (tuition fees, hostel, etc.), contain "lost earnings" as the main element, that is, income not received by students during the years of study. Essentially lost earnings measure the value of the student's time spent on the learning and are the alternative costs of using it.

At the same time, Schultz promoted the idea of educational capital – an offshoot of the concept of human capital – in the field of investment in education (Schultz, 1972).

In 2001 Simon S. Kuznets developed a method that became later one of the main analytical tools in the field of labour economics. The work developed the concept of human capital using which the differences in the average salaries of representatives of different professions were explained (Kuznets, 2001).

American economist E. Denison develops a classification of factors of economic growth. The author highlights twenty-three factors, including four factors related to labour, the other four are referred to capital, one is to land, and fourteen characterize the contribution of scientific and technological progress. According to Denison, the economic growth is defined more by the quality of the factors and their improvement rather than by the number of expended factors. And the quality of the labour force is viewed to be primary by Denison (Denison, 1974).

Analysing the economic growth of the USA for 1929-1982, E. Denison infers that education, which is the most important component of human capital, is the key factor of labour productivity growth. It is important to note that various methodological approaches to estimate the value of human capital exists.

J. Kendrick proposes a cost-based method to measure human capital – that is, to estimate it as an accumulated value of investment into a person based on statistical data. The given framework is quite efficient when applied to the USA since extensive and reliable statistics are available. According to J. Kendrick expenses incurred by families and society to raise children up to working age and obtain an occupation, expenses on retraining, advanced training, healthcare, labour force migration etc. are referred to be an investment in human capital (Kendrick, 1976).

Further, he includes investments in housing, expenditures for durable goods, stocks of goods in households, and R&D. As a result, J. Kendrick finds that in the 1970s human capital accounts for more than half of the accumulated national wealth of the USA. J. Kendrick's method allows us to assess human capital accumulation by its full "replacement cost"; however, it does not allow us to estimate the "net value" of human capital (accounting for its "depreciation").

J. Mincer in his study assesses the contribution of education and the duration of labour activity to human capital. Based on the USA statistics of the 1980s, the author finds that human capital efficiency depends on the number of years of general education, professional training, and the employee's age (Mincer, 1994).

It should be noted the study by C. Mulligan and S. Martin (Mulligan, Martin, 1995), where the authors propose a methodology for assessing the stock of total human capital using a system of indices. It can be noted here that the S index of science and synergy was included as one of the sub-indices, which was calculated according to the following formula: $S = (I + ION + W)$, where N is a gross domestic investment in science in R&D, W is the share of the country in total global investment in science.

Further, N. Sailaubekov et al. (Sailaubekov et al., 2018) develop a model for assessing university ranking based on lecturers' motivation. These factors are grouped into several blocks: material and monetary, material and non-monetary, and non-material. The study demonstrates that systematic and timely use of the approach improves the quality of human capital and contributes to the increase university's competitiveness.

A different approach is presented in the study by F. Milost, who considers human capital to be an important element of the business process; however, unlike the asset captured in the balance sheet, it cannot be valued using classical approaches. He classifies all the methods into monetary (involving a monetary valuation) and non-monetary (not involving a monetary valuation). By studying various methods for assessing human capital, he divides them into those that evaluate intellectual capital as a whole and those that evaluate human capital as part of intellectual capital. At the same time, he examines the essence of human capital – whether it has the attributes of an organization's asset or not, and the methodological base changes accordingly (Milost, 2014).

Ussenova, A., Sailaubekov, N., Sarkambayeva, S., Spanov, M., Ussenov, S. (2023). A New Approach for Measuring Human Capital and Business Activity at the Enterprises of Chemical and Petrochemical Industry.

A. Sakalas and Z. Liepe define human capital as a combination of knowledge, as well as the acquisition of appropriate skills, specific abilities, and competencies by employees, who are the source of economic growth and competitive advantages of a country or organization (Sakalas, Liepe, 2011).

Sam-Ho Lee believes that it is important to distinguish the concepts of education and socialization when defining human capital. Various approaches towards its valuation will be formulated based on that (Kang, Lee, 2015). The author bases the research on the comparison of the concepts and approaches to human capital assessment in the USA and in the countries of Southeast Asia. In the USA, socialization skills are more imperative, whereas, in Southeast Asia, academic performance is prioritized. This difference defines the entire system of evaluating human capital and its management techniques, including such aspects and factors as entrance tests, general training, job interviews and future salaries.

Of great practical importance is a joint study of the US National Science Foundation and the Organization for Economic Cooperation and Development that assesses the contribution of science (R&D) to human capital. The experts elaborated a system of indicators of scientific and technological progress, including R&D expenditures. This Frascati Manual now serves as an international standard for comparative analysis of research results. The manual sets out a methodology for assessing current and accumulated R&D expenditures as intangible capital and economic growth factor (OECD, 2015). The given methodology is based on the detailed information on R&D expenditures in the USA since 1920, and accounts for the time lag between the period when R&D takes place and the period when it is translated into the accumulated human capital as an increase in the stock of knowledge and experience.

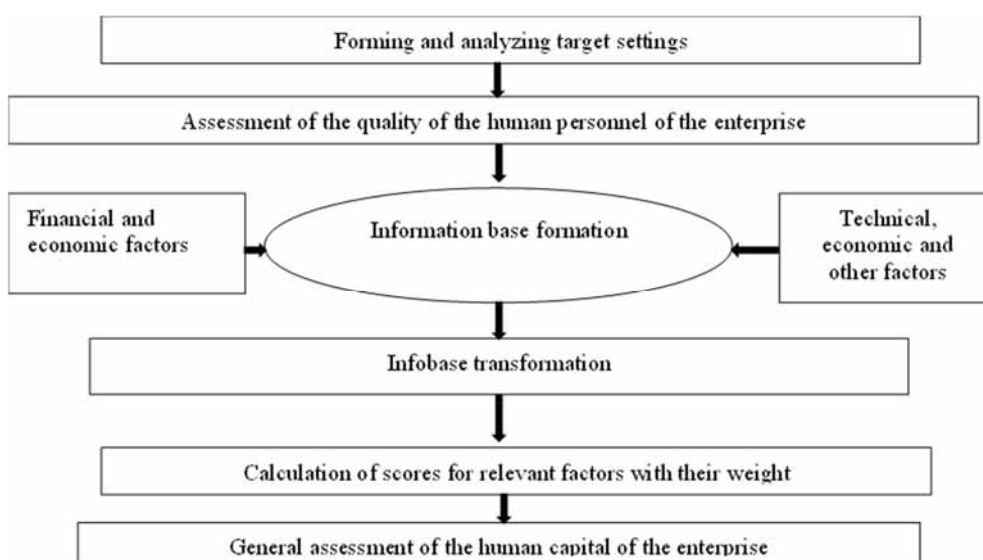
The alternative model proposed by the researchers from the University of Michigan represents a model of the individual value of employee that is based on the concepts of conditional and realizable values (Flamholtz, 1985). According to this framework, the individual value of an employee is determined by the volume of services that she is expected to provide or sell while working in the organization. This determines the expected conditional value of an employee. At the same time, the individual value depends on the expected likelihood that the employee will remain on site and fulfil her potential in a given organization. Thus, the conditional value includes all the potential income that the employee can earn for the organization assuming she works for it for the rest of her life. The value of an employee, given the likelihood that she remains in the organization for some time, determines the expected realizable value. In this way, the expected realizable value consists of two elements: the expected conditional value and the likelihood of continued membership in the organization. The last expresses management's expectation of how much income will be realized in the organization before the employee leaves.

The World Bank analysts made a significant contribution to the development of an extensive concept of national wealth that incorporates the contribution of human capital. They published a series of works substantiating this concept. The World Bank methodology summarizes the results and methods for assessing the human capital that belong to various schools and authors. Given methodology considers the accumulated knowledge and other components of human capital. Thus, the assessment is closely related to the level of education of employees.

3. Methodology

The approach presented in this paper is comprehensive and systemic. By comprehensiveness of the assessment of human capital, we understand the multidimensional nature of the proposed methodology, i.e., the assessment should consider various factors/groups of factors. Further, the methodology is systemic due to the development and application of the composite analytical measure. It is estimated as a convolution of several indicators. In this context, the convolution implies the generalization of indicators of one dimension to obtain a composite measure of the same dimension. Therefore, the model is as follows:

Figure 1. Model for the assessment of human capital at the enterprise



Source: Authors.

Data collection and methodology of human capital formation

According to the specified model, we present a methodology for measuring the quality of human capital that comprises the following steps:

Step 1. Collection and analytical processing of baseline information that include adjusting the data to a single measurement system. Procedure for assessing sustainability by a block of business activity indicators for the analysed enterprises for the period 2018-2020. The base year is 2018.

Step 2. Estimation and determination of the weights of analysed factors: The share of internal R&D expenditures; The share of personnel who attended advanced training; The share of personnel with higher education; The share of personnel with secondary vocational education.

Step 3. Estimation of indicators for corresponding factors based on weights.

Step 4. General assessment of enterprise human capital.

Further, we discuss each of the steps in more detail.

3.1. Collection and analytical processing of baseline information

Economic and statistical as well as technical indicators of the enterprise may serve as factors affecting its activity. In general, we assume that the number of such factors is n . Since indicators have different measurement units (percentages, shares, number of pieces, etc.), they should be normalized. For this purpose, the most used linear ten-point scale transformation is applied:

$$y(x) = 10 [x - x(\min)] / [x(\max) - x(\min)] \quad (1)$$

where x is the value of the baseline indicator, y is a normalized value of x .

If the initial value of the indicator is greater than the maximum, then the normalized value of this indicator will be considered equal to 10. If an increase in x describes both an increase in the severity of quality A and a decrease in quality B, then the difference $Y = 1 - y$ can serve as a normalized measure of quality B.

3.2. Estimation and determination of the weights of analysed factors

To estimate the weight of each factor, the method of expert assessments is used, which allows to rank of the degree of the importance of factors based on stakeholders' preferences (Sailaubekov, 2011).

As a part of the study, we interview the experts who are invited to consider the abovementioned factors that affect the assessment of human capital to rank their degree of importance. In accordance with this method, each expert should list the factors according to the degree of their importance.

The results of the expert analysis are as follows:

$$B_1 \succ B_2 \succ \dots \succ B_n \quad (2)$$

where: B_1, B_2, \dots, B_n – are the factors affecting the assessment of human capital. \succ – preference sign.

When ranking factors by degree of importance, there may be cases when a strict ratio of preferences is not achieved. But the methodology for assessing the weight of the corresponding factor does not change (Sailaubekov, 2009)

Based on preferences (2), a matrix of paired comparisons of factors affecting human capital is constructed (Table 1).

Table 1. Matrix of paired comparisons for estimation of factors weights

| Factor | B ₁ | B ₂ | ... | B _n | Total | Weight |
|----------------|----------------|----------------|-----|----------------|-------------|-----------------|
| 1 | 2 | 3 | ... | 4 | 5 | 6 |
| B ₁ | 1 | | 1 | 1 | <i>n</i> | $2/(n+1)$ |
| B ₂ | 0 | 1 | | 1 | <i>n</i> -1 | $2(n-1)/n(n+1)$ |
| ... | | | ... | | | ... |
| B _n | 0 | 0 | | 1 | 1 | $2/n(n+1)$ |
| Total | | | ... | | $n(n+1)/2$ | 1 |

Source: Sailaubekov, 2011.

Further, if one of the factors is preferable to another, then we put 1 in the corresponding cell of the paired comparisons matrix, otherwise, we put 0. Thus, the cells of the matrix are filled according to the following specification:

$$m_{kj} = \begin{cases} 1, & \text{if } B_k > B_j \\ 0, & \text{if } B_k < B_j \end{cases} \quad (3)$$

where *k* is a row (factor) number, *j* is a column number

The comparison values are then added by row and recorded in column 5 of Table 1.

The weight of the corresponding factor affecting the assessment of human capital is determined using the following formula:

$$\mu_k = \frac{\sum_{j=1}^n m_{kj}}{\sum_{k,j=1}^n m_{kj}} \quad (4)$$

Thus, the weights for each factor are obtained using the formula (4). Estimations are recorded in the corresponding cells of column 6 of Table 1.

3.3. Estimation of indicators for corresponding factors based on weights

Estimates of factors based on weights (*K_k*) are determined using the following formula:

$$K_k = \mu_k * y_k \quad (5)$$

It should be noted that the obtained calculations can be considered as one of the approaches to implement the weighted sum model (WSM), which is also called the weighted linear combination (WLC) or simple additive weighting (SAW).

3.4 General assessment of enterprise's human capital

The general assessment of enterprise human capital (*R*) is estimated using the following formula:

$$R = K_1 + K_2 + \dots + K_n \quad (6)$$

Ussenova, A., Sailaubekov, N., Sarkambayeva, S., Spanov, M., Ussenov, S. (2023). A New Approach for Measuring Human Capital and Business Activity at the Enterprises of Chemical and Petrochemical Industry.

Formula (6) defines the general (rating) assessment of enterprise human capital and considers the significance of the factor by incorporating weight indices to differentiate the assessment (Fishburn, 1967).

To rank and analyse enterprises under the study, we offer the rating system for the assessment of personnel quality presented in Table 2.

Table 2. The rating of enterprises based on the assessment of human capital

| Rank | Quality | Rating value | Threshold values | |
|------|---------|--------------|------------------|----------|
| A | A+ | High | 8.1-10.0 | 9.5-10.0 |
| | A | | | 9.1-9.5 |
| | A- | | | 8.1-9.0 |
| B | B+ | Satisfactory | 5.1-8.0 | 7.1-8.0 |
| | B | | | 6.1-7.0 |
| | B- | | | 5.1-6.0 |
| C | C | Poor | 0-5.0 | 0-5.0 |

Source: Sailaubekov, 2011.

The main features of the proposed methodology for rating enterprise human capital include the following :

- the proposed method is based on a comprehensive approach to assess human capital.
- the rating is performed based on enterprise activity data.
- the rating is comparative.
- a flexible estimation algorithm is used to obtain a rating score for human capital.

4. Results

Further, we apply the above methodology to assess human capital in KazAzot JSC and KazMunayGas JSC and test the hypothesis that the assessment of human capital, and hence its quality, increases with the amount of funds invested in R&D (research and development). Moreover, the assessment may depend on such factors as the level of employees' qualification and advanced training.

Thus, the model for assessing personnel quality comprises the following factors ($n = 4$), (Table 3):

x_1 – is the share of internal R&D expenditures, %

x_2 – is the share of personnel who attended advanced training, %

x_3 – is the share of personnel with higher education, %

x_4 – is the share of personnel with secondary vocational education, %;

x_5 – assessment of the enterprise stability by the block of business activity indicators.

Table 3. Enterprise input data

| Enterprise | The share of internal R&D expenditures, % | The share of personnel who attended advanced training, % | The share of personnel with higher education, % | The share of personnel with secondary vocational education, % | Sustainability assessment |
|-----------------|---|--|---|---|---------------------------|
| | <i>x1</i> | <i>x2</i> | <i>x3</i> | <i>x4</i> | <i>x5</i> |
| KazAzot JSC | 1 | 19 | 34 | 44 | 0,6429 |
| KazMunayGas JSC | 0,1 | 92 | 45 | 55 | 0,7124 |

Source: reports of KazAzot JSC and KazMunayGas JSC for 2018.

Since indicators may have different measurement units (percentages, shares, number of pieces, etc.), they should be normalized using the formula (1) (Malczewski, Rinner, 2015).

It is important to set the minimum and maximum values for each indicator. For *x1* the minimum value is 0, and the maximum is determined as the average value of this factor in developed countries and is equal to 2.5% (given that the indicator is equal to 3.5% in the USA, 2.4% in France, and 1.4% in Spain (R&D spending as a percentage of GDP, <https://w3.unece.org/SDG/ru/Indicator?id=123>)).

For *x2* the minimum value is 0, and the maximum value is 20% (the requirement to attend advanced training at least once every five years is incorporated for this factor) (Churchman et al, 1954).

For *x3*, the minimum value is 0 as well, and the maximum value is determined as the average value of this indicator in developed countries and is equal to 60%.

Discussed values and data correspond to innovative enterprises in developed countries and thus, may serve as a benchmark for the chemical (petrochemical) industry of the Republic of Kazakhstan.

Separately, in a brief form, will be given a procedure for assessing sustainability by a block of business activity indicators for the analysed enterprises for the period 2019-2020.

The necessary estimates are made based on the dynamic normative method, detailed in (Jumadilova et al., 2013), and includes the following steps:

Step 1. First, it is necessary to form a normative matrix of the business activity block, the construction of which is based on the growth rate of financial and economic indicators used to calculate these coefficients (Table 4).

Step 2. Based on the initial data of the balance sheet items and the income statement, an actual matrix of pairwise comparisons of the growth rates of financial and economic indicators corresponding to the block of business activity is built (Triantaphyllou, 2000).

For this purpose, the growth rates of appropriate indicators are calculated (Table 5).

Ussenova, A., Sailaubekov, N., Sarkambayeva, S., Spanov, M., Ussenov, S. (2023). *A New Approach for Measuring Human Capital and Business Activity at the Enterprises of Chemical and Petrochemical Industry.*

Table 4. Normative model for assessing the financial condition of an enterprise by a block of business activity indicators

| Indicators | RSP | B | NCA | CR | CA | AR | I | FA | CGS | Sum |
|------------|-----|---|-----|----|----|----|---|----|-----|-----|
| RSP | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| B | -1 | 0 | 0 | -1 | -1 | -1 | 0 | -1 | 0 | 5 |
| NCA | -1 | 0 | 0 | -1 | 0 | 0 | 0 | 0 | 0 | 2 |
| CR | -1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| CA | -1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| AR | -1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| I | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 2 |
| FA | -1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| CGS | -1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| | | | | | | | | | | 28 |

* RSP-revenue from sales of products; B-balance; NCA- non-current assets; CR-capital and reserves; CA-current assets; AR-accounts receivable; I-inventory; FA-fixed assets; CGS-cost of goods sold.

Source: Sailaubekov, 2011.

Table 5. Calculation of growth rates of indicators for KazAzot JSC

| Indicators | 2019 (tenge) | 2020 (tenge) | Growth rate in 2020 | Rank 2020 |
|------------|--------------|--------------|---------------------|-----------|
| RSP | 40 878 255 | 48 868 415 | 1,1955 | 3 |
| B | 96 513 889 | 109 854 609 | 1,1382 | 4 |
| NCA | 76 278 025 | 82 419 002 | 1,0805 | 6 |
| CR | 60 136 431 | 65 276 329 | 1,0855 | 5 |
| CA | 20 235 864 | 27 435 607 | 1,3558 | 2 |
| AR | 3 583 235 | 2 973 868 | 0,8299 | 9 |
| I | 6 594 530 | 6 715 969 | 1,0184 | 8 |
| FA | 61 551 398 | 64 440 835 | 1,0469 | 7 |
| CGS | 13 740 638 | 20 753 280 | 1,5104 | 1 |

Source: Authors.

Next, we build a matrix of actual ratios of indicators by growth rates for 2020 (Table 6).

Table 6. Matrix of actual ratios of indicators by growth rates of KazAzot JSC for 2020

| Indicators | Fact rang | 3 | 4 | 6 | 5 | 2 | 9 | 8 | 1 |
|------------|-----------|----|----|----|----|----|---|----|----|
| RSP | 3 | -0 | 1 | 1 | 1 | -1 | 1 | 1 | -1 |
| B | 4 | -1 | -1 | 1 | 1 | -1 | 1 | 1 | -1 |
| NCA | 6 | -1 | -1 | 0 | -1 | -1 | 1 | 1 | -1 |
| CR | 5 | -1 | 1 | 1 | 0 | -1 | 1 | 1 | -1 |
| CA | 2 | -1 | -1 | 1 | 1 | 0 | 1 | 1 | -1 |
| AR | 9 | -1 | -1 | -1 | -1 | -1 | 0 | -1 | -1 |
| I | 8 | -1 | -1 | -1 | -1 | -1 | 1 | 0 | -1 |
| FA | 7 | -1 | -1 | -1 | -1 | -1 | 1 | 1 | -1 |
| CGS | 1 | -1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |

Source: Authors.

Coincidences' matrix for KazAzot JSC in 2020 is given in Table 7.

Table 7. Match Matrix for 2020

| Indicators | Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Sum |
|------------|--------|---|---|---|---|---|---|---|---|---|-----|
| RSP | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 6 |
| B | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| NCA | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| CR | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| CA | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| AR | 6 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| I | 7 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| FA | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| CGS | 9 | | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | | | | | | | | | | | 18 |

Source: Authors.

Step 3. A generalizing assessment of the financial condition of KazAzot JSC is calculated according to the specified block of indicators, which characterizes the degree of approximation of the actual matrix to the normative one:

$$Y^{2020}(\text{AO «KazAzot»}) = 188/28 = 0.6429$$

where Y is an assessment of the financial and economic stability of KazAzot JSC by the block of business activity indicators.

The corresponding assessment of the stability of KazMunayGas JSC enterprise by the block of business activity indicators takes the following value:

$$Y^{2020}(\text{AO «KazMunayGas»}) = 14/28 = 0.0714$$

The quality of human capital for KazAzot JSC and KazMunayGas JSC can now be estimated.

Table 5 presents the normalized values of input data of analysed enterprises.

Table 8. Data for human capital assessment

| Factors | The share of internal R&D expenditures | The share of personnel who attended advanced training | The share of personnel with higher education | The share of personnel with secondary vocational education | Sustainability assessment |
|-----------------|--|---|--|--|---------------------------|
| | y_1 | y_2 | y_3 | y_4 | y_5 |
| KazAzot JSC | 4 | 9,5 | 8,50 | 7,33 | 6,43 |
| KazMunayGas JSC | 0,4 | 10 | 10,00 | 10,00 | 0,71 |

Source: reports of KazAzot JSC and KazMunayGas JSC for 2020

The weight of each factor is determined considering that $n=5$.

We assume the following order for the factors affecting the quality of human capital.

$$y_1 > y_2 > y_3 > y_4 > y_5$$

where the “greater than” sign implies greater weight of the factor (The choice of this ranking is hypothetical).

Ussenova, A., Sailaubekov, N., Sarkambayeva, S., Spanov, M., Ussenov, S. (2023). *A New Approach for Measuring Human Capital and Business Activity at the Enterprises of Chemical and Petrochemical Industry*.

The matrix of paired comparisons is constructed to estimate the weight of indicators (Table 9).

Table 9. Matrix of paired comparisons for estimating factors' weights

| Factors | y1 | y2 | y3 | y4 | y5 | Total | Factor Weight |
|---------|----|----|----|----|----|-------|---------------|
| y1 | 1 | 1 | 1 | 1 | 1 | 5 | 0,333 |
| y2 | | 1 | 1 | 1 | 1 | 4 | 0,267 |
| y3 | | | 1 | 1 | 1 | 3 | 0,200 |
| y4 | | | | 1 | 1 | 2 | 0,133 |
| y5 | | | | | 1 | 1 | 0,067 |
| | | | | | | 15 | 1,0 |

Source: Authors.

The general assessment of KazAzot JSC human capital quality:

$$RI = Y1 * v1 + Y2 * v2 + \dots + Y5 * v5 =$$

$$4 * 0,333 + 9,5 * 0,267 + 8,5 * 0,2 + 7,33 * 0,133 + 6,43 * 0,067 = \mathbf{6,97} \quad (7)$$

The general assessment of KazMunayGas JSC human capital quality:

$$RI = Y1 * v1 + Y2 * v2 + \dots + Y5 * v5 =$$

$$= 0,4 * 0,333 + 10,0 * 0,267 + 10,0 * 0,2 + 10,0 * 0,133 + 0,71 * 0,067 = \mathbf{6,18} \quad (8)$$

5. Discussion

According to the results, the quality assessment of KazAzot personnel based on a ten-point system is 6.97, whereas for KazMunayGas JSC the score is 6.18. In line with the classification presented in Table 2, both analysed enterprises are ranked as B, which implies that the quality of human capital in these enterprises is average or satisfactory.

The most important factor that drags down KazMunayGas JSC rank is R&D (research and development) and sustainability assessment (dynamic assessment of the business activity of the enterprise).

As for KazAzot JSC, this is a qualification of mid-level professionals and sustainability assessments that turns out to be a bottleneck. Although for all factors except R&D, the ratings are higher for KazMunayGas JSC, the overall score is higher for KazAzot JSC.

This is since the weight of the factor characterizing the share of enterprise R&D expenditures is taken as the greatest of all factors under consideration.

We make this assumption in the first place, since according to the experts of the US National Science Foundation and the Organization for Economic Cooperation and Development, R&D is one of the most significant factors affecting the quality of human capital. Indeed, a company's further development to a large extent depends on the way it manages R&D.

Thus, the R&D factor hampers the quality of human capital in KazMunayGas JSC. Even though KazMunayGas JSC is one of the largest companies in the oil and gas and

petrochemical industry, its investment in R&D is identified to be a great issue in the formation of its human capital.

To ensure stable development in the future, the company must pay great attention to the improvement of personnel quality through increased funding of R&D.

As for KazAzot JSC, the research results indicate that the qualification of mid-level professionals is one of the gravest weaknesses of human capital formation and has potentially great implications for the enterprise's further development.

6. Conclusion

The assessment of human capital in enterprises of the Republic of Kazakhstan is in the process of formation. Therefore, there is not much literature and research on these issues.

The model for evaluating human capital developed in this study is an attempt to fill the gap. The proposed model is based on the group of indicators for a comprehensive and systemic assessment of enterprise human capital and in general, may include up to n parameters.

Testing is performed for characteristics that reflect the state of such parameters as the share of internal R&D expenditures, the share of personnel who attended advanced training, the share of personnel with higher education and the share of personnel with secondary vocational education.

Thus, the research paper presents a methodology for developing a comprehensive and systemic approach towards human capital assessment.

The authors demonstrate step-by-step assessment for analysed enterprises and discuss the issues related to the quality of human capital in these enterprises.

Further research could expand the number of model parameters and incorporate such factors as personnel age structure; the average length of specialized service; staff turnover; cost of personnel training, healthcare and safety costs, and others.

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ANALYSIS OF THE EFFECTS OF THE SERVICE QUALITY ON CLIENT SATISFACTION IN THE TOURISM SECTOR IN KOSOVO²

Service quality is essential to create client satisfaction by keeping existing clients and gaining new ones in any business and especially in the tourism sector. The main objective of this paper is to analyze the relationship between service quality and client satisfaction and to pinpoint key components of them in the growth and sustainable tourism. Data has been collected from foreigners who have visited hotels in Kosovo and also from domestic tourists. The distributed questionnaire is a mixed questionnaire, which includes a combination of open and closed questions. A total of 30 hotels, divided into seven regions have been chosen to send questionnaires. Participants included in the study were 300 clients who received services in the mentioned hotels. The data was collected from clients who visited hotels in Kosovo during 2020-2021. The hotels were selected mainly based on their categorization, insisting that in the research we have hotels categorized between 3-5 stars. Client data is obtained in two ways: from their hotel estimates, by e-mail, and from the visitors, we found at the hotel during the event. The collected data were processed in SPSS and presented in tabular form. Data were analyzed using quantitative techniques. The ordinary Least Square (OLS) estimator model is used to analyze the relation between dependent and non-dependent variables. Results – Clients choose the hotel mainly online or according to their experience during the preliminary visits. The main reason for the visit was rest and recreation, their treatment was friendly and efficient, the services were provided on time and the cleanliness and comfort were rated as excellent as the food and drinks. In the conclusion is stated that clients have made it clear that the quality of services and satisfied clients can greatly influence the development of sustainable tourism. Age, gender and origin don't have a significant role to determine client satisfaction.

Keywords: tourism; service quality; client satisfaction; marketing; development

JEL: Z30; Z31; Z32; M31; M32

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1. Introduction

When analyzing the tourism sector we could notice that the quality of the services is crucial. All service providers make an effort to offer their clients the highest-quality services available, but they frequently fall short of their client's expectations since these clients have more sophisticated needs and greater expectations for service. Services are in a way most crucial factors to achieve a long-lasting competitive edge in the market in the fiercely competitive hotel business. Based on this, practitioners in the field of services and academic scholars concentrate their attempts on comprehending how clients judge the quality of services. Clients typically rate the service quality since this is based on how well clients feel their expectations are met or exceeded.

Despite the challenges in evaluating quality, buyers may have no other option but to choose a service based on its quality. According to recent studies, globalization, the introduction of new information and communication technologies, and rising client demand for high-quality goods and services have all had a significant impact on the way services are delivered.

Understanding what makes up and influences the quality of the service and client satisfaction could be extremely important for delivering high-quality services and ensuring their contentment. Evidence suggests that destination choice, consumption, and repeat business are related to service quality. For example, Said et al. (2013) and Devi Juwaheer, (2004) believed that measuring visitor satisfaction was essential for marketing tourism-related goods and services. High-quality goods and services can guarantee client happiness. According to Akbaba (2006), the quality of the service is viewed from the perspective of the client since it was this person's interpretation of the result that made up the service. Clients may value services differently and on a different basis, and they frequently have varied perspectives on the same service. The lifeblood of a hotel is regarded to be the level of fundamental service management. Client satisfaction and the will to return as repeat clients are tied to service quality (Devi Juwaheer, 2004).

Tourists are becoming more educated. Tourists know what to look for and appreciate what is offered to them. The mentality, knowledge, listening skills, and capacity to address the most important requests of the arriving visitors are what make the difference. Managers in the tourism industry work hard to increase client happiness and the quality of services hoping of attracting repeat business. Loyal guests will frequent the place again and tell others about it. Clients that are happy with a company are more likely to remain loyal to it and buy from it again. Rarely do clients usually make complaints; instead, they just go to another service provider. Numerous research has looked at the connection allying client loyalty and the quality of the services in relation to client complaints.

If we examine the hotel sector in Kosovo, we can conclude that it is characterized by a low level of service quality, an unfavourable organizational structure, and a low level of capacity utilization. The hotel facilities in Kosovo mainly meet the needs of mass tourism, and the lack of quality service is a result of the lack of standards for the design, construction and equipping of facilities.

There hasn't been much work done on analyzing the correlation between client satisfaction and service quality in Kosovo's tourism industry. Therefore, this research will complement

the previous studies and would serve as a good point for the next scholars. Kosovo tourism destinations are not explored broadly, while dealing with this topic is among the first inquiry that addresses empirically both the services quality and client satisfaction of the tourism industry in Kosovo.

For the analyses of this paper, we drafted and distributed a questionnaire and gathered the needed data. During the time period from November 2020 – May 2021, 300 clients responded to 12 questions. The data was collected in two ways: from hotel estimates, email and observations of hotel guests during the event. The collected data was analyzed using SPSS and presented in table form. Quantitative techniques were applied for analysis. Descriptive statistics were employed to describe the characteristics of the data and an Ordinary Least Squares (OLS) estimator model was used to investigate the relationships between the variables.

This paper is part of the doctoral thesis and author resumes of the coauthor of this paper Alban Fejza.

2. Literature

2.1. Defining the quality of the service

Service quality is used under the magnifying glass of comparing how the client's expectations are met in the service quality provided. This has been a field of continuous study among different actors, both from the field of researchers and also from those who apply it in practice. Parasuraman et al. (1985) give this definition of service quality: *"The discrepancy between clients' perceptions of services offered by a particular firm and their expectations about firms offering such services"*. Authors like Farah Sahul Hamil (2011) and Olorunleke, (2020) agree with the previous definition, while by Vargová et al. (2021) quality includes features in a product or service that meet or surpass stated or implied needs as well as pleasing or delighting the client.

The World Tourism Organization's (2003) definition is as follows: *"the outcome of a process that implies the satisfaction of all legitimate products and the need for service, client requirements and expectations, at acceptable prices, in accordance with the quality determinants underlying such as safety and security, cleanliness, accessibility, transportation, authenticity, and harmonization of tourism activities that are concerned with the human and natural environment"*.

In the tourism industry, service quality is essential to achieve the goals of the tourist organization and this further determines the right direction for the success of the tourist operator (Atilgan et al., 2003; Robustin et al., 2019; Vargová, 2021). The different evidences from different researchers better reflect the role of good client evaluations for the company but also the comparison made by clients with how much was promised by the company and how much was actually provided during the service (Johnston, 1995; Lee, Kim, 2020; Umashankar et al., 2017; Lee, Kim, 2020) while Zeithaml et al. (1996) proved that the client can judge a feature of the service which for him has a greater importance and greater specific weight in relation to other features of the service.

Clients possess' different preferences regarding measurements of client satisfaction. Client evaluation depends on many features and depending on how well client requirements and desires have been met that lead to client satisfaction (Juran & Godfrey, 2010) and this should be served to tourism experts to better analyze successfulness of the company in the long term (Hoffman & Bateson, 2001). Some clients feel satisfied if features of services such as Ease of access, Reliability, Efficiency, Safety, and Compassion are met (Joseph et al. 1999, Marković et al. 2012 and Debasish & Dey, 2015) while a category of clients consider price as a determinant of service satisfaction and therefore they choose hotels with medium prices (Reuland et al. 1985). Some other researchers found that climate or culture are crucial to client perceived satisfaction (Davidson et al. 2001)

2.2. Other factors indicating the Quality of Service

Geographic location – Geographic zone where the tourist will stay is of great significance and for this reason, not only the organization/hotel, but also the government institutions should be committed to creating the best possible infrastructure for tourist access to the area where the hotel is located and the accompanying facilities and also the other accompanying transport infrastructure must be well organized to facilitate physical communication between the tourist and the tourist area. Easy access to the tourist must be provided through means of land, sea or air transport.

Hotel – The place where the hotel is located is another factor that affects client satisfaction and the same must offer conditions not only for tourist accommodation but also other accompanying conditions such as sports and recreation grounds because they play a crucial role in client evaluation (Bernthal, Sawyer, 2004). If sports and recreation grounds are not close to the hotel. Then the hotel management should take necessary measures to provide internal transportation for their tourists. Today, hotels are committed to creating opportunities for people with health problems or disabilities because this attracts clients and makes them loyal to the hotel where they stay. Other possibilities that hotels offer today are the provision of transportation for city sightseeing.

Accommodation in touristic premises – Accommodation within the premises of the tourist facility is also an important factor. Hotels or other accommodation providers today offer different premises and different conditions depending on the "financial weight" of the client. They can be equipped with luxurious things or with other necessary things that meet the basic needs of the client, such as a bed, TV, internet, etc.

Interactions – Interactions are another factor that influences the client's decision to stay in a tourist location/ tourist hotel facility and is a matter of service quality (Brady, Cronin, 2001). Today, hotels organize different forms of communication with clients and between clients on a daily basis, making their stay in that hotel as good as possible and as attractive as possible so that the same tourist comes back next year or spread good words about the hotel "word of mouth". The organization of various games on the premises of the hotel (in swimming pools or sports fields) evokes interactivity and entices tourists to feel good in the objects of the hotel or touristic resort. Responsible hotel people should carefully notice and don't allow

tourists to disturb each other during the day and especially at night when the noise from one hotel room disturbs the tourist in the other room (Shonk, Chelladurai, 2009).

Environment – This is another important factor in client decision-making and evaluation of the service of the tourism resort/ hotel, from the inside and outside. The architecture and design of the hotel's premises affect the creation of familiarity of the tourist with the hotel and the creation of a good impression of the hotel and the feeling of visiting the same hotel again. Easy access to all hotel facilities such as restaurants, swimming pools, rooms, recreation centres and sports grounds is crucial in the evaluation of services by the client (Ram, Tchetchik, 2021).

Value – The value that clients receive during their stay in a hotel or tourist resort is also determining on evaluating the quality of services. The client usually judges by the ratio between what he gives and what he receives/cost-benefit analysis (Al-Sabbahy et al., 2004). In cases where the client estimates that he gets as much as he paid for or even more than that, he will rate the hotel highly and repeat coming to the same place and hotel. The tourist's impressions are related to the entire travel infrastructure, from his home to the tourist resort and if this impression is good, a good experience and repeat business is created for the hotel or the tourist resort.

2.3. The role of quality of the service in tourism

Tour operators and hotels that offer services to their clients try to fulfil them as best as possible so that the client can appreciate the service quality offered to them. Today we have a very competitive tourism sector, and hotels and other service providers strive to create as many comparative advantages as possible in the market of hotel services. The tourism sector today has a special importance and place in the creation of GDP in a country and the better this sector develops, the more it affects the increase in employment and income generation of that country. For this reason, operators must be careful to meet or exceeding client needs and wants the best possibly and reduce complaints and thus make tourism has a big part in the development of not only the tourism sector but also the country as a whole (Bajra et al., 2020). Quality and efficient service affect client satisfaction, increasing incomes from tourism for the hotel/tourist organization and, at the same time, increasing opportunities for new investments in tourism.

The quality of services in the tourism sector has a huge impact so managers must know how to assess the needs and wants of the client, what they want when they want it and how to provide that service (Akbaba, 2006). Each of the service providers in tourism determines its strategy for targeting the client or a certain category of clients, with which it wants to achieve a competitive and comparative advantage in the market.

Characteristics of the hotel industry in Kosovo

The hotel industry in Kosovo is characterized by an insufficient level of service quality, unfavourable structure, and low use of their capacity. The majority of Kosovo's hotel accommodations cater to mass tourism, and the lack of service quality is due to lax

requirements for facility design, building, and furnishing. As a result, the hotel industry in Kosovo is becoming less and less competitive on the global stage. The upkeep of the facilities, the degree of comfort, and the aptitude and motivation of the staff are other factors affecting the quality of the services industry in general and in Kosovo particularly.

In the table below we could notice that the most common type of accommodation units are hotels and motels and less hostels, apartments, and bungalows.

Table 1. Hotel facilities in Kosovo

| Types of accommodation | Units | Rooms | Beds |
|------------------------|------------|--------------|---------------|
| Hotel | 232 | 4 708 | 7 569 |
| Motel | 178 | 2 142 | 2 856 |
| Hostel | 24 | 119 | 347 |
| Apartments | 15 | 25 | 32 |
| Bungalow | 41 | 374 | 768 |
| <i>Total</i> | <i>490</i> | <i>7 368</i> | <i>11 572</i> |

Source: Kosovo Agency of Statistics www.ask.rks-gov.net.

Based on the data from the table above, we could notice that mostly in Kosovo are in Prishtina, the Capital of the Republic of Kosovo. Prishtina also has the largest number of rooms, 2778, i.e. the largest number of beds out of the total number of beds available to the hotel industry in Kosovo.

Table 2. Foreign visitors by countries, period 2017 – 2020

| Country | 2017 | 2018 | 2019 | 2020 |
|-----------------|----------------|----------------|----------------|----------------|
| Austria | 49728 | 51535 | 57414 | 24335 |
| Belgium | 29703 | 31625 | 33692 | 16469 |
| B & Herzegovina | 2199 | 2052 | 1907 | 525 |
| United Kingdom | 47564 | 53090 | 58235 | 29639 |
| France | 28321 | 29681 | 32165 | 17762 |
| Germany | 288637 | 208550 | 229486 | 98426 |
| Greece | 4914 | 5444 | 6062 | 3013 |
| Netherlands | 14988 | 16032 | 17128 | 6263 |
| Italy | 24581 | 26682 | 29203 | 12000 |
| Croatia | 26718 | 30679 | 32504 | 14496 |
| Montenegro | 143502 | 144851 | 154715 | 49907 |
| N. Macedonia | 989780 | 1046605 | 1086626 | 571276 |
| Poland | 10249 | 12355 | 12853 | 3723 |
| Serbia | 1273884 | 1342711 | 1399829 | 1112413 |
| USA | 43400 | 46481 | 48006 | 16397 |
| Albania | 1164973 | 1190651 | 1272024 | 1014498 |
| Slovenia | 12954 | 13203 | 12779 | 5742 |
| Spain | 3715 | 4279 | 4866 | 1274 |
| Turkey | 81829 | 78334 | 75345 | 28708 |
| Swiss | 171928 | 187374 | 207906 | 103400 |
| The others | 167555 | 185561 | 189590 | 73596 |
| <i>Total</i> | <i>4480582</i> | <i>4707785</i> | <i>4962335</i> | <i>3203594</i> |

Source: Kosovo Agency of Statistics www.ask.rks-gov.net.

Kosovo has recently become an important tourist destination since as a new country it has aroused the interest of many visitors to see up close the potentials and opportunities for development. In the comparison made for the period 2017-2020, there is a significant increase in foreign visitors, apart from 2020, the year of the COVID-19 pandemic, as in the rest of the world, there is a decrease in visitors due to travel restrictions. and anti-covid measures. Most visitors are from neighbouring countries: Serbia, Albania, and Northern Macedonia, while from other countries visitors are from Switzerland, Turkey, and Germany (Table 2).

3. Methodology and Data

The primary and secondary data were used to draft a questionnaire and get the best out of it. In order to prepare the questionnaire, firstly, the views of the supervisor will be elicited and then finally the research questionnaire will be revised.

3.1 Sampling and data

We gathered data from foreigners who visited hotels in Kosovo and also from domestic tourists. The distributed questionnaire is a mixed questionnaire, which includes a combination of open and closed questions. A total of 30 hotels, divided into regions such as: Pristina – 11, Peja – 5, Prizren – 5, Mitrovica – 2, Ferizaj – 3, Gjlani – 2 and Gjakova – 2, have been chosen to send questionnaires. Participants included in the study were 300 clients who received services in the mentioned hotels. The collected data were coded and entered into the SPSS program in order to create data that will be used for analysis. The variables to be measured were defined and labelled. Responses were coded with numbers, including open/closed questions. Data were analyzed using quantitative techniques.

Likert Scale has been used to collect data for this paper's purpose. Compiled Questionnaire consisted 12 questions, but in this section, we presented only 9 of them. Each question was coded between 1 (poor) to 4 (very good) respectively 1 (Absolutely disagree to 5 (agree). In addition, each Likert Scale shows two options: for domestic tourists and for foreigners. The ordinary Least Square (OLS) estimator model is used to establish the relationships between study variables.

Table 3. Client expectations

| Origin | Your expectations about this hotel are good: | | | | | In total |
|-----------|--|---------------|---------|------------------|---------------------|----------|
| | Agree | Somehow Agree | Neutral | Somehow disagree | Absolutely disagree | |
| Kosovo | 147 | 38 | 33 | 5 | 0 | 223 |
| Foreigner | 52 | 18 | 6 | 0 | 1 | 77 |
| Total | 199 | 56 | 39 | 5 | 1 | 300 |

Source: author's calculation.

As it is shown in Table 3, the majority of hotel clients declared their expectations for the hotel they stayed at were good, or in numbers, 255 out of 300 interviewers agreed or

somehow agreed that their expectations for the hotel were good, while neutral has been 39 respondents, 5 of them have answered with somehow disagree and only 1 has responded with absolutely don't agree.

Table 4. Contact from hotel personnel

| Origin | Before arriving to this hotel, you have been contacted by hotel personnel? | | | | | In total |
|-----------|--|---------------|---------|------------------|---------------------|----------|
| | Agree | Somehow Agree | Neutral | Somehow disagree | Absolutely disagree | |
| Kosovo | 104 | 33 | 48 | 14 | 24 | 223 |
| Foreigner | 26 | 9 | 12 | 2 | 28 | 77 |
| Total | 130 | 42 | 60 | 16 | 52 | 300 |

Source: author's calculation.

Data presented in Table 4 show that hotel personnel didn't pay so much attention on contacting clients before arriving at their hotel. From the total of 300 clients, only 130 responded with agree and 42 of them somehow agree, while 60 are neutral and 16 of them somehow don't agree, but the concern is at a high number of hotel clients declared that they absolutely disagree (52 of them) which shows that hotel personnel dealing with sales or marketing should pay more attention to these clients.

Table 5. Treatment at the hotel premises

| Origin | During your stay in the hotel, you had friendly treatment? | | | | | In total |
|-----------|--|---------------|---------|------------------|---------------------|----------|
| | Agree | Somehow Agree | Neutral | Somehow disagree | Absolutely disagree | |
| Kosovo | 143 | 46 | 31 | 2 | 1 | 223 |
| Foreigner | 57 | 17 | 3 | 0 | 0 | 77 |
| Total | 200 | 63 | 34 | 2 | 1 | 300 |

As shown in Table 5, around 90% (263 out of 300) of interviewed clients were satisfied with the friendly treatment they got from hotel personnel during their stay at the selected hotel and only 3 clients are somehow or absolutely disagreeing.

Table 6. Level of services

| Origin | Personnel of the hotel showed a high level of service: | | | | | In total |
|-----------|--|---------------|---------|------------------|---------------------|----------|
| | Agree | Somehow agree | Neutral | Somehow disagree | Absolutely disagree | |
| Kosovo | 133 | 58 | 21 | 10 | 1 | 223 |
| Foreigner | 49 | 21 | 6 | 1 | 0 | 77 |
| Total | 182 | 79 | 27 | 11 | 1 | 300 |

Source: author's calculation.

Responses presented in Table 6 show that the majority of clients interviewed agreed or somehow agreed that personnel of the selected hotel showed a high level of services, or 87% of them, while 12 clients didn't agree somehow or absolutely disagree and were neutral, not giving a positive or negative answer, were 27 clients.

Table 7. On-time service delivery

| Origin | Services have been offered on time and as declared? | | | | | In total |
|-----------|---|---------------|---------|------------------|---------------------|----------|
| | Agree | Somehow agree | Neutral | Somehow disagree | Absolutely disagree | |
| Kosovo | 127 | 67 | 20 | 6 | 3 | 223 |
| Foreigner | 49 | 22 | 4 | 0 | 2 | 77 |
| Total | 176 | 89 | 24 | 6 | 5 | 300 |

Source: author's calculation.

On-time service delivery seems to be at a high level because 265 out of 300 clients agreed or somehow agreed that this service was offered as it was declared to them, but there are also 5 very unhappy clients that declared that they absolutely disagree with their expectations toward the on-time service delivery, which should be a concern for hotel management.

Table 8. Prices

| Origin | Prices were similar to the ones declared by the hotel before arriving: | | | | | In total |
|-----------|--|---------------|---------|------------------|---------------------|----------|
| | Agree | Somehow agree | Neutral | Somehow disagree | Absolutely disagree | |
| Kosovo | 198 | 20 | 0 | 5 | 0 | 223 |
| Foreigner | 64 | 11 | 0 | 2 | 0 | 77 |
| Total | 262 | 31 | 0 | 7 | 0 | 300 |

Source: author's calculation.

A large number of clients (293) declared that they are satisfied with the prices declared by hotel personnel before arriving and after their stay in the selected hotel, but still there are 7 clients who declared that they somehow disagree with it, which should be a concern of management and they should try to clarify it with clients.

Table 9. Cleanliness and comfort

| Origin | Cleanliness and comfort were: | | | | In total |
|-----------|-------------------------------|------|--------------------|------|----------|
| | Very good | Good | Below expectations | Poor | |
| Kosovo | 197 | 24 | 1 | 1 | 223 |
| Foreigner | 72 | 5 | 0 | 0 | 77 |
| Total | 269 | 29 | 1 | 1 | 300 |

Source: author's calculation.

Clients of selected hotels declared to be satisfied with the cleanliness and comfort of the hotel since 298 out of 300 of them declared that cleanliness and comfort were very good or good, while only 1 declared that it was below expectations and 1 of them declared that cleanliness and comfort were poor.

Table 10. Food and beverages

| Origin | Food and beverages offered were: | | | | In total |
|-----------|----------------------------------|------|--------------------|------|----------|
| | Very good | Good | Below expectations | Poor | |
| Kosovo | 193 | 27 | 2 | 1 | 223 |
| Foreigner | 70 | 7 | 0 | 0 | 77 |
| Total | 263 | 34 | 2 | 1 | 300 |

Source: author's calculation.

Clients were mainly satisfied with food and beverages and answered with very good and good in 297 cases out of 300 clients interviewed, respectively 2 clients declared that it was below expectations and 1 declared that it was poor.

Table 11. Internet in the room and other hotel premises

| Origin | Internet in the room and other premises was: | | | | In total |
|-----------|--|------|--------------------|------|----------|
| | Very good | Good | Below expectations | Poor | |
| Kosovo | 183 | 35 | 2 | 3 | 223 |
| Foreigner | 70 | 5 | 2 | 0 | 77 |
| Total | 253 | 40 | 4 | 3 | 300 |

Source: author's calculation.

Regarding services like the internet in the room and other hotel premises, there is also a very good response from clients, 293 out of 300 clients responded that the internet was very good or good, while 4 of the declared that it was below the expectations and 3 of them declared that internet in the room and other hotel premises was poor.

If we compare respondent answers regarding satisfaction with quality standards offered in Kosovo hotels, we could notice that domestic clients were less satisfied with client satisfaction than foreigners which should be a concern of hotel management for the future.

3.2 Model testing

This section shows the testing model. Considering our data, we used the Ordinary Least Square (OLS) estimator. Therefore, the initial mathematical model consist takes form as below:

$$\beta = (XTX)^{-1}XTy \quad (1)$$

Next, since our data lies of n observations $[y_i, x_i]$, then each n includes a scalar response y_i and a vector of predictors (or regressors) x_i . The response variable is a linear function of the regressors. In other words, our testing model used to test the hypothesis is comprehended on main test variables (e.g., age, gender and origin) as shown below:

$$cus_satis_i = b_0 + b_1age_i + b_2gender_i + b_3origin_i + e_i \quad (2)$$

where, y_i stands as dependent on the variable for client satisfaction (cus_satis_i) for a client i , while b_1 , b_2 and b_3 represent the coefficients. Running regression models, we find that not all of the independent variables have the same magnitude on the dependent variable. Especially, age, gender and origin do not affect client satisfaction, however, they have a modest impact on dependent variable but not as expected.

In summary, in all cases clients are satisfied with services offered by hotels, but compare to domestic, the foreigners responded to be more satisfied with services provided by hotels. While age was not found to be impactful to client's satisfaction, and next the gender provides mixed results in terms of male versus female.

Table 12. Regression analysis

| Coefficients ^a | | | | | | | |
|---------------------------|------------|-----------------------------|------------|--------|------|-------------------------|-------|
| Model | | Unstandardized Coefficients | | t | Sig. | Collinearity Statistics | |
| | | B | Std. Error | | | Tolerance | VIF |
| 1 | (Constant) | 22.161 | 1.290 | 17.176 | .000 | | |
| | Age | -.56 | .347 | -1.613 | .873 | .884 | 1.131 |
| | Gender | .988 | .486 | 2.03 | .086 | .995 | 1.005 |
| | Origin | -.416 | .893 | -.466 | .641 | .880 | 1.136 |

a. Dependent Variable: cus_satis

4. Discussions and Conclusions

The quality of hotel services as a key factor and strategy in client satisfaction and the development of sustainable tourism has also been proven by the majority of hotel owners included in our study. Clients can be satisfied with their stay in the hotel only if they are offered quality services, and thus these two tourist categories, domestic and foreign, are considered primary in the development of sustainable tourism.

The use of marketing to attract new clients is an important factor, which together with the quality of services offered and client satisfaction, represents a good basis for attracting clients. In our paper, online marketing is preferred for attracting new clients and this is proven by the findings in this research. However, even though it is preferred by the majority in the study, we have not found any significant difference in the question of whether online marketing has influenced the benefit of new clients. At the end of their stay in the hotel, clients always appreciate the comfort offered by the hotel, which means good service, comfortable setting, easy access, good location, and all these are compatible with what the hotel offers in its offer. Clients included in our study were informed and found out about the hotel they visited mainly from the Internet. Then, the fact that they drew the same hotel before was also decisive. This is very important because surely the good service and their satisfaction with the services have made them choose the same hotel again. The clients involved in this research in absolute measure stated that the main reason for the visit was rest and recreation, while the second reason was the visit of relatives and friends. Young people also gave other reasons for their visit, in contrast to slightly older clients who mentioned rest and visiting relatives as the only reasons for staying at the hotel. The expectations of the clients for the hotel they visit are different and it was appropriate to meet those expectations. In our research, the majority of clients stated that their expectations were met. Both local and foreign clients agree with this finding. This data is very important because it shows that the general level of accommodation conditions, hospitality, food and services are up to par. When clients feel satisfied and expectations are met or exceeded, they will gladly return to stay and use the hotel and the previous destination.

The treatment during the stay at the hotel, according to the collected data, has been friendly and efficient. This is an additional piece of data that shows that, among other things, clients demand dignified and efficient treatment, which then directly affects their satisfaction with the services they have received. All clients used to be pleased by the necessary information received regarding the tourist destination. This is very positive because, in addition to

receiving services at the hotel, they also visited other parts of the hotel and this indirectly affects the development of sustainable tourism. Cleanliness and comfort offered in the hotels where the clients stayed were excellent or average, and there were no significant differences between local or foreign clients or between different genders and age groups. The quality of food and beverages as a very important determinant of the quality of hotel services and an important factor in client satisfaction has been evaluated differently by local and foreign clients. While local clients rate these services as excellent to some extent, foreigners absolutely rate them as excellent. The quality of the Internet in the room and in other areas of the hotel has been evaluated as excellent by the majority of clients and this in itself greatly affects the moment of determining the selection of the hotel because seeing the trend of using the Internet and its role in the life of they made staying in the hotel and performing other business and social commitments more comfortable for everyone. The prices proclaimed in the price list must always be the same as those at the time of payment processing at the hotel. Our clients agree that this report has been correct throughout. It should be mentioned also that from the group of foreign clients, there is no one who has declared that there are differences between the prices. In the research, we have a significant statistical difference between the sexes regarding the level of services, where female clients are significantly more satisfied with this level than male clients.

Having into consideration all findings of this research, the circumstances in which tourism is developed in Kosovo, the general level of services, economic and social conditions and investments in this branch, we could conclude that the quality of services offered in hotels in Kosovo is good and liked by clients. Client satisfaction with the services they receive in hotels in Kosovo is generally good, it is positively evaluated by clients and there is a tendency to introduce it into the business strategies of hotels. From all this, it can be concluded that the quality of hotel services and the level of client satisfaction are powerful pillars of the development of sustainable tourism in Kosovo.

Hotel owners, policymakers and all structures involved in tourism must continuously invest in increasing the quality of services, thereby achieving greater client satisfaction and this will inevitably affect the development of sustainable tourism.

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OPEN ENTREPRENEURIAL ACADEMIC CENTRES⁵

The increasing need for innovative ideas, technologies and products leads to the usage of new approaches and methods fostering innovative work. As it is found, the sharing economy covers not just consumption and customers' behaviour, but finance (crowdfunds), research (co-creation areas), entrepreneurship (co-working areas) and etc. As academic entrepreneurship often is not given priority in the university policy and goals, the paper aims to present specific requirements of the specific open space inside the universities /open entrepreneurial academic centre/ that uses co-working and co-creation approaches. Thus, the paper is focused on the basics of open entrepreneurial centres (paragraph 1), indicators for their entrepreneurial success (paragraph 2) and organization of the crowd-working space (paragraph 3).

Keywords: academic entrepreneurship; co-creation; co-working

JEL: I23; O31; O36

Introduction

OPEN ENTREPRENEURIAL ACADEMIC CENTRES, although a new phenomenon in universities around the world, are based on the classical theory of CENTRES FROM THEORY TO PRACTICE (T2P Centres). At the same time, the emphasis is not so much on establish entrepreneurs, as on creating a completely different model of behaviour and

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thinking of young people, through which they can make the connection from theoretical knowledge to their applicability in practice much easier and faster.

The **main research thesis** is that the OPEN ENTREPRENEURIAL ACADEMIC CENTRES are undoubtedly successful instruments for fostering entrepreneurial mindset establishment that have the potential for exponential increase of the newcomers' business in future. Thus, the OPEN ENTREPRENEURIAL ACADEMIC CENTRES are focused on the **entrepreneurial black-box** process and perquisites: mindset /resp. way of thinking of young academicians/ instead of **entrepreneurial results**: entrepreneurship and academic companies.

Accordingly, the main **research questions** are set as follows:

1. What are the *main characteristics* of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES, resp. how they differ from the T2P Centres.
2. How to *measure the effectiveness* of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES as their main goal is not to start students' start-ups or academic spin-offs.
3. How to organize the existence of OPEN ENTREPRENEURIAL ACADEMIC CENTRES taking into account the main principles of co-working and co-creation.

Of course, by establishing and using the open entrepreneurial centres, an opportunity is provided to use the CO-CREATION and CO-WORKING approaches for "group intelligence" in the generation and use of innovative entrepreneurial ideas, by analogy with social networks, which achieves:

- unfolding the creativity of people from the academic community, resp. mostly students, but also teachers and researchers;
- expanding the scope of functional and technological innovations;
- overcoming discrepancies between students' skills and labour market requirements;
- practical implementation and consolidation within the framework of the open entrepreneurship centres of acquired transversal skills and key competencies, such as problem-solving skills and entrepreneurial skills.

The realization of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES is related to encouraging the academic community to "be active", to seek and find solutions to conventional and new problems; to attract and manage resources – material, financial and human, to develop the attitudes of "mutual help" and the transfer of knowledge and technology. At the same time, there is a "shortening" of the distance between teachers/researchers, on the one hand, and students, on the other.

Moreover, by using the specific organization and dissemination of information, resp. formally or by word of mouth, changes the academic interaction and within the academic life /resp. lectures, seminars, individual and group assignments, etc./ thus teachers are perceived not so much as "conductors of knowledge" / lecturers/teachers, but as "creators" giving support for their students. Thus, a "lost form" of ACADEMIC GUIDANCE, resp. leader of

a group, stream or programme, acquires a new form and content through the so-called ACADEMIC MENTORING / TUTORING.

Last but not least, the OPEN ENTREPRENEURIAL ACADEMIC CENTRES are fully in line with public attitudes and sharing tendencies expressed through the so-called SHARING SOCIAL ECONOMY. In addition, the main advantages of academic training at "open doors" are the following:

- The created social skills of the students are used, which most of the time are worked in social groups;
- The acquisition of transversal skills is much more effective in physically more active students who have the opportunity to "share" their physical and mental energy with other colleagues.
- The removal of walls enables the reduction of aggression and the achievement of a higher degree of empathy while learning problem-solving and team management skills.

This type of skill acquisition encourages the use of a variety of communication skills; promotes cooperation and collaboration in teamwork – the main principles of CO-CREATION and CO-WORKING approaches (Waters-Lynch et al. 2016, Uda 2013, Lorenzo-Romeroa et al. 2014, Jotte et al. 2016 and others).

CO-WORKING firstly appears in the mid-2000s as a concept of occupancy of the workplace that saves time, space and money (Gabrielli, Fiorentino, 2022). So, co-working spaces are perceived as a part of the emerging **sharing economy** concept. Thus, a co-working space is a modern working environment that gives: flexibility, dynamics and resilient design, which are favourable requirements for start-ups, freelancers and creative industries (Pan et al. 2022, Kartika et al. 2019 and others). In addition, Kwiatkowski and Buczynski (2011) summarize five core values for co-working space: **collaboration, openness, community, accessibility and sustainability**.

Something more, co-working spaces have become a focal point that gives floor to all stakeholders: associations, groups of traders and clients, as well as supply entrepreneurial skills and propose business matchmaking for them (Gabrielli, Fiorentino, 2022). They could be effective instruments for small and medium businesses not just in big business conglomerates but also in small villages. For example, the added value of the proposed Rural Enterprise Hubs (REHs) are: geographical, social, institutional, cognitive, and organisational proximities for the co-working entrepreneurs (see Brown 2016)

CO-CREATION appears as a marketing instrument in the 2000s for creating brands collectively with consumers and other stakeholders that evolve in the mid-2010s as an instrument for promoting the social dimension of business as a result of viral Corporate Social Responsibility endorsement. In this meaning, co-creation is the process of collaboration of two or more parties in building a new type of value for themselves or others (Zuniga et al., 2021; Hughes, 2014).

The effectiveness of the co-creation is explained with the behavioural approach as messages / new products co-designed collectively with the participation of customers are more effective than those messages / new products designed by the companies only (Zhang, Jeong, 2023;

Fuchs, Schreier, 2012; Van Dijk et al., 2014; and others). And once again, the social dimension of customer behaviour makes them more favourable to companies/brands that are engaged with societal problems than individual ones.

Accordingly, the co-creation as a collaborative process considers the involvement of a (social) network (Prahalad, Ramaswamy, 2004; Romero, Molina, 2011) that creates the right environment for the development of co-creation of co-creative innovative value. Thus, the co-creation process needs a co-working approach, but the collaborative network success is based on group interests, individual and group objectives and type of cooperation (Takahashi, Takahashi, 2022; Li et al., 2022)

Summarizing, the co-creation and co-working approaches are set for the success of the entrepreneurial business (Ghezzi et al., 2022). The entrepreneurial business become more “open” from the value co-creation perspectives and respectively better sustainable to the viral environment through business cooperation and collaboration via co-creation and co-working initiatives, and it is proven for different sectors: ICT (Mohamad et al., 2022), Food Industry (Mars, 2022), Biotech industry (Ghezzi et al., 2022).

Another perspective on co-creation and co-working in fostering entrepreneurship is finding the role of the Universities / Research labs at the Strategic Framework of business establishment. Some papers discuss that role. For example, Benneworth et al. (2017) discuss the contribution of Universities to institutional entrepreneurship. They found 3 main areas of contribution: research projects in creating a novel knowledge pool; provision for local business clusters' high-value knowledge; and contribute funds in private/state research projects for collective benefit.

In that meaning, according to Jackson et al. (2022) and Mahlberg and Riemer (2017), the co-working space in universities embodies: **entrepreneurship, cutting-edge technologies, and transdisciplinary and collaborative working** as well as supports **matching students** with co-working members and gives interns access to developmental activities. Accordingly, Sankari et al. (2018) set that the benefits of academic co-working spaces are their attractiveness and community appreciation. In addition, according to Lahti (2021) through University Future Tech Labs (FTLabs): co-working spaces in Universities, the students receive **collaborative learning/teaching**, where learning is carried out as a team exploring or co-creating a project.

Additionally, the main interactions between Universities and (entrepreneurial) businesses are: formation of spin-offs; knowledge transfer (licensing or selling of intellectual property) and co-creation (De Silva et al., 2023). De Silva et al. (2023) proposed that Universities could offer customized training, incl. entrepreneurial training, and support (entrepreneurial) structures based on four types of the interplay between motivation and decision-making approaches in co-creation (i.e., push effectuation, push causation, pull effectuation, and pull causation). The establishment of such co-creation instruments affects the positive attitude of students towards the university, increasing their teaching experience satisfaction, and they become more committed to the university's brand (Beier et al., 2022). Accordingly, Shen et al. (2022) explore the co-creation cooperative construction between business and scientific community (resp. Universities and Research Labs) that explore the integration of industry, education and research.

Finally, according to Zhao et al. (2022) co-creation is considered to be a new entrepreneurship pedagogy strategy in entrepreneurship education in Universities. In addition, the idea of establishing an academic entrepreneurial hub /centre/ is not new. It is proposed for suburbs of big cities, for small villages and rural areas (Merrell et al., 2022; Hölzel et al., 2022). Furthermore, the Universities / Research Labs are put in focus for fostering innovations.

Following the literature analysis, a better understanding of the functions and role of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES requires the introduction of 2 concepts related to the implementation of the concept of these centres:

A. ACADEMIC ENTREPRENEURSHIP

Academic entrepreneurship is a phenomenon through which dynamically growing micro- and small enterprises are established for: realising high business growth, having a proactive market behaviour, implementing strategies oriented towards achieving sustainable competitive advantages, using high-tech innovations and taking on a large but calculated risk (Todorov 2002). Academic entrepreneurship is associated with: teachers' / researchers' spin-offs (Hayter et al. 2021); students' start-ups (Bagis, 2022); or entrepreneurial education (EE).

The role of existing academic entrepreneurs is essential to increase the impact of the obtained scientific results, as their main function is the transfer of knowledge and research results in the economy through the engagement of students / academic teachers and researchers. Academic entrepreneurs are actually laying the foundations for the revival of some of the traditional sectors and becoming key players in the new private industrial structures.

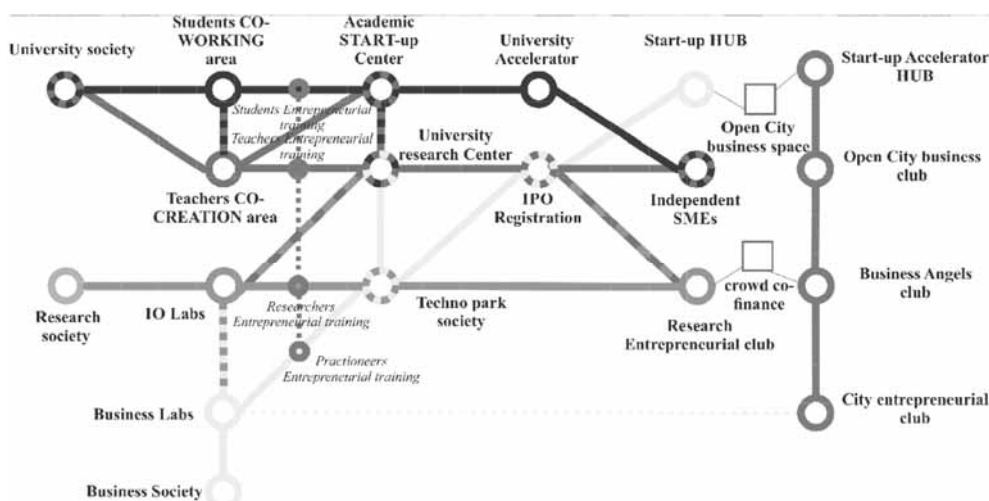
The specificity of academic entrepreneurship is determined by the fact that it combines features of intra-corporate entrepreneurship known from the literature with the autonomy of the authentic entrepreneur (Georgieva, 2013).

B. ENTREPRENEURIAL ROADMAP

The Entrepreneurial Roadmap defines the necessary support for the development and growth of new start-ups based on technology transfer from academia to business. The road map reveals the "stops" of an entrepreneurial idea from inception to the growth of the entrepreneurial business. For example, an entrepreneurship academy/entrepreneurship training can be the common stop/crossroads for any business idea, regardless of its origin – an academy, a research institute or a business organization.

The entrepreneurial road map is based on the proposed algorithm in Figure 1, presented with road stops expressing the realization of an entrepreneurial process and includes innovative creation /at the beginning of the road/ and financing of the entrepreneurial idea /at the end of the road/.

Figure 1. Road map of entrepreneurship



Source: Sterev, Milusheva, Hertleer, Saeed, Guagliumi, 2021.

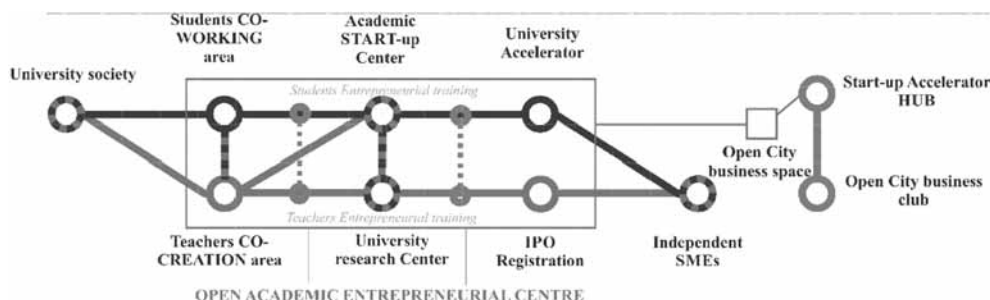
A given entrepreneurial roadmap is a distribution of entrepreneurial activities over time that lead to a goal: the establishment of an academic spin-off/start-up. Some of these activities could be implemented in parallel.

1. Functions and Role of Open Entrepreneurial Academic Centres

Despite the fact that the main goal of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES is to create specific attitudes and to develop modern skills necessary for students/academic staff to be full participants in economic life, this type of organization "showcases" and develops non-standard ideas of students/teachers/researchers whose ideas have a potential for development and, of course, have high added value.

Following the above, this type of "university/academic" structure should fulfil the role of a "centre" for the development of academic entrepreneurial ideas until the legal establishment of a sustainable /in-time/ innovative entrepreneurial business – spin-off or start-up. Accordingly, the OPEN ENTREPRENEURIAL ACADEMIC CENTRES follow the roadmap for promoting academic entrepreneurship (Figure 2).

Figure 2. Road map of an academic entrepreneurship



Source: Sterev, Milusheva, Hertleer, Saeed, Guagliumi, 2021.

According to the above road map (Figure 2), the functions inherent in the open entrepreneurial academic centres are:

- To provide a shared workspace for students, teachers and researchers to realize their "entrepreneurial ideas": this is CO-WORKING AREA (Waters-Lynch et al. 2016, Uda 2013 and others). Unlike shared business spaces, at OPEN ENTREPRENEURIAL ACADEMIC CENTRES the shared space is used to hold informal meetings between students, their teachers and researchers, which informal meetings are driven by a common interest: sharing and finding like-minded people. At the same time, shared spaces for academic entrepreneurship provide the minimally necessary academic infrastructure to work on the preliminary phases of realizing an entrepreneurial idea.
- To provide opportunities for the development of promising business ideas based on the joint work between students and/or professors and researchers in universities. This is CO-CREATION AREA (Lorenzo-Romero et al. 2014, Jotte et al. 2016 and others). Without pretending to be a real Start-up centre, OPEN ENTREPRENEURIAL ACADEMIC CENTRES create the necessary prerequisites for advising "academic entrepreneurs" by introducing the figure of an ACADEMIC MENTOR/TUTOR. For this purpose, through the OPEN ENTREPRENEURIAL ACADEMIC CENTRES, selected teachers /researchers – volunteers /ACADEMIC TUTORS/ are given the opportunity to organize meetings-discussions on topics important for the development of the entrepreneurial idea. For example, creating an entrepreneurial business model (entrepreneurial canvas); financing entrepreneurial ideas; digital tools for selling entrepreneurial products; protecting intellectual/industrial property rights, etc. An essential part of the activity of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES is to organize blended meetings with successful entrepreneurs /TUTORS/ to share their experiences, problems and solutions on a chosen topic.
- To lay the foundation of an entrepreneurial ecosystem for the development of academic entrepreneurship. Without usurping the functions of typical business accelerators, OPEN ENTREPRENEURIAL ACADEMIC CENTRES should ensure a possible exchange of information and/or mediate this exchange between the various stakeholders in the

entrepreneurial process. At the same time, an important part of these interested parties are the possible financial institutions /e.g. business angels, venture capital funds, etc./; professional consultants, public representatives, etc. In this interaction, the created "entrepreneurial groups" of academic entrepreneurs have the opportunity to find suitable ideas, people and finances, which will take them to a new entrepreneurial level, namely – applied development of their entrepreneurial ideas in a developing business.

The implementation of the specified functions is based on the observance of several principles:

- Academic freedom – students, teachers and researchers have the opportunity to develop their own independent or joint ideas without preventing their other colleagues from developing their entrepreneurial ideas and without disparaging or damaging the image and prestige of the higher education institution. Respect for academic freedom enables academic entrepreneurship to develop in many different directions without being limited to university specialization /if applicable/.
- Multidisciplinary approach – "future" academic entrepreneurs have the opportunity within the OPEN ENTREPRENEURIAL ACADEMIC CENTRES to "look" at their business idea "through the eyes" of others. The sharing of personal ideas, impressions and experiences, especially when representatives with different basic competencies (engineers, technologists, mathematicians, economists, doctors, etc.) participate in the open discussions. With such collaboration, the probability of creating an idea that combines principles from different sciences is much greater.
- Teamworking – teamwork is an integral part of the realization of the principle of a multidisciplinary approach. Teamwork requires the participation and commitment of different people in the realization of an entrepreneurial idea. In this way, each of the team members can focus on a specific task for the realization of the entrepreneurial business idea and thus increase the probability of success and transition to the next phase of academic entrepreneurship.
- Participation of various interested parties / entrepreneurial networks – representatives of various interested parties or entrepreneurial networks will be given the opportunity to participate within the OPEN ENTREPRENEURIAL ACADEMIC CENTRES. Of course, the most desired participation is of representatives of the student (including alumni), academic and research communities, but within the framework of the functioning of the centres, the participation of representatives of the financial sphere will be sought; accomplished entrepreneurs; representatives of big business; representatives of state and municipal structures; public figures, etc.

The OPEN ENTREPRENEURIAL ACADEMIC CENTRES should perform some specific tasks:

- to provide the necessary training to the "candidate-entrepreneurs" by organizing various events to increase the competence of the students/academic staff regarding the possibilities of creating and developing their own entrepreneurial businesses. These events can include:

- conducting blended trainings /Masterclasses/ on entrepreneurship with the participation of leading experts in different areas of entrepreneurial business establishment: economists, financiers, technologists, specialists in intellectual property rights, lawyers, etc. During the theoretical-applied trainings, the interested students/academics teachers/researchers will have the opportunity to acquire new or consolidate acquired entrepreneurial knowledge. At the same time, in compliance with the principle of a multidisciplinary approach, "entrepreneurial teams" can be established during the training to develop their own entrepreneurial ideas outside the training;
- conducting meetings-discussions with teachers. Within the discussions-meetings, short demonstrations will be made with the opportunity to ask questions and receive answers from leading specialists, thereby encouraging the acquisition of specific entrepreneurial skills. During the meetings, interested academic participants will have the opportunity to receive consultation and/or confirm their entrepreneurial actions from leading specialists/consultants in various fields;
- conducting meetings with entrepreneurs/business representatives. Within these meetings, business representatives will have the opportunity to share their entrepreneurial experience in various difficult situations in which an entrepreneur finds himself.
- Sharing and discussing good practices for fostering academic entrepreneurs to establish academic spin-offs or start-ups.
- To provide the necessary academic mentoring/tutoring to the "young" academic entrepreneurs. This activity requires the involvement of representatives of various interest groups to "facilitate" the establishment of entrepreneurial teams/groups and, on a voluntary basis, assist them with advice, consultation and recommendations. Of course, the development of the entrepreneurial idea itself is a priority of the academic entrepreneurs themselves, but the academic mentors/tutors should "guide" them in the right direction, so that the academic entrepreneurs themselves reach the "right" decisions for them. The realization of the task of academic mentoring/tutoring should be realized with the help of 3 techniques:
 - Discussion of a problem that arose when considering the entrepreneurial idea. At the same time, the academic mentor/tutor does not offer possible solutions, but through discussion with the academic entrepreneurs "directs" them to independent decision-making regarding the realization of the entrepreneurial business idea. Very often, within the framework of the discussion of the problems, the academic mentor/tutor can assign the implementation of a given task, through the implementation of which the academic entrepreneur will find his solution to his entrepreneurial problem.
 - Recommending relevant literature: scientific and applied, which will benefit academic entrepreneurs to understand the problem themselves and find its solution;
 - Recommending specialists/people from practice who can not only explain the "next" steps in the realization of the entrepreneurial idea, but also be co-teachers (mentors).

- To create an information database with ideas of various participants in the OPEN ENTREPRENEURIAL ACADEMIC CENTRES. In this way, prerequisites are created for finding "suitable" entrepreneurial teams. The important thing in creating this information base is to have a brief description of the entrepreneurial idea and what expertise the initiator of the entrepreneurial idea needs to see it through to the end and realize it in an entrepreneurial business. Although the openness of the database of entrepreneurial ideas should be the main approach in organizing the database of ideas, access should be limited to the following persons in order to prevent "idea predation":
 - Students / academic teachers/researchers participating in the events of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES;
 - Academic mentors/tutors participating in the events of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES, incl. and industry mentors;
 - Representatives of various stakeholders forming the entrepreneurial ecosystem of academic entrepreneurs.

2. Backgrounds of the Open Entrepreneurial Academic Centres

Regardless of the fact that the main result sought from the establishment and implementation of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES is the creation of an academic entrepreneurial business with high market potential (spin-off or start-up business), the desired result is a change in the motivation and attitudes of the participants in the various events – students/academic teachers/researchers business representatives.

A. Creating a high-potential academic entrepreneurial business requires many more activities than are envisaged in the conceptual framework of OPEN ENTREPRENEURIAL ACADEMIC CENTRES. Regardless of the fact that the activities of developing the entrepreneurial idea /carried out by START-UP centres/hubs and promoting the growth of entrepreneurial business /carried out by different types of accelerators and/or networks of business angels/ are not within the scope of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES, important indicators of the centre's activity are:

- A number of students/academic teachers/researchers participate in the various activities of the centre. If we assume that 1 in every 100 business ideas has the potential for development without being accepted as a "fixed idea" of the centre, the more participants in the activity of the centre, the greater the number of "successfully implemented" ideas for academic entrepreneurship.
- A number of "shared business ideas". It's no secret that "typical entrepreneurs" are full of ideas. Very often an entrepreneur thinks of 5-6 different entrepreneurial ideas at the same time. Lack of focus is one of the reasons for the numerous failures of many enterprising people. Through the OPEN ENTREPRENEURIAL ACADEMIC CENTRES, academic entrepreneurs can share their ideas by forming different entrepreneurial teams/networks to increase the overall probability of success of these entrepreneurs.

- A number of entrepreneurial ideas of academic entrepreneurs that have started to be realized in practice. Regardless of whether academic entrepreneurs will continue along the stops on the road map of academic entrepreneurship /Figure 2/ or deviate along one of the other stops for entrepreneurship development /Figure 1/, it is important to know how many of those involved academic staff in OPEN ENTREPRENEURIAL ACADEMIC CENTRES have changed their professional path. Moreover, this may not happen immediately and within the framework of their active participation in the OPEN ENTREPRENEURIAL ACADEMIC CENTRES, but after a certain period of time, for example: 1 – 5 – 10 or more years. This information will allow attracting these "successful" already academic entrepreneurs as tutors to the young academic entrepreneurs.
- A number of funded ideas of academic entrepreneurs. As part of the entrepreneurial ecosystem created and functioning within the OPEN ENTREPRENEURIAL ACADEMIC CENTRES, part of the entrepreneurial ideas with potential can be financed during the participation of the students/academic teachers/researchers in the centre. An example of this practice is the organization of competitions for academic entrepreneurs, with the winners receiving a cash prize for realizing their entrepreneurial idea.

B. The change in the motivation and attitudes of the participants in the OPEN ENTREPRENEURIAL ACADEMIC CENTRES is the real success of the concept. In this way, the "refusal" to develop an entrepreneurial idea is not a weakness of the centre's functioning, but part of creating such professional attitudes that lead to the subsequent success of the participating students/academic teachers/researchers in the labour market. The main qualitative psychological indicators expressing the internal motivation and attitudes towards starting a business, which change when participating in the OPEN ENTREPRENEURIAL ACADEMIC CENTRES events, are reduced to the following few more significant ones:

- Creativity – participating in the exchange of different ideas, meeting with different people with their specific competencies /knowledge, skills and experience/, discussing entrepreneurial ideas, even foreign ones, within the framework of meetings-discussions, allow the participating interested parties to be more -creative in their usual activity, even outside of academic entrepreneurship. In this way, this creativity is transferred to the work outside the OPEN ENTREPRENEURIAL ACADEMIC CENTRES and these people are more successful in their workplace.
- Visionary – the opportunity to see "one's" idea through the "eyes of others" enables the participants in the OPEN ENTREPRENEURIAL ACADEMIC CENTRES to "jump" their personal boundaries. In this way, their position changes and they "begin to think beyond" their thinking limitations. This allows them to be much more insightful regarding future plans and their implementation.
- Initiative – being able to share one's own entrepreneurial ideas shows participants that initiative is not a "bad trait". Adopting the attitude that "the front lines always fall first" inhibits initiative in any field of activity. Participation in the work of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES, however, shows that "innovators /the

first/ in a given field always win". This develops the sense of initiative of the stakeholders: students/academic teachers/researchers / business representatives etc.

- Motivation – successful employees are highly motivated. Participation in the activities of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES enables the participating stakeholders: students/academics researchers/business representatives etc., to be much more motivated and enthusiastic in carrying out their usual activities. "Carried on the wings" of the manifestation of creativity and initiative, the participating stakeholders "find" the appropriate work behaviour that brings them success in their usual work activities. Moreover, verifying the knowledge and skills they possess inspires them and makes them realize that they can achieve more and this also increases their personal motivation.

3. Role of the Open Entrepreneurial Academic Centres Fostering Academic Entrepreneurship

The role of the Universities in training students how to be entrepreneurs is well discussed in the literature. In that feature, entrepreneurship could be assigned with carrier development (to be an entrepreneur) or with academic knowledge for management of Small and medium enterprises.

As the taught intention to be an entrepreneur is well-researched, the development of an Entrepreneurial mindset is not. Hence, the entrepreneurial mindset is explained by the personality focused on dynamics, innovations and communication skills. Al-Ghazali et al. (2022) found that entrepreneurial mindset and mentality are used by entrepreneurs to make new recommendations and to assess risks and opportunities related to new business initiatives.

The entrepreneurial intention and entrepreneurial education are investigated in different countries: for example, Saudi Arabia (Al-Ghazali et al., 2022), Pakistan (Khawar et al., 2022), Chile (Acuña-Duran et al., 2022), China (Wang et al., 2022) or in different sectors: for example, Mining industry (Sörensen 2021), Textile and clothing industry (Stereu et al., 2021).

For analyzing the possible role of OPEN ENTREPRENEURIAL ACADEMIC CENTRES to foster academic entrepreneurship, we use the results of Entrepreneurial training under the ICT-TEX Project that is done in Venice, Italy in 2021 with the participation of 41 participants within 3 groups: students, researchers/teachers, entrepreneurs. The chosen example is close to the OPEN ENTREPRENEURIAL ACADEMIC CENTRES as it is provided as a co-working and co-creation project with the participation of different stakeholders.

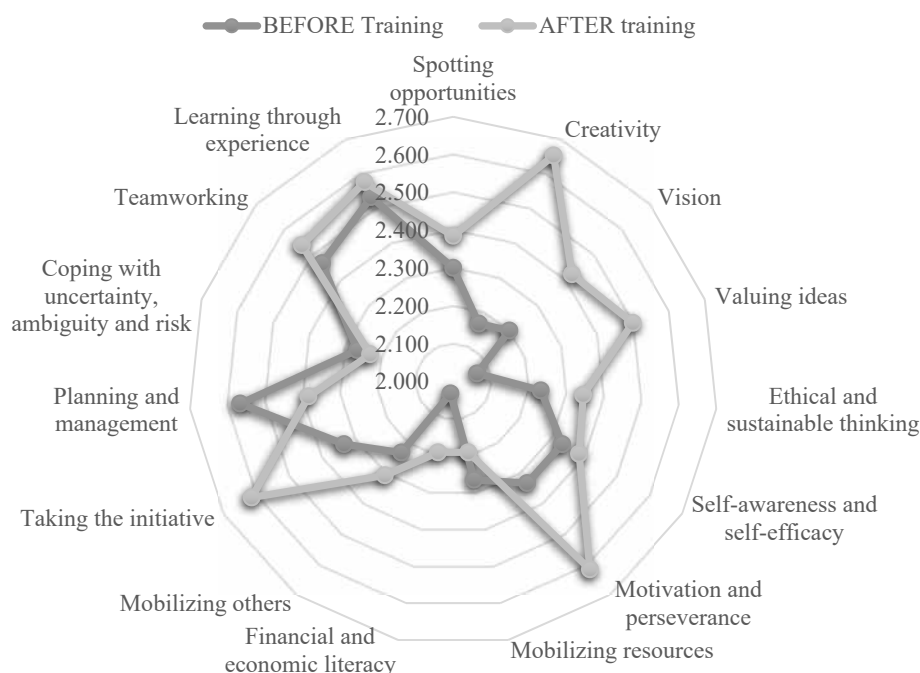
The research is done with the questionnaire of EntreComp framework (<https://ec.europa.eu/social/main.jsp?catId=1317&langId=en>) that covers 3 categories entrepreneurial skills:

1. Ideas and opportunities: Spotting opportunities; Creativity; Vision; Valuing ideas; Ethical and sustainable Thinking

2. Resources: Motivation and perseverance; Mobilising resources; Financial and economic literacy; Mobilising others
3. Into Action: Taking the initiative; Planning and management; Coping with uncertainty, ambiguity and risk; Working with others; Learning through experience

The Questionnaire was fulfilled before the start of entrepreneurial training and after the end of the training. The main results are presented in Figure 3 and Figure 4.

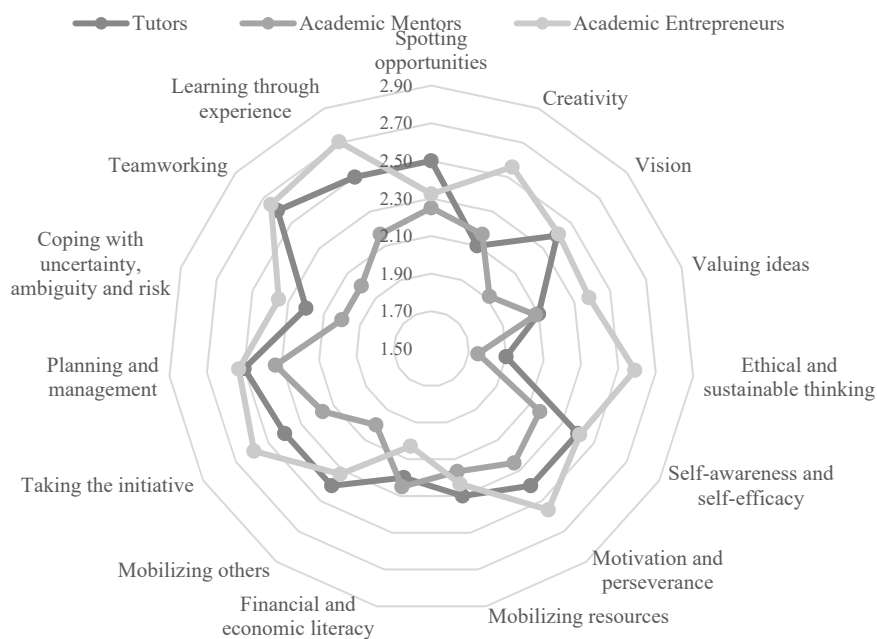
Figure 3. Changing attitudes *BEFORE* and *AFTER* academic entrepreneurial training



Source: Sterev, Milusheva, Yordanov, 2022.

The change in the motivation and attitudes of academic entrepreneurs: students / academic teachers/researchers, can be explained by the different motivational profiles of the different interested groups. Academic entrepreneurs are the most sceptical to change in personal attitudes before and after training. The sample profiles measured during the ICT-TeX project show that academic entrepreneurs should be perceived as the "artist's canvas" and through blended learning, they can be more motivated and more goal-oriented, as in creating their own START-up business, as well as when starting a professional career (Figure 4).

Figure 4. Attitudes of the various stakeholders when participating in the OPEN ENTREPRENEURIAL ACADEMIC CENTRES



Source: Sterev, Milusheva, Yordanov, 2022.

4. Approach to Organizing Open Entrepreneurship Centers

Looking at the results from the survey, the **OPEN ENTREPRENEURIAL ACADEMIC CENTRES** would be a very effective instrument for fostering academic entrepreneurship. The organization of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES is carried out by determining the necessary infrastructure and team for the implementation of the above-mentioned activities in the following way.

A. INFRASTRUCTURE.

Infrastructural, the functioning of such a centre needs appropriate premises and a base. In accordance with the basic principles of the existence of this type of entrepreneurial centre: with open doors, it follows that the centre must be physically located in a building/premises with public access. Similarly, the centre can also be located in the virtual space, and free access to the website/platform on which the centre is presented is also required. Restriction of access to a physical/virtual centre can only be done in relation to belonging to one or more interested groups through an access card/student card (for physical centres) or username and password (for virtual centres).

The public access and open nature of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES implies that it has suitable places to work "in the open", the necessary equipment for presentation through multimedia files, the necessary means of conducting demonstrations when organizing meetings-discussions, as well as the necessary literature, through which to increase the competence of interested academic entrepreneurs.

In addition to the physical infrastructure, the OPEN ENTREPRENEURIAL ACADEMIC CENTRES can also be located in the virtual space, such as on a website or on a specially developed platform for academic entrepreneurship, the physical infrastructure being duplicated virtually.

Along with the above, regardless of whether the OPEN ENTREPRENEURIAL ACADEMIC CENTRES are physical and/or virtual, a database of entrepreneurial ideas of the academic entrepreneurs needs to be built, as well as a platform to check the academic entrepreneurship motivation and attitudes of the stakeholders. The existence of such a base is key for the subsequent monitoring and control of the results of the centre's activity, as according to the data from the register of entrepreneurial ideas, the professional development of the participating academic entrepreneurs can be followed over time, and also the effect on motivation and attitudes can be monitored to the participants in the various events, in this way to offer exactly such blended trainings, where the highest motivational effect is observed.

B. TEAM

The functioning of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES requires that there are several groups of participants who support and ensure the functioning of the centre.

- Activity organizers: includes a team of 2-3 people who maintain the physical infrastructure, schedule and organize face-to-face and/or virtual academic entrepreneurship trainings, schedule and organize face-to-face and/or virtual meetings with active entrepreneurs / academic tutors, support meetings-discussions with academic mentors. The centre's organizing team should support the maintenance of the electronic database with entrepreneurial ideas and support (if necessary – a.n.) the verification of entrepreneurial motivations and attitudes in the platforms specialized for this. Along with the above, depending on the level of construction of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES, the team should support the organization and holding of contests for entrepreneurial ideas, support the organization of meetings with funding institutions and create contacts with the Centre for the transfer of technologies in the academic institution (if any).
- Academic entrepreneurs: students/academic teachers/researchers. The inclusion of this interested group forms the need for OPEN ENTREPRENEURIAL ACADEMIC CENTRES. For this purpose, it is necessary to identify these academic entrepreneurs and, above all, to attract them to take part in the activities of the centre. The lack of sufficient information about the centre, turning it into a "closed club" will inevitably lead to low interest and worsen the results of its activity. Anyone can be an entrepreneur as long as they get the support they need to realize their own ideas!

- Academic mentors. This group includes academic teachers /it is recommended that they have or have had their own entrepreneurial business/ who support academic entrepreneurs. Their role is to provide guidance and direction to academic entrepreneurs without influencing their entrepreneurial idea. It is necessary to organize meetings-discussions at least once every 2 weeks to demonstrate certain professional and personal skills necessary for the success of an academic entrepreneur through appropriate applied tools. Attracting such a group of academic mentors requires the creation of appropriate mechanisms within the framework of the employment of teachers in the academic institution (if similar academic teachers are available in the institution – a.n.) or appropriate mechanisms (through cooperation contracts with other academic institutions) for inclusion of their academic teachers.
- Academic tutors. This group includes successful entrepreneurs or successful executives. Their role is to encourage academic entrepreneurs to realize their entrepreneurial ideas. They share their experience, which can become a group experience for all students/academic teachers/researchers involved in the activity of the OPEN ENTREPRENEURIAL ACADEMIC CENTRES. It is necessary to organize meetings with the academic tutors once a month. Attracting a similar group of academic tutors requires the use of the mechanisms of the Alumni Clubs (persons who have graduated from the academic institution and successfully realized themselves in the professional sphere). Attracting academic tutors is related to giving them a "special" status in the academic institution (by promoting their participation, recognition of participation in the OPEN ENTREPRENEURIAL ACADEMIC CENTRES, etc.).
- Industrial mentors – it is necessary to attract people from the industry in various professional fields to support the academic entrepreneurs as business, technology or manufacturing mentors.

Conclusion

Undoubtedly, academic entrepreneurship is gaining more and more supporters in conditions of growing demand for innovative ideas and transfer of innovative ideas and technologies from the academy /universities and research institutions/ to business.

The promotion of academic entrepreneurship, however, requires the creation of an appropriate infrastructure through which the "academia-business" interaction can be successfully implemented. However, not only the physical existence of a "technology transfer unit" and/or "start-up/entrepreneurial centre" etc. is taken into account here, but the establishment of a complete entrepreneurial ecosystem through which the interaction between academic entrepreneurs and business is supported.

Of course, the academic entrepreneurship ecosystem is inextricably linked with the existing national and regional entrepreneurship ecosystems, and on the other hand, the academic entrepreneurship roadmap is part of the overall entrepreneurship development map in a given region/country, town, etc./. This requires, when implementing the road map for the promotion of academic entrepreneurship, to follow the main "stops" of promising entrepreneurial ideas

and by creating OPEN ENTREPRENEURIAL ACADEMIC CENTRES to "channel" the innovation potential of the academic community: students/academic teachers/researchers.

Moreover, an essential part of the functioning of such OPEN ENTREPRENEURIAL ACADEMIC CENTRES is organizing and conducting appropriate blended entrepreneurial educations and trainings, through which not only to increase the number of academic start-ups but also to increase motivation and build appropriate motivational attitudes of the participants in the whole process so that they become the future business leaders.

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THE DISCOUNT RATE IN THE ASSESSMENT OF EU-FUNDED INVESTMENT PROJECTS³

The article presents the effect of the financial discount rate on key financial indicators in the cost-benefit analysis used in the assessment of public investment projects – financial net present value, financial internal rate of return and financial gaps. It then estimates the Weighted Average Cost of Capital as an alternative approach for determining the discount rate. The model builds on the debt/equity ratio in the overall project investment portfolio and Capital Asset Pricing Model based on: (1) the return gained from investment in risk-free instruments; (2) the risk premium for the state (the so-called asymmetric state-related risk); (3) the business risk premium; (4) the project asymmetric risk premium. The model is then applied to an environmental investment project in Bulgaria.

Keywords: discount rate; weighted average cost of capital; cost-benefit analysis; public infrastructure financing; revenue-generating projects

JEL: H43; H54

Introduction

Bulgaria joined the European Union in January 2007, and the first experience with financing infrastructure projects from the Structural and Cohesion Funds coincided with the start of the 2007-2013 programming period. The managing authorities of the operational programs appraising and financing revenue-generating infrastructure projects – environment, transport and regional development, fully adopted and applied the requirements of the *EC Guide to Cost-Benefit Analysis of Investment Projects*, as this policy and approach continued in the 2014-2020 programming period.

In 2020, the European Commission published *Economic Appraisal Vademecum 2021-2027, General Principles and Sector Applications*. With this document, the Commission introduced a more flexible approach towards project appraisal in the 2021-2027 programming period compared to the previous ones. The discount rate is one of the affected project appraisal

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aspects, since with the *Vademecum* the EC does not define a reference discount rate but encourages the Member States to calculate their own country-specific and sector-specific discount rates. The option for using a different discount rate was available also before however, the Member States conveniently applied the reference discount rate proposed for the relevant programming period. For countries, such as Bulgaria, where public authorities and project developers have relied exclusively on the reference discount rate in project appraisal, that lack of reference discount rate will certainly pose challenges. Therefore, the objective of the article is to present the results of a study on a methodology to calculate and justify a discount rate for the assessment of EU-funded projects in Bulgaria to be applied in the 2021-2027 programming period, and to assess the credibility and implications of the calculated discount rate values.

1. The Cost-Benefit Analysis – Evolution and Focus in Assessing Public Investment Projects in the EU

The EU grant financing of public infrastructure comes along with requirements and rules for project assessment to ensure that the EU public financial resources support public projects that are not attractive for private funding. In terms of public infrastructure projects' assessment, two major approaches are distinguished depending on the revenue generation capacity of the projects.

The non-revenue generating projects lead to the construction and improvement of infrastructure for the provision of “pure” (Samuelson, 1954, pp. 387-389) or “next to pure” public goods like street lighting, rehabilitation of streets and squares, creation and maintenance of green areas, parks and gardens. These public goods are characterized by non-rival consumption and non-feasible exclusion of potential consumers (Musgrave, Musgrave, 1989, p. 44). Hence, each member of society may benefit from these projects without any limitations in access and without paying any fees. As these projects improve social welfare, they are entirely financed by grants and the assessment is done mainly based on public needs assessment, overall costs and cost-effectiveness, and in many cases based on political decisions.

The revenue-generating projects include a large variety of projects in sectors like transport, energy, environment (water and waste management), industry, telecommunications, public health, education and culture, cultural and historical heritage and conservation, recreation, tourism and entertainment, research, development and innovation. In terms of public finance theory, these projects are characterized by rival consumption and feasible exclusion of public services' potential consumers (Musgrave, Musgrave, 1989, p. 44). These projects generate revenues from tickets, fees, prices, etc., paid by the final consumers. However, due to their public nature and significant contribution to social welfare, which curbs their revenue generation potential, they are not quite attractive to commercial banks, funds and private investors like purely commercial and marketable projects. That is why these projects are financed partially by public authority grants covering a share of the project costs, as the remaining funding is provided from the own resources of the project promoter, also including credits.

In order to guarantee fair allocation of public resources in terms of grants to revenue-generating projects, the European Commission has developed a detailed project assessment methodology based on the cost-benefit analysis (CBA). In 1994, the EC published the first Guide to Cost-Benefit Analysis of Major Projects. The project assessment methodology has been constantly developed and improved based on the actual project implementation throughout the programming periods. As a result, five subsequent editions of the Guide have been published, respectively in 1997, 2002, 2008 and 2014, each one updating the methodology of the previous editions. The final edition bears the title Guide to Cost-Benefit Analysis of Investment Projects.

The economic theory recognizes a variety of analytical methods to assess and verify if projects achieve certain objectives in an effective and efficient way. These include cost-benefit analysis, cost-effectiveness analysis, least-cost analysis, multi-criteria analysis, etc. The European Commission has recognized cost-benefit analysis as a universal project assessment tool because it is based on an objective and verifiable method. The cost-benefit analysis enables the measuring in monetary terms of all the costs and benefits of a certain project for society no matter whether they are financial, economic or social. The cost-benefit analysis also allows sensitivity and risk assessment, which are also important for the overall project assessment.

According to the Guide, the cost-benefit analysis methodology for project assessment includes three large sections – financial analysis, economic analysis, sensitivity and risk analysis. The methodology for financial analysis of investment projects is based on three main pillars – assessment of the project's financial profitability; assessment of the financial gap, which determines the amount of the EU grant and the beneficiary's co-financing; and assessment of the project sustainability.

The methodology for economic analysis according to the Guide focuses on the assessment of the project's contribution to society's welfare. The key concepts here are: the application of shadow prices to indicate the social opportunity cost instead of market prices; consideration and monetarization of project-related externalities and benefits like increase/reduction of air pollution, greenhouse gas emissions, noise, soil and water contamination, ecosystem degradation, landscape deterioration, population healthcare status, etc.

The sensitivity analysis identifies critical variables that may impact the project's financial and economic performance and analyses scenarios of combinations of these variables. The risk analysis is qualitative and quantitative. The former arranges the possible risks in the matrix by analyzing the possible negative effects, the probability of occurrence and the severity of impact and proposes mitigation and/or prevention measures for the main project risks. Quantitative risk analysis is required when the residual risk after the proposed mitigation and/or prevention measures remains medium to high and involves statistical probability analysis.

The cost-benefit analysis methodology presented in the European Commission's Guides is very detailed and elaborate, as for each aspect of the analyses precise indicators, assumptions and formats of the calculation tables are required. In 2006 the European Commission published Council Regulation (EC) No 1083/2006 of 11 July 2006 laying down general

provisions on the European structural and cohesion funds. The Regulation provided a definition for a major project as one whose total cost exceeds EUR 25 million in the case of the environment and EUR 50 million in other fields. In 2013 the European Commission published Regulation (EU) No 1303/2013 of 17 December 2013 which defined the major project as one whose total eligible costs exceed EUR 50 million and in the case of projects promoting sustainable transport – exceeding EUR 75 million. In cases of major projects, the member-states were explicitly required by these regulations to perform a full cost-benefit analysis, including a risk assessment.

Non-major investment projects (below EUR 50 million) were not explicitly required to provide full cost-benefit analysis when applying to obtain EU grant funding from the member-state operational programs and it was up to the national authorities to decide to what extent to stick to the provisions of the Guide.

Thus in the 2014-2020 programming period, the focus of the assessment of non-major projects which constituted the majority of the EU-funded investment projects was shifted towards financial, sensitivity and risk analysis, as the economic analysis was already not obligatory and financial analysis became of key importance for project assessment.

2. Discount Rate in Financial Analysis – According to the Guide to Cost-Benefit Analysis of Investment Projects

The core indicators in financial analysis are the financial net present value, the financial internal rate of return and the financial gap, which are calculated by using the following formulas:

Financial net present value (FNPV). This is a financial indicator based on discounting of net cash flows by applying the following formula:

$$FNPV = \sum_{t=0}^T \frac{X_t}{(1+i)^t} = X_0 + \frac{X_1}{(1+i)} + \frac{X_2}{(1+i)^2} + \dots + \frac{X_T}{(1+i)^T} \quad (1)$$

where:

T is the project reference period;

X – the amount of the net cash flow for the respective year;

i – the discount rate.

The financial net present value is calculated for: (1) the total project investment costs – financial net present value of the investment (FNPV/C). This indicator shows how attractive for investors the analyzed project is. If it demonstrates negative FNPV/C then the project is not attractive for investors and needs public authorities' support in the form of grants; and (2) the national public contribution in the project costs – financial net present value of the capital (FNPV/K). This indicator shows how the project is influenced by the EU grants as

the FNPV/K increases as a result of the grant funding however again they should remain negative.

Financial internal rate of return (FIRR). This financial indicator shows the discount rate at which FIRR/C becomes equal to 0. It is calculated based on the following formula:

$$FIRR = \sum_{t=0}^T \frac{X_t}{(1+i)^t} = 0 \quad (2)$$

where:

T is the project reference period;

X – the amount of the net cash flow for the respective year;

i – the discount rate.

Similar to the FNPV, FIRR is also calculated for (1) the total project investment costs – financial internal rate of return of the investment (FIRR/C); and (2) the national public contribution in the project costs - financial internal rate of return of the capital (FIRR/K).

Financial gap. This financial indicator shows the percentage of the total project costs that cannot be covered by the project net revenues generated throughout the project reference period. This percentage converted in monetary terms forms the actual amount of the EU grant. The financial gap is calculated based on the following formula:

$$\text{Financial Gap (\%)} = \frac{\text{Discounted investments} - \text{Discounted net revenues}}{\text{Discounted investments}} * 100 \quad (3)$$

As seen from the formulas for calculation of the key indicators, discounting turns out to be a fundamental concept underlying project financial analysis required by the EC Guide. Discounting is the method for determining the present value of cash flows generated in a given year in the future, i.e. how much tomorrow's monetary unit is worth today. This concept originated in the 1800s and was first summarized by John Burr Williams (Williams, 1938, pp. 55-74). Nowadays it is widely used in the financial assessment of projects and financial markets.

The discount rate (factor, coefficient, norm, etc.) lies in the core of the concept as it is used in the coefficient by which the cash flow in the relevant year is multiplied in order to be calculated its present value.

$$\frac{1}{(1+i)^t} \quad (4)$$

The EC Guide provides two options for the discount rate to be applied by the project proposers:

- use a benchmark/reference discount rate proposed by the European Commission for the relevant programming period;

- use a different discount rate “justified on the grounds of international macroeconomic trends and conjunctures, the Member State’s specific macroeconomic conditions and the nature of the investor and/or the sector concerned” (European Commission, 2014, p. 42).

The first two editions of the Guide to CBA published in 1992 and 1997 did not explicitly recommend a reference discount rate though they used a 5% discount rate in real terms when providing examples for the calculation of the project financial indicators. The next editions of the Guide however recommended specific values for the given programming periods, which are presented in Table 1.

Table 1. Reference financial discount rates recommended by the EC

| Programming period (years) | % in real terms |
|----------------------------|-----------------|
| 2000-2006 | 6 |
| 2007-2013 | 5 |
| 2014-2020 | 4 |

Source: Guides to Cost Benefit Analysis for Investment Projects for programming periods 2000-2006, 2007-2013, 2014-2020, European Commission.

The reference discount rate proposed by the European Commission is considered as a benchmark:

- to discount the project’s net cash flows in order to calculate the FNPV/C and FNPV/K, i.e. if both indicators’ values turn to be positive after applying the benchmark rate, then the project is considered attractive for investors and the proposers should look for market financing but not EU grants
- to assess the projects’ profitability, i.e. if the project’s FIRR/C and FIRR/K values turn to be above the benchmark, then the project is determined as not eligible for grant financing with EU funds and private financing should be considered.
- to calculate the financial gap and further on the final amount of the EU grant. The higher the financial discount rate the higher the financial gap and thence the EU grant is. As seen from Table 1, the declining trends of reference financial discount rates indicate the attitude of the EC to reduce the overall amount of grants.

The authors’ review of revenue-generating infrastructure projects (waste and water management, transport, etc.) funded by the operational programs in Bulgaria indicates that the cost-benefit analysis for all projects in the 2007-2013 and 2014-2020 programming periods have applied the reference financial discount rate, recommended as a benchmark by the EC, and no project proposer has used the opportunity to justify a different financial discount rate. The national authorities also did not publish any specific guidelines to justify any overall country rate for Bulgaria or sector-specific rate.

With the Economic Appraisal Vademecum 2021-2027, General Principles and Sector Applications, published in 2020, the Commission introduced a more flexible approach towards project appraisal compared to the previous programming periods. The cost-benefit analysis again remains mandatory only for major projects, as for other projects tools such as

cost-effectiveness analysis and multi-criteria analysis in addition to CBA are proposed for voluntary use, based on sector and/or project type and scale.

In addition to this flexibility, the Vademecum also states that if “a financial analysis with a calculation of performance indicators is carried out, Member States are free to assess their own country- and/or sector-specific financial discount rate(s)”. No reference discount rate is explicitly recommended for the 2021-2027 programming period.

In this new context, the calculation of a justified financial discount rate becomes a significant challenge for project proposers in the programming period 2021-2027 as far as this rate is used not only in cost-benefit analysis but also in other methods like the ‘levelized cost’ concept which is often the core of cost-effectiveness analysis.

3. Discount Rate in Financial Analysis – Going Beyond the Guide to Cost-Benefit Analysis of Investment Projects

As the national authorities and the project proposers in Bulgaria will have to justify project discount rates in the 2021-2027 programming period, this section will present a feasible approach for the calculation of the financial discount rate.

A commonly used approach for determining the discount rate is to estimate the **Weighted Average Cost of Capital (WACC)**. The EC Guide refers to WACC as an option for the calculation of a discount rate in case the project promoters do not wish to apply the reference discount rate for the relevant period. The Guide also refers to country-specific and sector-specific WACC, however, it does not provide an elaborate methodology for the WACC calculation.

From an entrepreneur’s point of view, WACC is the actual cost of capital needed for financing a particular project (Frank, Shen, 2016, pp. 300-315). This implies that a project-specific discount rate should be calculated taking into account the cost of capital that the project proposer will alternatively have to allocate from his own resources (equity) or borrow from funding institutions (debt) instead of using grants.

As WACC refers to a project and its sources of financing the authors have chosen to apply the methodology for an environmental investment project in Bulgaria, as far as environmental infrastructure (water and waste management) financing represented a significant share of the project financing in the 2007-2013 and 2014-2020 programming periods in the country. The sample project, on which the approach will be tested, will have the following parameters: (1) project reference period of 30 years (3 years construction period and 27 years of operation period), as required by the EC Guide 2014-2020; and (2) average investment costs amounting to EUR 10 million. This value is based on the actual average project costs for the 2007-2013 and 2014-2020 programming periods – 7.3 million Euro for a waste project and 11 million Euro for a water project.

The funding institutions providing debt financing seek a smaller return on their funds considering the fact that they are ahead on private investors (equity holders) on the payment “queue” (the payment of interests and principals related to credits is paid ahead of profit

calculation and dividend payment). The entities that allocate equity into projects receive returns in the form of dividends (in case of sufficient and positive value cash flows) as well as in the form of eventual growth in the price of their shares on the stock market, which depends on the business cycle.

WACC depends on the debt/equity ratio in the overall project investment portfolio. Debt/equity ratios of 50/50; 60/40; 70/30 and 80/20 are thus reviewed for the sample EUR 10 million environmental projects.

WACC is determined by applying the approach that the cost of capital for one entity is the average weighted value of the equity costs and the debt financing costs. This is illustrated by the following formula:

$$WACC = \frac{E}{(D + E)} * Re + \frac{D}{(D + E)} * Rd * (1 - Tc) \quad (5)$$

where:

D is the amount of debt financing;

E – the amount of equity financing;

Re – the amount of aimed return on equity;

Rd – the cost of debt;

Tc – the corporate tax rate.

The return that the equity owners aim at **Re**, can be determined by applying the **Capital Asset Pricing Model – CAPM**. CAPM is a standard theoretical framework for evaluating the target return on equity. According to this model **Re** is calculated based on the following formula:

$$Re = Rf + \beta i * (\text{market risk premium}) \quad (6)$$

where:

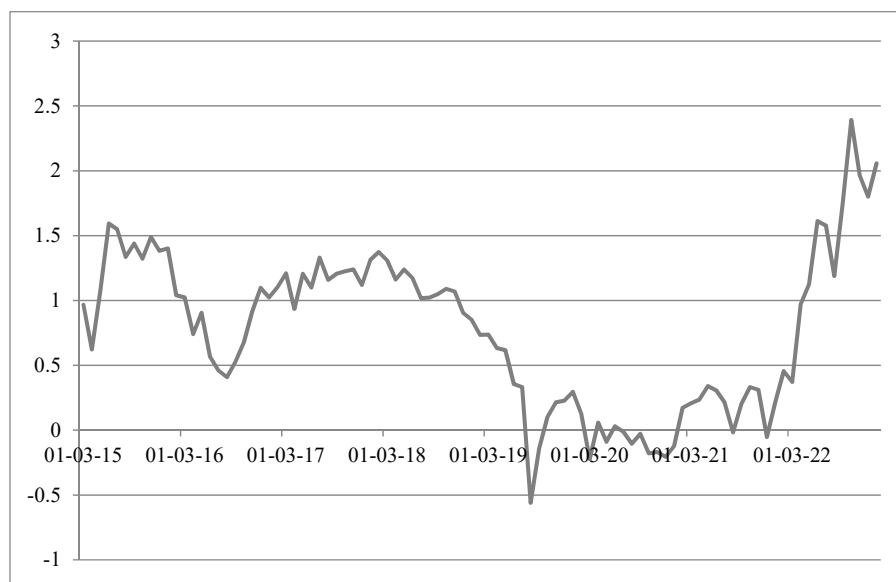
Rf is the return on investment in risk-free instruments;

βi – the so-called beta coefficient which measures the market volatility.

The **market risk premium** is calculated as a sum of the risk premium for the state (the so-called asymmetric state-related risk); the business risk premium; and the project asymmetric risk premium.

Return on investment in risk-free instruments (Rf). The regulatory and competition protection authorities usually consider state bonds as the most appropriate equivalent to risk-free instruments. For European projects, the yield on 30-year German state bonds denominated in EUR can be presumed as the rate of return of risk-free instruments. The fact that the reference period for large infrastructure projects is usually 20-30 years is another argument to support the selection of this financial instrument. The dynamics of return on investment in these bonds is presented in Figure 1.

Figure 1. Dynamics of yield on 30-year German state bonds in the period 2015-2023, %



Source: Bloomberg.

The dynamics of the yield on 30-year German state bonds in the period 2015-2023 indicates a series of significant fluctuations starting from 1.594% in July 2015 and plunging to negative values in the second half of 2019 and particularly in 2020 due to the Covid-19 pandemic. However, the market stabilized in 2021 and started to grow rapidly again in 2022. As far as expectations show that the market will continue to be stable, the average yield rate for 2022 of 1,285% could be used as an assumption for the *return gained from investment in risk-free instruments*.

The risk premium for the state (asymmetric state-related risk). In practice, the investors always claim additional returns related to the country where the project will be implemented. The usual measure of this risk is the difference between the yield of similar instruments in the relevant country and a selected low-risk country.

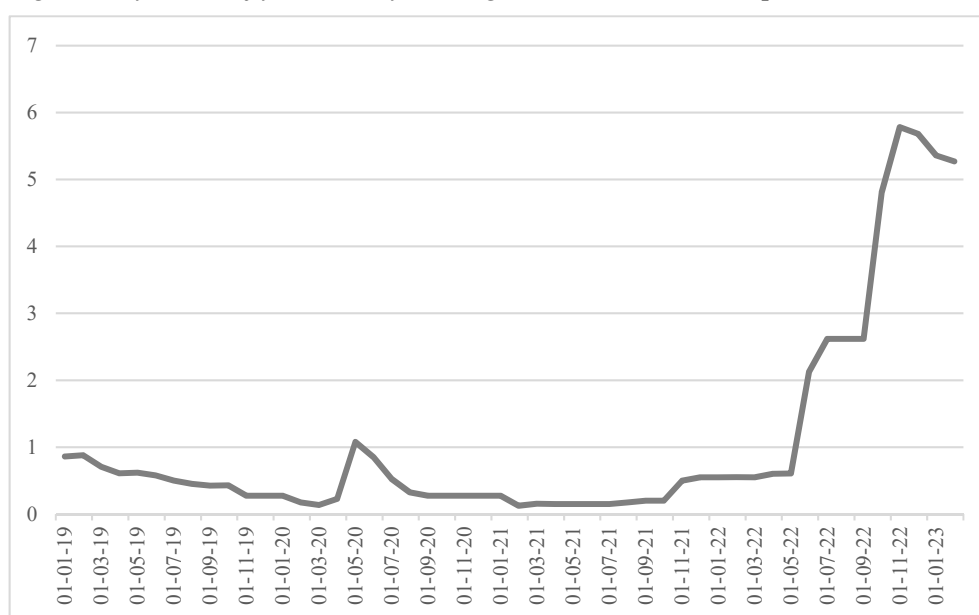
This poses several methodological issues related to the calculation of the asymmetric state-related risk for Bulgaria:

- The Bulgarian Government does not issue 30-year state bonds, so there is no instrument with a similar maturity to use for the gap calculation.
- The 20-year state bonds are the instrument with the longest maturity in Bulgaria, however, they are not frequently issued by the Government. For example, the most recent issue of such bonds was in 2019, while for instruments with shorter maturity several auctions per year are being performed. In the period 2019-2022, the 20-year bonds form 6.62% of the

overall state debt assumed through state bonds. Therefore, the 20-year state bonds are not frequently traded and no detailed yield statistics is available.

- For the purposes of the present study, the yield of the 10-year state bonds should be used in order to calculate the asymmetric state-related risk. These are the bonds with the next longest maturity period. The Ministry of Finance's auction data indicates that these bonds are issued several times a year and in the period 2019-2022, these bonds formed 30,3% of the overall state debt assumed through state bonds. These bonds are frequently traded and detailed statistics on their yield are available.

Figure 2. Dynamics of yield on 10-year Bulgarian state bonds in the period 2019-2023, %

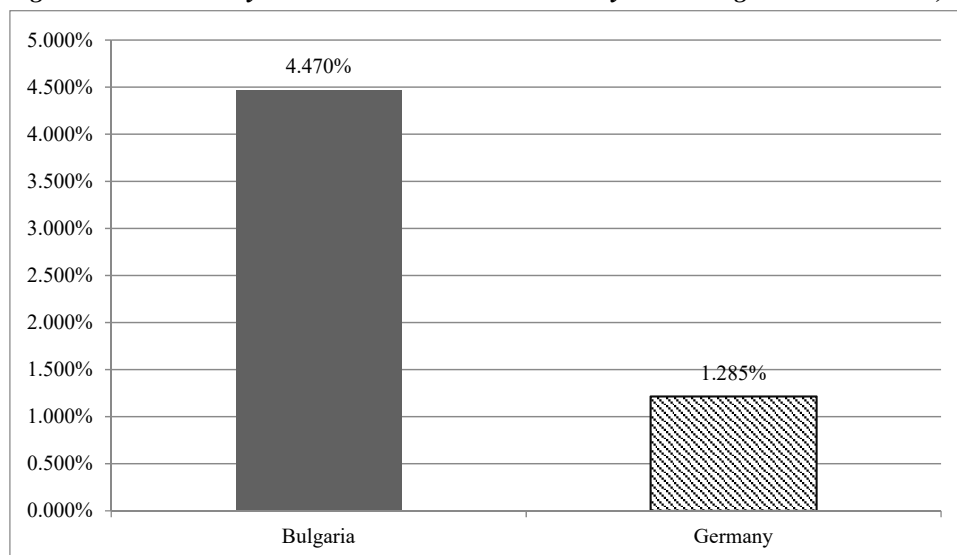


Source: World Government Bonds.

While from the beginning of 2019 until mid-2022 the dynamics of yield on 10-year Bulgarian state bonds remained relatively low at stable levels below 1%, after May 2022, it started to grow rapidly and at the beginning of 2023, it reached almost 6%. These fluctuations make it questionable which average value to assume as a 10-year state bond yield. The average yield for the entire 2022 is 2.42%, while the average yield for the second half of 2022 has grown almost twice to 4.02%. The short-term forecasts indicate a 4.47% yield by March 2024 which is even higher than the historical averages and this value will be assumed in the calculation of the asymmetric state-related risk.

Figure 3 presents the comparison of average yields of 30-year German state bonds and 10-year Bulgarian state bonds.

Figure 3. Yield on 30-year German state bonds and 10-year in Bulgarian state bonds, %



Source: Bloomberg, World Government Bonds.

Understandably, the yield of 10-year state bonds in Bulgaria is higher than the low-risk 30-year German state bonds. The 3.185% difference will be further on considered as a *risk premium for the state* (in the case of Bulgaria).

Business risk premium. This premium is the additional return over the yield from risk-free instruments, which the investors seek in order to invest in a certain sector, and is also called equity risk premium (ERP). The Bulgarian capital market is not well developed and liquid and so no official statistics about the yield on the corporate stock in general as well as by specific sectors is available. Therefore, assumptions for the value of ERP should be made based on foreign publications. According to a study by the Norwegian Bank for Investment Management (Norges Bank Investment Management. 2016), the average ERP for Europe is 5.8%. According to a study by professor Damodaran (Damodaran. A. 2022), ERP for Bulgaria in 2022 is 4.86%. The ERP values in both publications are determined based on historic data as ERP=4.86% will be applied for the purposes of the present study as far as it directly refers to the case of Bulgaria.

Project asymmetric risk premium. This is the risk related to the implementation of large investment projects with construction works. The risk usually materializes in public procurement problems leading to an extension of the construction period (as compared to the forecasted period of construction), excessive costs, problems with the quality of performance, etc. The integration of the project investment component in the so-called EPC contract (Engineering, procurement and construction) with a fixed price and turnkey build clauses significantly reduces the possibility for the materialization of these risks. The usual premium for asymmetric risk for environmental infrastructure projects is about 0.5-1%, which will be applied in the present sample project.

β coefficient. It measures market volatility or in other words, this is the systematic risk of a security or portfolio compared to the market as a whole. Investments/portfolios with β coefficient exceeding 1 are considered as more volatile. As pointed out above, the Bulgarian stock market is not well developed so no data and publications for overall or sector-specific β coefficient are available. Again, assumptions based on external publications should be made with the clear awareness that these assumptions are conditional and may be inaccurate. Publications for the β coefficient in different are available: 0.87 is the average coefficient calculated based on a study of European energy companies (Economic analysis for the Paks II nuclear power project); 0.74 is the average coefficient applied in a study for calculation of WACC for Dutch water companies (Harris, Figurelli, Guatri, Nezzo, 2021). As the present approach will be based on the environmental project including the water sector, the authors have considered the β coefficient for the Dutch water companies as more appropriate for the purpose.

Based on the assumptions for the four parameters of R_e , the coefficient is calculated at $1.285 + 0.74 \cdot (3.185 + 4.86\% + 1\%) = 7.978\%$.

The cost of debt (R_d) is determined by calculating the internal rate of return (IRR) of the debt financial flow for the particular sample project. This flow includes all debt parameters: initial fee; funds utilized every year; commitment fees for the amounts that have not been utilized; principal repayments and interest repayments. The credit assumptions are based on typical credits for implementation of similar projects: 20-year credit including 3 years for credit utilization and 17 years of credit repayment; 3% interest rate on an annual basis and credit-related fees.

The annual amounts of credit instalments, principal and interest repayments are calculated and allocated in the relevant year of the credit reference period. These form the credit net cash flow. Based on this flow the IRR (R_d) is calculated.

As pointed out above, different debt/equity ratios are possible for the implementation of the sample environmental project which is why 50/50; 60/40; 70/30 and 80/20 ratios are analyzed as WACC is calculated for each of them. The results are presented in Table 2.

Table 2. Calculation of WACC for a sample environmental project with different debt/equity ratios

| | Debt/Equity ratio | | | |
|---|-------------------|------------|------------|------------|
| | 50/50 | 60/40 | 70/30 | 80/20 |
| Project investment (Euro) | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 |
| Debt (Euro) | 5 000 000 | 6 000 000 | 7 000 000 | 8 000 000 |
| Equity (Euro) | 5 000 000 | 4 000 000 | 3 000 000 | 2 000 000 |
| Return on equity (R_e) (%) | 7.978 | 7.978 | 7.978 | 7.978 |
| Return from investment in risk-free instruments (%) | 1.285 | 1.285 | 1.285 | 1.285 |
| Risk premium for the state (%) | 3.185 | 3.185 | 3.185 | 3.185 |
| Business risk premium (%) | 4.86 | 4.86 | 4.86 | 4.86 |
| Project asymmetric risk premium (%) | 1 | 1 | 1 | 1 |
| Beta coefficient | 0.74 | 0.74 | 0.74 | 0.74 |
| R_d (%) | 4.06 | 4.06 | 4.06 | 4.06 |
| T_c (%) | 10 | 10 | 10 | 10 |
| WACC (%) | 5.82 | 5.38 | 4.95 | 4.52 |

Source: own calculations.

Conclusions

- WACC values vary depending on the debt/equity assumptions for the certain project and the sector in which it will be implemented as far as the R_e coefficient depends highly on sector specifics.
- WACC values are higher in scenarios with higher equity shares due to the higher return on equity sought by the investors. Respectively, WACC values are lower in scenarios with higher debt shares because using debt is usually cheaper compared to using equity.
- Despite the variations in the calculated WACC values for the different scenarios, they are around the 4-5% range of reference financial discount rate recommended by the Guide for cost-benefit analysis of investment projects for the 2007-2013 and 2014-2020 programming periods. These closer results are highly supportive of the selected methodology for the calculation of the discount rate although many of the assumptions made were highly conditional and uncertain.
- It is fully acknowledged that the discount rate is not the only variable that highly influences the financial analysis and assessment of investment projects. The time component in terms of the project reference period (number of years) also influences the project's net present value and rate of return. However, large investment projects have usually longer periods of construction and operation, and the time component is more or less fixed. Therefore if any of the WACC values calculated in the 4.52-5.82% range has been selected as a reference financial discount rate for the 2014-2020 programming period, this would mean that:
 - the analyzed projects will have smaller net present values, i.e. more projects will be unattractive for private investors and thence eligible for grant financing;
 - the internal rate of return of more projects will be below the reference level, i.e. they will be eligible for grant financing;
 - higher reference discount rate, if other things are equal, leads to higher financial gap values and respectively greater amounts of grant funding and less beneficiary co-financing.

For three consequent programming periods, the European Commission has been proposing lower and lower reference values for the financial discount rate. This is in line with the overall policy for reducing grant financing and increasing the share of financial instruments as funding sources because of their positive impact on the beneficiaries' financial discipline and on public spending in the context of constantly emerging needs for the reallocation of budget resources. On the threshold of the 2021-2027 programming period, the European Commission adopted a rather flexible approach to shift to the member-state national authorities the choice of project assessment methodology and the related issues like discount rate, etc. Therefore, the choice of assessment methodology should be done with great care and attention because it can support the implementation of policies favouring higher levels of grant or debt financing of public infrastructure projects, in other words, the discount rate can be used as an instrument to gear public policies. However, is this appropriate for Bulgaria? The implemented approach showed that due to the lack of official statistics and

studies, a lot of assumptions based on external sources need to be made, thus questioning the credibility of the results. Therefore, it is advisable for the Bulgarian authorities to continue applying the reference discount rate from the 2014-2020 period at least for the 2021-2027 programming period.

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FORESTRY ENTERPRISES DIAGNOSTIC AUDIT OF COMPLIANCE WITH THE SOCIAL RESPONSIBILITY PRINCIPLES⁴

This article improves the methodological approaches to the formation of diagnostic audit of forestry enterprises on the basis of international standards FSC and SA 8000. Three components of the audit and corresponding groups of indicators are proposed as: institutional (including indicators of compliance with the current legislation, organizational structure and management system effectiveness requirements), social (indicators of labour safety, personnel safety, corporate social responsibility, interaction with stakeholders), environmental (indicators of forest management, forest protection, economic measures implementation and their impact on the environment). The methodology was tested on the materials of the state enterprise "Kivertsivske Forestry". The results show that whilst enterprises mainly operate in accordance with the social responsibility principles, but there are identified several positions that need to be improved.

Keywords: social responsibility; forestry enterprises; international standards; diagnostic audit.

JEL: M14; Q23; H83

1. Introduction

During the years of Ukrainian independence, there are contradictions between the state and business, business and society. These contradictions are manifested in the unwillingness of businesses to fully comply with their obligations to the state, as evidenced by the presence of

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a large shadow economy; and frequent disregard by the business of the social functions performance, as evidenced by violations of legislation on labour and environmental protection. Therefore, the issue of forming the theory, methodology and technologies for conducting socially responsible business in Ukraine as a whole, and in the field of Forestry in particular, remains highly relevant. The latter is due to the forestry activities' specificity and versatility and their interaction with many other stakeholders.

Therefore, the problem of substantiating methodical approaches to assessing the social responsibility level and diagnosing the ability of an enterprise to implement the principles of social responsibility in its activities is being actualized.

This study is aimed to develop a methodology for a diagnostic audit of forestry enterprises' compliance with the social responsibility principles; its approval on the materials of the state enterprise "Kivertsivske Forestry".

2. Reference Sources Review

In the European Union, the social responsibility of business is considered as a key factor in improving the enterprises' competitiveness and increasing human living standards and social standards as a whole (Cherchyk, 2021). There is a clear understanding that the business use of social responsibility principles is a strategic priority of each enterprise, making a basis for their sustainable development.

The Green Paper of the European Union (Green Paper, 2001) defines corporate social responsibility (CSR) as "the integration of social and environmental aspects into the day-to-day commercial activities of enterprises and into their interaction with stakeholders on a voluntary basis". The International Business Forum for Social Responsibility (Business for Social Responsibility, 2006) defines CSR as "achieving commercial success through means that involve ethical values and respect for people, communities and the environment". The International Business Leaders Forum (International Forum of business leaders, 2020) defines CSR as "promoting responsible business practices that benefit business and society and help achieve socially, economically and environmentally sustainable development by maximizing the positive impact of business on society while minimizing its negative impact". The World Business Council for Sustainable Development (World Business Council for Sustainable Development, 2016) defines CSR as the "commitment of business to contribute to sustainable economic development by working with workers, their families, local communities and society at large to improve their quality of life".

According to the international standard ISO 26000 "Guidance on social responsibility", the social responsibility is "...the responsibility of an organization for its decisions and activities impact to the society and the environment through transparent and ethical behaviour that contributes to sustainable development, including account the health and well-being of society, takes into account the expectations of stakeholders and complies with current legislation, is consistent with international norms of behaviour and is integrated into the activities of the entire organization" (ISO:26000 "Guidance on social responsibility", 2010).

Scientists revealed an extensive interest in this topic. In particular, a systematic review of the CSR and business ethics concepts was given in the study by Gheraia, Z., Saadaoui, S. and Abdelli, H. (Gheraia et al, 2019); the historical path of social responsibility concepts development is traced in the works of Amin-Chaudhry, A. (Amin-Chaudhry, 2016), Ahmadian, A. and Khosrowpour, S. (Ahmadian, 2017), Carroll, A. B. (Carroll, 2008).

The CSR and sustainable business topics were studied by D'Amato, A., Henderson, S. and Florence, S. (D'Amato et al., 2009). The work (Kostetska et al., 2021) considers social entrepreneurship in nature management as a transformation of population impressions and experience into the region's economic growth in order to achieve personal well-being based on the inclusion principles.

Current practices of social responsibility trends and sustainable business use worldwide and in Ukraine are considered in the studies by Pochtovyuk, A., Semenikhina, V., Onyshchenko, O., Ruban, B. (Pochtovyuk et al, 2019). In particular, ones of the social responsibility principles' implementation forms in the Forestry field are the model forests (Cherchyk et al, 2019) and models of forest management support (Fontes et al, 2010).

A systematic study of the grounds, implementation forms and consequences of CSR standards spreading was carried out by Lister, J. (Lister, 2011). The author emphasizes that these standards currently solve the problems of sustainable development in many sectors, including forestry. However, their application becomes unsystematic without the government's attention, especially due to the deterioration of environmental and social conditions in vulnerable regions. Therefore, the research evaluates the role of the public sector in CSR, which can solve the questions posed by the author. In particular, forest certification management helps governments better manage the commercial forest sector and forest resources.

Hohnen, P. and Potts, J. (Hohnen et al., 2007) summarized existing approaches, international examples of selected CSR best practices and tools currently in use.

The issue of evaluating the enterprises' socially responsible activities' effectiveness has also been considered in numerous scientific research items. In particular, Litvinenko T. (Litvinenko, 2006) identifies the following areas of socially responsible activity: personnel development; health protection and safe working conditions; socially responsible restructuring; environmental protection and resource conservation; development of local communities; Good Business Practice. Scientist in work (Vorona, 2010) offers a system of indicators in four areas: personnel, business, society and enterprise image.

In the works (Levytska, 2012) and (Sayenko, 2005) the following indicators are proposed: expenditures on social measures, the effects of their implementation, the effectiveness of these measures, changes in the structure of a certain resource (staff stability, age structure of personnel, innovation activity).

In the article (Kalinescu et al., 2015) was developed an approach to assess value creation flows, including an indicator of social value as a result of the company's social interaction in the following areas: employees, consumers, ecology/society.

As for practical application, the most common methods and indicators for assessing social responsibility are the following:

- methodology for determining the enterprise's social investments effectiveness according to the United Nations Development Program;
- indices of socially responsible investment (FTSE4Good) reflecting environmental sustainability, positive engagement with stakeholders, and human rights protection and support (developed by the London Stock Exchange and the British Financial Times);
- the London Comparative Analysis Group model based on an assessment of the companies' contribution to the communities development and support;
- the London benchmarking group's initiative, which includes evaluating four types of cooperation: charitable donations; social investments or investments to the community; commercial initiatives; business practices;
- transparency and accountability index (by Beyond Business Ltd).

The evaluation process components are the means and methods of collecting and processing information. In particular, social accounting, audit and reporting, social monitoring and internal diagnostic audit are used to assess the social responsibility principles achievement level. Each system is quite flexible and has certain advantages and disadvantages. According to the authors, for this study advisable is to apply an internal diagnostic audit system, taking into account the forest management activities specifics and areas for improving the management systems.

3. Methodology

Diagnostic audit of forestry enterprises' compliance with the social responsibility principles should be comprehensive, take into account the social and environmental factors that form the forestry management system, and serve as the basis for making managerial decisions to ensure environmental safety and social justice.

The diagnostic audit must meet the following requirements:

- express strategic priorities of relations in the Forestry field and principles of sustainable forest development;
- cover the main activities of the enterprise;
- use a limited but sufficient number of indicators that characterize social, environmental, and economic processes;
- be accessible to stakeholders and the public;
- be flexible, take into account the social and environmental processes' dynamics;
- ensure comparability of indicators in time and space (Sinyakevich, 2007).

The diagnostic audit aims to identify weaknesses in assessing the level of Forestry compliance with the social responsibility principles. This makes it possible to develop a system of measures for minimizing threats and negative consequences of a social, economic and environmental nature.

Stages of diagnostic audit:

- 1) determination of approaches to the diagnostic audit system formation;
- 2) clarification of the diagnostic audit directions and components;
- 3) identification of the main criteria and indicators;
- 4) identification of the enterprise's and its reporting system's ability to generate a baseline for diagnostic audit;
- 5) creating an output database;
- 6) clarification of the individual indicators system within the main groups;
- 7) development of a methodology for processing indicators;
- 8) analysis of the enterprise's state by certain indicators groups;
- 9) assessment of indicator systems' compliance with established criteria (European Commission, 2021).

Since many forestry enterprises in Ukraine have certified management systems according to international ISO standards and work according to the Forest Stewardship Council (FSC) criteria, it is advisable to focus on these standards' indicators and criteria.

Therefore, the formation of a diagnostic audit indicators system is carried out in two directions: on the basis of international standards FSC and SA 8000 (Verkhovna Rada of Ukraine, 2007). Taking into account the specifics of the Forestry enterprise's activities, we consider it appropriate to distinguish three components of diagnostic audit: institutional, environmental and social (Ministry of Finance of Ukraine, 2011).

The Forestry enterprises' reporting system study concerning the formation of the initial base for diagnostic audit allowed us to draw the following conclusions:

- 1) information on FSC certification criteria is fully provided both in the framework of statistical and financial statements, as well as audit reports on compliance with the FSC certification requirements;
- 2) indicators of the diagnostic system's institutional, environmental and economic components are sufficiently provided;
- 3) indicators of the diagnostic audit social component are partially provided, in particular, to a sufficient extent in relation to personnel; indicators of interaction with stakeholders and social responsibility require additional research.

To solve this problem, one can use the recommendations for conducting the social responsibility self-assessment according to the SA 8000 standard. For the public recognition of self-assessment results, it is recommended to publish them in external media, which will

help improve the image of Forest Enterprise (FE). For this purpose, so-called non-financial reporting is formed, which is quite common abroad in the field of ecology and corporate social responsibility (it is published by 95% of Western companies).

The stage of forming the source data database involves studying reports and selecting indicators for the declared components of the diagnostic audit.

This allows to determine groups of indicators for each component, taking into account the specifics of forest management activities.

The institutional component includes indicators required under FSC certification. We have identified the following groups of indicators and corresponding verifiers:

1) compliance with the current legislation requirements:

- legal registration (extract from the Unified State Register of legal entities; constituent documents of the company);
- legal land ownership (state act on the right of forest land plots permanent use; planning and cartographic materials of forest management; forest management project);
- timely payment of all established fees related to forestry (accounting and tax reporting);
- legality of activities, including anti-corruption policies (inspections acts of compliance with legislative provisions, rules and regulations in the field of the forest, land, environmental protection and other legislation applicable to the enterprise);

2) efficiency of the organizational structure and management system:

- measures to ensure protection against restricted or illegal actions regarding the harvesting of wood and non-wood products of the forest, hunting and other illegal activities (availability of forest protection staff workers; dynamics of forest violations indicators);
- competence of management, its ability to think strategically, professionalism in making managerial decisions, modern management technologies availability (enterprise development strategy, job descriptions of managers; internship and professional development programs for managers);
- availability of a modern environmental-oriented corporate culture (enterprise development strategy, job descriptions);
- the level of social and labour relations regulation (the ratio between the number of production and management processes for which norms, procedures and rules have been developed to their total number).

The indicators system of the Forestry enterprises diagnostic audit institutional component is compiled according to FSC-STD-UKR-01-2019 V 1-0 FSC – a national standard for the forestry management system for Ukraine.

The social component includes indicators in accordance with the FSC certification and the international standard SA 8000 requirements. Therefore, a group of corporate social responsibility indicators is additionally identified:

1) labour safety indicators:

- personnel employed in harmful and dangerous working conditions; frequency and severity of occupational injuries and occupational diseases (statistical reporting, occupational injuries level);
- the share of employees working in difficult and harmful working conditions (the ratio of the number of personnel employed in conditions that do not meet sanitary and hygienic standards to the average number of employees);
- average number of disability days per employee (the ratio of unworked time due to temporary disability to the personnel number);

2) personnel safety indicators:

- practice and conditions of employment in accordance with ILO Conventions (employment orders; materials of inspections by relevant state authorities);
- availability of labour organizations and agreements which are the result of collective negotiations (collective agreement; minutes of collective bargaining);
- gender equality (personnel and statistical reporting; employee's settlement and payment statement);
- compliance with occupational health and safety rules to protect employees from occupational threats to safety and health (rules (instructions, manuals) on occupational health and safety);
- indicator of rights and freedoms implementation (the ratio of losses incurred by the enterprise due to the violation of legal norms and the total amount of losses prevented by the legal service);
- coefficient of the personnel material needs satisfaction (the ratio of average monthly salary per employee to its minimum level in the country);
- personnel stability coefficient (personnel and statistical reporting);

3) indicators of corporate social responsibility:

- salary level, its growth rate (employee's billing and payment list or other relevant documents);
- availability of a social package, mandatory and voluntary social insurance (industry agreement; collective agreement);
- cases of human rights violations, forced and children labour (personnel and statistical reporting; availability of lawsuits);

- number of education, advanced training, internship programs and number of their participants (personnel and statistical reporting);
- preventive measures to reduce occupational risks (collective agreement; personnel policy);
- cases of discrimination and reactions to them (personnel and statistical reporting; availability of lawsuits);
- retraining and advanced training of employees according to the program and requirements (staffing table; materials of employees' periodic certification/re-certification);

4) indicators of interaction with stakeholders:

- public access to disputes resolving (journal of Citizens' Appeals registration, book of Citizens' Appeals);
- appropriate employment opportunities for local communities and other services in accordance with the scale of economic activity (staffing table; employee personal registration cards; job ads);
- projects that contribute to local benefits under implementation (list of activities carried out by the enterprise to support local socio-economic benefits);
- local community involvement in determining the special significance places to which they have legal or customary rights (a certain list of places of special cultural, environmental, economic, religious or spiritual significance for local communities; forest management project);
- an enterprise, involving the interested parties in determining a list of wood and non-wood resources and ecosystem services that can strengthen the local economy (forest management project; strategic plan of the enterprise; the company's charter; documented evidence of stakeholder engagement);
- parties whose interests are affected are given the opportunity to be involved in monitoring and planning economic activities (register of parties whose interests are affected, involved in the negotiation process; evidence of cooperation with parties whose interests are affected).

The environmental component of the diagnostic audit includes indicators of forest management, forest protection activities, implementation of economic measures and their impact on the environment:

1) indicators of forest management sustainability:

- indicator of natural reforestation (share of natural forest renewal in the total area of logging);
- indicator of artificial reforestation in forest clearings (share of artificial reforestation in clearings);

- indicator of forest formation and improvement (share of sanitary and maintenance logging in the total area of logging);

2) indicators of forest protection activities:

- indicator of wood loss due to illegal logging (the ratio of illegal logging volume to the estimated cutting area);
- indicator of wood loss due to fires (the ratio of burned and damaged forest volume (in m³) to the estimated cutting area);
- indicator of forest tree stands death (share of lost areas in the total area of logging);
- indicator of selected forest areas conservation that has special environmental, cultural and historical significance and registered in the status of special territories (share of protected forest areas that have the special territories status);

3) indicators of economic measures implementation and their impact on the environment:

- the level of environmentally oriented infrastructure development (forest management project; documentation on road construction and infrastructure development);
- harvesting and extraction of wood and non-wood forest products are carried out in a way that is aimed at preserving the environmental values (forest management project; logging and forest tickets; technological process maps);
- harvesting technology aimed at optimizing the use of wood and non-wood forest products and liquid materials (forest management project; maps of the cutting process; certificates of harvesting sites inspection);
- waste disposal in an environmentally acceptable way (waste passport);
- environmental values and impacts; monitoring and assessment of economic activity's possible negative impacts (report on the environmental impact assessment; passports of natural reserve fund (NRF) objects; maps that show environmental values);
- implementation of measures to prevent the economic activity's negative impacts on environmental values (documented list of implemented corrective actions; regulations (passports) and security obligations for NRF objects).

The next step is to develop a methodology for processing indicators. Here one can use two approaches:

1) Diagnostics of compliance by individual indicators;

2) Diagnostics of compliance by indicator groups.

In our research, it is convenient to choose the first approach, as it allows you to identify the strengths and weaknesses of the enterprise. If the actual data meets the requirements, the Availability mark has a value of 1, when it does not meet – 0, and partially meets – 0.5. A negative value is not allowed. This will be the basis for attracting the necessary resources and assessing the various impacts of production and economic processes on the environment.

The sequence of Forestry Enterprises diagnostic audit we propose, in our opinion, allows one to identify the state and shortcomings of the enterprise's management system and to develop measures for improvement.

4. Methodology Testing

The proposed methodology was tested on the materials and results of studying the activities of the state enterprise "Kivertsivske Forestry".

4.1 diagnostic audit of social responsibility: institutional indicators

To analyze the institutional component, we use the criteria and indicators required for FSC certification (Table 1).

The legal status of SE "Kivertsivske Forestry" is a legal entity and business entity of the economy public sector. At the same time, the company carries out its activities on a commercial basis in accordance with the current legislation of Ukraine and the enterprise's Statute approved by the property management authority, maintains an independent balance sheet, has settlement, currency and other accounts, and a seal.

The financial and economic activities of the enterprise subject are carried out in accordance with legislative, regulatory, instructional and methodological materials related to forestry in Ukraine. Taxes are paid on time in full.

The regulation and control over the activities of the SE "Kivertsivske Forestry" is carried out by the following authorities: State Fiscal Service, statistical bodies – control over the timeliness of reporting, the correctness of accrual and disburse of relevant payments to the budget; State Labor Service – control over the registration of labour relations with employees, their remuneration, compliance with minimum state guarantees in remuneration (annual leave, overtime pay, actual working hours), their working conditions and labour protection; Kivertsivsky District Department of fire supervision – control of fire safety; Kivertsivsky Department of PrJSC "Volynoblenergo" – safety control when using electricity, Environmental Service – control over environmental pollution standards, sanitary and epidemiological service-control over compliance with sanitary and hygienic conditions in the workplace, etc. There were no lawsuits or violations during the study period.

So, according to the first criterion, full compliance with the legislation requirements has been identified.

Indicators of the organizational structure and management system effectiveness indicate the proper organization of measures to protect the forest from restricted and illegal activities, the availability of qualified forest protection staff; the management competence in the formation of strategic activity areas in general and particularly the corporate culture formation. However, the corporate culture environmental orientation is not completely clearly defined as a priority, as evidenced by the regulations and Statute of the enterprise and the results of the employees' survey.

Table 1. The indicators system of the forestry enterprises diagnostic audit's institutional component of the state enterprise "Kivertsivske Forestry"

| Group and name of the indicator | Verifiers | Availability mark |
|---|--|--|
| Indicators of compliance with legal requirements | | |
| 1.1.1. ⁵ Legal registration | Extract from the Unified State Register of Legal Entities. Constituent documents of the company. | 1 1 |
| 1.2.1. Legal land ownership | State act on the right of forest land plots' permanent use. Planning and cartographic materials of forest management. Forest management project. | 1 1 1 |
| 1.3.2. Payment of all legally established fees related to Forestry management is carried out in a timely manner. | Accounting tax reporting. | 1 1 |
| 1.3.3. Legality of activities, including 1.7.5. anti-corruption policy | Acts of inspections of compliance with legislative provisions, rules and regulations in the field of the forest, land, environmental protection and other legislation applicable to the enterprise | 1 (no lawsuits or rules violations) |
| Performance indicators of the organizational structure and management system | | |
| 1.4.1. Measures to ensure protection against illegal or restricted harvesting of wood and non-wood products of the forest, hunting, fishing, harvesting, and other illegal activities | Availability of forest protection workers staff Dynamics of indicators for violations (1 – if dynamics of illegal or restricted activities is negative, 0 – if available illegal or restricted activities) | 1 1 |
| competence of the company's management, its ability to think strategically, personnel professionalism in making managerial decisions, possession of modern management technologies | Employee survey, certification results, certificates of advanced training | 1 1 1 |
| availability of a modern eco-oriented corporate culture | Employee survey, company development strategy, job descriptions | 0.5 |
| Level of social and labour relations regulation | The ratio between the number of production and management processes for which norms, procedures and rules have been developed to their total number | 0.7 |

Source: reporting, regulatory documents of the enterprise, survey results.

A high level of social and labour relations regulation for administrative personnel has been established. There are job descriptions, developed norms, procedures and rules for a significant part of production processes, mainly those where working conditions differ from normal (severe and harmful working conditions).

Thus, the second criterion revealed partial non-compliance with the criteria.

⁵ Indicator items of the corresponding criterion FSC-STD-UKR-01-2019 V 1-0 FSC national standard of the forestry system for Ukraine were used

4.2. Diagnostic audit of social responsibility: social indicators

The social component includes indicators of labour safety, personnel safety, corporate social responsibility, and indicators of interaction with stakeholders.

Further, we proceed to analyse in more detail the labour safety indicators that characterize the risks of occupational injuries, severe and harmful working conditions, and morbidity (Table 2).

Table 2. Labour safety indicators at the state enterprise "Kivertsivske Forestry"

| Indicator name | Calculation formula/verifiers | Availability mark |
|--|---|-------------------|
| 2.3.6. Employed in harmful and dangerous working conditions. Frequency and severity of occupational injuries and occupational diseases | Statistical reporting | 0.5 |
| | Level of occupational injuries | - |
| Percentage of employees working in difficult and harmful working conditions | The ratio between the number of employees employed in difficult and harmful working conditions to the average number of employees | 26% |
| Number of occupational injuries | Company reports, sick leave | 1 case per year |
| Average number of disability days per employee | The ratio of unworked time due to temporary disability to the employees' number | 15 |

Source: calculated based on enterprise data.

According to the law of Ukraine "On labour protection", all employees whose activities are related to the organization of safe work are trained once every three years, as well as tested on knowledge of labour protection in the Lutsk training centre. Professional and technical training and periodic testing of staff knowledge by speciality are also provided for employees of the pine drying plant and boiler houses. They take courses at the training centre and receive appropriate certificates. Preliminary and monthly occupational safety and health briefings for all employees of the enterprise are carried out by the labour safety engineer.

Since 2014, the production divisions of the state enterprise "Kivertsivske Forestry" carry out certification of workplaces according to working conditions, which is provided by employees of the state enterprise "Volyn Expert and technical centre of Public labour sector of Ukraine". The proportion of workers engaged in difficult and harmful working conditions has increased due to the reduction of administrative and support staff. However, the level of injuries decreased, as did the duration of disability of one employee, which is a positive trend. Therefore, this group of indicators should be rated 0.5.

Personnel safety indicators (Table 3) include such components as compliance with current legislation, norms and rules in the field of labour and work with personnel.

In the study period, the average number of employees decreased. The largest number of workers and their share in the staff structure changes from 56.9% in 2020 to 52.2% in 2019. This category includes loggers, drivers of logging trucks and loaders, operators of woodworking machines, carpenters, repairmen, stackers and sorters of materials, boiler house machinists, and technical workers. In 2019, some specialists were laid off, so the share

in the structure decreased from 36% to 29.3%. The number of managers during the entire study period changed slightly – from 20 to 17 persons, and their share in the personnel structure increased from 9.8% to 13.8%. There were 2 ordinary employees: a typist and a rationing officer. Employees with higher education predominate among the staff. Their share in the personnel structure ranged from 43.9% to 52.8%. Such indicators of the number and structure of personnel indicate that the company is sufficiently provided with qualified employees.

Table 3. Personnel safety indicators at the state enterprise "Kivertsivske Forestry"

| Indicator name | Calculation formula/verifiers | Availability mark |
|---|---|--------------------------------------|
| 2.1.1. Employment practices and conditions in accordance with ILO Conventions | Job placement orders. Materials of inspections by relevant state bodies. | 1 1 (no violations detected) |
| 2.1.2. Availability of labour organizations and 2.1.3. agreements that are the result of collective bargaining | Collective agreement. Minutes of collective bargaining. | 1 1 (no violations detected) |
| 2.2. Gender equality | Personnel and statistical reporting. Employee's payroll. Working hours use timesheets. | 1 (no violations detected) 1 1 |
| 2.3. Compliance with occupational health and safety regulations to protect against occupational threats to safety and health. | Rules (instructions, manuals) on occupational health and safety | 1 (no violations detected) |
| Indicator of the realization of rights and freedoms | The ratio of losses incurred by the enterprise as a result of legal norms violation and the total amount of losses prevented by the legal service | 1 (no violations detected) |
| Coefficient of the personnel material needs satisfaction | The ratio of the average monthly salary per employee to its minimum level in the country | 1 (1,78) |

Source: according to the data of the enterprise's reporting.

The number of men and their share in the staff structure had a significant advantage during the entire study period: more than 70%. This ratio corresponds to the specifics of the company's activities, so one should not talk about gender inequity here.

Consequently, these indicators revealed full compliance with the established criteria.

Corporate social responsibility is one of the corporate culture and personnel policy components at the state enterprise "Kivertsivske Forestry", carried out in accordance with the regulation on personnel policy, the main tasks of which are optimization and stabilization of personnel, the application of an effective system of employees motivation, ensuring the responsibility of employees for the performance of their duties, compliance with Labor and production discipline, staff development, the formation and maintenance of a favourable

socio-psychological climate in the team. Indicators of corporate social responsibility are reflected in Table. 4.

Table 4. Indicators of corporate social responsibility of SE "Kivertsivske Forestry"

| Indicator name | Calculation formula / verifiers | Availability mark |
|---|--|---|
| Salary level, its growth rate | Employee's payroll statement | 1 |
| Availability of a social package, mandatory and voluntary social insurance (pension) | Industry agreement. | 1 |
| | Collective agreement. | 1 |
| Cases of human rights violations, forced and child labour | Personnel and statistical reporting. Availability of lawsuits | 1 1 (no violations detected) |
| Number of education, advanced training, internships, and foreign language learning programs; number of staff participating in those programs | Personnel and statistical reporting. | 5 programs |
| | | 12 persons |
| Preventive measures to reduce occupational risks | Collective agreement. HR policy | 1 1 |
| Cases of discrimination and response to those cases | Personnel and statistical reporting. | 1 (no violations were detected) |
| | Availability of lawsuits | 1 (no lawsuits were filed) |
| Retraining and advanced training of employees is carried out according to the program that meets the requirements of corporate social responsibility. | Personal accounting cards. Job descriptions. Materials of employees' periodic certification/re-certification | 0.5 (not all applications of corporate social responsibility are reflected in advanced training programs) |

Source: according to the data of the enterprise's reporting.

The level of wages and their growth rate are among the highest in the region. The collective agreement provides for a social package, mandatory and voluntary social insurance. There were no cases of human rights violations, forced and child labour, or discrimination.

The company constantly conducts professional training and retraining of employees in accordance with changes in production and management technologies, forestry management, and technical equipment. Professional training and retraining of workers take place on-the-job, at the workplace. Mentoring is applied. During 2019-2021, 76 employees were covered by such training. For management personnel, regular professional development is provided according to plans and schedules. Over the past three years, 9 personnel members have been taking courses at the Forestry Engineering University in Lviv city to improve their skills. Regional seminars are regularly held with the participation of representatives of the State Forest Resources Agency of Ukraine, as well as practical seminars on the basis of a specific forestry enterprise. Certification of employees is carried out according to plans once every three years in the Volyn Regional Department of Forestry and Hunting, the director of the enterprise undergoes the certification in the State Forest Resources Agency of Ukraine. Based on the certification results, career growth plans are formed (State Forest Resources Agency of Ukraine, 2014; Volyn Regional Department of Forestry and Hunting, 2014).

Thus, according to this criterion, compliance with all but one of the criteria was found.

Indicators of interaction with stakeholders are shown in Table 5.

Table 5. Indicators of interaction with stakeholders at the state enterprise "Kivertsivske Forestry"

| Indicator name | Calculation formula/verifiers | Availability mark |
|---|--|--|
| There is a dispute resolution procedure accessible to the public; it is developed by culturally appropriate involvement of parties whose interests are affected | The dispute resolution procedure is documented. Documentation confirming the disputes' existence and measures taken | 1 (Register of Appeals, book of Citizens' Appeals) |
| The company should provide local communities, contractors and suppliers with employment opportunities, training and other services in accordance with its business activities | Job ads/staffing announcements Staffing table. Employee personal registration cards. | 1 (employees of the enterprise are mostly local residents) |
| Projects and additional activities that contribute to local socio-economic benefits and are proportional to the socio-economic impact of the activities are implemented and/or supported. | List of activities carried out by the enterprise to support local socio-economic benefits. | 1 |
| Places of special cultural, ecological, economic, religious or spiritual significance to which local communities are entitled are determined by their involvement in a culturally appropriate way and recognized by the enterprise. | List of places of special cultural, ecological, economic, religious or spiritual significance is presented in documents and on maps. Forest management project. | 1 1 |
| The enterprise, with the involvement of stakeholders, determines a list of wood and non-wood resources and ecosystem services that can strengthen and diversify the local economy | Forest management project. Strategic plan of the enterprise. The company's Articles of Association. Documented evidence of stakeholder engagement | 1 1 1 1 |
| Parties whose interests are affected are given the opportunity to be involved in the processes of activities monitoring and planning | Register of parties whose interests are affected and involved in the negotiation process. Evidence of cooperation | 1 0.5 |

Source: according to the data of the enterprise's reporting.

Interaction with stakeholders largely depends on the effectiveness of the communication system that accompanies all the processes taking place in the state enterprise "Kivertsivske Forestry". First of all, these are communications between levels, divisions and employees of the forestry enterprise, carried out both in the horizontal plane and vertically: from the highest levels of management to the lowest, and "from bottom to top". At the same time, these are communications between the state enterprise "Kivertsivske Forestry" and external residents of the territory where the facilities of the state enterprise "Kivertsivske Forestry" are located. For external communications, the company uses meetings, discussions, telephone conversations, mail, internet services (website, electronic mailboxes, etc.), memos and reports.

The state enterprise "Kivertsivske Forestry" maintains an official information transfer routine, created by the organization's management, and informal ones formed on interpersonal relationships in the organization and abroad.

Internal communications of the state enterprise "Kivertsivske Forestry" are differentiated according to the degree of subordination into vertical (ascending or descending), diagonal and horizontal (information exchange channel for coordinating actions). The distribution of responsibility and authority between the decision-making process management stages in the state enterprise "Kivertsivske Forestry" is presented in Table 6. Strengthening of both internal and external interaction in the state enterprise "Kivertsivske Forestry" is carried out due to the functioning of a unified information system, an electronic document management system.

Table 6. Decision-making powers in the state enterprise "Kivertsivske Forestry"

| Management decision stages | Management decision subjects |
|---|--|
| Preparing a management decision | Director, deputy directors |
| Providing management decision-making and decision-making procedures | Director, deputy directors |
| Planning a management decision | Director, deputy directors, accountant, heads of departments |
| Execution of a management decision | Departments and divisions |
| Monitoring the decision implementation | Director, deputy directors |

Source: according to the data of the enterprise's reporting.

Over the years, this company has established close ties with many consumers of its products and suppliers of material resources.

The waste wood products (firewood, sawdust, seedlings) consumers are the population of the district and region. Ads about the possibility of purchasing firewood or other timber are posted on the office doors, although people themselves contact the forestry department, the lower warehouse for information. Price discounts are provided to wholesale customers when purchasing a large batch of goods. In addition, the company voluntarily provides free wood fuel to single and low-income citizens, disabled people, veterans, and large families, which also increases its popularity among the local population and contributes to the growth of its business image.

But the greatest popularity of the state enterprise "Kivertsivske Forestry" is brought by public relations, in particular, participation in vocational training for schoolchildren and young people to master the forester profession. Thus, on the basis of the Vorotnivsky forestry in the National Botanical Reserve "Vorotniv", the first "Forestry Youth Center" in Ukraine was created. 84 events of various kinds were held here, which were attended by more than 3 thousand people. Open training studios: "The forest doctor school"; "The forest designer school"; "The Hunter School"; "School Workshop"; "School of the young gardener"; "School of the young beekeeper", where career guidance, educational and research work is carried out. On the basis of several forest districts of the state enterprise "Kivertsivske Forestry", school student forestry enterprises have been created and are functioning.

SE "Kivertsivske Forestry" carries out foreign economic activity, allowing to cooperate with foreign partners and investors, exchange experience and technologies, and participate in international exhibitions.

In the communication management strategy at the state enterprise "Kivertsivske Forestry", much attention is paid to communications on the Internet and feedback tracking. The website of SE "Kivertsivske Forestry" is presented in a modern design, reflects the face of the enterprise and forms an image among potential customers and partners and other stakeholders. Modern information technologies provide a one to support and coordinate both technological processes and business activities of the organization.

In order to cooperate with state agencies and other interested parties, the Forestry Enterprise issued an order "On cooperation of the state enterprise "Kivertsivske Forestry" with interested parties" (No. 248/3 dated November 06, 2018). Consultations were held with interested parties: local NGOs – 2; representatives of the local population – 15; state organizations – 5; trade unions – 4; certified organizations – 4.

The state enterprise "Kivertsivske Forestry" has a book of registration for appeals, proposals, applications, complaints and a journal of personal reception of citizens. During this period, local residents regularly applied to the Forestry Enterprise for the purchase of firewood, timber, and financial assistance. No complaints were registered in the book during the study period.

Thus, it can be concluded that according to the results of the institutional and social indicators diagnostic audit, activities compliance of the state enterprise "Kivertsivske Forestry" with the business social responsibility principles was revealed.

4.3. Diagnostic audit of environmental indicators

The environmental component of the diagnostic audit at Forestry Enterprises includes indicators of forest management, forest protection activities, implementation of economic measures and their impact on the environment.

Indicators of forest management and forest protection activities at the same time characterize compliance with the forest renewal and reproduction, principles as well as forest preservation from negative anthropogenic impact (Table 7).

Indicators of forest management stability are not high enough. It is necessary to pay attention to forest self-healing, since the indicator has significantly decreased. Indicators of forest protection activities are consistently high, which has a positive impact on the conservation of woodlands.

The Forestry Enterprise has a monitoring system with the forest protection service, which constantly monitors the forest area according to FSC FM Activity Report.

In forestry, waste associated with logging and timber removal is minimized. In the developed cutting areas, in order to preserve and increase the fertility of the soil cover, cutting residues remain.

Table 7. Indicators of forest management and forest protection activities of the state enterprise "Kivertsivske Forestry"

| Group and name of the indicator | Calculation results | | |
|--|---------------------|--------|--------|
| | 2019 | 2020 | 2021 |
| Indicators of forest management sustainability | | | |
| Natural reforestation indicator | 0.311 | 0.134 | 0.159 |
| Indicator of artificial reforestation in clearings | 0.073 | 0.112 | 0.098 |
| Indicator of forest formation and improvement | 0.755 | 0.827 | 0.851 |
| Indicators of forest protection activities | | | |
| Indicator of wood loss due to illegal logging | 0.0003 | 0.0005 | 0.0006 |
| Indicator of wood loss due to fires | 0.0235 | 0.0000 | 0.0000 |
| Death rate of forest tree stands | 0.128 | 0.060 | 0.142 |
| Indicator of conservation of selected forest areas that have special environmental, cultural and historical significance and have special territories status (special values for conservation) (%) | 27 | 27 | 27 |

Source: according to the data of the enterprise's reporting.

The Forestry Enterprise pays special attention to the natural renewal of forests. Natural reforestation took place in an area of 305 hectares, which is 44.5% of the total reforestation area. Artificial planting of forest crops is carried out in areas where natural renewal is difficult or impossible.

The materials of cutting allotment and the conducted field audit show that logging carried out in order of wood formation and forests improvement contributes to the development of mixed forest tree stands, and reforestation after logging of main use is aimed at creating mixed forests to increase their resistance to diseases.

In the "Project for organization and development of the state enterprise "Kivertsivske Forestry", a strategy has been developed and is being implemented that provides for the transition from large continuous logging to narrow-section and selective logging. The maximum cutting area during main-use logging in a Forestry Enterprise does not exceed 5 hectares.

The analysis of documentation (logging tickets, cutting materials) showed that, in order to reduce the logging negative environmental consequences, old and hollow trees, dead wood, and seed trees of valuable species remain in cutting areas.

The state enterprise "Kivertsivske Forestry" has a high share of protected areas – 27%.

Consequently, the first and second groups of indicators revealed full compliance with the established criteria.

Indicators of economic measures implementation and their impact on the environment produced by SE "Kivertsivske Forestry" are shown in Table 8.

Table 8. Indicators of economic measures implementation at SE "Kivertsivske Forestry" and their impact on the environment

| Indicator name | Verifiers | Availability mark |
|--|---|------------------------------|
| Level of environmental-oriented infrastructure development | Forest management project. Documentation on road construction and infrastructure development. | 1 1 |
| Harvesting and removal of wood and non-wood forest products is carried out in a way aimed at preserving the environmental values | Forest management project. Log tickets. Forest tickets. Maps of the cutting area development technological process. | 1 1 1 1 |
| Harvesting technology is aimed at optimizing the use of wood and non-wood forest products and liquid materials | Forest management project. Logging and forest tickets. Maps of the cutting area development technological process. Statements on inspecting the places of harvesting wood and non-wood forest products. | 1 1 1 1 |
| Waste management in an environmentally acceptable way | Passport of the company's waste. Statistical reporting materials. | 1 1 |
| Monitoring and assessment of possible negative impacts from the economic activity | Environmental Impact Assessment Report. Passports of NRF objects. Forest management project. Forest management materials. List of regional Red Book species. Maps with plotted territories where environmental values are identified | 0.5 1 1 1 1 1 |
| Implementation of measures to prevent negative impacts of economic activity on environmental values | Forest management project. A documented list of implemented corrective actions. Hunting improvement project. Regulations (passports) and security obligations for NRF objects. | 1 0.5 1 1 |

Source: according to the data of the enterprise's reporting.

The company has monitoring procedures that track its business activities. Monitoring of changes in the forest fund state is carried out during continuous forest management by specialists of the Ukrainian State Forest Management Planning Association once per year, and the reserves of non-wood resources are evaluated by specialists during forest management. Based on these estimating results, the use of non-wooden forest products is projected. Forest pathology survey of the sanitary condition of forests is carried out once per quarter, reports of such surveys are drawn up for each Forestry Department, and the "Book of accounting for forest pests and diseases foci" is filled in.

In the process of planning forestry activities, the Forestry Enterprise evaluates their impact on the environment. In the "Project of organization and development of SE "Kivertsivske Forestry" are developed the environmental justifications and measures aimed at reducing the negative impact of forest management on forest ecosystems and the environment, based on "Instructions for assessing the possible social and environmental impact of forest management measures planned, and the environmental consequences of forest management works". When designing, building and reconstructing forestry roads, the Forestry Enterprise evaluates the impact of construction works on the environment.

The Forestry Enterprise has developed procedures for identifying, recording, protecting and monitoring rare and endangered plant and animal species on the territory of the Forest Fund (Order No. 248/5 of November 06, 2017 "On the identification of rare flora and fauna species, their monitoring and protection"). The Forestry Enterprise has compiled a list of rare and endangered plant and animal species that can potentially occur on the territory of the forestry enterprise. To identify rare and endangered species of plants and animals, the Forestry Enterprise involved researchers from the Poliskiy branch of the Ukrainian order "Sign of Honor" Research Institute of Forestry and Forest Melioration named after G. M. Vysotsky and the National Forestry Engineering University of Ukraine. The Forestry Enterprise, together with employees of research organizations, mapped the habitats of rare and endangered plant and animal species.

In forest areas classified under conservation status, logging of the main use is not provided, and forestry is carried out in order to preserve and increase the protective functions of these forest ecosystems. Logging in these areas is assigned in accordance with the forest management project, and when logging the formation and improvement of forests, the undergrowth is preserved.

SE "Kivertsivske Forestry" has implemented a computer program for drawing up cutting areas and accounting for trees, designed to avoid errors in determining areas for deforestation and cutting areas. These works are quickly and accurately performed by the forest allotment and taxing specialist using the electronic GPS system – taking site contours and making plans. After making measurements, the information is downloaded to a computer for further processing. Such equipment is used for laying trails and forest roads, determining the area of forest planting, drawing up plans for areas where it is necessary to improve the forest and logging for the main use. This makes it possible to properly allocate cutting areas, prepares a high-quality cutting fund, insures employees from mistakes, saves time and greatly facilitates work. In the future, it is planned to improve the use of GPS satellite systems for monitoring transport processes and fuel use.

Considerable attention is paid to the implementation of measures for the improvement of recreational forests. There are 6 large recreational points located therein. Places for recreation are created in each locality within the forest districts.

So, for the third group of indicators, compliance with the established criteria was revealed, except for two.

Thus, it can be argued that in general, the state enterprise "Kivertsivske Forestry" operates in accordance with the social responsibility principles. However, problematic issues have been identified that require management's attention, improvement of the management system and possibly transition to an integrated management system (IMS) according to such international standards as ISO 14000 + SA 8000 + FSC.

In our opinion, the main advantages of applying such an integrated approach over the existing ones refer to the ability to consider objects as complex socio-ecological and economic systems, and IMS should be aimed at optimizing interdependent economic, social, technological and natural processes in a single environment. The combination of socially, economically and environmentally oriented systemic and functional international standards

will ensure the implementation of sustainable development principles, socially responsible management in the context of ensuring comfortable living conditions, efficient use of all resources, environmental protection, and prevention of environmental problems. The authors' position is to use the IMS as a tool for ensuring an acceptable level of environmental quality, quality of life, and human development, achieving personal and national security, provides for the use of IMS for objects of various levels, implementation in the system of public management and public administration while ensuring the integrity of the research object and the object of managerial influence.

5. Conclusions

1. Never denying the role of state institutions in creating conditions to activate the implementation of social responsibility principles, we note that, in our opinion, every enterprise or corporation in the current regulatory environment should determine development priorities in accordance with these principles. At the same time, it is possible to use effective tools for implementing the social responsibility principles of business – international standards, the criteria and indicators of which should be used to diagnose the enterprises' social responsibility level.
2. Based on the international standards Forest Stewardship Council and Social Accountability 8000 (FSC and SA 8000), the authors improve the methodological approaches to the formation of a diagnostic audit of Forestry Enterprises' compliance with the social responsibility principles. Ones proposed it as a set of three groups of components: institutional (includes indicators of compliance with the current legislation requirements, the organizational structure and management system effectiveness), social (indicators of labour safety, personnel safety, corporate social responsibility, interaction with stakeholders), environmental (indicators of forest management, forest protection, implementation of economic measures and their impact on the environment).
3. Analysis results of the diagnostic audit institutional component indicators. Indicators of compliance with the legislation requirements got a rating of 1; therefore, full compliance with the current legislation according to the criteria and indicators of FSC certification was established. Performance indicators of the organizational structure and management system mainly meet the established requirements, but there are indicators of partial compliance, namely: the presence of a modern environmental-oriented corporate culture, since as a component it is reflected in the Statute and strategy of the state enterprise "Kivertsivske Forestry". However, there are elements of inconsistency in the activities conducted; the overall level of social and labour relations regulation is quite high, but this is more related to the activities of the management apparatus, and not production activities, so the ratio between the number of production and management processes for which norms, procedures and rules have been developed is 0.7.
4. Analysis results of the diagnostic audit social component indicators. The labour safety indicators generally indicate a high level for administrative personnel, significantly lower for workers engaged in logging and wood processing. The latter are classified as activities with a high risk of occupational injuries, the presence of severe and harmful working

conditions, and working in the open air leads to frequent morbidity. However, in the last three years, there were 2 cases of occupational injuries in 2018 and one in 2019 as well as one in 2020, that is, the level of traumatic injuries is low. The number of temporarily disabled employees decreased from 52 in 2018 to 22 in 2020, which had a positive impact on the average number of disability days per employee (from 16 to 13 days). But the share of employees working in severe and harmful working conditions is quite high – 25-26 %. Personnel safety indicators, including such components as compliance with current legislation, norms and rules in the field of labour and work with personnel, were rated 1, since no violations were detected in any of the positions, and the personnel material needs satisfaction coefficient is higher than the average for the Volyn region. Almost all corporate social responsibility indicators of the state enterprise "Kivertsivske Forestry" were assessed with a value of 1, since no violations were detected, there were no lawsuits. However, studies of retraining and internship programs show that not all the provisions of social responsibility are reflected there, so the score is 0.5. Indicators of interaction with stakeholders cover all of the enterprise's contact groups: consumers, suppliers, foreign partners, residents of local communities, public organizations, and local self-government authorities. However, this is the most problematic group of indicators, since it is still difficult to determine the effectiveness of planned and implemented activities.

5. The environmental component of the Forestry Enterprises diagnostic audit includes indicators of forest management, forest protection activities, implementation of economic measures and their impact on the environment. Indicators of forest management stability are not high enough. It is necessary to pay attention to forest self-healing, since the indicator has significantly decreased. These indicators were highest in 2018. Indicators of forest protection activities are consistently high, which is positive for the conservation of woodlands. The economic measures implementation rates and their impact on the environment at the state enterprise "Kivertsivske Forestry" are also high.
6. International standards and the formation of integrated management systems, based on them, are effective tools for implementing the principles of business social responsibility.

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A COMPARATIVE STUDY OF SEIGNIORAGE: EGYPT AND QATAR²

This study adopts the model of CB's balance sheet and government budget identity developed by Klein & Neumann (1990) to investigate the question of "Will the effect of monetary seigniorage on CPI inflation and real GDP growth be differentiated based upon the adopted monetary policy regime and the initial source of seigniorage?" The study compares Egypt and Qatar, as both countries apply asymmetric monetary policy regimes. Conclusions by structural VAR model are: (i) monetary seigniorage does not affect either CPI inflation or GDP growth in Egypt. The opposite is true in the case of Qatar. (ii) in contrast to the case of Qatar, the mechanism of the money supply channel is broken in Egypt because the central bank of Egypt applies a sterilization policy to maintain dual objectives for monetary policy, namely foreign exchange rate and inflation rate.

Keywords: Monetary Seigniorage; Fiscal Seigniorage; Structural VAR Model; Central Bank's Balance Sheet

JEL: E31; E42; E51; H68; C32

1. Introduction

Two concepts of seigniorage are reported in the literature (Klein, Neumann, 1990, Neumann, 1992; Bjerg, et al, 2017); the opportunity cost seigniorage and the monetary seigniorage. The concept of opportunity cost seigniorage is based upon the so-called state theory of money which regards the issuance of money as a credit with the state that individuals and banks are forced to hold it (Bjerg, et al., 2017; Bell, 2001). Hence, if money is viewed as a zero-interest loan to the government then seigniorage equals the interest savings by the government because of being able to issue securities (or currency) with zero interest rate or force commercial banks to hold reserves at zero interest or below the market interest rates. Therefore, the government revenue from issuing money is equivalent to the private sector's loss from forgone interest earnings by holding currency (or securities) with zero interest rates (Gross, 1989; Klein, Neumann, 1990; Groeneveld, Visser, 1997).

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Empirically, the opportunity cost seigniorage is less attractive because the choice of a benchmark nominal interest rate is somewhat arbitrary and hence the estimates of seigniorage under this approach are differentiated and lack consistency over time, given the change of the nominal interest rate as it is being used as a monetary policy instrument by central banks (CBs).

The second concept of seigniorage which is the ‘monetary seigniorage’ is defined as the difference between the face (or nominal) value of base money and its cost of production and maintenance. Thus, the monetary seigniorage measures the actual wealth transfer from the private sector to the CB. Bjerg, et al. (2017), however, argue that the concept of seigniorage should include both money issuance by the CB and the treasury, and revenues derived from money creation by commercial banks.³

There are many factors that may explain the reliance of governments on seigniorage. (i) The first factor is political instability. Cukierman et al. (1992) argue that the higher the level of political instability the higher the level of myopic government behaviour which translates into a higher level of seigniorage. Myopic governments maintain an inefficient tax system to constrain the behaviour of future governments. However, they compensate the shortage of tax revenue by collecting large seigniorage. (ii) The second is the size of the shadow economy or tax evasion. The shadow economy includes all legal goods and services produced within the economy but concealed from tax authorities (Schneider, Montenegro, 2010). Thus, a large shadow economy is associated with a low capacity to collect taxes and hence increases the reliance of government on seigniorage to offset tax evasion. (iii) The third is the natural resource rents which represent an important source of revenue for the government. The higher the natural resource rents, the less reliant on seigniorage and taxation by the government (Jensen, 2011; Elbahnasawy, Ellis, 2016). (iv) The fourth is the level of corruption within the economy. As corruption deprives the government of additional resources, the government relies on seigniorage to finance its operations. Yousefi (2014) finds evidence that the government compensates for lost revenue because of corruption by increasing the rate of monetary expansion to exploit seigniorage. (v) Finally, the fifth factor is the CB’s independence from the government. That is political independence (i.e., the ability of central banks to select the final objectives of monetary policy) and/or economic or operational independence (i.e., the CB adopts freely its monetary policy instruments). The higher the level of CB independence, the lower the level of seigniorage and hence inflation.

Obviously, all the above-mentioned determinants of monetary seigniorage are somehow related to a common factor which is “chronic budget deficit or equivalently insufficient tax revenues.” As monetary seigniorage represents a transfer of wealth from the private sector to the CB and then to the government budget, this paper utilizes the model of the CB’s balance sheet and the government budget identity developed by Klein & Neumann (1990) to investigate the question of “Will the effect of monetary seigniorage and fiscal seigniorage on the CPI inflation and real GDP growth be differentiated based upon the adopted monetary

³ Given the fact that seigniorage has historically been a source of income to the state, Benes and Michael (2012) and Bjerg, et al. (2017) argue that the prerogative to create money by commercial banks must be shifted back to the government and central banks by imposing 100% reserve banking.

policy regime and the initial source of seigniorage (i.e., being seigniorage initially comes from the assets side or the liabilities side of the CB's balance sheet)?

The study investigates this question in Egypt and Qatar, as both countries apply two differentiated monetary policy regimes, and they have a different experience with the budget deficit and fiscal dominance. The study adopts descriptive and analytical methodologies to investigate the theoretical aspects of monetary seigniorage and to compare monetary seigniorage indicators and the CB's balance sheet between Egypt and Qatar. In addition, the study relies on the structural VAR model to analyze the association between monetary seigniorage and CPI inflation and real GDP growth in Egypt and Qatar.

The remainder of this paper is as follows. Section 2 analyzes the aspects of monetary seigniorage. Section 3 analyzes the association between monetary seigniorage, the CB's balance sheet, and budget deficit. Section 4 compares monetary seigniorage indicators, the CB's balance sheet, and macroeconomic outcomes in Egypt and Qatar. Section 5 discusses the VAR model, variables, and empirical results. Section 6 offers concluding remarks.

2. Aspects of Monetary Seigniorage

Neumann (1992), Klein & Neumann (1990), Groeneveld and Visser (1997), and Bjerg, et al. (2017) regard monetary seigniorage as the total profit derived from money production and maintenance. A simple dynamic form of the monetary seigniorage comes as follows:

$$M_t = M_{t-1} + \Delta M_t \quad (1)$$

$$S_{mt} = \Delta M_t - c\Delta M_t \quad (2)$$

$$S_{mt} = S_{mt1} + S_{mt2} \quad (3)$$

$$S_{mt1} = d_{t-1}(M_{t-1}) \quad (4)$$

Equation (1) accounts for the money supply at the current period where ΔM_t denotes the change in the monetary base (or equivalently, the production or printing of new money by the CB) at the current period. Equation (2) defines net monetary seigniorage, S_{mt} , as the difference between the change in the monetary base, ΔM_t , and the cost of production and maintenance of money, $c\Delta M_t$, where c represents the average cost of production and maintenance of money. According to Equation (3), monetary seigniorage falls into two components, noninflationary seigniorage, S_{mt1} , and inflationary seigniorage, S_{mt2} . Based on Fisher (1911) 'equation of exchange' and Friedman (1956 and 1971), the noninflationary seigniorage, S_{mt1} , occurs when growth in the monetary base is consistent with the long-run growth rate of real GDP as accounted for by equation (4). That is, given the velocity of circulation in the long run, the noninflationary seigniorage at the current period, S_{mt1} , equals the lagged monetary base, M_{t-1} , times the long-run growth rate of real GDP, d_{t-1} . Combining equations 2 through 4, the inflationary seigniorage, S_{mt2} , is accounted for by equation (5) as follows:

$$S_{mt2} = \Delta M_t - d_{t-1}M_{t-1} - c\Delta M_t \quad (5)$$

Equation (5) defines inflationary seigniorage as it is the printing of new money that exceeds the noninflationary limit of money growth which is consistent with the long-run real GDP growth, d_{t-1} . In other words, given $c\Delta M_t=0$, inflationary seigniorage is zero if growth rate in money supply ($\frac{\Delta M_t}{M_{t-1}}$) is equivalent to the long-run growth rate of real GDP, d_t .

Obviously, not all monetary seigniorage will cause a rise in the inflation rate. It is the inflationary seigniorage, but not the noninflationary seigniorage, that could lead to an escalation of the rate of inflation.

Friedman (1971) regards inflation produced by the issuance of fiat money as a tax on cash balances. The real yield from the inflation tax equals the inflation rate times real money stock (or monetary base), such that:

$$RITR_t \left(\equiv \frac{S_{mt2}}{P_t} \right) = \pi_t * \frac{M_t}{P_t} \quad (6)$$

Where, $RITR_t$ stands for Friedman's real inflation tax revenue (synonymous to real inflationary seigniorage, $\frac{S_{mt2}}{P_t}$), π_t stands for the long-run inflation rate, and $\frac{M_t}{P_t}$, denotes real money stock⁴.

Basically, inflationary seigniorage reflects the case of fiscal dominance where the CB is coerced to finance the budget deficit. That is, if the CB cannot resist the government's demands for financing the budget deficit, then the CB is not factually independent (Awad, 2008, 2009).

3. Monetary Seigniorage and Budget Deficit

3.1. Monetary policy regimes and CB's balance sheet

The level and evolution of the monetary base and its counterparts in the CB's balance sheet are governed by the monetary policy regime and monetary policy objectives. Basically, the evolution of the CB's balance sheet comes from the demand for money. The growth in nominal GDP leads to higher demands for money balances by the private sector and, hence, higher demands by commercial banks for loans from the CB to meet their reserve requirements. To maintain its operational target, and, hence, achieve the final goals of monetary policy, the CB responds to commercial banks' demands by supplying the required reserves thereby monetary base expands.

⁴ The term "real inflationary seigniorage", $\frac{S_{mt2}}{P_t}$, from equation 5 is consistent in meaning with the term "real inflation tax revenue, in equation 6, $RITR$. Yet, the two formulas are expected not to deliver identical results because equation 5 considers the cost of production and maintenance of the new issued money, $c\Delta M_t$. In addition, the supply shocks may affect the rate of inflation reported in equation 6. That makes equation 5 more relevant for estimating inflation tax revenue, or "inflationary seigniorage", than does equation 6.

However, a change in the CB balance sheet can be referred to as an initial growth on the assets side which exceeds the demand for money on the liabilities side. The liabilities side is then characterized by either excess reserves or absorption operations of excess reserves by the CB. The sterilization process through the absorption of excess reserves may not be fully implemented given the large scale of excess reserves caused by the growth in the assets side. Importantly, the initial growth on the assets side is mostly caused by government loans from the CB and/or growth in foreign assets because of intervention by the CB in the foreign exchange market to maintain a targeted rate of foreign exchange (Rule, 2015).

Under the exchange rate targeting regime, the CB holds a significant amount of foreign assets and stands ready to intervene in the foreign exchange market to maintain the targeted price of foreign exchange. The intervention by the CB in the foreign exchange market in response to domestic currency depreciation or appreciation pressures will affect the size of the CB's balance sheet. For instance, the response of the CB to depreciations pressures will result in a decline in the foreign assets and hence a contraction in the CB's balance sheet, and vice versa.

If, instead, the CB simultaneously maintains multiple objectives for monetary policy, such as maintaining internal and external stability of the domestic currency, the CB will target the foreign exchange rate and use the nominal interest rate to stabilize the economy. In such a case, the CB will practice a sterilization process to maintain the two targets. That is the CB intervenes in the currency market to build up foreign reserves, but this will result in excess reserves on the liabilities side of the CB's balance sheet which in turn may jeopardize price stability. To maintain price stability, the CB will absorb excess reserves through open market operations and, hence, the nominal interest rate moves up⁵.

Currently, the goal of price stability represents the primary goal of monetary policy to most CBs. If the CB, however, is obliged to contribute to financing a budget deficit, the CB will probably be unable to maintain the goal of price stability⁶.

3.2. The CB's balance sheet and budget deficit

Klein & Neumann (1990) regard monetary seigniorage from two sides. On one hand, it represents a wealth transfer from the private sector to the CB. On the other hand, it is mainly used for financing the government budget deficit. Based on the model of the CB's balance sheet and the government budget identity developed by Klein & Neumann (1990), we derived equation (7)⁷ which links the change in the monetary base both to the budget deficit and other components of the assets side of the CB's balance sheet as follows:

⁵ Under the impossible trinity hypothesis, such a policy of sterilization will not continue so long. Given a free capital mobility, the CB cannot independently move nominal interest rate and maintain fixed exchange rate simultaneously for so long time.

⁶ Indeed, the contribution of the CB in financing budget deficit represents a direct monetization of government debt that could lead to poor macroeconomic outcomes and high inflation. As a result of this, many countries prohibit the direct financing of government debt by the CB. For instance, the Maastricht Treaty, which governs the European Union, includes such a prohibition. For more details on the CB balance sheet, see Rule, G. (2015).

⁷ The derivation of equation 7 is available upon request.

$$\Delta M_t = \Delta A_t + [\Delta B_t + \Delta D_t + e\Delta F_t + \Delta N_t] \quad (7)$$

Equation 7 shows that the change in the monetary base on the liabilities side of the CB's balance sheet, ΔM_t , is matched by changes in both fiscal and non-fiscal factors on the assets side. Non-fiscal factors on the assets side are the factors that are not related directly to financing the budget deficit. They include the purchasing of government debts by the CB in the secondary market, ΔB_t , loans offered by the CB to commercial banks, ΔD_t , acquiring net international reserves through intervention in the foreign exchange market, ΔF_t , where e denotes the nominal exchange rate and the change in other items of the assets side of the CB balance sheet, ΔN_t ⁸.

The fiscal factors that affect monetary seigniorage, however, are explained by the change in the government loans from the CB, ΔA_t , or equivalently the fiscal seigniorage, as follows⁹:

$$\Delta A_t = BD_t - \Delta TB_t - R_t \quad (8)$$

Where the size of fiscal seigniorage or new government loans from the CB, ΔA_t , is based upon the outstanding part of the budget deficit, BD_t , which is not covered by either issuing new government bonds to commercial banks, ΔTB_t , or by profits transferred by the CB to the government budget, R_t . Budget deficit, BD_t , however, is accounted for by equation 9 as follows:

$$BD_t = (G - T)_t + b(TB)_t + a(A)_t \quad (9)$$

Where, $(G - T)_t$ denotes the primary budget deficit which is the difference between government expenditure, G , and government taxes, T . $b(TB)_t$ denotes interest expenditure on government bonds, i.e., $(TB)_t$ stands for total government bonds and b stands for the nominal interest rate on government bonds. $a(A)_t$ represents the interest expenditure on government loans from the CB, i.e., a stands for the interest rate on government loans from the CB and $(A)_t$ denotes total government loans from the CB.

In comparison to equation 2, equation 7 underscores the composition of the monetary seigniorage, S_{mt} , given the cost of production and maintenance of newly produced money, $c\Delta M_t$. Clearly, both fiscal and non-fiscal factors in equation 7 are positively related to the monetary seigniorage.

In comparison to equation 5, equation 7 underscores fiscal and non-fiscal factors that cause a change in the monetary seigniorage thereby inflationary seigniorage, S_{mt2} , occurs, given the long-run growth rate of real GDP, d_{t-1} and the cost of production and maintenance of

⁸ Ellis and Elbahnasawy (2017) investigate the question of how the degree of exchange rate management affects the relationship between seigniorage and the government's natural resource revenues. One conclusion of this study is that under a fixed exchange rate regime an increase in the natural resource rents results in an increase in the domestic monetary base and, hence, an increase in the monetary seigniorage.

⁹ Rao, Nasir H. (2011) defines fiscal seigniorage as it includes government loans from the CB and profits transferred from the CB to the government budget and revenue from coinage.

money, $c\Delta M_t$. Consistent with equation 7, Edwards and Tabellini (1991) and Roubini (1991) found evidence for a positive correlation between budget deficit and seigniorage.

The association between monetary seigniorage and government loans from the CB is complicated especially when the CB adopts a sterilization policy to coordinate monetary policy objectives. Equation 7 highlights the fact that the change in the monetary base does not necessarily reflect the amount of seigniorage channelled to the government through government loans from the CB. For instance, if the new government loan from the CB is partly matched by an opposite change in some non-fiscal factors, the overall change in the monetary base will not be equal to the change in the government loans from the CB. Also, the monetary base is fixed if the CB applies full-scale sterilization so that the change in the government loans from the CB is totally offset by a change in the non-fiscal factors. Thus, whether or not the government loans from the CB cause monetary seigniorage, it is a practical question that needs to be verified.

In addition, when the CB extends loans to the private sector, reserves on the liabilities side of the CB's balance sheet will increase. Neumann (1996) defines total seigniorage, S_t , as the gross resource flow to the government sector is associated with base money creation. Accordingly, total seigniorage, S_t , in such a case is defined as:

$$S_t = S_{mt} + i^P A_{t-1}^P + i^F A_{t-1}^F \quad (10)$$

Where, S_{mt} is the monetary seigniorage and $i^P A_{t-1}^P, i^F A_{t-1}^F$ are the interest revenue from private sector debt and foreign sector debt, respectively¹⁰.

To sum up, it is the outstanding uncovered part of the budget deficit, but not all of the budget deficit, that may cause fiscal seigniorage or government loans from the CB. Yet, government loans from the CB will not necessarily cause a rise in the monetary seigniorage if the CB sterilizes its effect on the monetary base.

4. Monetary Seigniorage in Egypt and Qatar

4.1. The evolution of the CB's balance sheet

The Qatar Central Bank (QCB) is targeting the foreign exchange rate where the domestic currency, the Qatari Riyal, is fixed with the US dollar at an average price of QR 3.64 per USD since 2001¹¹. The natural resource rent plays a significant role in the Qatari economy where the gas and oil relative share in GDP reaches 38.6% in 2020¹². Given a fixed exchange rate regime, the change in the monetary base on the liabilities side, and, hence, monetary

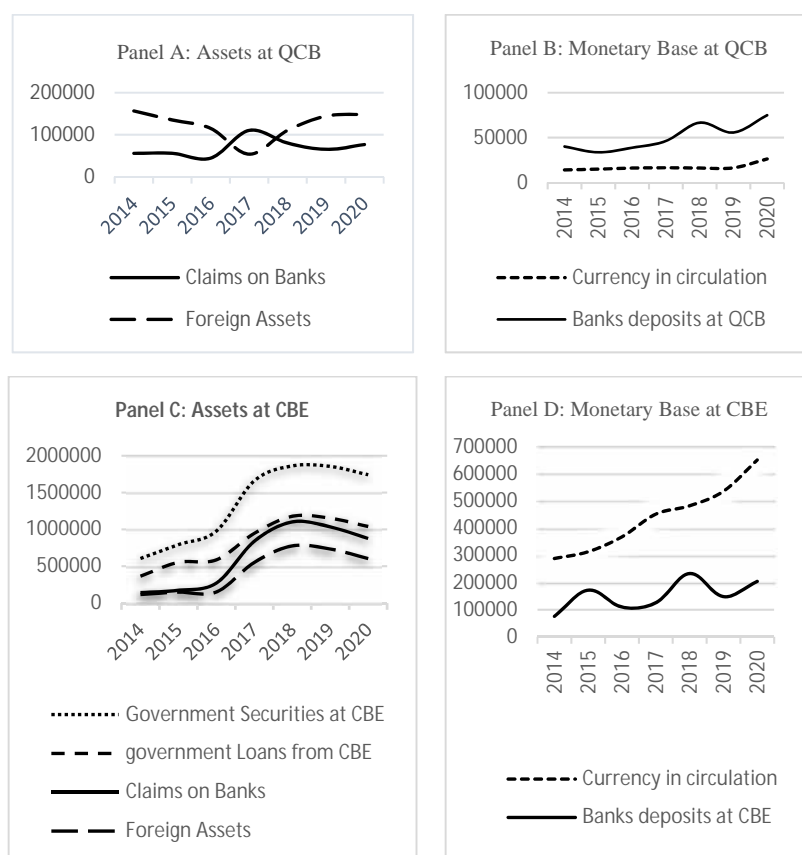
¹⁰ Basically, the interest revenue from loans offered by the CB to private and foreign sectors is included in the CB net profits and only the distributed part of the CB net profits, R_t , is transferred to the government budget as stated by equation 8 in the text above.

¹¹ <http://www.qcb.gov.qa/English/PolicyFramework/ExchangeRatePolicy/Pages/ExchangeRatePolicy.aspx>.

¹² QCB, The Forty Fourth Annual Reports 2020. Available at; <http://www.qcb.gov.qa/English/Publications/ReportsAndStatements/Pages/AnnualReports.aspx>.

seigniorage, is based upon the growth in the oil and gas sector. That is growth in real GDP through gas and oil exports leads to an expansion in the monetary base. Figure 1, Panel B, exhibits a steady growth in the monetary base during the period of 2014-2020, except for the crises of 2017 when some Arab countries cut their diplomatic and economic ties with Qatar¹³. With the onset of the crises, the QCB intervened in the market to mitigate financial panic by providing banks with additional liquidity, thereby banks' reserves rose.

Figure 1: Balance sheet of the ECB and the QCB



Source: Figure 1 is prepared by the author. Data on CB's balance sheet is collected from QCB and CBE Annual Reports; in different years.

Jensen (2011), and Elbahnasawy and Ellis (2016) indicate that countries with high resource rents rely less on both inflationary seigniorage and taxation. This is correct in the case of Qatar where the asset side of the QCB's balance sheet (Figure 1, Panel A) does not include

¹³ On 5 June 2017, Saudi Arabia, the United Arab Emirates, Bahrain, and Egypt cut diplomatic and all economic relations with Qatar. In January 2021, however, a process of reconciliation started to resume diplomatic and economic ties.

any government loans from the QCB. The influential part of the assets side of the QCB's balance sheet, however, is the foreign assets. To maintain the fixed foreign exchange rate, the QCB builds a significant amount of foreign assets thus free reserves of commercial banks (included in "banks deposits at QCB", Panel B) in the liabilities side and hence monetary seigniorage goes up, as shown in Panel B.

As for Egypt, the CBE announced the floatation of domestic currency in November 2016 especially after mounting pressures on the Egyptian pound and influential losses in the international reserves. Immediately after the floatation, the Egyptian pound depreciated by more than 50 percent and the CBE responded instantly by raising the nominal interest rate by 300 basis points to prevent the collapse of the domestic currency. One week after the floatation, the IMF approved a loan of \$12 billion to Egypt and released the first tranche of \$2.7 billion. Yet, the currently de facto foreign exchange rate regime in Egypt cannot be considered as a floated one because of systematic intervention by the CBE in the currency market to maintain the foreign exchange rate within some targeted limits¹⁴.

Basically, the CBE maintains dual objectives for monetary policy. On one hand, the CBE has an explicit monetary policy goal which is a goal of price stability¹⁵. On the other hand, the CBE has an additional implicit goal of monetary policy which is targeting the foreign exchange rate. Figure 1, Panel C shows a significant increase in the foreign reserves after 2016 because of the CBE intervention in the currency market to hold foreign assets.

In addition, the CBE is not factually independent as it is mandated to channel funds to the government to finance the budget deficit¹⁶. Unlike the QCB, the balance sheet of the CBE incorporates both government loans and government securities. Panel C, Figure 1, shows a successive increase in government loans and government securities in the CBE's balance sheet, especially during the last 5 years. As mentioned earlier, despite the absorption operations to sterilize the effect on the monetary base, the holdings of foreign assets, government securities, and government loans will eventually cause an expansion in the monetary base, thereby causing monetary seigniorage to skyrocket. Figure 1, Panel D, shows a successive increase in the monetary base and, hence, monetary seigniorage in Egypt during the last 5 years.

¹⁴ The de facto foreign exchange rate regime in Egypt is classified by IMF (2020) as a crawl-like arrangement where exchange rate remains within a narrow margin of 2% relative to a statistically identified trend for six months. For more details, see: IMF, Annual Report on Exchange Arrangements and Exchange Restrictions, 2020. Available at: <https://www.imf.org/en/Publications/Annual-Report-on-Exchange-Arrangements-and-Exchange-Restrictions/Issues/2021/08/25/Annual-Report-on-Exchange-Arrangements-and-Exchange-Restrictions-2020-49738>.

¹⁵ <https://www.cbe.org.eg/en/MonetaryPolicy/Pages/MonetaryPolicyFramework.aspx>.

¹⁶ Factual independence of the CB requires; (i) legal instrument independent; (ii) non-existence of the government representatives in the MPC as voting members; and (iii) no obligation for CB to finance budget deficit. Such requirements are not available in the case of the CBE under the Law No. 88 of the year 2003, amended by the Law No. 162 of the year 2004 and the Law No. 93 of the year 2005. In addition, such requirements are not available under the new promulgated law of the CBE and banking system No. 194 of the year 2020 (Awad, 2008 and 2009).

4.2. Seigniorage and macroeconomics outcomes

Unfortunately, there is no available data from the CBE and the QCB on the cost of production of domestic currency including banknotes and reserves¹⁷. Given that the cost of producing banknotes is relatively small, we may use the average cost ratio by some other CBs as an approximation for the cost ratio at the CBE and the QCB. According to the data released by the Bank of England and the Federal Reserve Bank, the average cost ratio of a newly produced banknote is roughly \$0.001¹⁸. Based on equations 2, 4, and 5, we calculated the monetary seigniorage, the inflationary seigniorage, and the noninflationary seigniorage for Egypt and Qatar during the period of 2001-2020.

Table 1: Seigniorage indicators in Egypt and Qatar (2002-2020)

| | | 2002-2010 | 2011-2020 |
|-------|--|-----------|-----------|
| Egypt | Seigniorage/GDP % | 4.2 | 3.3 |
| | Government loans/seigniorage % | 31 | 120 |
| | Total natural resources rents (% of GDP) | 11.54 | 7.4* |
| Qatar | Seigniorage/GDP % | 3 | 0.13 |
| | Government loans/seigniorage % | -2.1 | 0.0 |
| | Total natural resources rents (% of GDP) | 35.5 | 26.7* |

* calculated as an average for the period of 2011-2019.

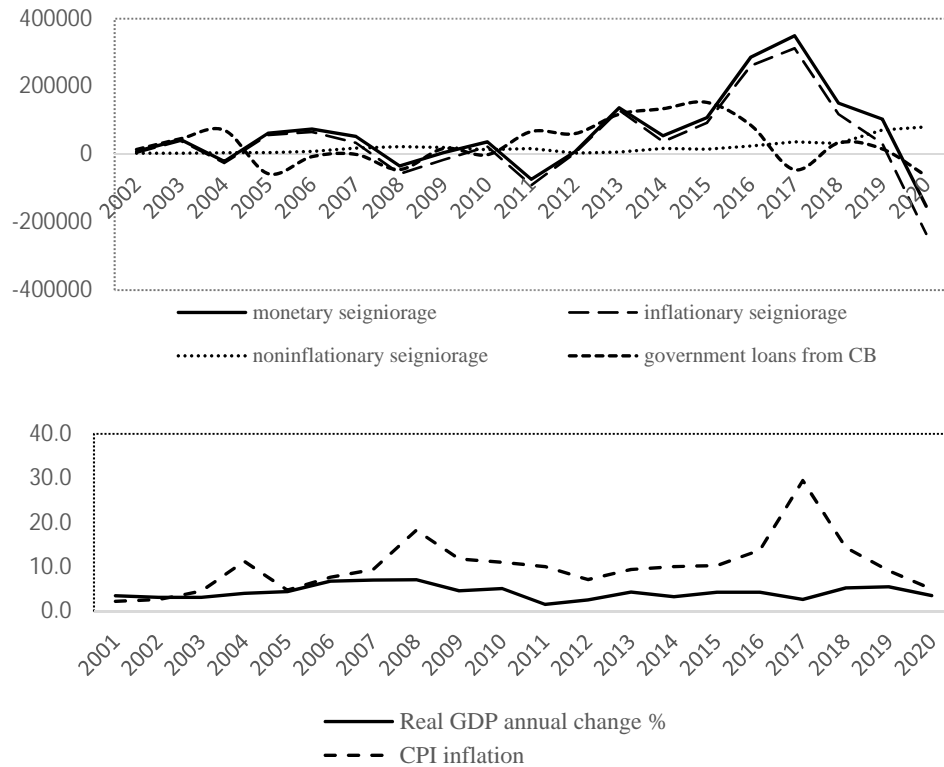
Source: Calculated by the author from data available at; IMF-IFS and the EIU. Total natural resources rents (% of GDP) calculated from WB-WDI.

Table 1 compares some seigniorage indicators in Egypt and Qatar during the periods of 2002-2010 and 2011-2020. The ratio of seigniorage/GDP in Egypt is higher than in Qatar, especially during the sub-period of 2011-2020. In addition, the ratio of government loans/seigniorage in Egypt jumped from 31% during 2002-2010 to 120% during 2011-2020, whereas it reached zero or negative in Qatar during the whole period. Natural resource rents to GDP in Qatar are roughly three times more than its counterpart in Egypt. This in part may explain why Egypt relies more on seigniorage than Qatar.

¹⁷ Major differences between banknote and reserves come as follows; the cost of producing banknotes is relatively small and includes the cost of security features, and the cost of the printing and distribution network. Yet, the banknote is a zero-interest paying liability. Unlike banknotes, the cost of producing reserves is almost zero. However, reserves are often an interest paying liability where many CBs remunerate required reserves to ensure that reserves do not play a monetary policy role (Rule, 2015).

¹⁸ The Bank of England released figures showing the average cost of a banknote during 2017 and 2018. It was between 7 and 8 pence per note. Available at; <https://www.bankofengland.co.uk/freedom-of-information/2020/questions-about-banknote-production>. In addition, the Federal Reserve Bank provides details in 2021 on the printing costs of Federal Reserve notes for each denomination that ranges between 6.2 cents per note (for denominations of \$1 and \$2) and 14 cents per note (for a denomination of \$100) available at; https://www.federalreserve.gov/faqs/currency_12771.htm.

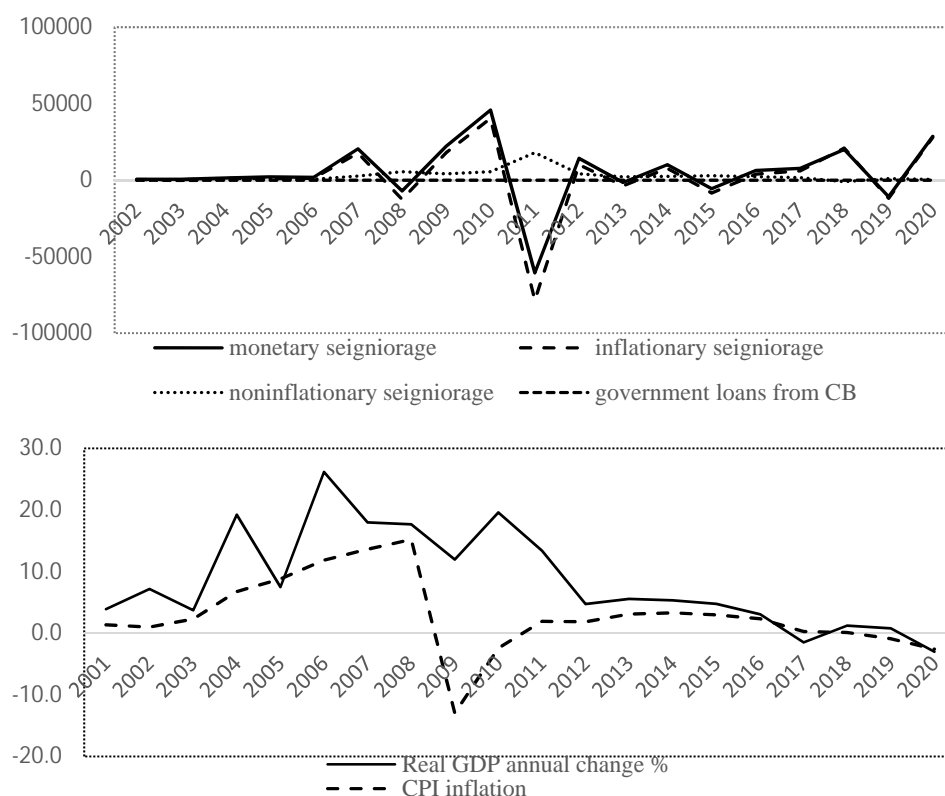
Figure 2. Seigniorage indicators and macroeconomic variables in Egypt (2001-2020)



Source: Figure 2 is prepared by the author. Data on the monetary base and claims on the central government to the CB is available at; IMF, international financial statistics (IFS). Real GDP annual change and CPI inflation are fetched from; the economist intelligence unit (EIU). Other indicators are calculated by the author.

Figure 2 highlights the movements of seigniorage indicators and macroeconomic variables in Egypt during the period of 2001-2020. Clearly, the association is reversed between CPI inflation and both monetary seigniorage and inflationary seigniorage, except for the years after 2015. Yet, the evolution and volatility of monetary seigniorage are not associated with real GDP growth in Egypt. This is consistent with the above analysis that the growth in the monetary seigniorage in Egypt is affected by developments of the assets side of the CBE's balance sheet, i.e., fiscal seigniorage or government loans. In addition, the change in government loans from the CBE is negatively related to movements in the monetary seigniorage. This partly explains the intervention by the CBE to sterilize the effect of government loans on the monetary base despite being unable to resist the government's demand for new loans.

Figure 3. Seigniorage indicators and macroeconomic variables in Qatar (2001-2020)



Source: Figure 3 is prepared by the author. Data on the monetary base and claims on the central government to the CB is available at; IMF, international financial statistics (IFS). Real GDP annual change and CPI inflation are fetched from; the economist intelligence unit(EIU). Other indicators are calculated by the author.

In contrast to the case of Egypt, Figure 3 detects a close association between the change of monetary seigniorage and real GDP growth in Qatar. This confirms the, above, analysis that the major source of seigniorage in Qatar comes from the liabilities side of the QCB's balance sheet. That is the growth in real GDP through gas and oil exports leads to an expansion in the monetary base because of the rise in net foreign assets.

5. Model, Variables, and Empirical Results

5.1. VAR Model and Variables specifications

The main contribution of structural VAR model estimations is to obtain non-recursive orthogonalization of the error terms for the purpose of impulse response analysis. A structural VAR model takes the following representation¹⁹.

$$A(L)Z_t = \varepsilon_t \quad (11)$$

Where Z_t is a $(k \times 1)$ vector of endogenous and exogenous variables, $A(L)$ is a $(k \times k)$ matrix polynomial in the lag operator (L) , and ε_t is a $(k \times 1)$ vector of unknown structural innovations. To find unknown structural (or orthogonal) innovations, a reduced form of Z_t is derived as follows:

$$\text{Define, } A(L) = A_0 + A^0(L) \quad (12)$$

Where A_0 is the contemporaneous coefficient matrix on L^0 in $A(L)$, and $A^0(L)$ is the coefficient matrix in $A(L)$ without contemporaneous coefficient A_0 . By substituting (12) in (11) and rearranging, we get:

$$Z_t = -H(L)Z_t + V_t \quad (13)$$

Where $H = A_0^{-1} A^0$ and $V_t = A_0^{-1} \varepsilon_t$. To identify structural shock, ε_t , from reduced form residuals V_t , restrictions $(n^2 - n)/2$ must be imposed on A_0 or, equivalently, A_0 must be imposed as a lower triangular matrix²⁰.

Variables of the structure VAR model, Z_t , including the growth rate of net foreign assets, $GNFA_t$, the growth rate of monetary seigniorage, GM_{0t} , the growth rate of real GDP, $GGDP_t$, and the CPI inflation rate, $CPII_t$, respectively. All variables are introduced in the first difference to maintain stationarity. Thus, the baseline identification scheme comes as follows:

$$Z_t = [d(GNFA_t) \quad d(GM_{0t}) \quad d(GGDP_t) \quad d(CPII_t)] \quad (14)$$

The order of variables in (14) reflects our implied assumptions over the model's variables that real GDP growth and CPI inflation respond contemporaneously to changes in monetary seigniorage and net foreign assets. In addition, the growth of monetary seigniorage (on the liabilities side of the CB's balance sheet) responds contemporaneously to changes in the growth of net foreign assets (on the assets side of CB's balance sheet), whereas the growth

¹⁹ For more details, see; Awad (2014).

²⁰ Given that the diagonal elements of A_0 are all unity, A_0 contains $n^2 - n$ unknowns. In addition, there are n unknown values $\text{var}(\varepsilon_t)$, thus the total unknown values equal n^2 . To identify n^2 unknowns from the estimated variance/covariance matrix with $(n^2 + n)/2$ known independent elements, it is necessary to impose an additional $n^2 - [(n^2 + n)/2] = (n^2 - n)/2$ restrictions on the system (Enders, 2004).

of net foreign assets responds to changes in the growth of monetary seigniorage after one lag, i.e., one year.

5.2 Empirical Results

Tables 2 and 3 highlight the stationary variables in Egypt and Qatar at different significance levels. According to Augmented Dickey-Fuller and Kwiatkowski-Phillips-Schmidt-Shin, all variables are integrated order zero or I~ (0).

Table 2. Test Results for Unit Roots-Egypt

| Variables | Augmented Dickey-Fuller | | | Kwiatkowski-Phillips-Schmidt-Shin | | |
|--------------|-------------------------|------------|----------------------|-----------------------------------|------------|---------------------------------|
| | Without Trend | With Trend | Lag Length using AIC | Without Trend | With Trend | Bandwidth using Bartlett Kernel |
| $d(GNFA_t)$ | -9.3** | -12.44** | 1 | 0.5* | 0.5** | 18 |
| $d(GM_{0t})$ | -4.75** | -4.39* | 1 | 0.5* | 0.5** | 18 |
| $d(GGDP_t)$ | -5.11** | -4.93** | 1 | 0.11 | 0.08 | 3 |
| $d(CPII_t)$ | -5.13** | -5.05** | 1 | 0.21 | 0.1 | 4 |

** and * indicate significance at the 1% and 5 % levels, respectively.

Table 3. Test Results for Unit Roots-Qatar

| Variables | Augmented Dickey-Fuller | | | Kwiatkowski-Phillips-Schmidt-Shin | | |
|--------------|-------------------------|------------|----------------------|-----------------------------------|------------|---------------------------------|
| | Without Trend | With Trend | Lag Length using AIC | Without Trend | With Trend | Bandwidth using Bartlett Kernel |
| $d(GNFA_t)$ | -5.5*** | -5.29*** | 1 | 0.44* | 0.43*** | 15 |
| $d(GM_{0t})$ | -7.07*** | -6.89*** | 1 | 0.36* | 0.36*** | 13 |
| $d(GGDP_t)$ | -3.66** | -2.31 | 3 | 0.16 | 0.116* | 1 |
| $d(CPII_t)$ | -5.25*** | -5.09*** | 0 | 0.27 | 0.26*** | 9 |

(***), (**), and (*) indicate significance at the 1%, 5%, and 10% levels, respectively.

Based on the order of variables in the baseline identification scheme 14, we estimate a structural VAR model using the above-mentioned stationary variables in Tables 3 and 4 over the period of 2002-2021. The lag length detected by the LR test statistic, FPE test, and HQ information criterion is two lags, where the model satisfies the stability condition that all roots are inside the unit circle.

Panels A and B, Figure 4, compare the response to a structural innovation in growth in net foreign assets, $d(GNFA_t)$ between Egypt and Qatar. Clearly, a positive shock in the growth of net foreign assets causes a significant decline both in the growth of monetary seigniorage, $d(GM_{0t})$, and the CPI inflation rate, $d(CPII_t)$, in Egypt. The opposite is correct for Qatar where a positive shock in the growth of net foreign assets causes an insignificant increase both in the growth of monetary seigniorage and the CPI inflation rate. However, Egypt and Qatar are similar regarding the insignificant effect of a shock in growth in net foreign assets on the change in the growth of real GDP, $d(GGDP_t)$.

Figure 4. Response to Structural Innovation in Net Foreign Assets-Egypt and Qatar

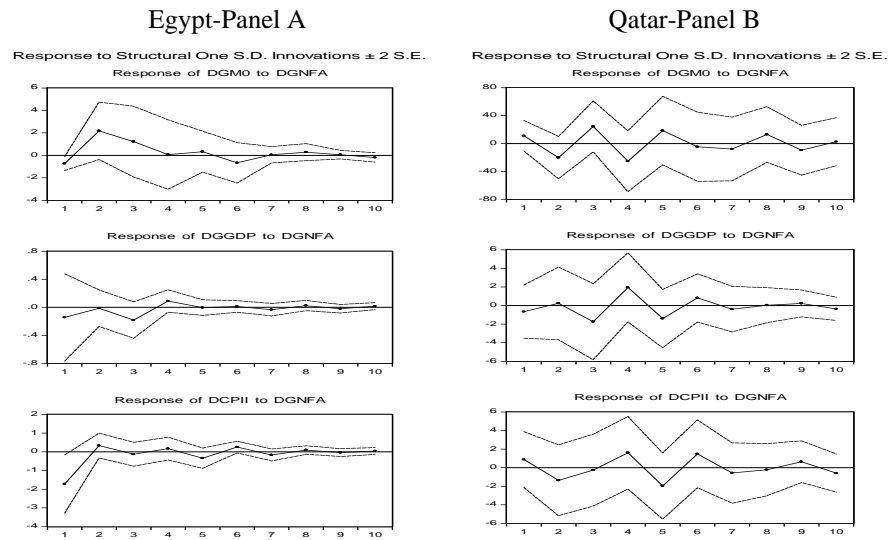
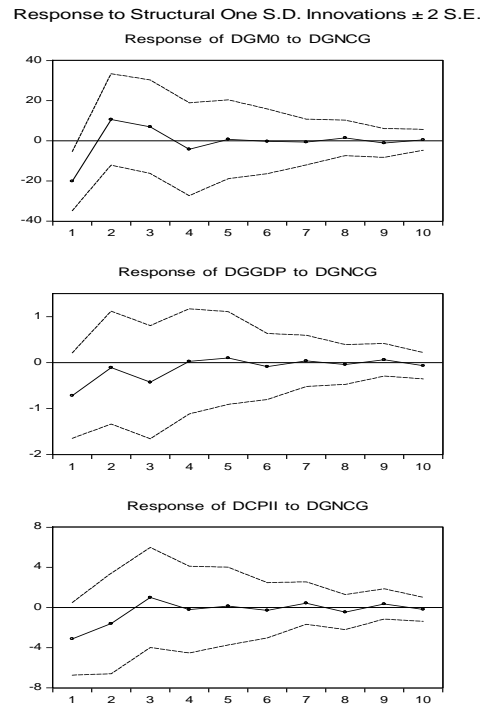


Figure 5. Response to Structural Innovation in Growth in Net Claims on the Central Government to the CBE



As mentioned earlier, the CBE maintains dual objectives of monetary policy, i.e., maintains a goal for price stability and a goal for the exchange rate. Hence, the CBE is practicing a sterilization policy to offset the effect of growth in net foreign assets with the growth in monetary seigniorage by cutting monetary seigniorage, thereby the speed of CPI inflation declines. On the contrary, the QCB does not maintain dual objectives for monetary policy as it is exclusively targeting the foreign exchange rate, thereby growth in net foreign assets directly transmits to growth in monetary seigniorage.

For robustness to the case of Egypt, we substitute the change in the growth of net foreign assets, $d(GNFA_t)$, with the change in the growth of net claims on central government to the CBE, $d(GNCG_t)$ where both variables are on the assets side of the CB balance sheet. Figure 5 shows responses of growth of monetary seigniorage, $d(GM_{0t})$, CPI inflation, $d(CPII_t)$, and real GDP, $d(GGDP_t)$ to a structural positive shock in the growth of net claims on the central government to the CBE, $d(GNCG_t)$. Clearly, the responses reported in Figure 5 are very close to that reported in Figure 4, Panel A. This confirms the above conclusion that the CBE is practising a sterilization policy to maintain dual objectives for monetary policy, i.e., the CBE responds to a positive shock in $d(GNCG_t)$ on the assets side by cutting monetary seigniorage on the liabilities side, thereby both the speed of CPI inflation and real GDP growth declines.

Figure 6. Response to Structural Innovation in Growth in Monetary Seigniorage

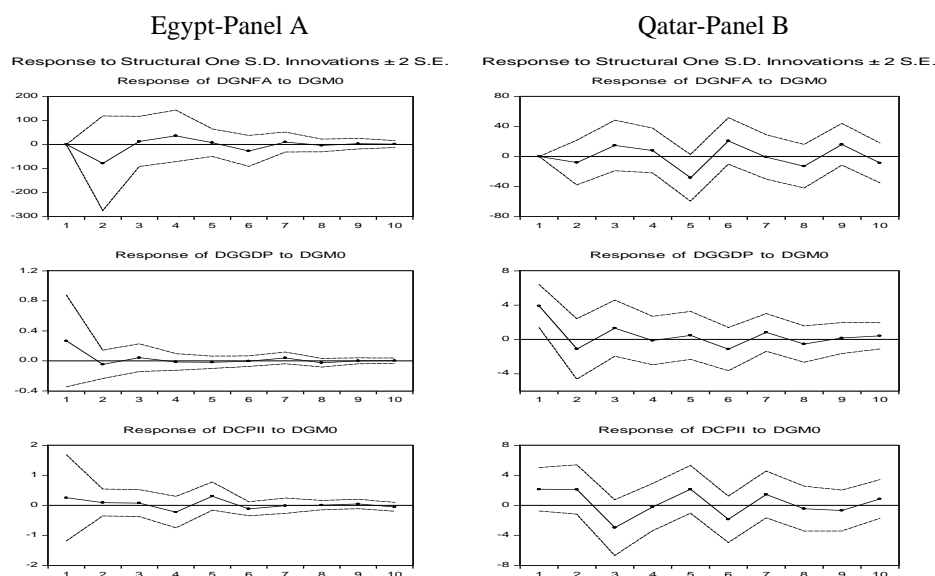


Figure 6 reports the responses to a structural positive shock in monetary seigniorage in Egypt and Qatar. As for Egypt, a positive shock in the growth of monetary seigniorage has an insignificant effect on real GDP growth and on CPI inflation. On the contrary, a positive

shock in the growth of monetary seigniorage in Qatar has a positive significant effect both on real GDP growth and on CPI inflation (at a 10% significance level).

This result indicates that, in contrast to the case of Qatar, the mechanism of a money supply channel is broken in the case of Egypt. Maintaining dual objectives for monetary policy renders the assets side of the CBE's balance sheet as more dominant than on the liabilities side. In other words, movements in the monetary seigniorage no longer respond to the side of demand for money as it undergoes the sterilization process.

In a nutshell, under a hybrid monetary policy regime which incorporates dual monetary policy objectives, like in the case of Egypt, the effect of monetary seigniorage on CPI inflation and real GDP is obsolete because the CB sterilizes changes in the money supply to maintain the objective of the foreign exchange rate. On the contrary, under the exchange rate targeting regime where the CB does not apply the sterilization policy, like in the case of Qatar, the association is straightforward between changes in monetary seigniorage and movements in CPI inflation and real GDP growth, i.e., high growth in the monetary seigniorage causes a high inflation rate and a high real GDP growth rate.

6. Conclusion

This paper utilizes the model of the CB's balance sheet and the government budget identity developed by Klein & Neumann (1990) to investigate the question of "Will the effect of monetary seigniorage on the CPI inflation and real GDP growth be differentiated based upon the adopted monetary policy regime and the initial source of seigniorage (i.e., being seigniorage initially comes from the assets side or from the liabilities side of the CB's balance sheet)? Descriptive and analytical methodologies are used to investigate the theoretical aspects of monetary seigniorage and fiscal seigniorage. In addition, a structural VAR model is used to quantify the structural effect of monetary seigniorage and fiscal seigniorage on CPI inflation and real GDP growth. The study is applied to Egypt and Qatar, as both countries adopt asymmetric monetary policy regimes, and they have different experiences with budget deficits and fiscal dominance.

Descriptive investigations revealed the following theoretical aspects of monetary seigniorage and fiscal seigniorage; (i) the outstanding uncovered part of the budget deficit may result in more government loans from the CB, i.e., fiscal seigniorage. (ii) Government loans from the CB cause a rise in the monetary seigniorage, if the CB does not sterilize its effect on the monetary base. (iii) Escalation of the rate of inflation occurs if a rise in the monetary seigniorage leads to a rise in the inflationary seigniorage. (iv) Inflationary seigniorage occurs when the growth rate in the monetary seigniorage exceeds the growth rate in real GDP. (v) Inflationary seigniorage reflects the case of fiscal dominance where the CB is coerced to finance the budget deficit through fiscal seigniorage. (vi) The existence of fiscal dominance along with dual objectives for monetary policy and sterilization process by the CBE have disrupted the association between change on the liabilities side of the CBE balance sheet and the change of demand for money.

Structural VAR model analysis of responses of CPI inflation and real GDP growth to shocks of monetary seigniorage and fiscal seigniorage reveals the following conclusions: (i) the effect of monetary seigniorage on CPI inflation and real GDP growth is weak and insignificant in the case of Egypt. Maintaining dual objectives for the exchange rate and the inflation rate under a hybrid monetary policy regime gives the CBE no choice but to sterilize changes in monetary seigniorage, thereby the mechanism of the money supply channel is idle. (ii) In contrast to the case of Egypt, the QCB exclusively targets the foreign exchange rate, hence the mechanism of the money supply channel is functioning properly where the effect of monetary seigniorage on CPI inflation and real GDP growth is significant.

The implications of the above conclusions are as follows: (i) given the hypothesis of the impossible trinity, it is not valid for the CBE to both maintain a target for the exchange rate and run a stabilizing monetary policy under free capital mobility. Thus, devaluation or floatation of the Egyptian pound is inevitable if the CBE is going to use monetary policy instruments to achieve the goal of price stability as a primary goal of monetary policy. (ii) Even though the goal of price stability is given priority among other objectives of monetary policy, the CBE will fail to stabilize the economy under fiscal dominance and the coercion of the CBE to finance the budget deficit. Thus, prohibiting the financing of the budget deficit by the CBE, i.e., fiscal seigniorage, is an indispensable task to achieve the goal of price stability. (iii) The floatation of the Egyptian pound in conjunction with prohibiting the financing budget deficit by the CBE will help the CBE to appropriately manage the level and direction of monetary seigniorage in response to the demand for money.

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SUMMARIES

Aysenur Tarakcioglu Altinay, Mesut Dogan, Bilge Leyli Demirel Ergun, Sevdie Alshiqi

THE FAMA-FRENCH FIVE-FACTOR ASSET PRICING MODEL: A RESEARCH ON BORSA ISTANBUL

This study aims to test the validity of the Fama-French Five-Factor Model (FF5F) for Turkey. Within the scope of the study, throughout 468 weeks between September 2009 and August 2018, the returns over the risk-free interest rate of 18 different intersection portfolios are used based on value, profitability, and investment factors. A total of 8424 portfolios (18 portfolios x 468 weeks) are generated in the study. As a result of the analyses, it is determined that the Five-Factor Asset Pricing Model is valid for Borsa İstanbul. Subsequently, it is concluded that the Fama-French Five-Factor Model has a higher explanatory power in describing the stock returns of the portfolios formed with stocks of small-scale companies compared to the portfolios formed with stocks of large-scale companies. The findings are consistent with the literature.

Keywords: CAPM; Fama-French Five Factors Model (FF5F); Stock Returns; Borsa İstanbul

JEL: E44; G11; G12

Sarbjit Singh Oberoi, Sayan Banerjee

BANKRUPTCY PREDICTION OF INDIAN BANKS USING ADVANCED ANALYTICS

The banking sector in India plays a crucial role in economic growth. A bank provides an opportunity for investments to encourage economic growth and the potential to yield higher returns. In this study, we develop a bankruptcy prediction model by using machine learning (ML) techniques, namely logistic regression, random forest, and AdaBoost, and compare these models with those developed using deep learning (DL) techniques, namely the artificial neural network (ANN). ANN results in the highest accuracy and the most favourable prediction model for bankruptcy. Data used in this study are collected from survived and failed private and public sector banks from India from March 2001 to March 2018. For bankruptcy prediction, we use the bank's macroeconomic and market structure-related features. The feature selection technique 'Relief algorithm' is used to select useful features for the bankruptcy prediction model. Because failed banks in comparison with survived were less in the dataset, the issue of imbalanced cases may have arisen, in which case most ML and DL techniques do not perform well. Thus, we convert the dataset into a balanced form by using the synthetic minority oversampling technique (SMOTE). The results of this study can help in performing financial analyses of banks and thus have significant implications for their stakeholders.

Keywords: Bankruptcy; Imbalanced Data; SMOTE; Relief Algorithm; Deep Learning; Artificial Neural Network

JEL: G21; G28; G34

Le Hoang Vinh, Ngo Van Toan, Pham Le Quang

NON-LINEAR IMPACT OF ICT ON PROFITABILITY OF COMMERCIAL BANKS IN VIETNAM

The aim of this article is to evaluate the nonlinear impact of ICT on the profitability of commercial banks in Vietnam and determine the ICT threshold for banks to gain additional profits from this

investment. The research sample was selected by purposive sampling method, including 25 commercial banks in the period 2010-2020. The estimation results according to the 2-step system GMM indicate that ICT has a U-shaped nonlinear effect on profitability, and profitability will be lowest when the readiness index for ICT development and application reaches 0.6052 according to the derivative method, if this level is exceeded, ICT will have a positive impact on profitability and vice versa.

Keywords: Commercial Banks; ICT; Nonlinear impact; Profitability

JEL: G20; G21; G32

Alexei O. Verenikin, Anna Y. Verenikina, John T. Finley, Khanifa V. Tyrkba, Maria V. Melanina

HUMAN CAPITAL FOR SUSTAINABLE REGIONAL DEVELOPMENT

The research aimed at the construction of the ranking of the human capital index in the regions of the Russian Federation based on the available data on the significant factors of sustainable development. Based on the premise that the components of the Human Capital Index calculated by the World Bank coincide with the Sustainable Development Goals from Agenda 2030 “Transforming our world”, the authors construct a Regional Rating of Human Capital Development in Russia using measurable indicators for 85 Russian regions for Targets 3 and 4 from National Sustainable Development Goals Indicator Set. The indicators were grouped into three pillars (subsets): Health, Education and Living standard, each pillar consisting of 2-4 sub-pillars and 2-6 indicators. All data for the indicator’s calculation is taken from official statistics. No expert assessment is used. The research methodology is based on generalized modified principal component analysis (GMPCA), verified by the authors’ previous research. The study reflects an integrated approach to assessing the efforts of Russian regional authorities in human capital development. The research lays the foundation for regular analysis of the rating and dynamics of its components in the Russian regions, which will allow for an assessment of the current state and potential of human capital development in Russian regions and can serve to improve regional socio-economic policy.

Keywords: principal components analysis; human capital; rating of regions

JEL: C38; E24; Q01; R11

Arben Fetoshi, Remzije Shahini-Hoxhaj

INTERNAL COMMUNICATION IN ORGANIZATIONS: THE CASE OF THE POST OF KOSOVO

Effective and transparent communication among publicly owned organizations is considered crucial for enhancing the staff’s performance and accomplishing strategic priorities. The paper examines the Post of Kosovo, as a major public enterprise and looks at internal communication and its impact on employees’ efficiency. Drawing on survey analysis and interviews, we find that the Post of Kosovo, as a public enterprise applied a closed type of hierarchical management, with no formal structure of communication in the organizational scheme. Our findings indicate that communication in the Post of Kosovo is characterized by a lack of transparency, control and manipulation, and centralized decision-making structures. It also indicates that communication has a direct impact on employee motivation and overall organizational performance. Thus, the findings of the study contribute to the existing literature on public enterprise management in transition societies and provide valuable insights into how internal communication can be used as an important tool for organizational success.

Keywords: public enterprise; internal communication; efficiency; the Post of Kosovo

JEL: L32; M12; M14; P31

Anel Ussenova, Nurlan Sailaubekov, Shynara Sarkambayeva, Magbat Spanov, Sadylbek Ussenov

A NEW APPROACH TO MEASURING HUMAN CAPITAL AND BUSINESS PERFORMANCE IN CHEMICAL AND PETROCHEMICAL ENTERPRISES

The paper proposes a new approach to measuring the quality of human capital in chemical (petrochemical) industry enterprises. At present, various qualitative and quantitative methods are presented in academic literature. However, measuring human capital quality in the case under consideration is complicated due to certain industry-specific features including difficulties in obtaining statistics.

The methodology presented in this research is an assessment of human capital based on the weighted factors that have the strongest impact on the formation of enterprise personnel according to the authors and further comparison of final indicators with the quality rating table. Thus, the given technique has a comparative nature and can be applied to rank enterprises that operate in the industry analyzed in the study. In general, the theoretical part of the methodology may include n factors.

Thus, to test the methodology, the factors mostly affecting human capital formation as well as available in terms of collecting the statistical data are considered. Those factors include: the share of internal R&D expenditures, the share of personnel who attended advanced training, the share of personnel with higher education, and the share of personnel with secondary vocational education.

Keywords: human capital; R&D (research and development); qualification; higher and secondary vocational education; assessment; rating; weighting factors

JEL: M12; M50; M52

Ejup Fejza, Alban Fejza

ANALYSIS OF THE EFFECTS OF THE SERVICE QUALITY ON CLIENT SATISFACTION IN THE TOURISM SECTOR IN KOSOVO

Service quality is essential to create client satisfaction by keeping existing clients and gaining new ones in any business and especially in the tourism sector. The main objective of this paper is to analyze the relationship between service quality and client satisfaction and to pinpoint key components of them in the growth and sustainable tourism. Data has been collected from foreigners who have visited hotels in Kosovo and also from domestic tourists. The distributed questionnaire is a mixed questionnaire, which includes a combination of open and closed questions. A total of 30 hotels, divided into seven regions have been chosen to send questionnaires. Participants included in the study were 300 clients who received services in the mentioned hotels. The data was collected from clients who visited hotels in Kosovo during 2020-2021. The hotels were selected mainly based on their categorization, insisting that in the research we have hotels categorized between 3-5 stars. Client data is obtained in two ways: from their hotel estimates, by e-mail, and from the visitors, we found at the hotel during the event. The collected data were processed in SPSS and presented in tabular form. Data were analyzed using quantitative techniques. The ordinary Least Square (OLS) estimator model is used to analyze the relation between dependent and non-dependent variables. Results – Clients choose the hotel mainly online or according to their experience during the preliminary visits. The main reason for the visit was rest and recreation, their treatment was friendly and efficient, the services were provided on time and the cleanliness and comfort were rated as excellent as the food and drinks. In the conclusion is stated that clients have made it clear that the quality of services and satisfied clients can greatly influence the development of sustainable tourism. Age, gender and origin don't have a significant role to determine client satisfaction.

Keywords: tourism; service quality; client satisfaction; marketing; development

JEL: Z30; Z31; Z32; M31; M32

Nikolay Sterev, Kostadin Kostadinov, Daniel Yordanov, Tsvetelina Yorgova

OPEN ENTREPRENEURIAL ACADEMIC CENTRES

The increasing need for innovative ideas, technologies and products leads to the usage of new approaches and methods fostering innovative work. As it is found, the sharing economy covers not just consumption and customers' behaviour, but finance (crowdfunds), research (co-creation areas), entrepreneurship (co-working areas) and etc. As academic entrepreneurship often is not given priority in the university policy and goals, the paper aims to present specific requirements of the specific open space inside the universities /open entrepreneurial academic centre/ that uses co-working and co-creation approaches. Thus, the paper is focused on the basics of open entrepreneurial centres (paragraph 1), indicators for their entrepreneurial success (paragraph 2) and organization of the crowd-working space (paragraph 3).

Keywords: academic entrepreneurship; co-creation; co-working

JEL: I23; O31; O36

Dochka Velkova, Yana Kirilova

THE DISCOUNT RATE IN THE ASSESSMENT OF EU-FUNDED INVESTMENT PROJECTS

The article presents the effect of the financial discount rate on key financial indicators in the cost-benefit analysis used in the assessment of public investment projects – financial net present value, financial internal rate of return and financial gaps. It then estimates the Weighted Average Cost of Capital as an alternative approach for determining the discount rate. The model builds on the debt/equity ratio in the overall project investment portfolio and Capital Asset Pricing Model based on: (1) the return gained from investment in risk-free instruments; (2) the risk premium for the state (the so-called asymmetric state-related risk); (3) the business risk premium; (4) the project asymmetric risk premium. The model is then applied to an environmental investment project in Bulgaria.

Keywords: discount rate; weighted average cost of capital; cost-benefit analysis; public infrastructure financing; revenue-generating projects

JEL: H43; H54

Larysa Cherchyk, Nina Khumarova, Anna Burda

FORESTRY ENTERPRISES DIAGNOSTIC AUDIT OF COMPLIANCE WITH THE SOCIAL RESPONSIBILITY PRINCIPLES

This article improves the methodological approaches to the formation of diagnostic audit of forestry enterprises on the basis of international standards FSC and SA 8000. Three components of the audit and corresponding groups of indicators are proposed as: institutional (including indicators of compliance with the current legislation, organizational structure and management system effectiveness requirements), social (indicators of labour safety, personnel safety, corporate social responsibility, interaction with stakeholders), environmental (indicators of forest management, forest protection, economic measures implementation and their impact on the environment). The methodology was tested on the materials of the state enterprise "Kivertsivske Forestry". The results show that whilst enterprises mainly operate in accordance with the social responsibility principles, but there are identified several positions that need to be improved.

Keywords: social responsibility; forestry enterprises; international standards; diagnostic audit.

JEL: M14; Q23; H83

Ibrahim L. Awad

A COMPARATIVE STUDY OF SEIGNIORAGE: EGYPT AND QATAR

This study adopts the model of CB's balance sheet and government budget identity developed by Klein & Neumann (1990) to investigate the question of "Will the effect of monetary seigniorage on CPI inflation and real GDP growth be differentiated based upon the adopted monetary policy regime and the initial source of seigniorage?" The study compares Egypt and Qatar, as both countries apply asymmetric monetary policy regimes. Conclusions by structural VAR model are: (i) monetary seigniorage does not affect either CPI inflation or GDP growth in Egypt. The opposite is true in the case of Qatar. (ii) in contrast to the case of Qatar, the mechanism of the money supply channel is broken in Egypt because the central bank of Egypt applies a sterilization policy to maintain dual objectives for monetary policy, namely foreign exchange rate and inflation rate.

Keywords: Monetary Seigniorage; Fiscal Seigniorage; Structural VAR Model; Central Bank's Balance Sheet

JEL: E31; E42; E51; H68; C32