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Measuring corporate management in business maturity forecasting models

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ABSTRACT

Modern corporate theory interprets enterprise-wide risk management (ERM) as an agent between stakeholders and corporate governance. In accordance with the latest ERM framework, corporate risk management in business includes the methods and processes used by organizations to manage uncertainty and use the opportunities associated with achieving their goals. The aim of the study is to measure corporate management in business maturity forecasting models. The author predicted a company cluster based on signal to noise ratio. As the basic model, the author used the calculation method proposed by G. Taguchi to assess product quality as well as for the design and optimization of processes. The research method used for the study was empirical. The author obtained financial performance data relating to all 218 companies from the SPARK database. It was applied two-step cluster analysis to compare companies within the sample. Also, it was calculated the geometric mean for each quantitative variable to avoid the influence of temporary shocks and distortions. The results of a nonparametric test showed that the relationship between the signal-to-noise ratio (SNR) and ERM is significant. Thus, based on the results of the theoretical and empirical studies, we can argue that the measurement of ERM through the SNR is justified.

Keywords: Risk management, Signal-to-noise ratio, Firm value, Logistic regression.

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1. Introduction

The implementation of corporate risk management optimizes the management processes of the company so that more disciplined companies over the long run outperform those that don't manage risk. Corporate risk management is a multifaceted and multidirectional system; therefore, it is impossible to apply agent theory in its pure form. Enterprise risk management is establishing itself as the dominant paradigm of corporate risk management [1-5]. A significant amount of research in the field of corporate risk management indicates its high relevance.

In general, the development of corporate risk management (hereinafter, corporate risk management and enterprise-wide risk management are used interchangeably) can be divided into two eras: practical and theoretical. The "practical era" is represented by a large number of risk management recommendations initiated by various departments, authorities, stock exchanges, financial companies, auditors, and consultants. Most of these recommendations resulted in modern risk management framework ERM, an integrated approach. The main goal of this framework is to formalize and systematize existing approaches to risk management that one way or another disclose a strategic approach to risk management [6-14].

C. Ingley and X. van der Walt [15-19] state that corporate risk management is a special function of corporate governance, which needs to be formalized in order to determine and increase its (corporate governance) effectiveness can be considered the beginning of a "theoretical era". From this point on, the approach to corporate

risk management has changed significantly. Thus, in earlier studies, ERM was defined as the minimum set of solutions for a given level of expected performance. And in later ones, corporate risk management is described as a tool to improve added value. In terms of methods, risk management has also undergone significant changes. The cost approach has significantly expanded the boundaries of management through a risk-return paradigm. Instrumental research methods resulted in dynamic models [20-25].

Currently, ERM is most often interpreted as a corporate governance tool that directs and coordinates the behaviour of managers, raising awareness of all sources of risk and combining the adoption of strategic and operational decisions in an organization, taking into account the company's risk appetite [26-28]. Thus, the positive role of RM is not in doubt. However, most hypotheses regarding ERM have not been confirmed [29-32]. In general, research in this field is carried out within the following areas:

- A cost-based approach explores how risk management reduces corporate costs (including management costs) [33-37];
- The value-based approach examines how value is created as a result of risk management;
- The market approach explores how the market responds to risk management signals [38-44].

Stakeholders are a key factor in risk management. In this case, ERM acts as an agent between different groups of stakeholders, both external and internal. Besides, the stakeholder approach, in the context of a theory of a firm there is an evidence of mature business; on the other hand, in using this approach, the analysis of each managerial process separately is pointless. A stakeholder approach seems to be most appropriate, as most researchers note that an empirical study of risk management systems is difficult due to the lack of information about what corporations do inside the company, the lack of transparency and low quality of publicly available information for assessing corporate governance [45-47], and the difficulties in perceiving the system from the point of view of management as an indicator of the quality of company management [48]. Based on the foregoing, we can assume that the deeper ERM is integrated into corporate governance, the higher its efficiency and lower costs, the better chance the firm has of building a mature business [49-53].

2. Materials and methods

Given the multitasking of ERM and its variability, as well as deep integration into all corporate processes, it would be wrong to manage each factor in these processes separately. In this case, we need an indicator that will allow us to compare the inputs and outputs of the company and, based on this, assess how effective the risk management system is. Based on the task, we can assume that the signal-to noise ratio may be the most acceptable measure of the difference between inputs and outputs. As the basic model, we will use the calculation method proposed by G. Taguchi [54] to assess product quality as well as for the design and optimization of processes.

The signal-to-noise ratio (SNR) is the reciprocal of the coefficient of variation. It measures the strength of a studied signal to the background noise. The issues of the commensurability of the signal-to-noise ratio and the correlation coefficient were studied by the authors [55-60]. This methodology is considered the most promising in terms of continuous improvement of the business strategy.

The research method used for the study was empirical. The 287 companies comprising the sample represent the Russian metal industry. We dropped companies for which at least one variable was missing, for a valid sample of 218 companies. This sample, which comprehensively represents the Russian metal industry, will shed light on the relationship between SNR and output, created by ERM. Software in which all calculations were carried out – IBM spss statistics -ver26 [61-64].

We obtained financial performance data relating to all 218 companies from the SPARK database. We calculated the geometric mean for each quantitative variable to avoid the influence of temporary shocks and distortions. Because the original data were positively skewed, signalling higher skewness, we worked with logarithms. We follow the literature on corporate risk management, corporate governance, and corporate finance to evaluate the relationship of SNR with relevant proxy.

Companies operate under the same conditions but achieve completely different results. This is largely determined by the type of organization of ownership, macroeconomic characteristics, the stage of the economic cycle, market competition, etc [65-72]. Their further development is determined by the level of risk that owners are ready to take on, as well as the entrepreneurial abilities of managers (agents). The role of management in this case is to increase the likelihood of achieving goals of a company, taking into account the specifics of the business. The probability of achieving certain goals depends, among other things, on corporate

risk management. Integrated management systems and continuous risk monitoring are most preferred. All of the above leads to our next hypothesis.
H1. The higher the signal-noise ratio, the more likely the maturity of the business is to be predicted.

3. Results and discussion

3.1 Validation of a variable and its application in business forecasting

Two-step cluster analysis is used to study the data structure, on the basis of which it will be possible to unite the sample into homogeneous groups. Initially, the number of groups was unknown. The main principles of clustering are as follows: inside the cluster, all objects are as similar as possible; this is determined based on the measure of proximity (the distance between the objects is minimal); and there is a clear distinction between clusters, which is determined based on a measure of distance (the distance between the clusters is the maximum). The principles of clustering must be respected at the same time [73-78].

The Schwartz's Bayesian criterion was used as a clustering criterion. To assess the quality of clustering, the silhouette criterion of cohesion and separation was used. The validation of the clustering results was carried out by applying different measures of proximity and distance [79-84]. Next, we estimated a logistic regression (using the cluster membership as a reference) that predicted the likelihood that a firm will improve its maturity in comparison with other companies, Equation (1):

$$\text{Logistic (Mature companies, } vs. \text{ Other)} = \alpha + \beta_1 \text{SNR} + \beta_2 \text{Costs} + \beta_3 \text{EVA} + \varepsilon i,t+1 \quad (1)$$

We follow the literature in accounting and corporate finance and use R&D investment, leverage, liquidity, profitability, size, and cash flow to proxy the heterogeneity of companies. Thus, for example, in empirical studies, R&D investment is used as a criterion for long-term growth [85] and effective risk management [86-89], as well as a criterion for the stability of the company in crisis situations. As the authors note, this feature rather steadily characterizes the maturity of corporate governance. J. Tirole [90] noted that companies differ significantly in their ability to generate cash flow. This criterion is stable and may be a characteristic of the company [91].

Cash flow was used as a sign of maturity and well-being of the company. Cash flow into assets is very important in assessing the ability to buy new assets in case old assets become obsolete. According to H. Jankensgård, the expected average value of future cash flows is maximized when agents make risk management decisions that are not affected by conflicts of interest and behavioural biases [1]. In a broad sense, a positive cash flow characterizes a company's profitability much better than profit itself. Financial leverage, on the one hand, demonstrates the preferences of companies when choosing a source of investment, on the other hand, it defines financial constraints. The size and the type of business entity were also used in cluster analysis.

In Table 1, we report the number of observations (N), the means, medians, and standard deviations (STDev) of the variables, and quartile (75% and 25%) distributions of the variables. We split the sample into public and not-public companies. In Table 2 we report the correlation between selected variables. The analysis revealed that there is a semi-strong correlation between binary variables for public companies.

Table 1. Descriptive Statistics

	No	Minimum	Maximum	Mean	Std. Deviation
SNR	218	92,76	225,66	159,5291	23,79244
Size	211	18,46	26,73	22,1016	23,79244
Intangibility	136	-16,87	-1,26	-8,3812	3,00499
CEO_tenure	139	0,00	2,77	1,6783	0,88909
Leverage	207	-7,69	1,36	-0,5590	0,91563
Profitability	158	-4,61	0,04	-2,7260	1,06155
Liquidity	211	-26,11	-17,50	-21,5770	1,93949

Table 2. Correlations

			Leverage	Profitability	Intangibility	Liquidity	NegCF
Size	Correlation Coefficient	1,000	0,591**	0,570**	0,667**	0,523**	0,470**
	Sig. (2-tailed)	.	0,000	0,000	0,000	0,000	0,000
	No	538	538	538	538	538	538
Leverage	Correlation Coefficient	0,591**	1,000	0,519**	0,663**	0,638**	0,483**
	Sig. (2-tailed)	0,000	.	0,000	0,000	0,000	0,000
	No	538	538	538	538	538	538
Profitability	Correlation Coefficient	0,570**	0,519**	1,000	0,541**	0,630**	0,553**
	Sig. (2-tailed)	0,000	0,000	.	0,000	0,000	0,000
	No	538	538	538	538	538	538
Intangibility	Correlation Coefficient	0,667**	0,663**	0,541**	1,000	0,668**	0,381**
	Sig. (2-tailed)	0,000	0,000	0,000	.	0,000	0,000
	No	538	538	538	538	538	538
Liquidity	Correlation Coefficient	0,523**	0,638**	0,630**	0,668**	1,000	0,469**
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	.	0,000
	No	538	538	538	538	538	538
NegCF	Correlation Coefficient	0,470**	0,483**	0,553**	0,381**	0,469**	1,000
	Sig. (2-tailed)	0,000	0,000	0,000	0,000	0,000	.
	No	538	538	538	538	538	538

** Correlation is significant at the 0.01 level (2-tailed).

The result is a model with six significant variables (Figure 1), and two clusters were obtained. The Bayesian Information Criterion (BIC) is of 1594,182 for the first one and 77,412 for the second one. The silhouette measure of cohesion and separation is sufficiently high (Figures 2-3). The second cluster (21% of sample) is presented with companies of large size, with positive profitability and sufficient liquidity. The financial leverage of these companies is more than one-third of total assets and presented with long-term debt. These companies usually invest in R&D but have negative CF in this current year. The predictor importance of these inputs is more than 0.6 [92-95].

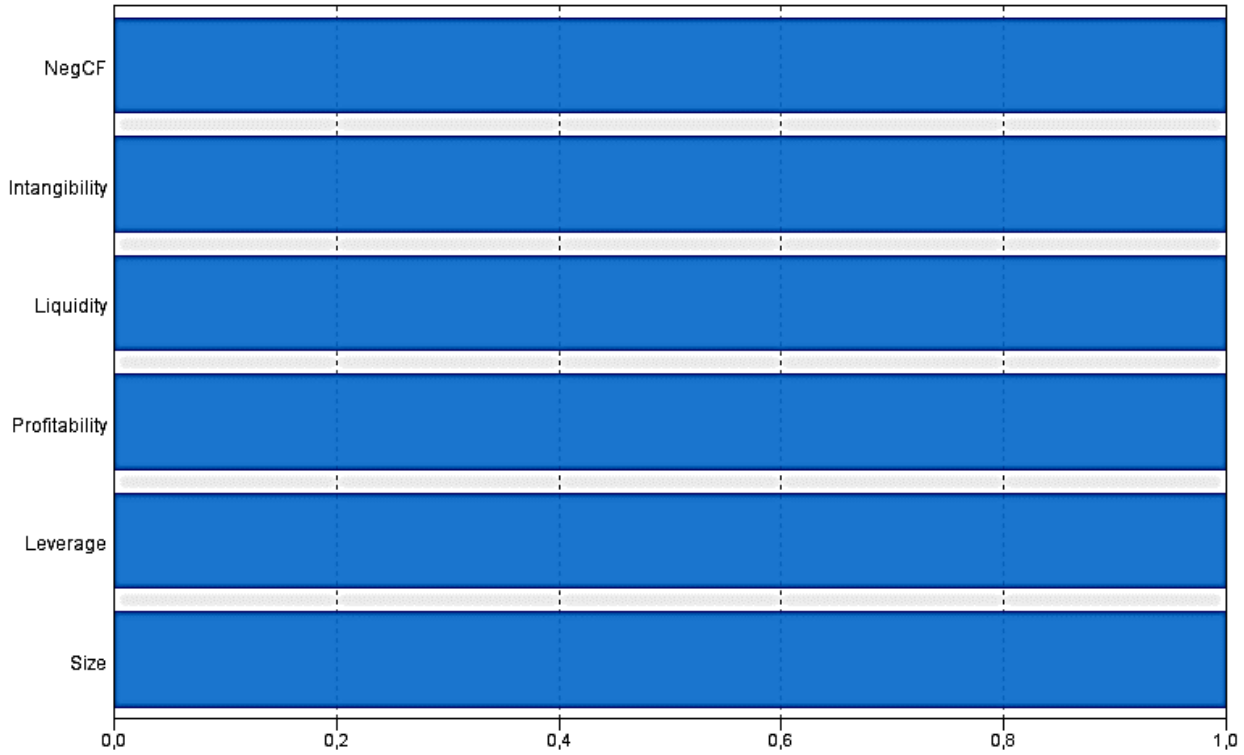


Figure 1. Predictor importance of variables

Algorithm	TwoStep
Inputs	6
Clusters	2

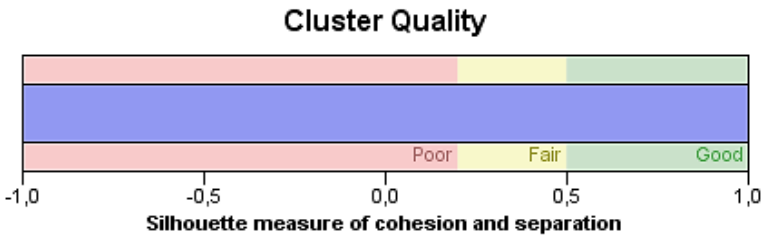
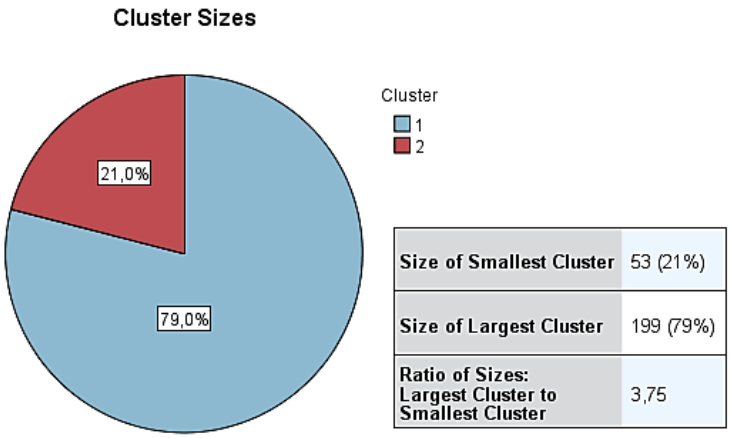


Figure 2. Model Summary



Size of Smallest Cluster	53 (21%)
Size of Largest Cluster	199 (79%)
Ratio of Sizes: Largest Cluster to Smallest Cluster	3,75

Figure 3. Cluster Sizes

Thus, 79% of companies look rather weak. These companies are of medium size, usually issue expensive short-term debt, and do not invest in sustainable growth. Thereby these companies do not meet the expectations set for public companies and are not under the interest of strategically oriented stakeholders. The companies included in the second cluster initially have inputs equal to the first cluster. The companies in this cluster are the result of the entrepreneurial management skill, which has found its own mechanism for the efficient use of factors affecting the transaction costs and sustainable growth. Long-term investments, diversification of investment projects, and as a result the sustainable profit and liquidity are the core of survival of any company.

In our study, we assume that corporate risk management will crowd out fewer promising companies towards more resilient ones, more interesting for stakeholders. The result is a model with three significant variables, and two clusters were obtained. The silhouette measure of cohesion and separation is sufficiently high. The first cluster (27% of sample) is presented with companies of medium size, with negative or zero profitability and zero R&D investment. Other variables are not significant in the model [96-98].

The results were verified by the Chi-square test, which confirmed the statistical significance of differences within groups. So, we have four different clusters both for public and not-public companies based on financial performance. Companies significantly differ from each other in size, size of debt, positive return on business, and long-term investments. Currently, 21% of companies have no problems with liquidity, but the cash flow is negative, which may be due to large investments made the day before [99-101].

3.2 The real effect of SNR on companies

Corporate risk management is provided by economic channels through which corporate governance affects the company's maturity. Excessive passion for managing value added does not necessarily imply optimality, since it can also mean over-investment, which reduces efficiency and increases the costs of the company. To solve

this problem, we tested the effect of costs, economic value added, and SNR on the firm to study the real impact of ERM [102-108].

In Table 3 we report the number of observations (N), the means, medians, and standard deviations (STDev) of the variables, and quartile (75% and 25%) distributions of the variables. In Table 4 we report the correlation (Spearman Rho) between selected variables. The analysis revealed that there is a semi-strong correlation between cluster membership and SNR and SGA [109-111]. There is no linearly significant relationship between EVA and cluster membership. The results of model 1 are reported in Table 5.

Table 3. Descriptive Statistics

		SNR	SGA	EVA
No	Valid	90	90	90
	Missing	0	0	0
Mean		135,97756	-2,03937	-1,49814
Std. Deviation		31,810561	1,628979	1,920455
Minimum		68,480	-10,835	-9,249
Maximum		196,460	1,851	4,169
Percentiles	25	109,85500	-2,60967	-2,58527
	50	135,78000	-2,25542	-1,51244
	75	162,85750	-1,35433	1,00000

Table 4. Correlations

			Cluster membership	SNR	SGA	EVA
Spearman's rho	Cluster membership	Correlation Coefficient	1,000	0,325**	-0,407**	-0,130
		Sig. (2-tailed)	.	0,002	0,000	0,222
		No	90	90	90	90
	SNR	Correlation Coefficient	0,325**	1,000	-0,330**	0,014
		Sig. (2-tailed)	0,002	.	0,001	0,896
		No	90	90	90	90
	SGA	Correlation Coefficient	-0,407**	-0,330**	1,000	0,228*
		Sig. (2-tailed)	0,000	0,001	.	0,031
		No	90	90	90	90
	EVA	Correlation Coefficient	-0,130	0,014	0,228*	1,000
		Sig. (2-tailed)	0,222	0,896	0,031	.
		No	90	90	90	90

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 5. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1*	SNR	0,018	0,009	3,750	1	0,050	1,018
	SGA	-0,586	0,225	6,774	1	0,009	0,557
	EVA	-0,099	0,135	0,544	1	0,461	0,906
	Constant	-2,586	1,218	4,512	1	0,034	0,075

* Variable(s) entered on step 1: SNR, SGA, EVA.

The coefficient estimate of the relationship between SNR and dependant variables is significant at the 5% level and positive in Model 1, indicating that SNR has a positive impact on cluster membership. At the same time, SGA is significant at the 1% level and negative to cluster membership. EVA is not significant in the model; however, Omnibus Tests of Model Coefficients (Table 6) suggest that adding a variable to the model

is justified and significant at 0.001. The determination coefficient is very low (Table 7) [112-114] and shows that only 28% of the response variation is explained by the variation of model variables. According to the Hosmer and Lemeshow test (Table 8), the model is adequate; the statistical significance is above 0.5 and equal to 0.647.

Table 6. Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	19,362	3	0,000
	Block	19,362	3	0,000
	Model	19,362	3	0,000

Table 7. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	86,989*	0,194	0,279

* Estimation terminated at iteration number 5 because parameter estimates changed by less than 0,001.

Table 8. Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	6,000	8	0,647

The average classification percentage is 74%, which means that cluster membership predicted by the logit model is 74%, the same as predicted (Table 9). The asymptotic significance of the ROC-curve (Table 10) is less than 0.05 and equal to 0.000. The constructed model predicts the probability quite well [115-117]. Thus, we can assume that the contribution of ERM to the company is significant, which was confirmed in our hypotheses.

Table 9. Classification Table

Observed			Predicted		
			Cluster Membership		Percentage Correct
			1	2	
Step 1	Cluster Membership*	1	21	4	84,0
		2	19	46	70,8
	Overall Percentage				74,4

* The cut value is 0,750.

Table 10. Area Under the Curve

Test Result Variable(s): Predicted probability				
			Asymptotic 95% Confidence Interval	
Area	Std. Error*	Asymptotic Sig.**	Lower Bound	Upper Bound
0,781	0,055	0,000	0,673	0,888

* Under the nonparametric assumption.
** Null hypothesis: true area = 0.5.

4. Conclusions

In this paper, we predicted a company cluster based on signal to noise ratio. Two-step cluster analysis revealed that only 21% of companies have satisfactory results and may be of interest to interested parties as an object of long-term relationships. The coefficient of determination of the model, explaining the impact of SNR on the welfare of the company, is small enough, but sufficient to study the real contribution of ERM. On the path to maturity, ERM is a more necessary step than a means of creating a mature company. Our findings are supported by the most recent work in the theory and practice of corporate risk management, that state that

corporate risk management and corporate governance are inseparable, the higher the integration, the higher the effect.

In this study, the relationship between risk management and transaction costs, as well as their combined effect on the maturity of the company, is not sufficiently studied. The study can be qualitatively improved by comparing the results of random walks and the logistic model. Of considerable interest is the ability of ERM to mitigate the effects of information asymmetry, which in the long term brings more losses than the risks of internal business processes.

References

[1] H. Jankensgård, "A Theory of Enterprise Risk Management," *Corporate Governance: The International Journal of Business in Society*, vol. 19 no. 3, pp. 565-579, 2019.

[2] C. Ingley and X. van der Walt, "Do Board Processes Influence Director and Board Performance," *Corporate Governance: An International Review*, vol. 13, no. 5, pp. 632-653, 2005.

[3] T. J. Andersen and P. W. Schrøder, Strategic Risk Management Practice: How to Deal Effectively with Major Corporate Exposures, Cambridge University Press, New York, 2010.

[4] M. Beasley, D. Pagach and R. Warr, "Information Conveyed in Hiring Announcements of Senior Executives Overseeing Enterprise-Wide Risk Management Processes," *Journal of Accounting Auditing and Finance*, vol. 23, pp. 311-321, 2008.

[5] R. E. Hoyt and A. P. Liebenberg, "The Value of Enterprise Risk Management," *Journal of Risk and Insurance*, vol. 78, no. 4, pp. 795-822, 2011.

[6] D. Hilson and R. Murray-Webster, Understanding and Managing Risk Attitude, MPG Books, Bodmin, 2005.

[7] C. Smithson and B. Simkins, "Does Risk Management Add Value? A Survey of the Evidence," *Journal of Applied Corporate Finance*, vol. 17, pp. 8-17, 2005.

[8] D. F. Larcker, S. A. Richardson and I. Tuna, "Corporate Governance, Accounting Outcomes, and Organizational Performance," *The Accounting Review*, vol. 82, no. 4, pp. 963-1008, 2001.

[9] A. Davila and G. Foster, "Management Control Systems in Early-Stage Start-Up Companies" *Accounting Review*, vol. 82, pp. 298-342, 2007.

[10] C. D. Ittner and D. F. Larcker "Assessing Empirical Research in Managerial Accounting: A Value-Based Management Perspective," *Journal of Accounting and Economics*, vol. 9, pp. 349-410, 2001.

[11] G. Taguchi, Introduction to Quality Engineering. Asian Productivity Organization, New York, 1986.

[12] B. Wang, A. M. Goodpaster and M. A. Kennedy, "Coefficient of Variation, Signal-To-Noise Ratio, and Effects of Normalization in Validation of Biomarkers from Nmr-Based Metabonomics Studies," *An International Journal Sponsored by the Chemometrics Society*, vol. 128, pp. 9-16, 2013.

[13] M. Massa, F. Wu, B. Zhang and H. Zhang, "Saving Long-Term Investment from Short-Termism: The Surprising Role of Short Selling," *SSRN Electronic Journal*, 2015, Available from: https://ssrn.com/abstract=25588761.

[14] J. Choi, C. X. Mao and A. Upadhyay, "Corporate Risk Management Under Information Asymmetry," *Journal of Business Finance and Accounting*, vol. 40, no. ½, pp. 239-271, 2013.

[15] J. Tirole, The Theory of Corporate Finance, Princeton University Press, Princeton, 2006.

[16] F. N. Almeida, J. K. Htoo, J. Thomson and H. H. Stein, "Amino Acid Digestibility in Camelina Products Fed to Growing Pigs," *Can. J. Anim. Sci.*, vol. 93, no. 3, pp. 335-343, 2013.

[17] A. N. Dunets, I. B. Vakhrushev, M. G Sukhova, M. S. Sokolov, K. M. Utkina and R. A. Shichiyakh, "Selection of Strategic Priorities for Sustainable Development of Tourism in a Mountain Region: Concentration of Tourist Infrastructure or Nature-Oriented Tourism," *Entrepreneurship and Sustainability Issues*, vol. 7, no. 2, pp. 1217-1229, 2019.

[18] D. Rodnyansky, R. Abramov, G. Valeeva, I. Makarov and O. Levchegov, "Methods to Evaluate Public Administration Efficiency: The Case of the Volga Region," *International Journal of Engineering and Advanced Technology,* vol. 8, no. 5, pp. 2261-2271, 2019.

[19] I. V. Morozov, Y. M. Potanina, S. A. Voronin, N. V. Kuchkovskaya and M. D. Siliush, "Prospects for the Development of the Oil and Gas Industry in the Regional and Global Economy," *International Journal of Energy Economics and Policy,* vol. 8, no. 4, pp. 55-62, 2018.

[20] A. R. Aharonovich, "Socio-Economic Importance of State Support for Youth Innovative Entrepreneurship in the Economic Development of the State," *Academy of Entrepreneurship Journal,* vol. 25, no. S1, pp. 1-6, 2019.

[21] A. V. Kostruba and V. A. Vasylyeva, "Termination of Right in the Mechanism of Civil Legal Relations," *Rivista di Studi sulla Sostenibilita,* vol. 2020, no. 1, pp. 287-300, 2020.

[22] D. V. Rodnyansky, R. A. Abramov, M. L. Repin and E. A. Nekrasova, "Estimation of Innovative Clusters Efficiency Based on Information Management and Basic Models of Data Envelopment Analysis," *International Journal of Supply Chain Management,* vol. 8, no. 5, pp. 929-936, 2019.

[23] R. A. Abramov, S. A. Tronin, A. V. Brovkin and K. C. Pak, "Regional Features of Energy Resources Extraction in Eastern Siberia and the Far East," *International Journal of Energy Economics and Policy,* vol. 8, no. 4, pp. 280-287, 2018.

[24] R. A. Abramov, "Regional Economic Policy Based on Industrial Sector Clustering in the Context of Sustainable Development," *Research Journal of Pharmaceutical, Biological and Chemical Sciences,* vol. 7, no. 2, pp. 2100-2106, 2016.

[25] B. M. Nurgaliyev, K. S. Lakbayev and A. K. Kussainova, "Euraspol as an Additional Mechanism for Transnational Crime Control," *Life Science Journal,* vol. 11, no. 9, pp. 421-425, 2014.

[26] E. Shavina and V. Prokofev, "The Cluster Approach in the Economic and Innovative Development of Mining Region (On the Example of the Kemerovo Region)," *E3S Web of Conferences,* vol. 174, 04017, 2020.

[27] J. S. Tsertseil, V. V. Kookueva and K. V. Ordov, "Regional Competitiveness Within the Cluster's Territory: Case of the Volga Federal District's Chemical Industry," *Progress in Economics Research,* vol. 37, pp. 169-184, 2017.

[28] B. M. Nurgaliyev, K. S. Lakbayev, A. K. Kussainova and A. V. Boretsky, "Impact of Organized Crime on Shadow Economy: Social Impact Assessment," *Asian Journal of Applied Sciences,* vol. 7, no. 1, pp. 644-651, 2014.

[29] T. Sakulyeva, "Towards the Development of Innovative Technologies for the "Mobility as a Service" System," *Journal of Physics: Conference Series,* vol. 1515, no. 3, 032003, 2020.

[30] E. Dotsenko, "NBIC-Convergence as a Paradigm Platform of Sustainable Development," *E3S Web of Conferences,* vol. 21, 04013, 2017.

[31] A. H. Tran, N. L. T. Minh and D. Ushakov, "Evaluating the Efficiency of Migration Regimes and Their Role in the Progress of Common European Labor Market," *International Journal of Recent Technology and Engineering,* vol. 2, no. Special Issue 11, pp. 3883-3888, 2019.

[32] D. Shakirova, E. Ivanova, A. Y. Abaidilda and A. B. Maidyrova, "Management of University Innovation Potential in the Modern Reality of Kazakhstan," *International Journal on Emerging Technologies,* vol. 10, no. 2, pp. 141-144, 2019.

[33] A. V. Kostruba and V. A. Vasylyeva, "International Regulation of Termination of Rights in the Field of Civil and Intersubjective State Relations," *Astra Salvensis,* vol. 1, pp. 131-153, 2020.

[34] A. V. Serebrennikova, T. F. Minyaseva, N. S. Kala, A. A. Malinovsky, V. M. Malinovskaya and S. V. Grynchak, "Comparative Analysis of Foundations of Legal Regulation of Criminal Liability for Organ Trafficking in the Russian Federation, Kazakhstan, and the European Union," *Journal of Advanced Research in Law and Economics,* vol. 11, no. 4, pp. 1405-1415, 2020.

[35] I. S. Glebova, S. N. Kotenkova and R. A. Abramov, "The Analyses of Socio-Economic Development Tendencies of the Capital Cities in the Modern Russia," *Social Sciences and Interdisciplinary Behavior - Proceedings of the 4th International Congress on Interdisciplinary Behavior and Social Science, ICIBSOS,* Jakarta: CRC Press, 2016.

[36] G. E. Adygezalova, R. M. Allalyev, A. V. Kiseleva and N. A. Grigorieva, "Copyright Violation and Distribution of Prohibited Content on the Internet: Analysis of Legal Arrangements in the Legislation of the Russian Federation," *Journal of Advanced Research in Law and Economics,* vol. 9, no. 1, pp. 6-14, 2018.

[37] E. Akhmetshin, I. Morozov, A. Pavlyuk, A. Yumashev, N. Yumasheva and S. Gubarkov, "Motivation of Personnel in an Innovative Business Climate," *European Research Studies Journal,* vol. 21, no. 1, pp. 352-361, 2018.

[38] I. G. Salimyanova, A. A. Novikov, E. V. Novikova, I. V. Lushchik, A. F. Savderova, N. V. Berezina, L. G. Rudenko and R. M. Allalyev, "Economy Digitalization: Information Impact on Market Entities," *Journal of Environmental Treatment Techniques,* vol. 7, no. 4, pp. 654-658, 2019.

[39] A. Markovska and A. Isaeva, "Public Sector Corruption: Lessons to Be Learned from the Ukrainian Experience," *Crime Prevention and Community Safety,* vol. 9, no. 2, pp. 118-129, 2007.

[40] A. Niyazbayeva, S. Baizakov and A. Maydirova, "Competitiveness of the Tourism Cluster of Kazakhstan: Comparative Analysis of Key Indicators," *Journal of Applied Economic Sciences,* vol. 12, no. 5, pp. 1443-1450, 2017.

[41] A. Ruslan Agarunovich, "Management Functions of Integrative Formations of Differentiated Nature," *Biosciences Biotechnology Research Asia,* vol. 12, no. 1, pp. 991-997, 2015.

[42] A. Borodin and I. Mityushina, "Evaluating the Effectiveness of Companies Using the DEA Method," *Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu,* vol. 6, pp. 187-193, 2021.

[43] S. V. Laptev, F. V. Filina and L. V. Degteva, "The Organization of Agricultural Markets as a Factor of Innovative Development in the Agricultural Economy," *Studies in Systems, Decision and Control,* vol. 282, pp. 347-355, 2020.

[44] S. A. Makushkin, "Company's Personnel Motivation," *Espacios,* vol. 40, no. 40, pp. 1-16, 2019.

[45] B. M. Nurgaliyev, K. S. Lakbayev, A. V. Boretsky and A. K. Kussainova, "The Informal Funds Transfer System "Hawala" as a Segment of the Shadow Economy: Social Impact Assessment and Framework for Combating," *American Journal of Applied Sciences,* vol. 12, no. 12, pp. 931-937, 2015.

[46] T. G. Bondarenko, E. A. Isaeva, O. A. Zhdanova and M. V. Pashkovskaya, "Model of Formation of the Bank Deposit Base as an Active Method of Control Over the Bank Deposit Policy," *Journal of Applied Economic Sciences,* vol. 11, no. 7, pp. 1477-1489, 2016.

[47] M. I. Ermilova, D. Ushakov and S. V. Laptev, "Financing the Russian Housing Market: Problems and the Role of the State," *Opción,* vol. 34, no. Special Issue 17, pp. 1074-1087, 2018.

[48] A. Maydirova and V. Biryukov, "Human Capital Quality as a Determinant of Efficient Public Administration," *Actual Problems of Economics,* vol. 143, no. 5, pp. 386-398, 2013.

[49] K. S. Lakbaev, D. A. Uakasov and K. R. Tusupbekov, "About Economic Basics and Social Consequences of Extremism and Terrorism," *Man in India,* vol. 97, no. 20, pp. 365-371, 2017.

[50] S. Mishchenko S. Naumenkova, V. Mishchenko and D. Dorofeiev, "Innovation Risk Management in Financial Institutions," *Investment Management and Financial Innovations,* vol. 18, no. 1, pp. 191-203, 2021.

[51] N. Israfilov, I. Ablaev, A. Seisinbinova and T. Sakulyeva, "Impact of Supply Chain Management Strategies on the Performance Indicators of Small and Medium-Sized Businesses," *International Journal of Supply Chain Management,* vol. 9, no. 4, pp. 544-552, 2020.

[52] L. G. Fezchenko, "Technological Aspects of Naming," *Information Age,* vol. 3, no. 4, 2019.

[53] N. A. Antoniuk, "Forecasting in Anti-Crisis Management Under Reforming Conditions," *Scientific Bulletin of Mukachevo State University. Series "Economics",* vol. 2, no. 12, pp. 15-20, 2019.

[54] D. I. Bayanov, L. Y. Novitskaya, S. A. Panina, Z. I. Paznikova, E. V. Martynenko, K. B. Ilkevich, V. L. Karpenko and R. M. Allalyev, "Digital Technology: Risks or Benefits in Student Training?" *Journal of Environmental Treatment Techniques,* vol. 7, no. 4, pp. 659-663, 2019.

[55] K. S. Lakbaev, G. M. Rysmagambetova, A. M. Saitbekov and Y. O. Mukhamedzhanov, "Investigative Measures in Prejudicial Inquiry: The Concept, Content and the Basics of Law Enforcement," *Man in India,* vol. 97, no. 20, pp. 373-380, 2017.

[56] A. B. Maydirova, R. A. Baizholova, L. K. Sanalieva, G. T. Akhmetova and A. A. Kocherbaeva, "Strategic Priorities of Kazakhstan Innovative Economy Development," *Opción,* vol. 36, no. Special Edition 27, pp. 779-793, 2020.

[57] I. N. Kuksin, R. M. Allalyev, V. I. Lipunov and I. V. Tyurin, "The Economic Foundations of the Rule of Law in the Russian Federation," *International Journal of Criminology and Sociology,* vol. 9, pp. 1622-1625, 2020.

[58] S. Naumenkova, S. Mishchenko and D. Dorofeiev, "Digital Financial Inclusion: Evidence from Ukraine," *Investment Management and Financial Innovations,* vol. 16, no. 3, pp. 194-205, 2019.

[59] H. L. T. Mai, H. T. Van and D. Ushakov, "Migration Policy, Labor Immigration and Economic Growth: Qualitative Analysis of Correlations and Interaction Scenarios," *International Journal of Recent Technology and Engineering,* vol. 8, no. Special Issue 11, pp. 3876-3882, 2019.

[60] A. V. Kostruba and O. S. Hyliaka, "Designing of Legal Model of Legal Relations Cessations," *Astra Salvensis,* vol. 1, pp. 69-86, 2020.

[61] Y. V. Lyandau and M. G. Umnova, "Development of Management System of Public Procurement Participation in Supplier Companies," *Quality - Access to Success,* vol. 22, no. 182, pp. 95-101, 2021.

[62] D. T. Akhmetov, K. S. Lakbayev and G. M. Rysmagambetova, "State of Emergency as a Kind of Special Conditions: The International Practice, the Basics of Preventing and Combating," *Man in India,* vol. 97, no. 7, pp. 13-21, 2017.

[63] O. Kruzhilko, O. Polukarov, S. Vambol, V. Vambol, N.A. Khan, V. Maystrenko, V. P. Kalinchyk and A. H. Khan, "Control of the Workplace Environment by Physical Factors and Smart Monitoring," *Archives of Materials Science and Engineering,* vol. 103, no. 1, pp. 18-29, 2020.

[64] K. S. Lakbayev, G. M. Rysmagambetova, A. U. Umetov and A. K. Sysoyev, "The Crimes in the Field of High Technology: Concept, Problems and Methods of Counteraction in Kazakhstan," *International Journal of Electronic Security and Digital Forensics,* vol. 12, no. 4, pp. 386-396, 2020.

[65] B. M. Nurgaliyev, G. M. Rysmagambetova, K. S. Lackbayev and A. A. Shulanbayev, "Problems and Conflicts of the Intelligence and Criminal Procedure Legislation of the Republic of Kazakhstan," *Rivista di Studi sulla Sostenibilita,* vol. 2020, no. 1, pp. 391-402, 2020.

[66] A. Maidyrova and A. Tariverdi kizi Mamedova, "Economic and Legal Aspects of Labor Market Regulations in the Modern Kazakhstan," *Business: Theory and Practice,* vol. 14, no. 4, pp. 267-277, 2013.

[67] E. Y. Sidorova and L. I. Goncharenko, "Tax Regulation of Customs Payments in the State Policy of Russia," *Lecture Notes in Networks and Systems,* vol. 115, pp. 636-642, 2020.

[68] M. Demiral, O. Demiral, A. Khoich and A. Maidyrova, "Empirical Links Between Global Value Chains, Trade and Unemployment," *Montenegrin Journal of Economics,* vol. 16, no. 4, pp. 95-107, 2020.

[69] A. V. Bobrova, E. A. Stepanov, T. Sakulyeva, G. Z. Zhumabekova and A. I. Yesturliyeva, "The Influence of Alternative Fuels on the Development of Large-Scale Production," *Journal of Environmental Accounting and Management,* vol. 8, no. 4, pp. 335-349, 2020.

[70] A. V. Raichenko, V. G. Antonov and Y. V. Lyandau, "Visualization of Corporate Digital Management," *Studies in Systems, Decision and Control,* vol. 314, pp. 947-956, 2021.

[71] A. V. Kostruba and P. F. Kulynych, "Improvement of Public Control Over the Use of Land Resources as an Important Aspect of Modernisation of the Ukrainian State in the XXI Century," *International Journal of Criminology and Sociology*, vol. 9, pp. 3095-3103, 2020.

[72] O. Kruzhilko, V. Maystrenko, O. Polukarov, V. P. Kalinchyk, A. Shulha, A. Vasyliev and D. Kondratov, "Improvement of the Approach to Hazard Identification and Industrial Risk Management, Taking into Account the Requirements of Current Legal and Regulatory Acts," *Archives of Materials Science and Engineering*, vol. 105, no. 2, pp. 65-79, 2020.

[73] K. Y. Babenko, "Management of Territorial Economic Development: Project Approach," *Scientific Bulletin of Mukachevo State University. Series "Economics",* vol. 1, no. 13, pp. 135-139, 2020.

[74] A. Lapidus and I. Abramov, "Studying the Methods for Determining and Maintaining Sustainability of a Construction Firm," *MATEC Web of Conferences*, vol. 251, 05017, 2018.

[75] G. M. Karasayev, K. A. Yensenov, K. M. Aldabergenov, B. S. Zhumagulov and T. M. Aminov, "From the History of International Economic, Industrial and Political Relations Between Kazakhstan and Russian Federation (1991-1998)," *Journal of Advanced Research in Law and Economics,* vol. 10, no. 5, pp. 1434-1437, 2019.

[76] S. Zhang, T. N. Sakulyeva, E. A. Pitukhin and S. M. Doguchaeva, "Neuro-Fuzzy and Soft Computing – A Computational Approach to Learning and Artificial Intelligence," *International Review of Automatic Control*, vol. 13, no. 4, pp. 191-199, 2020.

[77] M. K. Haliantych, A. V. Kostruba and N. I. Maydanyk, "Legal Aspects of the Implementation of a Pledge of a Bill of Lading as a Security: National Legal Realities," *International Journal of Criminology and Sociology*, vol. 10, pp. 363-367, 2021.

[78] I. V. Muradov and E .Y. Sidorova, "Formation of an Effective Corporate Governance System for Industrial Enterprises," *International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM,* vol. 18, no. 5, pp. 407-414, 2018.

[79] R. Baizholova, Z. Abylkassimova and A. Ramashova, "Problems of Staffing for Innovation Sector," *Actual Problems of Economics*, vol. 178, no. 4, pp. 232-245, 2016.

[80] D. Topchiy and A. Bolotova, "Systematization of Factors Affecting the Organizational Processes in the Conversion of Buildings," *IOP Conference Series: Materials Science and Engineering*, vol. 753, no. 3, 032042, 2020.

[81] B. S. Omirbayeva, R. A. Baizholova and D. M. Nurkhaliyeva, "Health Care System in Transition: Some Aspects of Financing," *Journal of Advanced Research in Law and Economics,* vol. 8, no. 4, pp. 1260-1275, 2017.

[82] A. Yermekbayev, V. Khairullayeva, V. Iztayeva, B. Zhuztayeva and A. Doszhanova, "Relations Between Turkey and Russia in the Context of Energy Partnership," *International Journal of Energy Economics and Policy*, vol. 10, no. 4, pp. 166-171, 2020.

[83] L. R. Kucher and O. M. Zamrii, "The Role of the Competitive Personality of the Manager in Management," *Scientific Bulletin of Mukachevo State University. Series "Economics",* vol. 1, no. 13, pp. 32-37, 2020.

[84] A. Lapidus, A. Khubaev and T. Bidov, "Development of a Three-Tier System of Parameters in the Formation of the Organizational and Technological Potential of Using Non-Destructive Testing Methods," *E3S Web of Conferences*, vol. 97, 06037, 2019.

[85] A. A. Yermekbayev, L. Z. Abzhaparova and V. A. Iztayeva, "The Russian-Turkish Relations in the Context of Syrian Crisis," *Opcion*, vol. 35, no. Special Issue 19, pp. 362–380, 2019.

[86] Y. Li, A. M. Arutiunian, E. L. Kuznetsova and G. V. Fedotenkov, "Method for Solving Plane Unsteady Contact Problems for Rigid Stamp and Elastic Half-Space with A Cavity of Arbitrary Geometry and Location," *INCAS Bulletin*, vol. 12(Special Issue), pp. 99-113, 2020.

[87] A. Yermekbayev, G. Shotanova, L. Abzhaparova and A. Sultanova, "Russia and Turkey: Energy partnership. Central Asia and the Caucasus," *Opcion*, vol. 20, no. 3, pp. 34-41, 2019.

[88] A. V. Kostruba, "Right Deprivation in the Legal Regulation Mechanism of Civil Property Relations: Comparative Analysis of International Legislation," *Asia Life Sciences*, vol. 22, no. 2, pp. 143-156, 2020.

[89] A. B. Maydirova, R. A. Baizholova, L. K. Sanalieva, G. T. Akhmetova and A. A. Kocherbaeva, "Strategic Priorities of Kazakhstan Innovative Economy Development," *Opción*, vol. 36, no. Special Edition 27, pp. 779-793, 2020.

[90] A. Lapidus and A. Makarov, "Automation of Roof Construction Management by Means Artificial Neural Network," *Advances in Intelligent Systems and Computing*, vol. 692, pp. 1168-1176, 2018.

[91] K. A. Yensenov, G. M. Karasayev, S. Z. Dyusen, B. R. Naimanbayev and M. K. Islamov, "The Model of Interethnic Accord in the Republic of Kazakhstan (1991-2018): Historical Research Aspect," *Analele Universitatii din Craiova - Seria Istorie*, vol. 35, no. 1, pp. 79-92, 2019.

[92] G. M. Karasayev, S. T. Nabiyev, K. A. Yensenov, B. S. Zhumagulov and A. A. Oskembay, "Stalin's Agricultural Collectivization Activities in Kazakhstan (XX C. 20-30)," *Opcion*, vol. 36, no. Special Edition 27, pp. 169-187, 2020.

[93] A. Lapidus and I. Abramov, "Implementing Large-Scale Construction Projects Through Application of the Systematic and Integrated Method," *IOP Conference Series: Materials Science and Engineering*, vol. 365, no. 6, 062002, 2018.

[94] Y. Haydanka, "Urgent Decentralization Problems in the Czech Republic at a Regional Level: Political, Administrative and Sociological Dimensions," *Public Policy and Administration*, vol. 19, no. 2, pp. 253-265, 2020.

[95] G. M. Karasayev, K. A. Yensenov, B. S. Zhumagulov, K. M. Aldabergenov and B. T. Batkeeva, "The Historical Aspects of Economic and Legal International Relations of Independent Kazakhstan and China (1991-1997)," *Journal of Advanced Research in Law and Economics*, vol. 10, no. 5, pp. 1444-1451, 2019.

[96] M. M. Kamruzzaman, W. He and X. Peng, "Performance of Relay Assisted Uplink Wireless Communication Using Multi-Layered STBC For Multiple Access Channel," *Telecommunication Systems*, vol. 71, no. 3, pp. 309-320, 2019.

[97] A. V. Kostruba, R. A. Maydanyk and V. V. Luts, "Bonum Requirements of the Beneficiary in the Corporate Rights Protection System in Ukraine: Implementing Best Practices," *Asia Life Sciences*, vol. 1, pp. 189-207, 2020.

[98] A. S. Zinchenko, "Project-Focused Personnel Management Approach of Higher Educational Institutions," *Asia Life Sciences*, vol. 22, no. 2, pp. 243-256, 2020.

[99] D. Topchiy and A. Bolotova, "Assessment and Inspection of the Technical Condition of Monolithic Reinforced Structures in Transportation Infrastructure Facilities," *Journal of Physics: Conference Series*, vol. 1425, no. 1, 012005, 2020.

[100] A. Lapidus, N. Cherednichenko and V. Smotrov, "The Impact of Technology Installation of Injection Mortar Systems for a Long-Term Behavior of Anchor Connections," *Procedia Engineering*, vol. 153, pp. 371-377, 2016.

[101] D. V. Topchiy and A. S. Bolotova, "The Monolithic Buildings Complex Renovation's Organizational and Technological Model Creation," *IOP Conference Series: Materials Science and Engineering*, vol. 913, no. 4, 042016, 2020.

[102] E. L. Kuznetsova, G. V. Fedotenkov and E. I. Starovoitov, "Methods of Diagnostic of Pipe Mechanical Damage Using Functional Analysis, Neural Networks and Method of Finite Elements," *INCAS Bulletin*, vol. 12(Special Issue), pp. 79-90, 2020.

[103] S. S. Rybakova, D. A. Myronov and N. V. Rogova, "Areas for Improvement of the Hotel Management Efficiency in Ukraine Through the Implementation of Communication Policy," *Scientific Bulletin of Mukachevo State University. Series "Economics"*, vol. 7, no. 2, pp. 117-125, 2020.

[104] M. M. Kamruzzaman, "Arabic Sign Language Recognition and Generating Arabic Speech Using Convolutional Neural Network," *Wireless Communications and Mobile Computing*, vol. 2020, 3685614, 2020.

[105] L. R. Prus, "Customs Management: International Supply Chains Maintenance and Implementation of a Customs Policy to Counter the COVID-19 Crisis," *Scientific Bulletin of Mukachevo State University. Series "Economics"*, vol. 8, no. 1, pp. 130-143, 2021.

[106] A. Lapidus and D. Topchiy, "Construction Supervision at the Facilities Renovation," *E3S Web of Conferences*, vol. 91, 08044, 2019.

[107] V. Klimina, A. Yurgaitis and D. Topchiy, "Unified Classification of Defects Detected by the Technical Examination," *E3S Web of Conferences*, vol. 110, 01086, 2019.

[108] I.A. Kapitonov, "Peculiarities of Applying the Theory of International Business by Russian Oil and Gas Companies," *Space and Culture, India*, vol. 6, no. 4, pp. 5-14, 2018.

[109] G. M. Karasayev, Z. N. Zhaxygeldinov, K. A. Yensenov, B. R. Naimanbayev and Z. S. Bakirova, "The Place and History of the Activities of Kazakhstan in the United Nations Organization (1991 – 2016)," *Journal of Advanced Research in Law and Economics*, vol. 10, no. 7, pp. 2008-2016, 2019.

[110] A. V. Kostruba, "Corporate Responsibility in the Environmental Protection as an Element of Public-Private Partnership in Ukraine," *Public Policy and Administration*, vol. 20, no. 1, pp. 118-126, 2021.

[111] A. V. Kostruba and O. S. Hyliaka, "Theoretical Substantiation of the Model of Borrowing Rights-Terminating Facts," *Rivista di Studi sulla Sostenibilita*, vol. 2020, no. 2, pp. 189-203, 2020.

[112] A. A. Lapidus, and A. N. Makarov, "Model for the Potential Manufacture of Roof Structures for Residential Multi-Storey Buildings," *Procedia Engineering*, vol. 153, pp. 378-383, 2016.

[113] A. Lapidus and T. Dmitry, "Formation of Methods for Assessing the Effectiveness of Industrial Areas' Renovation Projects," *IOP Conference Series: Materials Science and Engineering*, vol. 471, no. 2, 022034, 2019.

[114] D. Topchiy and A. Bolotova, "Studying Specific Features of the Monolithic Construction Technology Based on Systemic Analysis," *IOP Conference Series: Materials Science and Engineering*, vol. 603, no. 5, 052004, 2019.

[115] Y. Sun, M. Y. Kuprikov and E. L. Kuznetsova, "Effect of Flight Range on the Dimension of the Main Aircraft," *INCAS Bulletin*, vol. 12(Special Issue), pp. 201-209, 2020.

[116] D. Topchiy and A. Bolotova, "Risk Management in Monolithic Construction," *IOP Conference Series: Materials Science and Engineering*, vol. 962, no. 2, 022078, 2020.

[117] H. Yu. Podakova and I. A. Nechayeva, "Staff Management as a Tool for Building a Competitive Position of Universities," *Scientific Bulletin of Mukachevo State University. Series "Economics"*, vol. 7, no. 2, pp. 40-49, 2020.