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Abdalmuttaieb M. A. Musleh Al-Sartawi
Abdulnaser Ibrahim Nour *Editors*

Artificial Intelligence and Economic Sustainability in the Era of Industrial Revolution 5.0

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Abdulnaser Ibrahim Nour
Editors

Artificial Intelligence and Economic Sustainability in the Era of Industrial Revolution 5.0

 Springer

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Preface

Countries seek to achieve sustainable development, particularly economic sustainability through practices that enable long-term economic growth and extend the positive effects of this growth to the environmental, social, and cultural aspects of society. Economic sustainability emphasizes achieving economic growth in terms of volume and quality while also maintaining the health and stability of societal growth and the human ecosystem. Economic sustainability aims to preserve capital and labor, to improve the standard of living, the effective use of assets, along with maximization of profits. The principles of economic sustainability can hence be considered in line with the elements of Industry 5.0. Both seek to and include the welfare and well-being of workers, individuals, and the society. This publication accordingly focuses on topics related to the role of technology and AI in advancing the welfare and well-being of the society.

The publication *Artificial Intelligence and Economic Sustainability in the Era of Industrial Revolution 5.0* has provided a platform for interdisciplinary research from multiple perspectives, disciplines, and researchers. The publication covers topics in the fields of technology, economics, accounting, finance, and knowledge management especially from the perspective of the more human-centric society—Society 5.0.

This publication consists of 99 chapters. The call for papers sought submissions in full research papers and hence attracted many submissions which were reviewed in a double-blind process by academics in the relevant fields.

This book provides insight on important areas related to artificial intelligence, sustainable development, and Society 5.0. The papers present a wide range of topics including block cipher, entrepreneurship and AI, AI and stock trading decisions, digital transformation, knowledge management, chatbot engineering, cybersecurity, and smart metering system.

As editors, we would like to take this opportunity to thank our reviewers for refereeing the chapters as well and their contributions toward the improvement of quality and content of the chapters. Particular thanks go to our authors and reviewers for the quality of the papers. We are grateful for receiving papers and submissions from two conferences, (1) The Fifth Scientific Conference of the College of Economics

and Social Sciences 2023 (CESS) and (2) The International Conference on Global Economic Revolutions 2022. Finally, we would like to thank the executive editor of CESS 2023, **Dr. Islam Abdeljawad**, for his hard work and support in organizing the conference, leading the editorial team, and reviewing the final accepted papers for publication.

Manama, Bahrain
Nablus, Palestine, State of
October 2023

Abdalmuttaleb M. A. Musleh Al-Sartawi
Abdulnaser Ibrahim Nour

Introduction

The Fifth Industrial Revolution or 'Industry 5.0' has been dubbed as the digital revolution with a *soul*. In this sense, Industry 5.0 addresses the technocentric limitations of Industry 4.0. Sustainable technologies, human-centric artificial intelligence, and manufacturing simulation are essential for implementing the key elements of Industry 5.0 which include **human-centricity, sustainability, and resilience**. Countries seek to achieve sustainable development, particularly economic sustainability through practices that enable long-term economic growth and extend the positive effects of this growth to the environmental, social, and cultural aspects of society. Economic sustainability emphasizes achieving economic growth in terms of volume and quality while also maintaining the health and stability of societal growth and the human ecosystem. Economic sustainability aims to preserve capital and labor, to improve the standard of living, the effective use of assets, along with maximization of profits [1]. The principles of economic sustainability can hence be considered in line with the elements of Industry 5.0. Both seek to and include the welfare and well-being of workers, individuals, and the society.

Industry 5.0 is an effort to address the human impacts of the Fourth Industrial Revolution. In light of the rapid developments of the Industrial Revolution 5.0, the importance of this conference to achieve a sustainable economy is embodied in several aspects. As the limited natural resources threaten the sustainability of the economy, the development of new operations and investment in various resources is a necessity for the long-term sustainability of any business activity [2].

On the other hand, preserving human life is important, as climate change causes damages that impede the human ability to continue living, so reducing energy consumption and adjusting the food production approach provides an opportunity for the growth and stability of future generations. Also on this list are discovery and innovation [3]. When the environment gets worse, it becomes harder to come up with new ideas and find new parts that can be used to make products and services that help the economy.

In Society 5.0, organizations need to seize both national and international market opportunities through reliable employees who can effectively and efficiently utilize

digital technology [4]. It is the role of organizations, through strategies, policies, and training, to increase employee engagement and voice.

Abdalmuttaleb M. A. Musleh Al-Sartawi
2023

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Financial Distress Determinants: Empirical Evidence from Insurance Companies Operating in Palestine and Jordan



Muath Asmar  and Hasan Farhood

Abstract Financial distress is a situation where a corporation is unable to meet its financial obligations, which may lead to bankruptcy or insolvency. This paper examines the determinants of financial distress of insurance companies in Palestine and Jordan. Data were collected from 7 Palestinian to 19 Jordanian insurance companies from 2011 to 2021. Random effect model for panel data estimation were used in the empirical analysis in this study. According to the findings, a company's profitability, firm size, and capital adequacy positively and significantly affect Altman Z-Score, which reduces the likelihood of financial distress for insurance companies in Palestine and Jordan. The loss ratio negatively impacts Altman Z-Score, increasing the possibility of financial distress for Palestine and Jordan-based insurance businesses. This study provides important insight to the management, creditors, policymakers and regulator about the financial distress and its determinants of insurance companies in Palestine and Jordan.

Keywords Financial distress · Insurance companies · Emerging markets

1 Introduction

When a company's financial situation deteriorates to the point where it may be unable to satisfy its financial responsibilities, such as paying off its debts or operating expenditures, it is said to be in financial distress. Failure, insolvency, default, and bankruptcy describe corporate financial distress, according to research [1, 2]. The likelihood that a firm may file for bankruptcy increases when it is in financial

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distress, which will damage the company's reputation [3]. Poor management causes more businesses to go into financial distress than does economic distress [4]. Despite the fact that financial distress does not always indicate an eventual failure, a large and ongoing decline in a company's financial performance due to financial distress might ultimately lead to bankruptcy, which would be very costly for creditors and investors [1]. Financial distress is considered an important issue from both academic and practical perspectives. Therefore, several studies have investigated the determinants of financial distress [3, 5, 6]. However, few studies have examined the causes of financial distress in financial institutions, especially in emerging markets. Thus, this study examines the causes of financial distress in Palestine and Jordan insurance companies. These countries' insurance companies rank second after banks. Insurance companies also provide financial loss indemnity, reduce uncertainty, and facilitate fund transfer. These activities performed by insurance firms result in large-scale investment and a thriving economy [7]. Furthermore, this study was conducted in Palestine, which has unique economic and political situations [8] and high unemployment rates [9] and needs to attract investments and enhance its business sector [10], and Jordan, which has had significant challenges and economic issues as a result of a number of factors, including regional instability, dependency on aid and remittances from Gulf countries, strain on natural resources, and high unemployment [11].

Due to its critical role in providing financial protection against various risks, the insurance industry is one of the most heavily regulated industries worldwide. Despite this, insurance companies continue to face financial difficulties, which can hinder their ability to fulfill their contractual obligations to policyholders. For the stability of the industry and the protection of policyholders, it is essential to comprehend the causes of financial distress. This study contributes to the existing literature by investigating the financial distress determinants of insurance companies operating in Palestine and Jordan. This study seeks to investigate the effects of firm profitability, liquidity, leverage, capital adequacy, earnings growth, and loss ratio on the financial distress of insurance companies operating in Palestine and Jordan.

Identifying the financial distress of insurance companies is a key challenge. Since market integration is a common issue around the world [12, 13], financial distress in the insurance industry might be a systemic risk to the whole financial system. Furthermore, insurance companies operate under complex regulatory frameworks aimed at protecting policyholders and ensuring solvency and financial stability. Financial distress in the insurance sector could create challenges for regulators, potentially leading to regulatory intervention, increased oversight, and regulatory changes. Above all, financial distress in the insurance sector could lead to economic impacts, damage the rights and interests of its stakeholders, influence a company's operational sustainability, and decrease economic growth [14].

There are five sections in this study. Following a review of the relevant literature, the data and research methodology employed for the current study are presented. The discussion of the results is presented in Part 4, and the study is concluded in Sect. 5.

2 Literature Review

Because it can result in insolvency and bankruptcy, financial distress is a serious problem for businesses. It happens when a business is in financial trouble and is unable to meet its financial obligations, putting it at risk of going out of business. Altman [15] created the first multivariate bankruptcy prediction model in the late 1960s, called the Altman Z score. After this seminal study, academics in banking, finance, and credit risk began to use the multivariate method for failure prediction. Another well-known model for predicting financial distress is the Ohlson O-Score, developed by Ohlson [16]. The O-Score uses a logistic regression model to predict the likelihood of financial distress based on accounting variables.

Financial distress can lead to business failure. When a company can't pay its bills, it risks going out of business. Altman Z score was the first multivariate bankruptcy prediction Altman [15]. After this seminal study, banking, finance, and credit risk academics used multivariate failure prediction. The Ohlson O-Score predicts financial distress [16]. The O-Score predicts financial distress using accounting variables and a logistic regression model. Altman's Z-score and Ohlson's O-score are two of the main techniques used to forecast bankruptcy [17]. Indeed, these two models were used by many previous studies to measure the financial distress and predict the bankruptcy of the companies [18–22]. Several studies have examined the determinants of financial distress in different industries. For instance, Chava and Jarrow [23] found that financial distress is positively related to leverage, size, and liquidity risk. Caporale and Cerrato [24] have investigated the insolvency risk of general insurance firms in the UK, the found that macroeconomic and firm-specific factors both play important roles. Grishunin and Bukreeva [25] have analyzed the determinants of insolvency for Russian insurance companies, using financial, non-financial, and macroeconomic variables. They found that credit risk for Russian insurance companies is driven by profitability, asset liquidity, and premium collection discipline. Strategic management efficiency [26, 27], sales channel management [28], and reinsurer credit quality also mattered. Insurance penetration and inflation also affect Russian insurance companies' creditworthiness. Isayas [29] examines the causes of Ethiopian insurance companies' financial distress. The results show that profitability, firm size, leverage, and company age all negatively affected financial distress. Asset tangibility and loss ratio improve insurance companies' financial distress.

Numerous studies have examined financial distress variables in banking and financial institutions. Discussing the most important factors as follow.

2.1 *Company Profitability*

Company profitability is one of factors that affects the financial distress [30]. A company's capacity to create revenue above costs is measured by profitability ratios, which show how well a company generates profits from sales and/or its capital assets

[29]. The greater a company's profitability ratio, easier it is for the company to get away from financial difficulties. As a result, profitability declines, and the likelihood of financial distress rises [31]. Several studies have investigated the relationship between profitability and financial distress. For example, a study by Dwiantari and Artini [32] found that profitability has a significant negative effect on financial distress. Therefore, the following hypothesis is formulated.

H1: There is a negative effect for profitability on financial distress of Palestine and Jordan insurance companies.

2.2 *Firm Size*

Firm size is a vital factor that affects financial distress. Larger insurance companies often have greater levels of capital and stronger solvency ratios, which may help them resist financial distress. Several studies have investigated the relationship between firm size and financial distress and found mixed results. For instance, Parker and Peters [33] found significant positive effects of firm size on financial distress. Moreover, Boubaker and Cellier [6] and Thim and Choong [34], Choong [34] found that firm size was negatively associated with the Z-score. While Fawzi and Kamaluddin [35] found that firm size had no significant relationship with financial distress, Hence, the following hypothesis is expressed:

H2: There is a negative effect for firm size on financial distress of Palestine and Jordan insurance companies.

2.3 *Liquidity*

The liquidity ratio is considered an important factor that affects financial distress. When a company runs into financial trouble, it often begins to pay off its trade payables slowly and takes out additional bank loans, both of which will raise current liabilities and cause the current ratio to fall, signaling a problem [32]. The company's high liquidity level indicates that it has a strong capacity to settle its present obligations. Consequently, the potential for financial distress will be avoided by the company [36]. Erni and Abel [37] found that liquidity has a negative and significant influence on the financial distress of manufacturing companies. On the other hand, several studies, such as [29, 38], found that liquidity ratios had no significant relationship with financial distress. Thus, the following hypothesis is formulated:

H3: There is a negative effect for company liquidity on financial distress of Palestine and Jordan insurance companies.

2.4 Leverage

The next factor that affects financial distress is leverage, which refers to the use of debt financing. In the context of insurance companies, the use of debt can lead to higher returns on equity when investment returns exceed the cost of borrowing. However, a highly leveraged firm is anticipated to have a decline in its capacity to pay interest in the future due to cash flow issues, which are associated with distressed companies' status [35]. In the literature, the effects of leverage on financial distress are mixed. Several studies, e.g., [29, 39], show that an increase in corporate financial distress will occur as firm leverage increases. However, a number of studies, like [40], show that the relationship between leverage and financial distress is negative. On the other side, research such as [41] showed that leverage did not significantly affect business financial distress. Accordingly, the following hypothesis is formulated:

H4: There is a positive effect for company liquidity on financial distress of Palestine and Jordan insurance companies.

2.5 Capital Adequacy

The subsequent factor that affects financial distress is capital adequacy, which measures the capability of a company to meet its debtors through its operating cash flows and is a key element in rating consideration [42]. The capital adequacy ratio is intended to determine how effectively companies can withstand an acceptable amount of loss before going bankrupt [29]. In addition, Pietrzak [43] contends that the most significant indicator of difficult financial circumstances is inadequate capital adequacy. The capacity of an insurance firm to pay its financial obligations and absorb unforeseen losses is related to its capital adequacy. In other words, it serves as a gauge of a company's financial stability and capacity to maintain profitability in the face of unfavorable circumstances. So, the following hypothesis is formulated:

H5: There is a negative effect for is capital adequacy on financial distress of Palestine and Jordan insurance companies.

2.6 Earnings Growth

One of the firm-specific factors that affects financial distress is earnings growth. Earnings growth is crucial for the insurance sector since insurers depend on investment income to fund their underwriting operations. Insurance companies receive premiums from policyholders and invest the money to make more money. The capacity of an insurer to make further investments in its operations and maintain its financial health is significantly influenced by earnings growth. However, Isayas [29] found

that the effect of capital adequacy on earnings growth was statistically insignificant. Consequently, the following hypothesis is formulated:

H6: There is a negative effect for is earnings growth on financial distress of Palestine and Jordan insurance companies.

2.7 Claim Incurred (Loss) Ratio

An indicator that affects the financial distress of the insurance companies is the claim incurred (loss) ratio. It is calculated by dividing the total amount of claims paid out by an insurance company over a specific period, including claim adjustment expenses, by the total amount of earned premiums for the same period. Serval studies [44, 45] found that the claim incurred (loss) ratio is negatively related to the profitability of insurance companies. However, several studies [46] found that the claim incurred (loss) has a positive relationship with the profitability of insurance companies. Other studies [7] found no relationship between claims incurred and the profitability of insurance companies. Above all, a previous study [29] found that the claim incurred (loss) ratio had a positive and statistically significant effect on the financial distress of insurance companies. Therefore, the following hypothesis is expressed:

H7: There is a positive effect for claim incurred on financial distress of Palestine and Jordan insurance companies.

3 Research Methodology

This section of the study focuses on data, sample and population, research model, variable measurement, and analysis methods.

3.1 Data

The 26 insurance companies from 2011 to 2021 are included in this research, 19 of which are Jordanian and 7 of which are Palestinian. On the websites of the Palestine Stock Exchange and the Amman Stock Exchange, the annual reports (income statement and statement of financial situation) are where the data are manually gathered. The final data set consists of a balanced panel data set with 285 observations.

3.2 Measurement of Variables

The factors in this research were measured in accordance with earlier literature. The dependent and independent variables are listed in Table 1, along with a description of how the variables were measured.

The dependent variable employed in this study is the Altman Z score (AMZ) to measure financial distress. In addition, the Altman Z-score was used in a plethora of previous studies to measure financial distress in non-financial sectors [e.g., 6] and in insurance companies [e.g., 29, 47]. The Altman Z-score has the capacity to distinguish between financially distressed companies and those that are not [48]. When the z score is between 1.23 and 2.9, it is an indication that the firm is in a gray zone. If the z score is greater than 2.9, the firm is good; if the z score is below 1.23, the firm is regarded as being in a distress zone [15]. The Z-score for non-manufacturing and emerging markets is as follows: [29].

$$\text{Altman Z score} = 3.25 + 6.56x_1 + 3.26x_2 + 6.72x_3 + 1.05x_4 \quad (1)$$

X_1 = net working capital divided by total asset

X_2 = retained earnings divided by total asset

X_3 = EBIT divided by total asset

X_4 = total equity divided by total liability

Table 1 Measurement of variables

Variable type	Variable name	Measurement	References
Dependent variable	Financial distress	Altman Z score	[49]
Independent variables	Profitability (ROA)	Net income/total asset	[50]
	Firm size (Ln (asset))	The logarithm of total assets	[51]
	Liquidity (liquidity)	Current asset/current liability	[52]
	Leverage (D/E)	Total liability/total equity	[11]
	Capital adequacy (CA)	Total equity/total asset	[52]
	Earning growth (PG)	(EBIT _t -EBIT _{t-1})/EBIT _{t-1}	[29]
	Loss ratio (Loss ratio)	Net claims incurred/Net earned premiums	[53]
Control variable	Country (country dummy)	0 for firms from Palestine and 1 otherwise	[8]

3.3 *Research Model*

The following model was estimated to test the hypotheses of this study: The year and firm subscripts are dropped for clarity.

$$\begin{aligned} \text{Financial Distress} = & b_0 + b_1 \text{ROA} + b_2 \text{in (asset)} + b_3 \text{Liquidity} \\ & + b_4 \text{D/E} + b_5 \text{CA} + b_6 \text{PG} + b_7 \text{loss ratio} \\ & + b_8 \text{country} + e \end{aligned} \quad (2)$$

where e is the error term, b_i are the regression coefficients, and the other variables are self-explanatory.

4 Results

The findings of this paper are presented in this section. Firstly, the results of correlation analysis are presented, and descriptive statistics and the estimation results of the model are discussed later.

4.1 *Correlation Analysis*

The correlation coefficients [54], as shown in Table 2, represent the connection between each pair of variables. The Altman-Z-Score is positively connected with ROA, liquidity, capital adequacy, earning growth, loss ratio, and county. It is negatively correlated with size and leverage. The correlation matrix shows no correlation that exceeds 0.39 between independent variables. Multicollinearity is therefore unlikely to be an issue among the explanatory variables [55]. In addition, the variance inflation factor (VIF) was computed to confirm the absence of multicollinearity. In untabulated results, the biggest VIF value in the whole model is 2.10 (capital_adequacy), while all other variables have VIFs below 2. As a general rule, a VIF of 10.0 or above indicates the presence of a multicollinearity issue [56]; however, this was not the case in our investigation.

4.2 *Descriptive Statistics*

Table 3 shows descriptive statistics of the variable that was used in this study. The Altman-Z-Score for sampled insurance companies ranges from negative -2.65 to 9.43 , with a mean of 5.082 , an average ROA of 1.78% , a size of 17.466 , liquidity of

Table 2 Correlation coefficients

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Altman Z score (1)	1.000							
(2) ROA	0.318	1.000						
(3) Size	-0.153	0.272	1.000					
(4) Liquidity	0.291	-0.019	-0.064	1.000				
(5) Leverage	-0.304	-0.120	-0.071	-0.140	1.000			
(6) Capital adequacy	0.601	0.197	0.032	0.352	-0.385	1.000		
(7) Earning growth	0.045	-0.011	0.053	0.046	-0.007	0.076	1.000	
(8) Loss ratio	0.377	-0.316	-0.320	0.289	-0.121	0.313	0.005	1.000

Table 3 Descriptive statistics

	Mean	Median	Maximum	Minimum	Std. dev	Observations
Altman_Z__score	5.083	5.256	9.440	-2.657	1.450	285
ROA	0.018	0.026	0.139	-0.215	0.040	285
Size	17.467	17.361	19.505	16.276	0.656	285
Liquidity	2.900	2.463	13.591	0.203	2.439	285
Leverage	2.196	1.918	45.557	-19.013	3.237	285
Capital_adequacy	0.362	0.342	0.819	-0.056	0.129	285
Earning_growth	-0.046	-0.019	26.526	-52.281	4.943	285
Loss_ratio	0.947	1.001	1.682	0.020	0.286	285
Country	0.733	1.000	1.000	0.000	0.443	285

2.9, leverage of 2.195, capital adequacy of 36.22%, and earnings growth of negative 4.55%.

4.3 Estimation Results

Using panel data analysis, the Hausman test is used to choose between a fixed-effects model and a random-effects model. The result of the Hausman test shows that the chi-squared statistics were not statistically significant at 5%, which suggests that the best approach is the random effect model for panel data estimation. Thus, panel-estimated generalized least squares (EGLS) were used in this study. Using EGLS that can correct for heteroskedasticity or autocorrelation [57], The findings

presented in Table 4 demonstrate that, at a 1% level of significance, a number of factors significantly affect the dependent variable, the Altman Z score. With an R-squared value of 0.606302, the regression model can account for 60.63% of the variation in the Altman Z score.

The independent variables that have a positive and statistically significant impact on the Altman Z score are ROA, firm size, and capital adequacy. This suggests that companies with a higher return on assets, a larger size, and better capital adequacy ratios tend to have a higher Altman Z score, indicating higher financial stability. These results are consistent with the previous studies [32, 34, 43]. On the other hand, loss ratio has a negative and statistically significant impact on the Altman Z score. This suggests that loss ratio has a negative and substantial influence on the degree of Altman Z-Score, which increases the likelihood of experiencing financial distress for insurance companies operating in Palestine and Jordan. These results are consistent with the previous studies [29].

However, liquidity, leverage, and earnings growth do not have a statistically significant impact on the Altman Z score. These results are consistent with the previous studies [29, 41]. The regression model also includes a variable for country, which has a positive and statistically significant impact on the Altman Z score. This suggests that companies located in Jordan tend to have a higher Altman Z score, indicating higher financial stability.

Above all, the results of this regression analysis provide evidence that various financial ratios and firm-specific factors are associated with the financial stability of companies, as measured by the Altman Z score.

Table 4 Estimation results panel EGLS (cross-section random effects)

Variable	Coefficient	Std. error	T-statistic	Prob
C	-7.866282	3.380445	-2.326996	0.0207
ROA	9.326083*	1.524804	6.116252	0.0000
Size	0.562702*	0.174784	3.219423	0.0014
Liquidity	-0.013657	0.042721	-0.319676	0.7495
Leverage	0.005408	0.026370	0.205064	0.8377
Capital_adequacy	6.002293*	0.874314	6.865144	0.0000
Earning_growth	0.001404	0.008886	0.158036	0.8745
Loss_ratio	-0.887775*	0.290260	-3.058552	0.0024
Country	2.248132	0.418031	5.377910	0.0000
R-squared	0.606302*			
F-statistic	53.13069	Prob (F-statistic)		0.000000

* Indicate statistical significance at the 1% level. The dependent variable is Altman_Z_Score

5 Conclusion

This study investigates the factors that led to the financial distress experienced by insurance companies in Palestine and Jordan during the period between 2011 and 2021. The empirical analysis in this study was conducted using a random effect model for estimating panel data (EGLS). According to the findings, factors such as a company's profitability, firm size, and capital adequacy have a positive and substantial influence on the degree of the Altman Z-Score, which reduces the likelihood of experiencing financial distress for insurance companies operating in Palestine and Jordan. While the loss ratio has a negative and substantial influence on the degree of Altman Z-Score, which increases the likelihood of experiencing financial distress for insurance companies operating in Palestine and Jordan, this study points out the determinants of the financial distress of insurance companies in emerging markets. These firms are especially vulnerable to the financial system and economic stability in these markets. This study contributes to the literature by identifying the nature of the financial distress situation of insurance companies in Jordan and Palestine and the financial characteristics that might contribute to the survival of these companies. This research offers valuable information to the management, creditors, policymakers, and regulators of insurance firms in Palestine and Jordan regarding the financial distress of these companies and the factors that contribute to it. While the variables in this study were limited, additional studies may involve the development of a more appropriate procedure for identifying the factors that impact the financial distress of insurance firms in developing economies.

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