

Impact of ISO 14 001, ISO 9 001 and ISO 45 001 on economic performance and competitive potential of European companies

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Abstract

In this paper, we investigate the impact of voluntary standards and approaches in environmental management (ISO 14 000 or EMS), quality management (ISO 9000) and occupational health and safety management (OHSAS 45001) on economic performance of European companies. From the perspective of business practices, implementation of these standards is currently considered as one of the basic tools for building competitive potential of companies. We used a sample of 442 European listed companies for the period 2017-2021. The key analytical tools utilized to identify and model the relationships between management system certifications and economic variables were multivariate regression analysis and logistic regression. The study has found no significant direct impact of ISO certifications on economic performance. The expected benefits of these certifications are context-dependent and are influenced by existing regulatory frameworks and market maturity. The study suggests insignificant effects of these certifications in mature, highly regulated markets. Another finding is that firms with lower economic performance are more likely to adopt management system certifications, supporting the hypothesis that firms with lower productivity seek certification to achieve efficiency gains and build basic competitive advantages. The findings are set in the context of a strict regulatory environment in Europe, where existing regulation may mitigate other benefits of certifications. The study also considers the potential saturation of certifications in developed economies, which could reduce their competitive advantage. The analysis includes a time series covering the pre-pandemic and pandemic periods and finds no significant benefits of these certifications for economic resilience during COVID-19.

Keywords: *corporate economic performance; ISO certification; ISO 14 001; ISO 9 001; ISO 45 001; European listed companies*

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1 INTRODUCTION

In the dynamic environment of modern business, the role of stakeholders is becoming increasingly crucial to the success and sustainability of businesses (Fobbe & Hilletoft, 2021; Goodman, Korsunova & Halme, 2017; Samant & Sangle, 2016). Corporate stakeholders include employees, customers, shareholders, suppliers, the community and the environment, and future generations (Zsolnai, 2006; Jagoda et al., 2023; MacGregor Pelikánová & Sani, 2023). Their interests, concerns, and expectations significantly shape corporate strategies and operations and ultimately influence corporate performance (Freeman, 2010; Hristov & Appoloni, 2022; Wheeler & Sillanpa, 1998). Recognizing and meeting the needs of these stakeholders has become a fundamental principle of building competitive advantage strategy and successful business management, and a prerequisite for sustainability (Baric, 2017; Sharma

& Starik, 2004; Ogutu et al., 2023; Sigurðsson et al., 2023). ISO 14001, ISO 9001 and ISO 45001 (formerly ISO 18001) standards are practical tools for managing stakeholder relationships and encourage businesses to adopt a systematic approach to stakeholder engagement (Martín-de Castro, Amores-Salvadó & Navas-López, 2016; Vieira Nunes et al., 2022). Companies that proactively engage with stakeholders and take their interests into account build stronger relationships, leading to greater loyalty and support (Hristov & Appolloni, 2022). This, in turn, can lead to positive word-of-mouth marketing and customer support, which is in line with the ISO 9001 customer-centric approach (Ferreira et al., 2015). For example, ISO 14001 requires organisations to identify and involve relevant stakeholders in environmental management processes. This ensures that the interests and views of the community are included in decision-making, leading to better outcomes for both the company and its stakeholders (Castka & Prajogo, 2013). By understanding environmental issues and health and safety considerations, a company can proactively address potential problems and adapt its practices (Borusiak et al., 2021; Boczkowska et al., 2022). Aligning business strategies with stakeholder expectations, guided by ISO 14001 and ISO 45001 standards, can lead to improved operational efficiency and innovation (Lo et al., 2014; Loureiro, Romero, & Billo, 2020).

The introduction of voluntary standards in the areas of quality, environmental, and occupational health and safety management is a strategic decision for a company to increase efficiency and reduce risks (Darabont et al., 2017; Purwanto et al., 2020). Due to the high cost of certification, many decision-makers are concerned with the gains from maintaining certification and individual management systems or integrated management systems and the financial benefits that certification and maintenance of management systems will bring (e.g., Frondel, Krätschell & Zwick, 2018; Cañón-de-Francia & Garcés-Ayerbe, 2009). There has also been increasing interest in how management standards contribute to corporate resilience during economic shocks. For these reasons, the actual impact of ISO standards on economic performance and competitive advantage remains a topic of ongoing debate in academic literature. For example, Tarí et al. (2012) highlights the operational benefits of ISO 9001 and ISO 14001, but does not emphasize their impact on economic resilience. Recent research by Podreca et al. (2024) explores the adoption of ISO 45001 and its impact on productivity and profitability. However, the study does not account for how multiple certifications interact to influence overall financial health during crises.

Thus, the main research question of our study is whether firms with certified management systems (CMS) according to ISO 14001, ISO 9001 and ISO 45001 are more profitable and whether they were more economically resilient during the COVID-19 pandemic, which can be considered as the basic characteristics of long-term competitive edge during significant macroeconomic disturbances.

This paper finds no significant direct effect of ISO 9001, ISO 14001 and ISO 45001 certifications on the economic performance of European listed companies. Furthermore, it indicates that companies with lower economic performance are more likely to adopt these certifications in an attempt to improve efficiency and meet competitive standards. The study contextualises these findings in the light of the highly regulated European market and suggests that existing regulations may mitigate further benefits of these certifications. It also includes an analysis of the impact of certifications during the COVID-19 pandemic, which found no significant resilience benefits.

The paper is structured as follows. First, we present the theoretical background focusing on the different management systems and their impact on firm performance. Then, hypotheses are formulated about the relationships between management systems and firm performance. Next, we discuss the research methodology and the results follow. The paper concludes with a discussion section, including future research directions and managerial implications.

2 THEORETICAL BACKGROUND AND HYPOTHESES FORMULATION

The voluntary adoption of quality, environmental and occupational safety management systems certified by third-party audits to ISO standards has become an important complement to mandatory policies based on legislation. In 2021, China held the highest count of global ISO 9001, ISO 14001, and ISO 45001 certificates. China held approximately 427,000 ISO 9001 certificates, 217,600 ISO 14001 certificates and 189,000 ISO 45001 certificates in 2021, followed by Italy, Germany, Japan, and the United Kingdom, respectively (ISO, 2022a-c). There is empirical evidence that the adoption of these management systems has benefits for society in terms of improving the environmental profile and safety of employees. However, in spite of the common “managerial wisdom,” the impact of the standards on the economic performance of the company, and thus its competitive potential, is not nearly as clear.

Satisfying the needs of the customer is at the heart of business, because without the customer there is no business (Davies, 2016; Dabija et al., 2022). All notions of quality are centred around the customer and their requirements (Veber, 2007; Kiba-Janiak et al., 2022). ISO 9001, the standard for quality management systems (QMS), emphasizes customer satisfaction and continuous improvement. By incorporating ISO 9001, companies align their processes with customer expectations and feedback. The organization identifies and manages many interrelated activities. The activity of using resources and converting inputs into outputs can be considered a process. Often, the output of one process forms the input to the next process. The process approach, therefore, means that the organisation of workers among themselves, the solution to certain problems, situations, etc., as well as the set of workers who make decisions and their level of responsibility at any given stage of the process are known in advance (Dentch, 2016; Łucjan et al., 2023). This reduces the need for managing work and helps improve employee engagement, which, from a long-term perspective, is currently considered fundamental to building a competitive advantage through human resource management. This results in a reduction in the need to manage the work and helps to improve employee engagement, which from the long-term perspective is currently considered as basic in building competitive advantage based on human resource management (Borisov & Vinogradov, 2022; Rózsa et al., 2023; Szostek et al., 2020; 2023; 2024). However, all processes must build on each other, not interrupt each other, for the system to make sense. Such an approach emphasises the importance of: understanding requirements and how to meet them, the need to consider processes in terms of added value, achieving process performance and efficiency results, and continuous process improvement based on objective measurement (Natarajan, 2017). The requirements for a quality management system are specified in the standard where an organisation needs to demonstrate its ability to consistently provide a product that meets customer and relevant regulatory requirements, and intends to improve customer satisfaction through effective application of the system, including processes for continuous improvement, and assurance of compliance with customer and relevant regulatory requirements (ISO, 2015).

Motivations for ISO 9001 certification include market, productivity, and competitiveness factors, with productivity being the most significant (Fonseca, Cardoso & Nóvoa, 2022). The

impact of ISO 9001 QMS implementation and certification has been analysed in a number of studies, the results of which are contradictory. Some authors conclude that there is a positive relationship between ISO 9001 certification and financial improvement of companies, while the focus of ISO 9001 on process efficiency additionally leads to increased operational performance and cost savings, which indirectly benefit shareholders and other stakeholders (Nurcahyo & Zufadlillah, 2021; Psomas & Pantouvakis, 2015; Psomas & Kafetzopoulos, 2014; Chatzoglou, Chatzoudes, & Kipraio, 2015; Ochieng, Muturi, & Njihia, 2015; Chatzipetrou et al., 2017). Bakhtiar et al. (2023) performed a study related to ISO 9001 certification and its impact on various aspects within an organization. The results indicate that ISO 9001 certification planning, organizational commitment, and adherence to procedures significantly influence the development of a quality culture. While ISO 9001 planning and organizational commitment do not notably affect operational performance, the proper application of procedures and the presence of a quality culture have a substantial positive impact on operational performance. The study, performed on Indonesian companies, suggests that organizational performance is greatly enhanced by the combination of ISO 9001 implementation and a strong quality culture, with the latter acting as a mediating factor. However, other authors discuss the actual influence between ISO 9001 and economic performance (Cândido, Coelho, & Peixinho, 2016; Sila & Walczak, 2017) or point out the difficulties in managing a quality management system (Salgado et al., 2014; Tamayo-Torres, Barrales-Molina, & Nieves Perez-Arostegui, 2014). In a study by Mahmood et al. (2014), the findings suggested an absence of statistical significance between financial indicators (ROE, ROI, and cash flow) and the ISO 9001. Astrini (2018), after a comprehensive literature review, highlighted that 77% of longitudinal studies exploring this correlation did not exhibit a significant link between these factors. Chiarini (2019) addressed the question of why operating companies decertify ISO 9001. A study surveyed 167 Italian manufacturing SMEs that cancelled ISO 9001 certification. Contrary to prior concerns, respondents found certification costs manageable due to a commercial approach from the certification body and digitalization. While external audits and paperwork posed few issues, internal audits varied in difficulty, tied to process measurement. Top management commitment and measurable improvements were key challenges, with customer disinterest being the primary reason for certification cancellation. The study by Cândido, Coelho, and Peixinho (2016) reveals that decertified firms perform similarly to their matched counterparts after decertification. In contrast to certification, ISO 9001 decertification does not lead to significant financial abnormal performance.

The relationship between ISO 9001 certification and economic performance is formulated by the following hypothesis:

H₁: ISO 9001 certification positively impacts firm performance.

Economic development leads to social development but, on the other hand, environmental devastation threatens the existence of more than just human society (United Nations, 2022; López-Felices et al., 2023; Dvorský et al. 2023; Oláh et al., 2023; Streimikiene et al., 2024). Human society depends on the quality of the environment and its resources (Fenitra et al., 2024; Arshi & Wallis, 2024). The contradiction between environmental, social and economic concerns has been narrowed by the conceptual approach in sustainable development (Brundtland, 1987; Balcerzak & MacGregor Pelikánová, 2020; Streimikiene, 2023; Zhidebekkyzy et al., 2024). Activities touching the environment do not respect national boundaries and, therefore, the issue is under international scrutiny. Environmental policy must be an integral part of the organization, and these requirements are set by the environmental management system (EMS), which thus ranks among other management systems of the

company and becomes an important condition of business (Peña et al., 2023). ISO 14001, the international standard for environmental management systems, encourages companies to consider the environmental impact of their activities. The standard encourages businesses to work with environmental stakeholders such as regulators, local communities and environmental organisations. Stakeholder pressure, both primary and secondary, positively affects environmental competitiveness, with ISO 14001 adoption moderating this relationship (Seroka-Stolka & Fijorek, 2022). By incorporating the principles of ISO 14001, businesses can minimise their environmental footprint, build trust with stakeholders interested in environmental sustainability and comply with relevant regulations. ISO 14001 specifies the requirements for an environmental management system in a way that enables the organisation to be guided in the right direction, to establish policies and objectives that are supported by legislation and the significant environmental aspects that the company has identified, influences and can manage. ISO 14001 requires the organisation to identify its environmental aspects and to assess those that have or may have a significant effect on the environment. The introduction of EMS by companies, or its certification according to ISO 14001, has been criticized in some cases as a superficial measure to improve the perception of the company by stakeholders without any real effort to improve environmental performance (Boiral, 2007). The study by Iatridis and Kesidou (2018) challenges the traditional notion that external pressures are the sole drivers of ISO 14001 adoption. Their study focused on firms in Greece during an economic crisis, highlighting that weak external pressures can lead to symbolic or substantive implementation of ISO 14001, impacting firms' competitiveness differently. In times of economic crisis, such as in Greece, weak external pressures often lead companies to adopt ISO 14001 symbolically. However, firms with strong internal motivations use ISO 14001 to differentiate themselves and enhance competitiveness, particularly in international markets. In this context, it is important to note that the introduction of EMS does not ensure that the company continuously improves its environmental performance and/or that it does not exceed the legislative measures (Rondinelli, Vastag and Panacea, 2000). Cañón-de Francia and Garcés-Ayerbe (2009) find that ISO 14001 certification has a negative effect on the market value of less polluting and less internationalized firms in Spain, and in the case of more polluting and more internationalized firms, the results do not suggest clear evidence that the economic impact of ISO 14001 certification is negative.

The effect of ISO 14001 certification on economic performance is formulated by the following hypothesis H2:

H₂: ISO 14001 certification positively impacts firm performance.

Effective occupational health and safety systems support a firm's competitiveness by reducing accidents and preventing reputational damage (e.g., Mohammadfam et al., 2017; Podreca et al., 2024). Pagell et al. (2023, 2014) highlight the importance of occupational safety in the supply chain, which underpins supply chain management outcomes, and go on to cite occupational safety as a critical operational consideration that is equivalent to factors such as cost, quality, flexibility, delivery and innovation. Moreover, the importance of safety goes beyond specific corporate entities, as it is upheld as a basic human entitlement by a significant majority of government bodies and the general public. In the corporate context, ensuring safety in the workplace is a legal and ethical responsibility and serves as a prerequisite for maintaining operational authority. Deficiencies in workplace safety highlight an organization's shortcomings in meeting the expectations not only of employees, but also of regulators and other stakeholders. Since a significant proportion of safety incidents occur in the operational environment, poor safety performance may indicate ineffective operational management. As a result, safety comes to the fore as a key operational consideration. ISO 45001, the standard for

occupational health and safety management, emphasizes the well-being of employees and other stakeholders affected by a company's operations (ISO, 2018). The link between OHSAS and operational effectiveness remains ambiguous. Robson et al. (2007) suggest that although occupational health and safety management systems (OHSMS) can reduce injuries and increase productivity in the workplace, there is insufficient evidence on the effectiveness of certified OHSMS. Abad et al. (2013) found a positive effect of OHSAS on labour productivity, albeit with a larger effect on safety performance. Similarly, Lafuente and Abad (2018) found that organizations with below-average safety performance are more likely to adopt OHSAS, but this certification does not have a significant effect on their productivity. Lo et al. (2014) conducted a study on U.S. listed manufacturing companies and reported that OHSAS certification not only acts as a signalling tool but actually leads to better economic performance.

H₃: OHSAS 45001 certification positively impacts firm performance.

It can be difficult to operate several parallel management systems covering quality, environment and occupational health and safety and to ensure that they are aligned with the organisation's strategy. The standards (ISO 9001, ISO 14001, ISO 45001) to which management systems are implemented and subsequently certified all have similar management principles and other common features, thus offering the opportunity to link them together (Bernardo et al., 2015). The synergistic effect, saving of resources compared to operating three isolated systems, improved operational efficiency and internal communication, greater flexibility in decision making, increased quality of goods and services produced or provided, and increased reliability of products and processes speak for the integration of the different management systems (Nunhes, Barbosa & de Oliveira, 2017; Zeng, Shi & Lou, 2007). H₄ is thus formulated as follows:

H₄: As the complexity of management systems increases, corporate performance increases.

3 RESEARCH METHODOLOGY AND DATA

Multivariate regression analysis and logistic regression are the key analytical tools we used to identify and model the relationships between management system certifications and economic variables. Multivariate regression analysis allows us to quantify the contributions of individual variables to explain the variation in the dataset. In the application, we paid particular attention to detecting and addressing multicollinearity, which may bias the results of the regression analysis. Specifically, it is a bias in the values of the regression coefficients, i.e., it is a bias in the contributions of the individual explanatory variables. Thus, the presence of multicollinearity may affect the interpretation of the resulting regression model. Strategies for identifying and eliminating multicollinearity were carefully implemented to ensure the reliability of the regression analysis results (Farrar & Glauber, 1967). Heteroskedasticity was another important aspect of the analysis. This deviation from homoskedasticity can disturb the efficiency of the parameter estimates. Our methodology included a thorough evaluation of heteroskedasticity and potential corrective measures to ensure a robust interpretation of the results (Rosopa, Schaffer & Schroeder, 2013). A logistic regression model was applied to create a model that describes the effect of the explanatory economic variables on the binary explanatory variable. The logistic regression results served as the basis for the construction of a classification table that graphically illustrates the model's success in classifying positive and negative cases. To quantitatively evaluate the classification performance, we used the ROC curve (receiver operating characteristic), which visualizes the relationship between model sensitivity and

specificity at different thresholds. This curve provided us with a comprehensive view of the model’s ability to discriminate between positive and negative instances.

The variables used in the models are listed in Table 1 below.

Tab. 1 – Measurement. Source: own research based on data from the Eikon database

Economic variables	Management system certification
Gross Margin (<i>X1</i>)	ISO 14 000 or EMS
EBITDA (<i>X2</i>)	ISO 9000
Revenue/Employee (<i>X3</i>)	OHSAS 18001
Operating Profit Margin (<i>X4</i>)	
pretax ROA (<i>X5</i>)	
pretax ROE (<i>X6</i>)	
EV/EBIT (<i>X7</i>)	
P/E (<i>X8</i>)	

In our research, panel data was used to identify dynamic patterns and trends. The subject of our research is European listed companies. Secondary data for the period 2017 to 2021 was used. The data was obtained from the Eikon database.

At the date of data collection, we identified 442 European listed companies with complete data. According to the Thomson Reuters Business Classification, companies are divided into ten economic sectors; see Tab. 2.

Tab. 2 – Scope of activities of the companies investigated. Source: own research based on data from the Eikon database

Sector	<i>n</i>	<i>%</i>
Basic Materials	48	10.86
Consumer Cyclical	56	12.67
Consumer Non-Cyclical	41	9.28
Energy	8	1.81
Financials	66	14.93
Healthcare	33	7.47
Industrials	101	22.85
Real Estate	14	3.17
Technology	52	11.76
Utilities	23	5.20
Σ	442	100.00

4 RESULTS

To test hypotheses $H_1 - H_3$, we used a multivariate regression analysis model. Economic variables entered the model as dependent variables and management system certification as independent variables. In this model, there was no effect of CMS on the economic performance of the firms.

Neumayer and Perkins (2004) and Raines (2002) suggested that a certified EMS yields greater gains for firms in developing countries, where productivity levels are expected to be relatively low, than for firms in developed countries with higher productivity levels. In light of this, we

decided to test the assumption that firms with lower levels of economic performance are more likely to adopt CMS. In model (1), CMS are replaced by a single variable that was taken as the dependent variable; economic variables were taken as independent variables. Due to the nature of the dependent variable y (1 - company uses voluntary instruments, 0 - company does not use voluntary instruments), a logistic regression was used.

Data is available for 442 companies over five years. Thus, in total, a set of 2,210 records is available. The set of these records was randomly divided into two subsets. A subset of training data and a subset of testing data. Both subsets contain the same number of records/elements.

The dependence of the CMS y on the economic variables X_1 to X_8 is expressed by the following logistic model:

$$y = \frac{e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8}}{1 + e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8}} \tag{1}$$

where $\beta_0, \beta_1, \dots, \beta_8$ are the unknown regression coefficients, X_1, X_2, \dots, X_8 for $i = 1, \dots, 1,105$ are the observed values of the variables from Table 1 for 221 companies over a five-year period.

Tab. 3 – Original model. Source: own research based on data from the Eikon database

	Intercept (β_0)	X_1 (β_1)	X_2 (β_2)	X_3 (β_3)	X_4 (β_4)	X_5 (β_5)	X_6 (β_6)	X_7 (β_7)	X_8 (β_8)
Estimate	11.7629	-1.8333	1.5309	-1.5508	-2.4133	-1.3993	1.8283	0.2544	-0.1348
(p-value)	(1.56e-12)	(5.7e-5)	(0.02488)	(1.72e-6)	(3.64e-6)	(0.02525)	(0.00448)	(0.27606)	(0.6165)
Log-Likelihood: -178.9336									

According to the Wald test, it can be seen that not all coefficients are statistically significant for the model at the 0.05 significance level. Therefore, a reduced model will be calculated.

$$y = \frac{e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6}}{1 + e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6}} \tag{2}$$

$i = 1, \dots, 1105$.

Tab. 4. Reduced model. Source: own research based on data from the Eikon database

	Intercept (β_0)	X_1 (β_1)	X_2 (β_2)	X_3 (β_3)	X_4 (β_4)	X_5 (β_5)	X_6 (β_6)
Estimate	11.3207	-1.5727	1.7570	-0.9959	-2.6346	-1.1940	1.5007
(p-value)	(1.58e-12)	(0.000179)	(0.002208)	(2e-5)	(1.28e-6)	(0.02179)	(0.00638)
Log-Likelihood: -180.3145							

According to the Wald test, all coefficients are statistically significant for the model (they are important for the expression of dependence / have informative value) at the significance level of 0.05. A set of test records is used to assess the fit of the reduced model. By fitting the records from the test set, the ROC curve and the corresponding area under this curve are calculated and plotted.

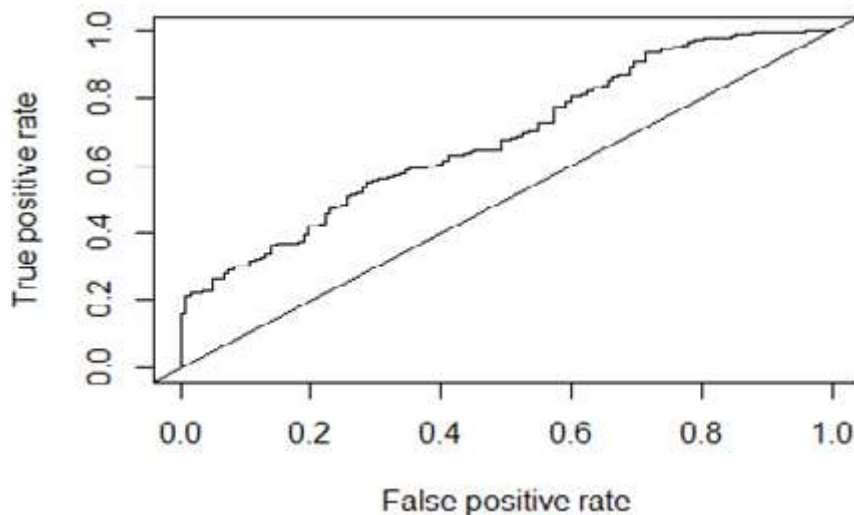


Fig. 1. ROC curve for the reduced model. Source: own research based on data from the Eikon database

The area under the ROC curve is equal to 0.68126. This number is greater than 0.5, the model has some predictive ability.

H4 expressing the complexity of the management system and its effect on economic performance is tested by the following regression model (3). For H4, we use ROA as a proxy for economic performance. Ionaşcu et al. (2017) used the MSscore to express the complexity of the management system. MSscore - Management system score for company *i* in year *t*:
 3 - ISO 9000, ISO 14 000 and 18001 certifications
 2 - the company has implemented and certified two management systems,
 1 - the company has implemented one of the three management system
 The dependence of ROA on MSscore is expressed by the following model.

$$ROA = \beta_{0t} + \beta_{1t} \cdot MSscore_{it}, \tag{3}$$

$i = 1, \dots, 442, t \in T = \{2017, 2018, 2019, 2020, 2021\}$.

The model results for each year are shown in Table 5.

Tab. 5 – Results of model (3). Source: own research based on data from the Eikon database

	<i>t</i>				
	2017	2018	2019	2020	2021
Intercept (β_{0t}) (p-value)	9.8467 (3.75e-14)	10.4210 (1.32e-15)	9.7552 (7.74e-16)	8.026 (1.48e-12)	8.392 (3.54e-11)
MSscore _{<i>i</i>} (β_{1t}) (p-value)	-0.1564 (0.761)	-0.2915 (0.568)	-0.3814 (0.418)	-0.453 (0.308)	0.373 (0.451)
R ²	0.000254	0.000885	0.00175	0.00273	0.00148
F-statistic (p-value)	0.0928 (0.761)	0.326 (0.568)	0.658 (0.418)	1.041 (0.308)	0.569 (0.451)

At the $\alpha = 0.05$ significance level, the estimates of the β_{1t} coefficients are not statistically significantly different from 0 (p-value > 0.05). Thus, the MSscore term of the regression model

is insignificant for expressing the dependence. The low values of the coefficients of determination (R^2) indicate that model (3) does not capture the predicted dependence well. According to the F-statistics and the corresponding p-values, model (3) as a whole does not have a good predictive value. The use of the management system did not affect ROA in the same year.

The shift in the dependence of ROA on MSscore is expressed by the following model:

$$ROA_{t+j} = \beta_{0t+j} + \beta_{1t+j} MSscore_{it}, \tag{4}$$

$i = 1, \dots, 442, t \in T = \{2017, 2018, 2019, 2020, 2021\}, j \in \{1, 2, 3, 4\}$.

The model results for each year are shown in Table 6.

Tab. 6. Results of model (4). Source: own research based on data from the Eikon database

$t = 2017$	$t + j$			
$j = 1, 2, 3, 4$	2018	2019	2020	2021
Intercept (β_{0t+j}) (p-value)	10.035 (1.03e-14)	9.605 (1.09e-14)	8.013 (3.05e-12)	8.607 (2.39e-11)
MSscore _i (β_{1t+j}) (p-value)	-0.160 (0.754)	-0.293 (0.55)	-0.462 (0.312)	0.33 (0.52)
R^2	0.000269	0.000975	0.0028	0.00113
F-statistic (p-value)	0.0984 (0.754)	0.357 (0.55)	1.026 (0.312)	0.415 (0.52)

At the $\alpha = 0.05$ significance level, the coefficient estimates of β_{1t+j} are not statistically significantly different from 0 (p-value > 0.05). Thus, the MSscore term of the regression model is insignificant for expressing the dependence. The low values of the coefficients of determination (R^2) indicate that model (4) does not capture the predicted dependence well. According to the F-statistics and the corresponding p-values, model (4) as a whole does not have a good predictive value. The use of the management system in 2017 did not affect the ROA in subsequent years.

Tab. 7 – Results of model (4). Source: own research based on data from the Eikon database

$t = 2018$	$t + j$		
$j = 1, 2, 3$	2019	2020	2021
Intercept (β_{0t+j}) (p-value)	10.240 (2.69e-16)	7.949 (4.98e-12)	8.929 (4.91e-12)
MSscore _i (β_{1t+j}) (p-value)	-0.546 (0.265)	-0.419 (0.359)	0.219 (0.67)
R^2	0.00338	0.00229	0.000495
F-statistic (p-value)	1.246 (0.265)	0.844 (0.359)	0.182 (0.67)

At the $\alpha = 0.05$ significance level, the coefficient estimates of β_{1t+j} are not statistically significantly different from 0 (p-value > 0.05). Thus, the MSscore term of the regression model is insignificant for expressing the dependence. The low values of the coefficients of determination (R^2) indicate that model (4) does not capture the predicted dependence well.

According to the F-statistics and the corresponding p-values, it can be seen that model (4) as a whole does not have a good predictive value. The use of the management system in 2018 did not affect the ROA in subsequent years.

Tab. 8 – Results of model (4). Source: own research based on data from the Eikon database

$t = 2019$	$t + j$	
$j = 1, 2$	2020	2021
Intercept (β_{0t+j}) (p-value)	7.488 (1.72e-11)	8.785 (3.57e-12)
MSscore _i (β_{1t+j}) (p-value)	-0.258 (0.557)	0.251 (0.613)
R ²	0.000919	0.000682
F-statistic (p-value)	0.346 (0.557)	0.257 (0.613)

At the $\alpha = 0.05$ significance level, the coefficient estimates of β_{1t+j} are not statistically significantly different from 0 (p-value > 0.05). Thus, the MSscore term of the regression model is insignificant for expressing the dependence. The low values of the coefficients of determination (R²) indicate that model (4) does not capture the predicted dependence well. According to the F-statistics and the corresponding p-values, model (4) as a whole does not have a good predictive value. The use of the management system in 2019 did not affect the ROA in subsequent years).

Tab 9 – Results of model (4). Source: own research based on data from the Eikon database

$t = 2020$	$t + j$
$j = 1$	2021
Intercept (β_{0t+j}) (p-value)	8.762 (3.93e-12)
MSscore _i (β_{1t+j}) (p-value)	0.266 (0.592)
R ²	0.000758
F-statistic (p-value)	0.288 (0.592)

At the $\alpha = 0.05$ significance level, the coefficient estimates of β_{1t+j} are not statistically significantly different from 0 (p-value > 0.05). Thus, the MSscore term of the regression model is insignificant for expressing the dependence. The low values of the coefficients of determination (R²) indicate that model (4) does not capture the predicted dependence well. According to the F-statistics and the corresponding p-values, model (4) as a whole does not have a good predictive value. The use of the management system in 2020 did not affect the ROA in the following year.

The effect of years (time) on ROA on MSscore is expressed by the following model:

$$ROA = \beta_0 + \beta_1 MSscore_i + \beta_2 \cdot x_{2017i} + \beta_3 \cdot x_{2018i} + \beta_4 \cdot x_{2019i} + \beta_5 \cdot x_{2020i} + \beta_6 \cdot x_{2021i}, \quad (5)$$

$i = 1, \dots, 442$. The variables x2017 to x2021 take the numbers 0 and 1.

The model results for each year are shown in Table 10.

Tab. 10 – Results of model (5). Source: own research based on data from the Eikon database

Intercept (β_0) (p-value)	9.699 (2e-16)
$MSscore_i$ (β_1) (p-value)	-0.181 (0.406)
β_2 (p-value)	0.204 (0.707)
β_3 (p-value)	0.466 (0.39)
β_4 (p-value)	-0.412 (0.445)
β_5 (p-value)	-2.31 (1.8e-05)
β_6 (p-value)	-0.0821 (0.852)
R^2	0.018
F-statistic (p-value)	6.879 (2.26e-06)

At the significance level $\alpha = 0.05$, the coefficient estimates β_1 to β_4 are not statistically significantly different from 0 (p-value > 0.05). Thus, the MSscore term and the terms representing the years 2017, 2018, 2019 and 2021 of the regression model are insignificant for expressing the dependence. The term representing the year 2020 is significant (p-value < 0.05) for expressing the dependence. According to the F-statistic and the corresponding p-values, the model (5) as a whole has a predictive value, although given the low value of the coefficient of determination, this predictive value is low.

Calculation of the reduced model considering only the effect of 2020.

$$ROA = \beta_0 + \beta_1 x_{2021i}, \tag{6}$$

$i = 1, \dots, 442$. The variable x_{2021} takes the numbers 0 and 1.

Tab. 11 – Results of model (6). Source: own research based on data from the Eikon database

Intercept (β_0) (p-value)	9.339 (2 e-16)
β_1 (p-value)	-2.373 (3.09e-08)
R^2	0.016
F-statistic (p-value)	30.91 (3.08e-08)

At the $\alpha = 0.05$ significance level, the coefficient estimates β_0 and β_1 are statistically significantly different from 0 (p-value < 0.05). Thus, the term representing the year 2020 is significant to express the dependence. According to the F-statistics and the corresponding p-values, it can be seen that model (6) as a whole has a predictive value, although given the low value of the coefficient of determination, this predictive value is low. The coefficient estimate of β_1 has a negative sign, indicating that there is a decline in ROA in the sample of firms under

study in 2020. The COVID-19 pandemic period negatively affected ROA (e.g., Mahssouni et al., 2023), and CMS did not provide European traded firms with greater resilience.

4 DISCUSSION

In a model in which economic variables are the independent variables and voluntary instruments are the dependent variables, companies with lower economic performance are more likely to certify CMS. This finding is consistent with studies that indicate the fact that companies with already high levels of efficiency make relatively small gains from implementing and certifying management systems, so their incentive to adopt the standard is lower. These claims are supported, for example, by research by Neumayer and Perkins (2004) and Raines (2002), who found that ISO 14001 brought greater gains to certified firms in developing countries, where relatively low levels of productivity can be assumed, than to firms in developed countries with higher levels of productivity. The research sample focusses on European companies, and European legislation on environmental and occupational safety related standards is active and ambitious (Cifuentes-Faura, 2022; Selin & VanDeveer, 2015). Thus, in such a developed legal environment, management system certification does not bring additional positive benefits beyond existing laws compared to the implementation of these standards in emerging economies. Another possible explanation is also a certain inflation of these certifications in developed economies, where, due to the spread of these standards, they no longer transformed into a competitive advantage that leads to better economic performance. Last but not least, the explanation may again lie in the research sample, where listed companies are surveyed, and these companies undergo ESG screening in the initial public offering process in the European environment. European companies have been preparing for mandatory ESG reporting for a long time, and as of 5 January 2023, the Corporate Sustainability Reporting Directive (Directive (EU) 2022/2464) is in force, which obliges all large companies and all traded companies (except traded micro companies) to disclose non-financial information on environmental, social, and governance aspects.

The impact of the COVID-19 pandemic on corporate behaviour has been significant and can be assessed at different levels. Studies are emerging on the ability of firms to adapt to the new context in terms of strategy and operations. Companies reduced investments in fixed asset renewal and focused on reducing operating costs, and further changed strategy in workforce, supply chain, logistics and cash flow management (Al-Fadly, 2020; Juergensen, Guimón & Narula, 2020). The COVID-19 pandemic also accelerated digitalisation and brought new opportunities for the future (Abidi, El Herradi & Sakha, 2023; Amankwah-Amoah et al., 2021). Our study addressed the question of whether firms with certified management systems - ISO 14001, ISO 9001 and ISO 45001, were more economically resilient during the COVID-19 pandemic. The analysis, covering both the pre-pandemic and pandemic periods, found no significant benefits of these certifications for economic resilience during COVID-19. However, CMS are an important tool for managing sustainability, meeting stakeholder needs and enhancing corporate environmental, social and governance (ESG) performance (Ronalter, Bernardo & Romani, 2023; Mushafiq et al., 2024). Bifulco et al. (2023) looked at the ESG performance of European listed companies and found that despite significant disruption in corporate behaviour in areas such as labour, investment and supply chain, the pandemic did not deter companies from following ESG practices. Studies by Bifulco et al. (2023) and Gao and Geng (2024) highlight the importance of ESG practices in mitigating the negative impacts of external shocks and increasing competitive advantage. Other studies also indicate that ESG responsibilities towards stakeholders appear to be an important competitive factor of modern firms (e.g., Habib & Mourad, 2024; Sandberg, Alnoor & Tiberius, 2023). For example, the

study by Taliento, Favino and Netti (2019) demonstrates that superior ESG performance of European listed companies, especially when it exceeds industry benchmarks, enhances corporate competitiveness. Firms with higher relative ESG scores benefit from improved efficiency, stronger reputation, and greater stakeholder trust, which directly contributes to long-term competitive advantage.

5 CONCLUSION

The implementation and certification of quality, environmental and occupational health and safety management systems have become an important part of operational management for many organisations. It has been considered as a standard tool for keeping a competitive position. Our study aimed to investigate the impact of CMS according to ISO 14001, ISO 9001 and ISO 45001 standards on the economic performance of firms and to determine their resilience during the COVID-19 pandemic. Through structured literature analysis, hypothesis formulation, application of methodology, and interpretation of results, several key findings emerged.

Regarding ISO 9001 certification, our findings are consistent with the literature search suggesting mixed results on the relationship between ISO 9001 certification and firm economic performance. Although some studies suggest a positive correlation between ISO 9001 certification and financial improvement, others do not find a significant relationship. The results of our study suggest that within listed European companies, ISO 9001 certification does not have a direct impact on economic performance. Similarly, our examination of the effect of ISO 14001 certification on firm performance indicates that in the mature highly competitive environment of European markets, ISO 14001 certification does not produce direct effects on economic performance. Regarding ISO 45001 certification, which focuses on occupational health and safety management, the results do not suggest a potential positive effect on economic performance in this case either. The developed model was applied to a time series that covered the period before and during the COVID-19 pandemic. Finally, our examination of the integration of multiple CMS does not suggest potential benefits in terms of economic performance.

We summarise the limitations of the study as follows. First, limitations of the data source: the data was obtained only from European companies and limited to the period 2017 to 2021. This limitation may affect the generality of the conclusions and the applicability to other regions or time periods. Second, company selection limitation: The study focused only on public European companies, which may exclude other types of organisations such as SMEs or those that are not publicly traded. Thus, the results and conclusions of the study may not generally be applicable to a wider range of organisations. Third, limitations of the research methods: The analytical methods used in the study may influence the results. For example, multivariate regression analysis provides useful insights but is sensitive to meeting the assumptions of its application. All these limits should be taken into account in the interpretation and application of the results of this study.

Our study contributes to the theoretical framework concerning the impact of ISO 14001, ISO 9001 and ISO 45001 certification on the economic performance of companies with empirical evidence from European companies. The widespread adoption of ISO certifications demonstrates their perceived value as tools for improving operational management, sustainability, and regulatory compliance. Our study challenges the assumption that these certifications universally improve economic performance, especially in advanced economies where existing regulations are stringent. As our findings indicate, these certifications do not

automatically result in improved economic performance, especially in competitive markets where regulatory frameworks already enforce high standards like those in Europe. This highlights an important insight for practitioners: while certifications may enhance a firm's legitimacy and help meet stakeholder expectations, they cannot be treated as a sole strategy for improving performance. Therefore, firms should integrate ISO certifications with broader, innovative strategies that drive efficiency, resilience, and adaptability. Additionally, the COVID-19 pandemic has highlighted the importance of adaptive capabilities, digitalized processes, process innovation, workforce engagement, and supply chain resilience (e.g., Al-Fadly, 2020). Managers should therefore view ISO certifications as tools for reinforcing operational frameworks. This understanding can guide firms to proactively use certifications as a tool for continuous improvement. While ISO certifications remain valuable for ensuring compliance, they must be aligned with broader organizational goals to drive competitive advantage in dynamic markets.

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