The role of environmental risk management in company profitability within sustainable development goals

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Abstract. This research aims to investigate the impact of enterprise resource planning (ERP) management systems on the environmental and financial performance of Ukrainian companies. To attain the paper's goal, this study is carried out in the following logical sequence: 1) Analysing the multifaceted role of ERP systems in modern business frameworks, including their capacity to manage stakeholder conflicts and mitigate environmental risks. 2) Empirically testing the hypothesis through a sophisticated partial least squares structural equation modelling (PLS-SEM) model, highlighting the mediating role of stakeholder influence on environmentally oriented activities. The application of structural modelling tools and PLS-SEM techniques has revealed a statistically significant positive correlation between ERP management system efficiency and company profitability (impact strength = 0.497). Since all indicators of'stakeholder influence intensity on environmentally oriented company activities' have a statistically significant influence at the 1% level, the establishment of goals for environmentally oriented company development and the corresponding ERP management system should consider the interests of all company stakeholders. The research results can be helpful for policymakers and businesses seeking to promote ERP adoption for environmental sustainability, enhance transparency, and achieve a synergistic effect between environmental objectives and profitability.

1 Introduction

Environmental risk management is a crucial component of effective enterprise management, particularly when evaluating the potential impact on profits and losses [1-9]. Its primary objective is to optimize favorable results while mitigating adverse consequences stemming from unforeseen environmental challenges. Unlike traditional risk management, which is

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often viewed as an ancillary task, environmental risk management is deeply intertwined with the day-to-day operations of an organization. The evolution from conventional business practices to contemporary sustainable approaches has induced a significant transformation in the landscape of corporate governance systems. Business owners are now recognizing the imperative not only to concentrate on economic and financial metrics but also to foster a heightened demand for their products within the framework of the green economy. In this paradigm shift, companies are increasingly acknowledging the interplay between environmental sustainability and profitability. By proactively managing environmental risks, enterprises can minimize potential damage to their reputation, avoid costly legal actions, and harness opportunities for innovation and cost savings. Sustainable practices are no longer seen as mere ethical considerations but rather as strategic imperatives that can bolster long-term competitiveness and enhance brand value. Furthermore, as environmental concerns gain prominence in the public consciousness, consumers, investors, and regulatory bodies are demanding greater transparency and accountability from businesses. This shift towards sustainability necessitates that enterprises integrate environmental risk management into their core strategic planning and decision-making processes. Embracing sustainable practices not only aligns with societal expectations but also positions companies to adapt and thrive in an evolving business landscape driven by eco-conscious consumers and stringent environmental regulations [10-31].

This collective evidence underscores the imperative for risk management to evolve into an integrated approach within the framework of modern market dynamics. A pivotal prerequisite in this evolution is the incorporation of fundamental principles of ecological production [32-66]. These principles encompass a strategic orientation towards long-term objectives, a proactive diversification of the product portfolio aligned with future trends, the acquisition of supplementary competitive advantages, access to a burgeoning high-profit segment comprising environmentally conscious consumers, meticulous adherence to international management standards, and the enforcement of additional quality control measures, all while nurturing a positive corporate image among stakeholders, among other considerations. However, it remains that the measurement of the environmental risk management system's influence on a company's operations and the evaluation of its overall effectiveness constitute relatively uncharted territory.

In the study [67], the author primarily focused on identifying the drivers of social and environmental risk management (SERM) in resilient supply chains and acknowledging the importance of these drivers for the implementation of SERM practices by enterprises. Representative case studies of three electronics manufacturing firms were also considered in this research to gain practical insights. Periodic data analysis was conducted for the collected datasets from these companies. Since the sequences of the collected data showed saturated sigmoidal tendencies, the Verhulst model was deemed the best fit for the data sequences. The research [68] significantly contributed to the understanding of how enterprise risk management (ERM) can positively impact the business performance of oil and gas companies in Malaysia. The authors developed a comprehensive framework based on various components of a risk management framework, shedding light on the effective implementation of ERM within this specific industry. The findings of this study underscore the pivotal role of enterprise risk management in elevating business performance. Notably, ERM was identified as a key driver in reducing the cost of capital, bolstering profitability, and augmenting shareholder value within oil and gas companies. These outcomes highlight the strategic importance of ERM as a valuable tool for organizations striving to attain sustainable success in a competitive landscape. The primary objective of the research [69] was to investigate the impact of enterprise risk management (ERM) on both financial performance and firm value, with a specific focus on how environmental, social, and governance (ESG) performance moderates this relationship. The analysis encompassed a

dataset comprising 680 firm-years of observations from publicly listed companies in the ASEAN 5 countries (Indonesia, Malaysia, Philippines, Singapore, and Thailand) over the period spanning from 2014 to 2018. The findings of the study revealed a notable and statistically significant positive correlation between the implementation of ERM and both financial performance and firm value. Furthermore, the investigation unveiled an intriguing dimension of this relationship by showcasing the pivotal moderating role of ESG performance. Specifically, it was found that ESG performance significantly amplifies the positive impact of ERM on firm value, highlighting the growing importance of sustainability factors in the contemporary business landscape. In the study [70], the researchers highlighted that sustainability has brought about a fundamental shift in the landscape of business operations. The increasing awareness among companies worldwide about environmental challenges has spurred the drive toward sustainable development. By giving due emphasis to sustainability risk management (SRM) and incorporating sustainability agendas as integral components of their corporate strategies, companies not only impact their financial performance but also ensure their long-term viability within their respective industries. Sustainability has indeed ushered in a paradigm shift, necessitating a reevaluation of how businesses operate. The growing global consciousness regarding environmental threats has propelled sustainability to the forefront of corporate concerns. Companies that prioritize sustainability are not merely focused on immediate financial gains; they are actively investing in strategies that promote responsible resource management, environmental stewardship, and social responsibility. One critical aspect of this shift is the integration of sustainability risk management (SRM) into business strategies. By recognizing and proactively addressing sustainability-related risks, companies are better positioned to safeguard their operations, reputation, and financial health. SRM involves identifying potential risks associated with environmental, social, and governance factors and developing strategies to mitigate these risks. This not only helps protect against adverse events but also fosters resilience in the face of an evolving business landscape.

In the studies conducted on the convergence of environmental risk management systems (ERMS) with digitalization [71-87], Industry 4.0 [88-95], education [96-106], and energy efficiency [107-114], a multifaceted picture emerges of how these elements intertwine to shape the sustainability landscape for organizations. Digitalization, a central theme in this context, has fundamentally transformed ERMS by enabling real-time data collection and analysis. This shift equips organizations with the tools to proactively identify and respond to environmental threats, ensuring more effective risk mitigation strategies. Furthermore, Industry 4.0, characterized by the integration of cutting-edge technologies, seamlessly incorporates ERMS into the fabric of modern manufacturing. This integration ensures that environmental considerations are not an afterthought but an integral part of production processes, optimizing resource usage and minimizing environmental risks. Education is another crucial facet of this ecosystem, as informed and educated employees are pivotal for the successful execution of ERMS strategies. Knowledge and awareness imparted through education empower the workforce to actively participate in environmental risk mitigation efforts. Last, energy efficiency emerges as a key enabler of sustainable ERMSs. Excessive energy consumption is a common source of environmental risks, and organizations are increasingly integrating energy-efficient practices into their ERMS. This includes the adoption of renewable energy sources, process optimization, and energy waste reduction. Such measures not only mitigate environmental impacts but also contribute to cost savings and long-term sustainability. In essence, the amalgamation of ERMS with digitalization, Industry 4.0, education, and energy efficiency presents a holistic approach to environmental responsibility, enhancing both operational efficiency and profitability for organizations in an interconnected and ever-evolving world.

The consensus among leading scholars and industry analysts, when scrutinizing methodological recommendations for the integration of a risk management system into a company's operations, underscores a critical stipulation: it must not impede the company's economic activities or adversely affect its core performance metrics. In essence, risk management should function as a dual-purpose mechanism, serving not only to curtail potential losses but also to unveil latent opportunities [115-125]. As an enterprise undertakes the modernization of its processes and technologies, it should do so with the utmost diligence to avoid jeopardizing the interests of its stakeholders or sacrificing profitability due to bureaucratic hurdles that may arise during the implementation of the environmental risk management system.

In this context, the primary proposition of the research is that a robust environmental risk management system serves a dual purpose. On the one hand, it facilitates the resolution of conflicts among stakeholders related to the development of environmentally conscious businesses. On the other hand, it generates added value for enterprise stakeholders by diminishing the probability of environmental risks occurring and subsequent profit loss.

2 Materials and Methods

To test the proposed hypothesis, an algorithm for evaluating the effectiveness of an environmental risk management system at the enterprise was determined, which includes the following steps: determining the presence, direction, and strength of the impact of the environmental risk management system on the profitability of the enterprise; defining the criteria for the effectiveness of decisions regarding the environmentally oriented development of the enterprise; and differentiating types of environmental risk management processes at the enterprise. An important argument for implementing an environmental risk management system at the enterprise is its impact on the performance of the enterprise based on a specific set of factors. This indicates the existence of cause-and-effect relationships consisting of internal and external factors.

To investigate the impact of the introduction of an environmental risk management system on the profitability of the enterprise, a PLS-SEM (partial least squares structural equation modelling) model was developed in the study. In contrast to the traditional SEM, the PLS-SEM possesses the capability to model and assess intricate causal relationships involving both hidden (latent) and observable variables [126-144]. Latent variables encapsulate phenomena that are not directly observable and are defined by a set of observable variables. The PLS-SEM examines the connection between the robust aspects of latent variables and gauges how effectively the model elucidates the constructed target constructs. The latent variables employed to evaluate the effectiveness of the environmental risk management system within an enterprise encompass the efficacy of the environmental risk management process within the enterprise, the intensity of stakeholder pressure on environmentally oriented activities undertaken by the enterprise, the enterprise's size, and its level of profitability. The procedure for constructing the initial PLS-SEM comprises several stages. In the initial stage, PLS-SEMs are developed to determine the latent variables.

To ascertain the strength of stakeholder pressure on environmentally oriented activities within the enterprise, a PLS-SEM is formulated. This model employs an external formative type structure. In this context, the latent variable "strength of stakeholder pressure on environmentally oriented activities" emerges through the influence of the following observable variables: suppliers, intermediaries, labor unions, investors, shareholders, environmental rating agencies, the general public, and consumers.

1. The formal representation of the PLS-SEM in formative type for assessing the strength of stakeholder pressure on environmentally oriented activities within the enterprise will be presented in the form of Formula (1):

$$LSI = \mu_{0j} + \mu_{jk} SI_{jk} + \varepsilon_j, \quad (1)$$

where μ_{0j} – free variable; μ_{jk} – loading coefficient and direction of connection; SI_{jk} – explicit variables of stakeholders (suppliers, intermediaries, labor unions, investors, shareholders, environmental rating agencies, the public, consumers, respectively), SI = [1; 5], Cronbach's coefficient is 0.95; ε_j – standard error; j – block of corresponding variables for the t-period; k – number of variables.

2. PLS-SEM for determining the effectiveness of environmental risk management processes.

In this context, the latent variable "effectiveness of environmental risk management processes" acts as the driving force behind the explicit variables, which include operational objectives, strategic objectives, transparency, and the transparency of enterprise reporting, as well as compliance with prevailing legislative regulations in the environmental protection sphere. In this scenario, the formulaic representation of the PLS-SEM for evaluating the effectiveness of environmental risk management processes can be formulated as follows:

$$LERMI = \mu_{0j} + \mu_{jk} Strat_{Ecjk} + \mu_{jk} Operat_{Envjk} + \mu_{jk} Transp_{Mjk} + \mu_{jk} Compl_{Sjk} + \varepsilon_j, \quad (2)$$

where $Operat$ – explicit variable of environmental risks of the enterprise, operational goals; $Strat$ – explicit variable of environmental risks of the enterprise, strategic goals; $Transp$ – explicit variable of environmental risks of the enterprise, transparency and transparency of enterprise reporting; $Compl$ – explicit variable of environmental risks of the enterprise, compliance with current legislative norms in the field of environmental protection.

3. PLS-SEM for determining the scalability of the enterprise.

This model involves the construction of an external formative type model. In this case, the latent variable "enterprise scalability" is influenced by the following explicit variables: asset size and the number of employees. The model takes the form of the following formula:

$$LSZ = \mu_{0j} + \mu_{jk} CZ_{jk} + \varepsilon_j, \quad (3)$$

where CZ_{jk} – explicit variables of enterprise scalability (asset size, number of employees, respectively).

4. PLS-SEM for determining the level of enterprise profitability.

The model is constructed based on an external formative type model. The latent variable "level of enterprise profitability" is influenced by the following explicit variables: pretax enterprise profit, weighted average cost of capital, and amount of invested capital. The formulaic representation of the model is presented by Formula (4):

$$LCP = \mu_{0j} + \mu_{jk} P_{jk} + \varepsilon_j, \quad (4)$$

where P_{jk} – explicit variables of enterprise profitability (pretax enterprise profit, weighted average cost of capital, and amount of invested capital, respectively).

In the second stage of constructing the PLS-SEM, it is imperative to confirm the existence, direction, and magnitude of the influence between qualitative and latent variables within the model. To accomplish this, we formalized the relationships within the constructed models, resulting in the overall model taking the shape of a system of equations that describe the dependencies between explicit and latent variables, both formative and reflective in nature. The generalized models representing the influence of qualitative variables on the latent variables within the enterprise's environmental risk management system can be expressed using formula (5):

$$\begin{cases} LCP = \mu_{0j} + \mu_{jk} LERMI_{jk} + \mu_{jk} LSI_{jk} + \mu_{jk} LCZ_{jk} \varepsilon_j, \\ LSI = \mu_{0j} + \mu_{jk} SI_{jk} + \varepsilon_j, \\ LERMI = \mu_{0j} + \mu_{jk} Strat_{Ecjk} + \mu_{jk} Operat_{Envjk} + \mu_{jk} Transp_{Mjk} + \mu_{jk} Compl_{Sjk} + \varepsilon_j, \\ LCZ = \mu_{0j} + \mu_{jk} CZ_{jk} + \varepsilon_j, \\ LCP = \mu_{0j} + \mu_{jk} P_{jk} + \varepsilon_j, \end{cases} \quad (5)$$

where LSI – Latent Variable of Stakeholder Pressure on the Environmental Activities of the Company; $LERMI$ – Latent Variable of Environmental Risk Management Process Efficiency of the Company; LCZ – Latent Variable of Company Scale; LCP – Latent Variable of Company Profitability Level.

To validate the proposed approach for assessing the impact of the environmental risk management system's effectiveness on profitability levels, calculations were conducted using data from leading engineering companies in Ukraine for the period spanning from 2012 to 2019.

3 Results and discussion

The empirical data concerning the assessment of the direction and strength of influence between parameters in the PLS-SEM are displayed in Fig. 1.

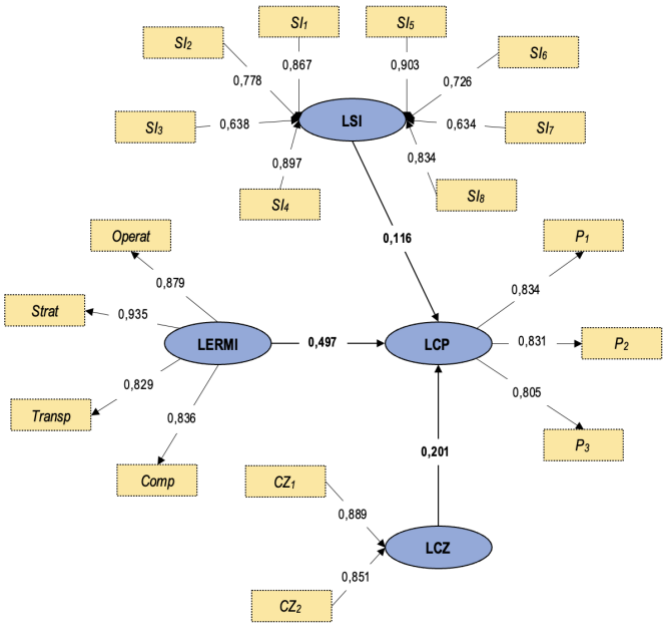

Fig. 1. The graphical interpretation of the impact of qualitative variables on the latent variables related to the effectiveness of the environmental risk management system within the enterprise, the scale of the enterprise, the level of stakeholder influence on the company's activities, and its profitability level.

Sources: developed by the authors

The empirical results, as presented in Fig. 1, confirm a positive, statistically significant relationship between latent variables and company profitability. The most significant impact on company profitability is attributed to the effectiveness of the environmental risk

management process (0.497), followed by enterprise scale (0.201) and the influence of stakeholder pressure on environmentally oriented activities (0.116). These findings support the initial hypothesis proposed at the beginning of the study, suggesting that implementing an effective management system not only reduces the likelihood of environmental risks but also enhances overall company performance.

After studying the latent variable 'the strength of stakeholder pressure on environmentally oriented activities,' it was observed that the manifest variables of this component exert an equally statistically significant influence. This factor indicates that all stakeholder groups are interested in the implementation of a balanced environmental risk management system. When examining the latent variable 'the effectiveness of the environmental risk management process,' it is important to highlight the variable'strategic goals' since it exhibits the strongest influence (0.935) among other variables. The manifest variable 'transparency and reporting transparency of the company' had the least impact (0.829). The influence on the latent variable 'enterprise scale' by the manifest variables 'asset size' and 'number of employees' is also equivalent (0.889 and 0.851, respectively). Therefore, the identified positive relationships in shaping an effective environmental risk management system enable the company to achieve a synergistic effect in increasing its profitability level.

4 Discussion and conclusion

Analysing the experiences of Ukrainian companies has revealed a compelling connection between the implementation of enterprise resource planning (ERP) management systems and a host of environmental and financial advantages. Beyond the immediate environmental benefits, such as reductions in air and water pollution and waste generation, ERP systems are emerging as pivotal drivers of enhanced profitability for these organizations. This phenomenon stems from the multifaceted role ERP systems play within modern business frameworks. One of the central roles of an effective ERP management system is its capacity to effectively manage and mitigate stakeholder conflicts that often arise in the context of environmentally focused corporate initiatives. By providing a structured framework for managing and reporting on environmental impact, ERPs facilitate transparency and accountability, thereby resolving potential disputes among stakeholders. On a complementary note, ERP systems have proven instrumental in minimizing the exposure of companies to environmental risks, thereby safeguarding profits. This reduction in risk is achieved through enhanced data-driven decision-making, which enables proactive risk management and minimizes profit loss scenarios. To empirically test this hypothesis, a sophisticated partial least squares structural equation modelling (PLS-SEM) model was constructed. Within this model, a latent variable known as "the strength of stakeholder influence on environmentally oriented activities of the enterprise" serves as a mediating factor. It stands between the effectiveness of the ERP management system and the company's overall profitability. This mediation underscores the intricate relationship between ERP systems, stakeholder dynamics, and financial outcomes. Building a highly effective ERP management system is a pivotal cornerstone of this framework, but it is not the sole determinant of success. Equally important is the active engagement of all stakeholders in the company's activities. This collaborative approach ensures that environmental objectives are met while concurrently bolstering profitability. Moreover, the scale of assets and workforce within the company plays a significant role in achieving a synergistic effect, mirroring the principles of neoclassical Cobb–Douglas theory, where capital and labor are fundamental drivers of economic growth.

To encourage the adoption of enterprise resource planning (ERP) systems and harness their environmental and financial advantages, the Ukrainian government can implement a multifaceted policy approach. First, incentivizing businesses with financial benefits such as

subsidies or tax breaks for ERP adoption geared towards environmental sustainability would be a strategic move. Second, strengthening environmental reporting standards and regulations can be pivotal in promoting transparency and compliance, making ERP systems instrumental in this process. Third, capacity-building efforts, including technical and environmental management training, can equip businesses to effectively implement and utilize ERP systems. Fourth, investment in research and development initiatives focused on enhancing ERP systems' environmental capabilities should be encouraged through public–private collaborations. Last, facilitating stakeholder engagement platforms can help resolve conflicts and promote consensus-building among businesses, environmental organizations, and local communities, further facilitated by ERP transparency features.

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