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EDITORIAL: Responsible business practices towards current challenges and future prospects

Dear readers!

In the field of responsible management, there are various approaches to its concept and definition, however, to date, there is no universally accepted solution on this issue (Carroll et al., 2020). It is a fact that by choosing and implementing core values, an entity transmits various messages within the society where it operates and, in particular, to all stakeholders. These messages may concern the identity that each entity wishes to present, the expected behavior with the contracting parties within the entity, either within it or outside this organization. Undoubtedly, the effective communication of the values it advocates and their unwavering application can be the guide for ethical guidance in all aspects of the operation of each entity (Robin & Reidenbach, 1987). So, a first approach, one could say, about how an entity can improve relationships and results towards all stakeholders, is to try to promote transparency as a core value and integrate it through various processes in the culture and communication within and outside the entity.

In recent decades, it has been observed that the concept of ethical evaluation by various individuals or entities can be significantly influenced by the cultural, professional, or other social characteristics (common religion among them, subject of work accepted by the whole society, e.g., no tobacco or gambling, etc.) of the business activity (Parris et al., 2016). Consequently, the concept of ethical and responsible action of any business activity is constantly being redefined within society, and there is a steadily increasing number of stakeholders who are more concerned with the aspects and characteristics of business actions in their way of thinking. Thus, stakeholders are now actively interested in both the consequences of professional actions and what they cause, as well as the ultimate purpose behind each action, and this makes them skeptical to distrustful of entities that are active in businesses (Darke & Ritchie, 2007).

In relation to the above, transparency can again serve as a key tool for addressing stakeholder mistrust and improving responsible management practices of entities. The need for greater organizational transparency and orientation towards responsible actions of businesses without a universal definition has become a popular topic in the media, among managers, and academic researchers (das Neves & Vaccaro, 2013). However, such a complex issue should be managed with care in order to ultimately meet the expectations that various stakeholders have of businesses. Furthermore, in the recent past, there has been an expectation or legal direction that stakeholders, whether internal or external, should have access to detailed data about the business activities of each entity. This expectation stems from the development of technology, the ease of access to data, and the demand for information without restrictions or "filters" in the reality of the business world, thus promoting the concept of transparency in every way and as something to be expected (Parris et al., 2016).

On the other hand, the development and implementation of ethical behaviors towards customers is evaluated within a society and by all stakeholders almost always as a responsible and correct model of behavior that can exist (Ferrell & Gresham, 1985). However, this can prove particularly difficult if the issues mentioned earlier that can influence the way stakeholders perceive and act, such as cultural, professional, or other social factors, are also taken into account (Parris et al., 2016). Finally, it should not be ignored that the challenge that always exists for development on a responsible basis is business actions aimed at improving performance, competitiveness, and profitability (Zadek, 2006).

Therefore, the academic and professional interest in recognizing and promoting responsible and sustainable business action has been growing steadily in recent years (Geissdoerfer et al., 2018). According to Stubbs and Cocklin (2008), sustainability is defined as a model in which sustainability concepts shape the business's driving force and decision-making process and the dominant neoclassical business model is transformed, rather than complemented, by social and environmental priorities.

Previous research has also suggested that investors are attracted to socially responsible investment (SRI) options (Domini, 2001; Fowler & Hope, 2007). This is again driven by various cultural, professional, or other social characteristics that are important to investors in their investments, according to the ethical values they espouse (as mentioned earlier). Historical evidence suggests that about 10% of all investment funds in the United States were influenced

by some form of personal, professional, or other social characteristic (Sauer, 1997; Fowler & Hope, 2007). As of late 2003, investments influenced by some form of specific social characteristic amounted to approximately $2.164 trillion in the United States (Social Investment Forum, 2003). In particular, a large part of the investment capital, influenced by specific social characteristics, came from pension plans, which did not want to invest in companies involved in the production of cigarettes and tobacco, but also in the manufacture of military equipment (Social Investment Forum, 2003; Fowler & Hope, 2007).

In addition, the choice for responsible business action by adopting the circular economy option constitutes a regenerative business and industrial system that aims to restore natural and social capital by ensuring the efficient circulation of materials and energy (Witjes & Lozano, 2016; Stahel, 2016). Approaching that every element of the economy can constitute a significant asset, this strategy attempts to reduce energy consumption in the production process and promote renewable energy sources (Kafestidis et al., 2024). According to Van Buren et al. (2016), the goal is to create an economy where waste is minimized during the production and consumption processes, while maintaining the value of resources and materials for as long as possible.

Mayer et al. (1995) argue that an individual or an entity is considered trustworthy based on positive evaluations in three dimensions: ability, benevolence, and integrity. In continuation with them, limited transparency towards stakeholders ends up increasing skepticism, while at the same time leading to a decrease in trust for responsible business actions in the various entities (Parris et al., 2016). For this reason, the future that follows is expected to push business entities to the necessity of conducting their business activities in a different and more responsible way (Zadek, 2006).

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CONTENTS

BANKING, ECONOMIC GROWTH, MARKET STRUCTURE, AND INSTITUTIONAL QUALITY THROUGH THE PERSPECTIVE OF BUSINESS PERFORMANCE AND RESPONSIBILITY

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Abstract

This paper reviews the theoretical foundations and implications of the role of banking in promoting economic growth. Based on financial intermediation theory, the paper underscores the crucial role of banks in facilitating the optimal allocation of resources, managing risks, and supporting economic development. Additionally, this paper addresses the differences between the structure-conduct-performance (SCP) hypothesis and the efficiency hypothesis (EH) and recognizes how each approach influences the banking industry in different contexts, with a particular focus on emerging and developed economies. Also, the paper highlights the importance of regulatory framework and institutional quality in shaping the effectiveness of banking systems, emphasizing the need for balanced regulation to promote stability without stifling innovation. According to these visions, policymakers should focus on stimulating competition, reinforcing regulatory and governance structures, and boosting technological advancements to improve banking efficiency. Furthermore, digital banking and financial inclusion are needed to enhance accessibility and competitiveness. Policymakers and regulators should implement a holistic approach that prioritizes innovation, regulatory quality, and financial stability to safeguard sustainable economic growth.

Keywords: Banking, Performance, Responsibility, Growth, Structure

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1. INTRODUCTION

The banking sector plays a crucial role in the economy, acting as the intermediary between savers and borrowers, stimulating the efficient allocation of resources, and supporting economic growth and stability. Abuzayed et al. (2012), Awdeh et al. (2013), and Claessens (2009) argue that the banking industry is a key driver of economic welfare, stability, and growth among countries, and the significance of a well-functioning financial system for the economic growth of these countries is broadly acknowledged both in theoretical and empirical studies (Levine, 1997; Ben Naceur et al., 2014). In the context of economic development, banks are not just institutions for deposit and loan services but essential promoters for growth, investment, and risk management.

However, at the present time, institutional quality and political risks are considered major concerns for policymakers in the global economy. In the post-war period, a number of countries have witnessed dramatic changes in their regime and economies; for instance, Latin America experienced

major hyperinflation and unemployment rates in the 1970s and 1980s (Faria & McAdam, 2015). Also, by the end of 2008, several banks had experienced bankruptcy and collapse due to the US subprime sector in 2007, which globally affected other banking sectors in other economies.

Furthermore, this study reviews the structure of the sector and the impact of institutional quality on the performance and stability of banks, providing policy implications about the effectiveness of structural reforms that have been forced by the International Monetary Fund (IMF). The author also provides evidence about how the quality of the institutional environment and competition conditions would help regulators to intervene to restructure the market and attract potential investors and lenders to be engaged in this market, guaranteeing their rights via a better-functioning banking sector.

This paper aims to explore the theoretical underpinnings of banking and its relationship with economic growth, market structure, and institutional quality. By reviewing existing literature and proposing a conceptual framework, the paper examines how the banking sector influences, and is influenced by, the broader economy. This study offers a comprehensive review of the literature on the banking sector and its impact on economic growth, market structure theories in banking, and the role of institutional quality in explaining banking performance. By presenting key theoretical perspectives and empirical findings, this paper provides a valuable understanding of the dynamic relationship between financial intermediation and economic development.

The main contribution of this paper is to bridge the gap between different strands of literature, providing a full view of how banking sector efficiency, market structure, and institutional variables affect the financial performance of banks. This paper is different from previous studies as it focuses on a single aspect, but this paper integrates multiple perspectives, allowing policymakers, scholars, and industry officials to better understanding of the interconnected nature of banking sector performance. Furthermore, this paper contributes to the ongoing academic discourse by identifying gaps in the existing literature and suggesting potential directions for future research. It underscores the significance of regulatory structure, financial innovation, and institutional quality in adopting a robust banking system. It provides implications for economic policy and growth.

The key research question of this paper is:

RQ: How do institutional quality, market structure, and banking sector efficiency influence economic growth and the stability of financial systems?

This question will be explored through an in-depth analysis of existing literature and empirical evidence.

The paper is organized as follows. Section 2 discusses the literature on the relationship between banking and economic growth, including key theoretical frameworks. Section 3 provides a review of the literature about the impact of market structure on the banking sector's performance. Section 4 presents a conceptual framework about institutional quality and banking stability, and Section 5 concludes with policy implications and recommendations for future research.

2. BANKING AND ECONOMIC GROWTH

The foundational theory in banking literature is financial intermediation theory, which underscores the vital role of banks in facilitating the flow of funds between savers and borrowers. Banks play a crucial role in mobilizing savings from households and directing them into productive investments (McKinnon, 1970). Higher savings rates contribute to increased capital formation, which is a key driver of economic growth (Shaw, 1973). The finance-growth relationship has been widely debated in economic and finance literature over numerous hypotheses as follows:

- Supply-leading hypothesis: This perception postulates that economic growth is driven by the development of the banking sector via expanding financial and banking services and providing funds to productive investments to ensure the optimal allocation of resources (Levine, 1997). This view is supported by studies showing that financial institutions foster innovation and investment, leading to economic expansion.
- Demand-following hypothesis: This perspective suggests that the development of the banking sector is shaped by economic growth, as increasing economic activities increase the demand for banking services (Robinson, 1952). However, this approach has been criticized since the banking sector's development is a passive response rather than an active driver of growth.
- Endogenous growth theory: This approach highlights that financing innovation projects and reducing transaction costs leads to improved performance of banks, which in turn results in fostering long-term economic growth (Romer, 1986; Pagano, 1993). Nevertheless, banks may resort to developing themselves as a result of political and security problems in addition to shortcomings in legislation, which led to a lack of cash liquidity in banks, forcing these banks to invest in digital technology to alleviate these problems. The author observed this evolution in developing economies such as Libya, as the banking sector has been partially transformed from a cash-oriented banking system to a digital-oriented banking system.

However, the significance of a well-functioning banking sector for the growth and welfare of a country has been highlighted by Diamond (1984), King and Levine (1993), Levine (1997), Claessens (2009), Abuzayed et al. (2012), and Ben Naceur et al. (2014). The banking sector is considered the intermediary between savers and borrowers, smoothing the efficient allocation of funds and stimulating economic growth. The classical financial intermediation theory, as argued by Diamond (1984), suggests that the frictions in capital markets can be eliminated by banks via smoothing savings and investments. However, he also argued that banks operate as monitors of borrowers, as well as reducing the risks associated with lending. This process ensures the optimal allocation of funds, resulting in industrial development and economic growth.

In the same context, King and Levine (1993) highlighted that the economic growth measured by the gross domestic product (GDP) is shaped by financial development in 80 countries over the period 1960–1989, suggesting that a well-functioning banking sector accelerates economic growth. Additionally, Levine (1997) argued that the banking industry is essential for the economic

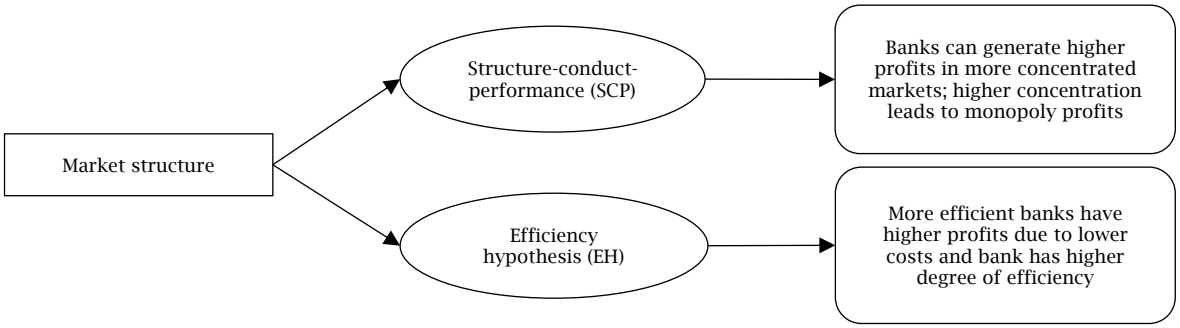
growth of a country. In his research, he argues that well-functioning financial systems, including banks, are fundamental for stimulating economic growth by ensuring that savings are efficiently directed into promising investments. His research indicated that long-term economic growth is associated with the financial system's ability to mobilize savings, allocate capital, and secure liquidity.

Likewise, Rajan and Zingales (1998) examined the relationship between financial development and growth, highlighting that efficient allocation of resources to businesses requires a well-developed banking system. They analyzed data from various countries and suggested that in countries with more developed financial systems, industries can develop quicker via depending on external source of finance They concluded that higher levels of industrial development and faster economic growth is caused by efficient banking sector in terms of low cost of borrowing and easier access to financial resources. Levine et al. (2000) also demonstrated that banking sector efficiency positively affects economic growth by improving capital allocation and fostering innovation. Regarding the small and medium-sized enterprises (SMEs), Beck (2004) confirmed that financial development eliminates credit restrictions, all of which contribute to economic growth.

3. MARKET STRUCTURE AND BANK PERFORMANCE

There are two paradigms employed in the banking literature to examine the behavior of the banking industry: structural and non-structural approaches. Structural approaches are basically based on the traditional structure-conduct-performance (SCP) hypothesis and the efficiency hypothesis (EH) (see Figure 1).

Figure 1. Market structure hypotheses



Research based on structural paradigms assumes that market concentration deteriorates competitive conditions in a market by adopting collusive behavior among enterprises (Berger, 1995). On the contrary, non-structural paradigms state that factors other than market structure and concentration can influence market competition; for instance, boundaries to entry/exit and general contestability of the market (Panzar & Rosse, 1987).

These theories, which assume that a positive relationship between profitability and market structure exists, have been tested, and they are supported by many cases of empirical findings. The traditional SCP hypothesis argues that market concentration creates benefits to firms that enjoy greater market power, giving them the ability to set prices that are less favorable to customers and, therefore, the positive relationship between profitability and market structure is found (Smirlock, 1985; Hannan, 1991; Berger, 1995). Unlike the above-mentioned hypothesis, the competing EH states that the positive relationship between concentration and performance is associated with firms having good management and technology, and therefore lower unit cost leading to higher unit profits; more efficient firms tend to reveal lower costs and then higher profits. In other words, firms with superior management or production technologies have lower costs and hence higher profits (Berger & Hannan, 1989; Berger, 1995).

Regarding the competition in developing banking economies, it has intensified significantly in recent years as deregulation, liberalization, technological progress, and globalization of trading and capital markets have impacted all features of banking operations and consequently affected the profitability of banks (Obamuyi, 2012). The notion that market structure affects the performance of an industry originates in the classical model of the theory of a firm. In a pure competitive model, there are a large number of banks. The larger the number of banks, the higher the competition and the lower the concentration ratio (Samad, 2008). In this matter, the Basic theory of the SCP hypothesis was developed by Bain (1951). He posited that the economic performance of industry is a function of the conduct of buyers and sellers, which in turn is a function of the industry's structure.

The economic perspective of enterprise in the industry is based on the welfare maximization (resources employed yield the highest value output) is considered as a measurement of economic performance (Jang & Peng, 2000). Moreover, this model emphasizes that the economic performance of a sector is a task of the conduct of buyers and sellers that represents the role of the sector's structure. The activities of the sector's buyers and sellers are referred to the conduct as seller activities consist of installation and utilisation of capacity, promotional and pricing policies, research and development, and inter-firm competition. Industry or sector structure (the determinants of conduct) contains variables such as the number and size of buyers and sellers, technology, the degree of product differentiation, the extent of vertical integration, and the level of barriers to entry (Bain, 1951; Jang & Peng, 2000). A market with relatively few banks and barriers to entry would lead banks to collude and earn supernormal profits.

As a result of collusion, all banks operating in the market are able to gain monopoly profits; the more concentrated the market, the less

the degree of market competition. Thus, the SCP hypothesis advocates that changes in market concentration may have a positive impact on a firm's financial performance, suggesting that the subsequent positive relationship between market structure and performance is a result of non-competitive pricing behaviour of banks with a large market share (Berger & Hannan, 1989; Goldberg & Rai, 1996). The main argument emphasized by the SCP supports the collusive power of the market and stimulates the 40 strategies that improve market concentration. Therefore, if SCP holds in the banking sector, those strategies can be endorsed.

However, the positive relationship between market concentration and performance has been challenged by the EH. The EH argues that the aggressive behaviour of efficient banks in the market causes a growth in such banks' size and market share. The EH implies that the positive association of market share and higher performance is the result of a firm's superior efficiency. It is argued that higher profits made by large firms in a concentrated market are the consequence of economies of scale and superior efficiency (Berger, 1995; Goldberg & Rai, 1996). In cases where a firm is highly efficient relative to competitors, the firm is able to maximize profits by sustaining its size and pricing strategy or by reducing its prices and expanding its operations. Berger and Hannan (1989) pointed out that firms that enjoy superior efficiency in a market produce an unequal market share and a high level of concentration. Hence, this hypothesis implies that the positive direction between profit and concentration leads to lower costs and is accomplished through superior operational management and an efficient production process (Goldberg & Rai, 1996).

A number of empirical studies of SCP and EH have investigated the relationship between the market structure and bank performance. Hannan (1991) employed an explicit model of the banking business in order to develop and critically evaluate the relationship between bank conduct and market structure implied by the SCP model. This model proposed the function of market share and concentration in estimating the association between firm conduct and market structure. In this regard, Hannan (1991) and Goldberg and Rai (1996) highlighted that the relationship between return on assets and market concentration should comprise measures of the capital asset ratio as well as the ratio of fixed costs to total assets in the regression model.

3.1. Structure-conduct-performance and bank performance studies

Early empirical studies have examined both price information (Berger & Hannan, 1989) and firm performance as represented by profitability variables (Lloyd-Williams et al., 1994). In a multi-product industry such as the banking sector, it is not recommended to employ a single measure of price as a proxy of a firm's overall performance for the banking business. On the contrary, profitability measures can be regarded as a comprehensive performance measures because they incorporate both expenditures and revenues into one measure (Lloyd-Williams et al., 1994).

However, the market concentration was first employed to measure the impact of concentration on performance among banks in the domestic United States market. In this regard, Lloyd-Williams et al. (1994) investigated the applicability of two competing 43 hypotheses, SCP and EH, to assess the structure of the banking industry in Spain using the concentration ratio and market share for each bank to characterise its efficiency over the period 1986–1988. Findings implied that market concentration is found to have a positive impact on the performance of Spanish banks measured by return on assets, which in turn supports the traditional SCP hypothesis. In the same context, the relationship between market structure and performance of European banks has been investigated by Goldberg and Rai (1996). It concentrates on studying solely large banks in each country, as the European banking market is controlled by large banks with a branching spread across the country, so it is doubtful that branches are able to significantly impact any prices. The empirical results do not reveal a positive and remarkable relationship between concentration and profitability for the sample of banks in 11 countries during four years of the study (1988–1991). Further, it did not observe any evidence to support one of the two versions of the EH for banks operating in those countries with a low concentration of banks. Finally, slight support was detected for the SCP hypothesis; hence, a simple policy of strict boundaries on cross-border acquisitions and growth is not reasonable.

In emerging economies, the effect of the 1991 liberalisation policy has been examined by Jang and Peng (2000) to identify whether market structures and firm performance in the industry differ in the periods before and after the 1991 revision to the Banking Act. They tested two competing hypotheses (SCP and EH hypotheses) in the context of market structure and the performance of enterprises. Findings prior to the 1991 revisions do not support both hypotheses (SCP and EH) in Taiwan's banking sector. Whereas, results assert that the 1991 revision to the Banking Act has stimulated competition and brought about an emphasis on efficiency in the banking business in Taiwan.

With respect to Middle East and North Africa (MENA) economies, the impact of a bank's characteristics, financial structure, and macroeconomic indicators on its net interest margins and profitability in Tunisian 44 commercial banks is examined by Ben Naceur (2003) for the period 1980–2000. This study found that the market concentration has a negative and significant impact on net interest margins, but it is insignificant with returns on average assets. Such results indicate that market concentration is less beneficial in terms of profitability for the Tunisian commercial banks and competition. Whilst in the State of Qatar, El-Kassem (2017) investigated determinants of conventional and Islamic banks' profitability over the period 2006–2011. Results support the SCP hypothesis as the relation between the profitability of conventional banks and market concentration is found. Also, another study, which included all the Arab Gulf Cooperation Council (GCC) countries, by Al-Muharrami and Matthews (2009), evaluated the performance of the GCC banking sector in the context of the SCP hypothesis over the period 1993–2002. With respect to methodology and data of this study, Al-Muharrami and Matthews (2009) employed the methodology of Berger and Hannan (1998) in testing the relationship between market structure and bank performance as the basic model. The data of the study covers 52 banks operating in five GCC countries during

the period 1993–2002, as well as the UEA during the period 1995–2002. The empirical findings of the study showed that the banking business in the Arab GCC is influenced by the mainstream SCP hypothesis. The positive relationship between market concentration and profitability would influence regulatory decisions in terms of mergers, which can be used by regulators and policymakers to reassess the market structure and performance, so as to decide whether they should intervene to change market structure, so as to enhance competition and quality of banking services and to deter insolvency.

3.2. Efficiency hypothesis and bank performance studies

On the other hand, Smirlock (1985) argued that in concentrated markets, profitability has resulted from superior operational efficiency. This argument has been investigated by a number of studies in emerging economies. In Bangladesh's banking sector, two hypotheses, the SCP and the EH were tested by Samad (2008) using the approach 45 adopted by Smirlock (1985) and Lloyd-Williams et al. (1994) as the basis of the methodology of the study took into account both market share and concentration to test the two competing hypotheses. Empirical findings of this study showed that the SCP hypothesis is rejected for explaining bank performance in Bangladesh, as return on assets (ROA) and return on equity (ROE) for the three or four largest banks were not satisfactory, one of which functioned with losses. On the other hand, findings with regard to the coefficient of market share were positive and significant, and, therefore, the EH is supported.

Aguirre et al. (2008) empirically examined and critically reinvestigated the SCP and EH hypotheses in terms of individual banks of different sizes that function within specific universal and functional regulatory banking regimes. All data of this study were gathered from balance sheets and income statements with regard to large commercial banks in ten nations for a total of 133 banks. In the case of commercial banks granted an authorization by governments of countries to perform activities relating to investment, trading, real estate, and insurance activities, the bank is categorized as belonging to the universal banking regulatory regime.

On the other hand, the bank is classified to work within the limits of the functional banking framework. With respect to the sample, Canada, France, Germany, Italy, Spain, Switzerland, and the UK are considered as the set of markets that have embraced the universal banking regulatory framework, and their banks run within its limits. A total of 79 individual banks were selected for the period 1986–1994, comprising 672 observations. Belgium, Japan, and the US are considered to be countries that work within the limits of the functional or segmented banking system, as data were selected in terms of 54 banks for the period 1986–1994, comprising a total of 443 observations. They suggested support for the EH, indicating that efficient banks earn higher market shares and gain profit ability, and therefore, banks that operate in nations that permit non-traditional activities are more efficient and 46 profitable. With respect to the way in which size and banking systems impact bank performance, results state that the universal banking and separate system are supported by EH. The effects of bank-specific, industry-specific, and macroeconomic determinants of bank profitability in Greece were examined by Athanasoglou et al. (2008), who employed an empirical structure that combines the traditional SCP hypothesis. Greek banks reinforced their position in the domestic banking business by adopting new technology as well as improving infrastructure, which in turn played a remarkable role in enhancing the performance of bank profitability. This study examined the profitability of Greek banks for the period 1985–2001, and the analysis was restricted to just commercial banks, as banks in Greece are typically general-purpose banks and they used the Herfindahl-Hirschman index (HHI) to represent market concentration. Findings of the study indicate that profitability persists to a moderate extent to imply that leavings from a perfectly competitive market structure cannot be that large. With respect to bank-specific determinants, all of them show a significant effect on bank profitability, excluding size. However, there is no evidence to support the SCP hypothesis, and the business cycle displays a positive asymmetric impact on bank profitability in the case that output is above its trend. These findings supported the competing hypothesis (EH) that if a bank enjoys a higher degree of efficiency in respect of good management and technology than its competitors, the bank can easily gain a larger market share by lowering its prices and earning economic profits.

4. BANKING AND INSTITUTIONAL QUALITY

Institutional theories highlighted that strong governance frameworks diminish prospects for corruption and enhance financial transparency (North, 1990). The principal-agent theory suggests that corrupt behavior among bank officials can be prohibited by a sound package of incentives and monitoring mechanisms (Shleifer & Vishny, 1993). The financial intermediation theory underscores that credit is misallocated by corruption, resulting in an increase in the cost of borrowing and decreasing financial inclusion (Levine, 2005).

The institutional theory clarified that financial stability and market efficiency are shaped by well-established institutions (North, 1990). The banking sector is the key mechanism of economic development, ensuring capital allocation, investment, and overall economic growth. Nevertheless, the effectiveness and stability of banks are mainly reliant on the quality of institutions. Institutional quality encompasses factors such as regulatory efficiency, legal enforcement, transparency, and corruption control, all of which play a critical role in maintaining financial stability (La Porta et al., 1998).

Institutional quality refers to the strength and effectiveness of a country's regulatory, legal, and governance structures. In respect of banking, a low level of corruption, compliance with regulations are characteristic of strong institutions, producing an attractive environment for investment. Barth et al. (2004) argued that well-regulated banks are less prone to experiencing crises, as institutions implement sensible financial practices. In addition, Beck et al. (2006) suggested that transparency in the banking sector stimulates investor confidence and reduces fraudulent practices.

The theoretical models of banking development show that institutional and regulatory factors are found to play a vital role in determining

the efficiency and stability of the banking sector. In this regard, La Porta et al. (1997) highlighted that the promotion of financial development can be achieved by the power of a country's legal system and the protection of investor rights. They suggested that developed and stable financial systems exist in countries with sound legal protections for creditors and investors.

However, the impact of institutional quality on financial development and stability has recently received attention from numerous scholars in this field (Shleifer & Vishny, 1997; Demirgüç-Kunt & Huizinga, 1999; La Porta et al., 2000; Fang, Hasan, et al., 2014; Elfeituri, 2022). Shleifer and Vishny (1997) argued that making major decisions can be prevented by well-structured regulations, which would affect the valuation of firms in developing countries. Additionally, La Porta et al. (1998) confirmed that institutional variables, in particular legal rules, protect the interests of shareholders, and the degree of their enforcement is essential. This aligns with the findings of Beck et al. (2000), who suggested that legal frameworks and government interventions significantly influence banking sector stability and growth by generating favorable environments for their growth. For instance, well-enforced property rights and transparent regulations can reduce the risks associated with banking, leading to more active participation in financial markets.

Furthermore, La Porta et al. (2000) argued that well-functioning laws and regulations can be found in better-developed economies. Although the bank regulations and supervisory power consist of several activities, such as entry regulations, activities regulations, capital regulation, and private sector monitoring. Although the bank regulations and supervisory power include numerous activities in terms of entry regulations, activities regulations, capital regulation, and private sector monitoring (Barth et al., 2004).

The relationship between banking stability, growth, and the quality of the institutional environment remains questionable. In the same context, other associated studies emphasize that the financial performance of banks is significantly influenced by business market, credit, and labour regulations (Barth et al., 2004; Mamatzakis et al., 2013). Prior studies found mixed results regarding the impact of regulatory and supervisory policies on bank performance. Barth et al. (2004) indicated that regulatory and supervisory practices affect the bank's development and stability. Also, other studies underscore the importance of the quality of institutions that enforce secure property rights for financial development (Beck et al., 2010) and the likelihood of financial fragility being positively associated with weaker institutions. In this matter, Demirgüç-Kunt and Detragiache (1998) and Ben Bouheni (2014) argued that strengthening regulatory and supervisory frameworks and compliance would lead to boosted financial stability in Europe. Similarly, Fang, Hasan, et al. (2014) pointed out that in transition countries, banking stability has improved after financial reforms and restructuring of corporate governance.

With respect to capital regulations, these regulations have been enacted to secure financial sustainability via encouraging banks to hold higher capital buffers to improve their capabilities in absorbing potential losses and decrease non-performing loans and bank risk (Tan & Floros, 2013; Bermpei et al., 2018). Also, as argued by Elfeituri (2022), official supervisory power can also help to increase bank stability by allowing regulators to prevent some issues associated with banking operations. However, to safeguard the soundness of regulatory enforcement, the rule of law and judicial efficiency should be effectively conducted, as some studies underscored that regulatory enforcement is improved by higher levels of rule of law (Bermpei et al., 2018; Elfeituri, 2022).

Regarding the corruption, this is one of the most concerning issues for most developing economies. Corruption in the banking sector undermines financial stability, leading to reduced investor confidence and distorting economic growth. The author argues that the optimal allocation of resources is not found in most developing economies. Bermpei et al. (2018) said that the efficient lending process and loan repayment can be achieved by the control of corruption, as control of corruption limits the misallocation of resources. Moreover, Toader et al. (2018), who examined the banking sector in the European Union, find that adopting a corporate governance code eliminates corruption and, therefore, boosts banking stability. La Porta et al. (1998) noted that corruption in banking can be prevented by sound transparency of financial reporting and independent auditing mechanisms. Additionally, Barth et al. (2004) suggested that effective regulatory structures tend to improve monitoring and compliance, resulting in minimizing the risk of corrupt practices within financial institutions. In more recent studies, Ferwerda and Kleemans (2019) indicated that detecting and preventing illegal financial flows can be accomplished by strengthening anti-money laundering regulations, thereby reducing corruption in the banking sector.

Corruption in the banking sector remains questionable, particularly in developing countries, which are characterised by a weak, less developed institutional environment, and the financial systems of those countries are mostly bank-based systems. Therefore, weakness in the institutional environment and corruption would discourage foreign and domestic investors from injecting their funds into the domestic economy, resulting in inefficient allocation of resources. Hence, these negative effects would cause increased social inequality, poverty, unemployment, and low economic growth.

Weak implementation mechanisms considerably deteriorate the effectiveness of anti-corruption measures in banking. Kaufmann (2005) argued that the lack of independence of regulatory organizations, resources, or political will would lead financial institutions to be involved in bribery, money laundering, and fraud. Furthermore, weak judicial structures contribute to postponed trials and foster a culture of impunity. Other empirical studies underscore that stringent enforcement is essential for preventing corruption in the financial sector. For instance, Barth et al. (2005) highlighted that those countries with robust supervisory tools exhibited lower levels of banking fraud. On the other hand, nations with unproductive enforcement had higher rates of financial misconduct. Nevertheless, there are international organizations, namely the Financial Action Task Force (FATF) enforce compliance with global anti-corruption standards. But, compliance with regulations needs local enforcement, as international pressure is not enough to achieve this task properly. This particular issue is found in developing economies due to political interference.

Political intervention in banking regulation may lead to manipulation and circumvention of laws. Banks that have a direct relationship with political authorities may receive selective treatment and be exempted from examination, while other banks may be subject to more stringent investigation (Johnson & Kwak, 2011). This bias reduces confidence in the financial sector and discourages foreign investment due to regulatory and corruption risks. For instance, Barth et al. (2005) highlighted that banks that are directly politically connected and operate in economies with weak institutional frameworks tend to be sponsored and receive preferential treatment despite financial instability. Likewise, La Porta et al. (2000) underscored that elites and those with political power may have priority in obtaining credit, which increases the spread of corruption. This matter requires regulatory independence and external auditors to eliminate political intervention. Central banks with strong independence, such as the European Central Bank (ECB), demonstrate that sound governance can safeguard unbiased enforcement of banking regulations (Goodhart, 2010). Though financial education is crucial, systemic improvements are completely required. Transparency and consumer protection rules can lead to limit financial manipulation, ensuring that vulnerable groups are well-protected (Organisation for Economic Co-operation and Development [OECD], 2013).

However, mitigating corruption in banking has become necessary. Quah (2017) argued that a well-defined legal framework is needed for minimising corruption. Countries that have introduced strict anti-corruption laws, such as Singapore, have effectively reduced financial misconduct through stringent enforcement and independent regulatory organizations. Conversely, Rose-Ackerman and Palifka (2016) stated that some countries have comprehensive legal frameworks, but they could not implement them successfully due to systemic corruption within enforcement bodies. Addressing the issue of systemic corruption within enforcement bodies is discussed by Rose-Ackerman and Palifka (2016), who suggested implementing a multi-faceted approach that reinforces institutions, improves transparency, and reduces unrestricted power. Rose-Ackerman and Palifka (2016) asserted that launching well-resourced, politically independent agencies dedicated to investigating and prosecuting corruption would lead to mitigating this issue. Whilst Djankov et al. (2008) suggested that officials need to declare their assets, resources, and sources of income to eliminate unlawful development. Also, an independent judiciary would help to ensure that corrupt officials are accountable (Treisman, 2000).

5. CONCLUSION

This paper outlines and discusses literature, issues, and theories associated with the banking industry. It indicated that the banking sector plays a vital role in economic growth by ensuring the efficient allocation of resources and fostering investment. Additionally, this study highlighted that a well-functioning banking system promotes economic expansion and, therefore, confirms that efficient banking enhances capital access and achieves economic development.

Also, this reviews theories that impact the performance of the banking sector, such as the SCP and the EH. While some scholars argue that higher market concentration leads to superior profitability, others underscore that efficiency and innovation are the main determinants of financial performance. According to these visions, policymakers should focus on fostering competition, reinforcing regulatory and governance structures, and boosting technological advancements to improve banking efficiency.

However, regulations should balance between competition and stability of banks to ensure that financial institutions operate efficiently while inhibiting monopolistic behavior. Furthermore, digital banking and financial inclusion are needed to enhance accessibility and competitiveness. Policymakers and regulators should implement a holistic approach that prioritizes innovation, regulatory quality, and financial stability to safeguard sustainable economic growth. Regarding the quality of the institutional environment, the literature indicated that institutional quality plays a remarkable role in shaping bank performance and stability. Findings showed that banking stability and profitability would be safeguarded if those banks operated in a better environment with a high quality of regulatory framework and a higher level of corruption control, emphasising that institutional quality should be carefully considered to safeguard the stability of the financial system and the national economy as a whole.

However, this paper has a number of limitations. Firstly, it is mainly based on a review of existing literature without empirical analysis. This limits the ability to quantify the specific impact of each factor discussed, such as institutional quality or technological innovation, on banking sector performance. Secondly, the scope of the paper is general and does not examine a specific region or country.

Future research could extend the examination to include using panel data or case studies to assess the interrelationship among banking sector development, institutional quality, and economic growth. Additionally, further examination into the role of artificial intelligence and blockchain in transforming banking efficiency and regulation is needed. Furthermore, researchers might also investigate how financial inclusion initiatives affect underserved populations and contribute to financial system resilience in different institutional environments. By addressing these limitations, future studies can provide reliable visions for policymakers and contribute to a profound understanding of how the banking sector can successfully support sustainable development in various economic circumstances.

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LESSONS FROM THE VOLKSWAGEN EMISSIONS SCANDAL: A LITERATURE REVIEW

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Abstract

The Volkswagen emissions scandal, often referred to as "Dieselgate", has become a pivotal case study in corporate ethics, regulatory compliance, and crisis management. This literature review explores the academic discourse surrounding the scandal, identifying key lessons for businesses, regulators, and policymakers. The review categorizes insights into five themes: 1) corporate governance failures, 2) ethical lapses, 3) regulatory implications, 4) consumer trust, and 5) long-term reputational damage. Beyond synthesizing existing findings, this paper contributes to the literature by framing the scandal through the lens of responsible business. In particular, it emphasizes how fostering a culture of accountability, embedding ethical decision-making into corporate strategy, and aligning compliance practices with broader societal responsibilities can help firms prevent similar crises. The review concludes with a discussion of how companies can build transparency, integrity, and resilience in the aftermath of misconduct, offering actionable implications for the advancement of responsible and sustainable business practices.

Keywords: Volkswagen Scandal, Business Ethics, Regulatory Compliance

Authors' individual contribution: The Author is responsible for all the contributions to the paper according to CRediT (Contributor Roles Taxonomy) standards.

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1. INTRODUCTION

The Volkswagen emissions scandal emerged in 2015 when the U.S. Environmental Protection Agency (EPA) revealed that the automaker had installed software to cheat emissions tests in millions of diesel vehicles. This revelation sent shockwaves through the global automotive industry and raised urgent questions about corporate ethics and regulatory oversight. The purpose of this paper is to synthesize existing research on the Volkswagen scandal and derive lessons that can inform future corporate practices and governance models.

This review contributes to the existing literature by providing an integrative analysis of scholarly work related to the scandal, including governance, ethics, regulation, consumer response, and strategic recovery. While several papers have examined individual dimensions of the crisis, this review seeks to consolidate findings to offer a multidimensional perspective. It also provides a reference framework for scholars, practitioners, and policymakers to better understand the interrelated factors behind such corporate misconduct. Accordingly, the main research question guiding this paper is:

RQ: What key lessons does the Volkswagen emissions scandal provide for advancing responsible business practices in terms of corporate governance, ethics, regulatory compliance, and long-term stakeholder trust?

The structure of the paper is as follows. Section 2 presents the literature review, which combines the methodology and thematic analysis. This section begins with a description of the integrative review approach and then discusses the scandal across six main themes: 1) corporate governance and leadership failures, 2) ethical culture

and organizational behavior, 3) regulatory failures and policy implications, 4) consumer trust and market response, 5) financial and legal repercussions, and 6) long-term strategic shifts. Section 3 synthesizes the key lessons learned and best practices suggested by scholars. Section 4 provides the conclusion, highlighting the main results in relation to responsible business while also noting the limitations of the paper and directions for future research.

2. RESEARCH FRAMEWORK

This literature review adopts an integrative approach, drawing on peer-reviewed journal articles, case studies, and policy reports published primarily between 2015 and 2024. Sources were identified through academic databases such as Scopus, Web of Science, and Google Scholar, using keywords including Volkswagen scandal, "Dieselgate", corporate governance, business ethics, regulatory compliance, and consumer trust. Studies were selected based on their relevance to the ethical, regulatory, and governance dimensions of the scandal, while opinion pieces without scholarly grounding were excluded. The review then organizes the findings into thematic categories that capture the major debates and lessons learned.

The Volkswagen emissions scandal, also known as "Dieselgate", erupted in September 2015 when the EPA issued a notice of violation against the company for installing illegal software in diesel vehicles to manipulate emissions test results. According to Ewing (2017), the software commonly referred to as a "defeat device" was capable of detecting when a vehicle was undergoing emissions testing and temporarily reducing engine performance to lower nitrogen oxide emissions. However, in normal driving conditions, these vehicles emitted pollutants up to 40 times above the legal limits. The scope of the deception was vast, affecting approximately 11 million vehicles worldwide, including nearly half a million in the U.S. Regulatory bodies, such as the EPA, the California Air Resources Board (CARB), and various European and Asian agencies led investigations that uncovered long-term, deliberate misconduct involving senior executives and technical teams. The fallout was immediate and severe: Volkswagen faced billions of dollars in fines, settlements, and compensation payouts, along with multiple criminal charges and the resignation or prosecution of top-level executives. The scandal also led to a sharp decline in the company's market value and severely tarnished its global reputation. More broadly, the incident ignited debates on the reliability of corporate self-regulation and the adequacy of emissions testing protocols. It also served as a wake-up call for the automotive industry to reevaluate environmental compliance and corporate accountability, leading to increased investment in cleaner technologies and more robust governance frameworks. The subsequent literature review will, therefore, be discussed across six main themes: first, corporate governance and leadership failures; second, ethical culture and organizational behavior; third, regulatory failures and policy implications; fourth, consumer trust and market response; fifth, financial and legal repercussions; and sixth, long-term strategic shifts.

2.1. Corporate governance and leadership failures

Numerous scholars, including Palmer (2012) and Langevoort (2018), highlight that weak corporate governance structures at Volkswagen enabled the scandal. A highly centralized decision-making system and a culture of obedience suppressed dissenting voices. Volkswagen's supervisory board failed in its oversight role, allowing executives to operate with impunity. The literature points to the need for independent board members, transparent reporting lines, and mechanisms that encourage whistleblowing and ethical discourse.

Other researchers have noted that Volkswagen's governance model suffered from a lack of transparency and accountability, exacerbated by the company's dual-board system and strong influence of labor unions and political stakeholders (Valentini & Kruckeberg, 2018; Volkswagen Group, 2024). The failure to establish effective checks and balances allowed unethical decisions to go unchallenged, highlighting the need for governance frameworks that support critical questioning and internal dissent. Mayer (2021) argues that effective corporate governance must integrate ethical purpose at the core of business strategy rather than treating compliance as a formal obligation. Additionally, Li (2016) emphasizes that board diversity and independence are crucial in preventing groupthink and enhancing strategic oversight. In the case of Volkswagen, these structural and cultural deficiencies created a permissive environment for misconduct, revealing the pressing need for reforms that emphasize accountability, stakeholder inclusivity, and ethical leadership.

2.2. Ethical culture and organizational behavior

The scandal has been widely discussed in the context of business ethics. According to Kellerman (2024), Volkswagen's culture prioritized performance and market dominance over ethical considerations. Employees were reportedly aware of the cheating software but feared retaliation for speaking up. This finding is consistent with Trevino and Nelson's (2017) argument that organizational culture is a critical determinant of ethical behavior. Ethical training, tone at the top, and employee empowerment are frequently recommended reforms.

Further studies, such as those by Kaptein (2015) and Sims and Brinkmann (2003), underscore that organizational ethics are not only shaped by formal codes of conduct but also by informal norms and leadership behavior. At Volkswagen, a results-driven culture combined with rigid hierarchies created an atmosphere where employees felt pressured to meet unrealistic goals, even at the cost of violating ethical standards. Bird and Waters (1989) observed that in many corporations, managers often discuss ethics only when prompted, which reinforces the notion that ethics is secondary to performance. Moreover, ethical fading — where individuals unconsciously disregard ethical dimensions of decisions — appears to have played a role at Volkswagen (Tenbrunsel & Messick, 2004). This highlights the importance of embedding ethics into everyday decision-making processes and performance metrics. Ethical lapses at Volkswagen were not the result of a single failure but the culmination of systemic cultural weaknesses.

Addressing such issues requires long-term commitment to fostering integrity, encouraging moral courage, and aligning incentives with ethical outcomes across all levels of the organization.

2.3. Regulatory failures and policy implications

The role of regulators is another central theme in the literature. Critics argue that regulatory agencies were slow to detect the fraud due to a lack of rigorous testing and excessive reliance on automakers' self-reported data (Balleisen, 2017). The scandal has led to calls for stricter emissions testing, real-world driving condition assessments, and more robust whistleblower protections. Scholars advocate for cross-border regulatory cooperation and the strengthening of institutions tasked with enforcing compliance.

Additional research suggests that regulatory capture and insufficient inter-agency coordination may have further hindered timely detection and enforcement (Bennear & Stavins, 2007; Carpenter & Moss, 2013). In the European Union, fragmented regulatory authority and the lack of centralized enforcement allowed Volkswagen to exploit gaps in oversight mechanisms (Vanderkolk, 2017). Furthermore, the scandal highlighted deficiencies in transparency requirements and the effectiveness of deterrence-based approaches. According to Fiorino (2020), modern regulatory systems should move beyond compliance monitoring to include proactive risk assessment and continuous industry engagement. Baldwin et al. (2012) argue for a more responsive regulation model that is flexible, context-sensitive, and inclusive of stakeholder participation. In light of the Volkswagen case, these insights support the adoption of integrated, well-resourced regulatory frameworks that balance enforcement with preventive strategies. There is also growing advocacy for the mandatory use of independent third-party testing and data verification, which could reduce the risk of conflict of interest and fraud. Strengthening legal protections for whistleblowers, improving inter-agency data sharing, and deploying real-world emissions testing are further recommended policy enhancements that can restore public trust and accountability in environmental governance.

2.4. Consumer trust and market response

The breach of consumer trust was immediate and far-reaching. The study by Aichner et al. (2021) demonstrates that Volkswagen's brand equity plummeted after the scandal, although long-term effects varied by region and consumer segment. Some customers remained loyal due to brand affinity or lack of alternatives, while others shifted to competitors. The literature suggests that rebuilding trust requires transparency, accountability, and demonstrable changes in business practices.

Subsequent research has reinforced the significance of ethical brand perception in consumer behavior. According to Tanner and Mansell (2025), brand recovery in the wake of corporate misconduct is contingent on swift and genuine efforts to acknowledge wrongdoing and implement corrective actions. Similarly, Laufer and Coombs (2006) argue that companies must adopt a victim-centered approach and communicate clearly with stakeholders to mitigate reputational damage. In Volkswagen's case, the company's initial response was perceived by many as evasive and inadequate, contributing to skepticism and prolonged public backlash (Che et al., 2023). Furthermore, KPMG (2016) reported a decline in consumer confidence not only in Volkswagen but in the diesel automotive segment overall, signaling wider implications for the industry. Scholars such as Lyon and Montgomery (2015) emphasize that greenwashing, misleading claims about environmental performance, can have enduring negative effects on brand integrity if uncovered. Rebuilding trust requires sustained efforts, including product recalls, fair compensation, transparent sustainability commitments, and a shift toward corporate social responsibility. The Volkswagen case illustrates that trust, once broken, demands not only financial reparation but also cultural and operational transformation to win back consumer loyalty and restore credibility.

2.5. Financial and legal repercussions

The scandal resulted in more than $30 billion in penalties and settlements, according to various reports (Hotten, 2015). Legal scholars such as Coffee (2020) argue that punitive damages serve as both a deterrent and a necessary consequence for misconduct. Volkswagen's legal troubles extended to shareholder lawsuits, criminal charges, and class actions. The case underscores the high cost of ethical lapses and the importance of compliance frameworks.

Further legal analysis reveals the complexity and global scope of the financial consequences faced by Volkswagen. According to Bertelli (2021), the company faced multi-jurisdictional litigation that included environmental fines, consumer fraud settlements, and investor claims under securities law. In the U.S. alone, Volkswagen agreed to pay over $14.7 billion to settle claims with the U.S. Department of Justice, the Federal Trade Commission, and affected consumers (U.S. Department of Justice, 2017). In Germany, top executives, including former chief executive officer (CEO) Martin Winterkorn, faced criminal indictments for fraud, market manipulation, and breach of fiduciary duty (Office of Public Affairs, 2018). Additionally, the scandal prompted several countries to revise their legal frameworks for corporate liability, with the European Commission (2017) proposing tighter rules on vehicle certification and emissions reporting.

Academic literature emphasizes the role of robust internal controls and risk management systems in mitigating legal exposure (Kraakman et al., 2017). The Volkswagen case demonstrates how regulatory non-compliance can trigger cascading legal and financial consequences, including reputational harm, share price volatility, and loss of investor confidence. Moreover, the scandal has contributed to broader discussions about executive accountability and the ethical obligations of multinational corporations. As Jung and Sharon (2019) note, financial penalties must be complemented by structural reforms to corporate governance and compliance in order to prevent recurrence. In sum, the legal and financial aftermath of "Dieselgate" serves as a powerful reminder of the intersection between law, ethics, and sustainable business strategy.

2.6. Long-term strategic shifts

In response to the scandal, Volkswagen announced strategic changes, including a shift toward electric vehicles and a renewed commitment to sustainability. Scholars like Oosthuizen (2019) argue that such moves are essential for reputational repair and competitive positioning. However, skepticism remains about whether these initiatives represent genuine transformation or merely symbolic gestures.

Following "Dieselgate", Volkswagen launched its "Together — Strategy 2025" plan, which aimed to transition the company into a global leader in sustainable mobility. This strategy included a €35 billion investment in electric vehicle development, the introduction of the ID. series, and efforts to reduce carbon emissions across its production chain (Volkswagen AG, 2019). The company also pledged to become carbon-neutral by 2050, aligning with broader environmental and regulatory expectations within the European Union (International Energy Agency [IEA], 2021).

Scholars such as Lundgren and Viganò (2024) highlight that such transitions can enhance corporate legitimacy, particularly when accompanied by measurable performance indicators and transparent reporting. Nevertheless, critics warn that post-crisis sustainability commitments can sometimes mask ongoing unethical practices — commonly referred to as greenwashing (Delmas & Burbano, 2011). In the case of Volkswagen, media coverage and stakeholder skepticism have persisted, questioning whether its corporate values have genuinely evolved or simply been rebranded for reputational gain (Boiral et al., 2022).

Moreover, the strategic shifts initiated by Volkswagen reflect a broader trend of environmental, social, and governance integration into business models following major ethical lapses. Eccles and Klimenko (2019) suggest that companies under public scrutiny often undergo a reevaluation of risk, stakeholder engagement, and sustainability goals. However, they stress that meaningful change is contingent upon embedding these values at all organizational levels, not merely within corporate communications or investor relations. The Volkswagen case, therefore, underscores both the opportunity and challenge of crisis-driven transformation. To sustain credibility, organizations must ensure that their strategic shifts are authentic, embedded in corporate culture, and subject to ongoing stakeholder dialogue and independent oversight.

3. LESSONS LEARNED AND BEST PRACTICES

The reviewed literature identifies several important lessons and best practices that organizations and regulators can adopt to prevent and mitigate the risks of corporate misconduct. Strengthening corporate governance by establishing independent oversight, clear accountability structures, and functional whistleblowing channels is fundamental. Equally vital is fostering an ethical corporate culture, which can be achieved through ethical leadership, transparent decision-making, and employee empowerment. On the regulatory front, enhancing the independence, capacity, and enforcement powers of watchdog agencies can facilitate the early detection and deterrence of corporate fraud. From a reputational standpoint, companies must prioritize transparency and sincerity in their communications during and after crises to rebuild consumer trust. Finally, embracing genuine, long-term strategic changes, such as investing in sustainability and compliance, can help restore organizational credibility and ensure resilience. These lessons highlight the interconnected nature of governance, ethics, regulation, and communication in safeguarding both corporate integrity and public trust.

4. CONCLUSION

The Volkswagen emissions scandal serves as a powerful case study in what can go wrong when corporate governance, ethics, and regulation fail simultaneously. The academic literature provides a comprehensive framework for understanding the causes and consequences of the scandal and offers actionable insights for corporations and regulators alike. A major result highlighted in this review is that responsible business practices, such as embedding ethical values into corporate culture, strengthening governance structures, ensuring regulatory compliance, and maintaining transparency with stakeholders, are essential to restoring trust and preventing similar crises in the future. The scandal demonstrates that long-term corporate resilience depends not only on financial recovery but also on a genuine commitment to accountability and sustainability.

At the same time, this paper is not without limitations. The review is limited to published scholarly sources between 2015 and 2024 and does not include primary empirical research, which may constrain the depth of analysis. Additionally, while the paper synthesizes key themes from the literature, it cannot cover the entire breadth of ongoing debates in business ethics, regulation, and corporate accountability. Future research should, therefore, build on this foundation by incorporating empirical studies, cross-industry comparisons, and longitudinal analyses of reforms to better assess the effectiveness of responsible business practices in the aftermath of corporate misconduct.

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ECONOMIC SUSTAINABILITY OF RENEWABLE ENERGY INTEGRATION: A COMPARATIVE COST-BENEFIT ANALYSIS USING EIRR, NPV, AND LCOE ACROSS SMALL ISLANDS AND URBAN SYSTEMS

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Abstract

This study evaluates the economic sustainability of renewable energy (RE) integration through a comparative cost-benefit analysis (CBA) using three metrics: the economic internal rate of return (EIRR), net present value (NPV), and levelized cost of energy (LCOE). Focusing on Mauritius as a representative Small Island Developing State (SIDS), the analysis contrasts its RE economics with urban grid systems to assess scale, financing, and policy implications. The paper aims to address how different geographies affect the economic feasibility of RE deployment, a gap often overlooked in conventional financial models. Drawing on secondary data from project reports, policy papers, and utility tariffs, the study applies scenario-based sensitivity testing to compare hybrid solar-wind projects with diesel-backed grids. The results indicate that while small island systems face higher LCOEs and delayed breakeven points, they exhibit competitive EIRRs when factoring in avoided import costs and long-term sustainability gains. The paper concludes that SIDS require tailored economic appraisal models that incorporate externalities, financing constraints, and institutional risks. Policy implications include the adoption of blended finance, viability gap funding, and performance-based procurement to improve RE bankability across constrained grid environments.

Keywords: Renewable Energy Economics, Cost-Benefit Analysis (CBA), Small Island Developing States (SIDS), Levelized Cost of Energy (LCOE), Hybrid Energy Systems

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1. INTRODUCTION

The transition to renewable energy (RE) has gained prominence as countries seek to mitigate climate risks, reduce dependency on fossil fuel imports, and promote long-term energy resilience. However, the economic appraisal of RE projects often applies standardised cost–benefit models that inadequately account for geographical, institutional, and systemic diversity — particularly in the context of Small Island Developing States (SIDS) and decentralised urban systems. While urban grids benefit from load diversity and established infrastructure, SIDS face challenges including small-scale demand, high dependence on imported fuels, and limited access to concessional finance (International Renewable Energy Agency [IRENA], 2021; Surroop et al., 2018).

The most commonly applied metrics — economic internal rate of return (EIRR), net present value (NPV), and levelized cost of energy (LCOE) provide powerful tools for project evaluation. Yet, these indicators often fail to incorporate factors such as system vulnerability, price volatility, avoided environmental costs, and institutional delivery risks (Gudlaugsson et al., 2023). For instance, LCOE does not always reflect opportunity costs or systemic inefficiencies in scale-constrained island grids (Awerbuch, 2000; Bhattacharyya, 2011; Berna-Escriche et al., 2025). Similarly, project-level internal rate of return (IRR) may obscure macroeconomic benefits such as reduced exposure to energy import shocks (Lal Karn et al., 2023; Weisser, 2004).

This paper addresses a critical gap in the literature by applying a comparative cost-benefit analysis (CBA) lens to RE projects in Mauritius, a SIDS targeting 60% RE by 2030 (Central Electricity Board [CEB], 2023), and benchmarking urban power systems. Mauritius serves as an ideal anchor case due to its mature energy planning framework, procurement reforms, and ongoing experiments in decentralised generation.

The study is guided by two research questions:

RQ1: How do cost–benefit outcomes of RE projects differ across SIDS and urban grid contexts using EIRR, NPV, and LCOE?

RQ2: What policy-relevant financial strategies can improve the bankability of RE integration in constrained environments?

The study adopts a comparative financial analysis approach, grounded in energy economics and project finance theory, using real-world data and scenario modelling. It draws on national policy documents, donor reports, and RE project evaluations to estimate and contrast economic outcomes under different deployment conditions.

This paper contributes to the field in four key ways:

1) by highlighting the impact of contextual risks on standard cost metrics;

2) by showing how fiscal and external factors reshape project feasibility across system scales;

3) by synthesising comparative experiences from Africa, South Asia, and SIDS;

4) by proposing a differentiated policy framework that includes blended finance, viability gap funding, and performance-linked procurement.

Recent studies have similarly stressed the need for dynamic modelling in energy investment planning, especially in vulnerable geographies (Osiolo, 2021; Pueyo, 2018). This paper builds on those insights by offering a policy-grounded and economically differentiated perspective on RE transitions in small-scale power systems.

The rest of the paper is structured as follows. Section 2 reviews the literature. Section 3 presents the research methodology. Section 4 provides case study results. Section 5 discusses the main findings. Section 6 concludes the paper.

2. LITERATURE REVIEW

The transition to RE systems is widely recognised as essential for achieving long-term climate, energy security, and economic development goals. Numerous studies have demonstrated the environmental and financial advantages of integrating RE into national energy portfolios, particularly in urban settings where emissions, energy demand, and infrastructure intensity converge (Energy and Environmental Economics, 2014; Sharma et al., 2022). Yet, these benefits are not always realised equitably or efficiently across geographies, particularly in the context of SIDS, where structural and institutional constraints persist.

In island contexts, the economic sustainability of RE transitions remains under-evaluated. Timmons et al. (2019), Timmons et al. (2020), and Painuly et al. (2021) argue that conventional metrics, such as LCOE and IRR, fail to capture the full value of RE in fragile systems. Their findings highlight the importance of tailoring evaluation frameworks to incorporate externalities, policy volatility, and scale constraints. Gudlaugsson et al. (2023) further emphasise that economic modelling must be adapted to fragmented regulatory environments and emerging energy systems, particularly in remote or underfunded regions.

From a methodological standpoint, CBA has long served as a foundation for RE planning. Seminal applications using the analytical hierarchy process (Akash et al., 1999) enabled structured comparisons between solar, wind, and hydro resources. Clinch (2004) argued for expanding CBA beyond direct cost-revenue analysis to incorporate environmental damages, resilience benefits, and fuel price volatility. While these early frameworks were groundbreaking, they lacked the dynamic modelling capacity now needed to evaluate system-wide RE transitions.

To address these gaps, recent studies have advocated integrating multi-criteria decision analysis (MCDA) into RE investment appraisal. MCDA allows evaluators to compare not only financial returns but also environmental impacts, institutional feasibility, and social acceptability (Akinyele & Rayudu, 2014; Hao et al., 2023). In modern RE literature, MCDA complements CBA by providing a holistic decision-making framework suited to complex, geographically variable environments. This is particularly relevant for SIDS and decentralised urban grids, where conventional economic indicators may obscure critical system-level trade-offs.

Technological innovations are also reshaping energy economics. Sharma et al. (2022) discuss how digitalisation, data-driven monitoring, and smart grid integration reduce deployment costs and improve energy yield predictability. Gudlaugsson et al. (2023) propose embedding these technological parameters into economic simulations, especially for grid-constrained SIDS. Loth et al. (2022) show that municipal support for integrated RE infrastructure can lower LCOE and improve financial viability when co-designed with local actors.

Policy and governance contexts play a pivotal role in investment outcomes. Carley and Konisky (2020) highlight the importance of institutional trust

and stakeholder engagement in RE project success. Sovacool et al. (2021) further argue for embedding energy justice principles into financial evaluation, emphasising procedural fairness, equitable access, and distributive outcomes. Zhang et al. (2024) observe that financial sustainability is increasingly tied to blended finance mechanisms and regulatory innovation, while Pueyo (2018) identify how public-private coordination enhances grid modernisation and cost-efficiency in transitional economies.

Despite the growing body of work, there remains a notable gap in comparative financial evaluations that assess RE viability across both SIDS and large-scale urban systems using multiple economic indicators. Most studies continue to focus narrowly on isolated geographies or single financial metrics, which limits their generalisability for cross-contextual policymaking. Few combine LCOE, NPV, and EIRR into a unified evaluative framework that reflects both macroeconomic trends and microgrid realities.

This study responds to this gap by anchoring its analysis in energy economics and MCDA-informed project finance theory, applying EIRR, NPV, and LCOE across contrasting energy contexts. It does so using real-world cases from Mauritius and selected urban grids to explore how capital intensity, avoided import costs, and policy instruments shape project outcomes. In doing so, the paper contributes to a more context-responsive understanding of RE financial viability, one that reflects not just profitability but also structural capability, institutional adaptability, and equitable energy transition pathways.

3. RESEARCH METHODOLOGY

This study adopts a comparative multi-case study design to conduct a comprehensive CBA of RE integration across a range of geographic and socio-economic contexts. The analytical framework incorporates both quantitative and qualitative approaches, employing well-established economic evaluation metrics: NPV, EIRR, and LCOE, to evaluate the financial viability of RE technologies.

3.1. Case study selection criteria

The six case studies — Colombia (Providencia Island), Nauru, France (St. Jean), Spain (Barcelona), Seychelles, and Mauritius were selected using purposive sampling based on theoretical and practical relevance. These cases represent a spectrum of energy system characteristics: SIDS, urban energy systems, and hybridised infrastructures. Selection was based on three core criteria:

1) Strategic alignment with the research aim of evaluating RE integration in both decentralised (island-based) and centralised (urban) systems.

2) Availability of reliable and detailed datasets, including technical specifications, cost structures, and policy documentation.

3) Representation of heterogeneous socio-political, economic, and infrastructural conditions to facilitate cross-contextual comparison.

This diversified case matrix enhances the analytical depth of the study and enables a nuanced understanding of how localised factors influence CBA outcomes and policy implications in RE adoption.

While this study employs a comparative case study design combined with CBA, other methodological approaches could have been considered. For example, a quantitative panel data econometric model could allow statistical generalisation across a larger sample of countries, or a systems dynamics modelling approach could simulate feedback loops within energy-finance-environment systems. However, given the geographic and infrastructural heterogeneity across the selected cases, such methods would risk oversimplifying context-specific dynamics. The case-based CBA method was therefore selected to preserve analytical depth and allow integration of both financial metrics and socio-environmental variables. This approach aligns with best practices in project finance evaluation in energy planning (Asian Development Bank [ADB], 2017; Lal Karn et al., 2023; Weisser, 2004).

3.2. Data sources and analytical framework

The research integrates data from official publications, feasibility studies, government reports, and peer-reviewed academic literature. Quantitative inputs for cost modelling and economic performance estimation were sourced from project-level documentation, national and regional energy agency reports, and simulation tools such as HOMER, alongside methodological references from the ADB project evaluation guidelines. To complement the quantitative analysis, qualitative dimensions such as socio-environmental co-benefits, stakeholder participation, and policy implementation dynamics were incorporated to provide contextual depth and explanatory power.

Each case study's CBA followed a structured framework, assessing:

- capital and installation costs;
- operation and maintenance (O&M) expenses;
- revenue generation from electricity sales or displacement;
- environmental externalities, including avoided greenhouse gas emissions;
- strategic benefits, such as improved grid stability and reduced dependence on fossil fuel imports.

In the case of Providencia Island, HOMER software was used to simulate system configurations and evaluate financial and operational outcomes under varying technical and economic assumptions. For the remaining cases, CBA was conducted based on reported data from feasibility studies, institutional documentation, and peer-reviewed sources, using standardized economic indicators.

Where data permitted, uniform evaluation metrics were applied across case studies, incorporating discount rates (e.g., 11.5% for Providencia Island) and analysis periods (e.g., 20–25 years) aligned with international norms. Sensitivity analyses were explicitly conducted in selected cases, such as Nauru and Seychelles, to test the robustness of project viability under different cost and implementation scenarios. Other case studies employed scenario modelling or comparative estimation approaches. Although full parameter uniformity was not always attainable due to context-specific constraints, internal methodological coherence was preserved within each case to ensure the validity of comparison and analytical consistency.

3.3. Limitations

The selection of geographically and economically diverse case studies was intended to reveal patterns in RE viability across a range of contextual realities. However, inherent differences in project scale, regulatory environments, institutional maturity, and socio-technical configurations limit the extent to which findings can be directly compared or broadly generalised. To address this, the study emphasises intra-case coherence and context-specific analysis, rather than imposing uniform benchmarks across all cases.

Selection bias was mitigated by prioritising cases based on their relevance to the study's core questions rather than on performance outcomes or data richness. While this approach may reduce representational breadth, it enhances the analytical depth and policy relevance of each case.

By clearly articulating these limitations and grounding the analysis with each case's specific context, the methodology remains transparent, replicable, and well-suited for informing investment strategies and policy frameworks across diverse settings.

4. CASE STUDY RESULTS

The case studies presented demonstrate the critical role of comprehensive CBA in assessing the viability of RE projects across various contexts, from small islands to urban centres. Table 1 summarises the key aspects of each case study.

Table 1. Summary of case studies

Location	*Project type*	*Key findings*	*Economic indicators*
Providencia Island, Colombia	Solar PV + BESS	High cost-effectiveness of PV for replacing diesel	Significant fuel savings
Nauru	6 MW Solar + BESS	Economically viable with an EIRR of 13.7%	EIRR > 9% economic opportunity cost of capital
St. Jean, France	RE integration	€104 million economic gain over 20 years	Enhanced system flexibility
Barcelona, Spain	Energy efficiency + Storage	8.2-year payback period	Reduced gas demand and CO2 emissions
Seychelles	Solar Park	Confirmed economic and financial viability	Positive EIRR and NPV
Mauritius	Diverse RE projects	22% current RE share, targeting 60% by 2030	Long-term economic viability demonstrated

4.1. Providencia Island in Colombia

The National Renewable Energy Laboratory (NREL), based in Colorado (USA), conducted a CBA to assess the viability of integrating RE and energy storage into the isolated power system of Providencia Island, a picturesque Colombian destination. The study focused on integrating photovoltaic (PV) panels and a battery energy storage system (BESS), considering existing fuel costs, discount rates, and capital cost estimates. Using the HOMER model, which is known for its sophisticated analysis capabilities, the analysis, which considered economic parameters such as an 11.5% discount rate and a projected analysis period of 25 years, indicated that PV was a highly cost-effective alternative for replacing expensive diesel fuel on Providencia Island. Integrating battery storage to store excess PV generation was essential at higher levels of PV penetration to ensure system stability and reliability. The study suggested that additional PV, wind turbine generators, and energy efficiency programs could result in significant fuel savings (Olis, 2021). The latter also provided valuable insights for sustainable energy planning and implementation. These findings, as documented by Olis in 2021, demonstrate the economic and environmental benefits of integrating RE and energy storage solutions into remote power systems.

4.2. Nauru Island nation in the Pacific Ocean

Nauru, a small Island nation in the Pacific Ocean region, has achieved nearly 100% electricity grid coverage but relies heavily on expensive imported fossil fuels for power generation, with solar power installations fulfilling only 3% of its national energy requirements. To tackle this issue, a three-fold proposal was put forward for the implementation of a 6-megawatt solar power facility, a BESS, and the enhancement of the capabilities of the Nauru Utilities Corporation. An economic analysis was carried out to identify the most cost-effective options for meeting the anticipated increase in electricity demand, considering the LCOE and aligning with the guidelines of the ADB and industry best practices. Project economic costs encompass initial expenses such as construction, electrical and mechanical works, a control system for the BESS, and ongoing operational and maintenance costs. The project's economic viability was assessed by computing the EIRR and comparing it with the 9% economic opportunity cost of capital. The study also demonstrated economic feasibility with an EIRR of 13.7%, surpassing the 9% economic opportunity cost of capital. Sensitivity analysis confirmed resilient economic performance against variations in capital costs, O&M expenses, and potential implementation delays (ADB, 2019). The projected EIRR remained above 9% in all scenarios, indicating resilient economic performance against identified risks.

4.3. St. Jean in France

The CBA was conducted to evaluate the economic advantages associated with integrating renewable energy sources (RES) and intelligent energy technologies, which involved examining two distinct scenarios: one without integrating intelligent energy and RE technologies and the other with integrating RES technologies into the share of energy production at St. Jean in France. This analysis revealed that incorporating RE technologies into the energy system resulted in an impressive overall economic gain of €104 million over 20 years. These economic gains primarily stemmed from the system's enhanced flexibility, categorised as avoided cost for energy system stakeholders, and indicated a substantial return on investment over the 20-year simulation period. Additionally, the anticipated

payback period for implementing RE technology in the second scenario was notably shorter compared to the first scenario, highlighting its economic viability. Furthermore, developing and retrofitting the system with greener and low-carbon energy technologies enhanced energy security and stability. The integration of RE technologies enhanced energy security and system flexibility, contributing to a more resilient and reliable energy infrastructure (Tyagi & Vasiljeviene, 2013).

4.4. City of Barcelona in Spain

A project at a sports complex, with excellent amenities, including top-notch swimming pools located in Barcelona, Spain, focused on improving energy efficiency by adding an air-handling unit (AHU), a seasonal thermal energy storage (STES) system, and a heat pump. Initially, the complex used traditional energy sources like electricity and natural gas. However, the aim was to explore energy-efficient measures and demand response by installing monitoring equipment for a building energy management system (Tyagi, 2012; Sharma et al., 2022). A trial project was conducted to assess the benefits, focusing on distributed end-user energy storage facilities using Li-Ion batteries. The evaluation compared two scenarios: Scenario A, representing traditional energy systems, and Scenario B, integrating intelligent solution technologies alongside the traditional systems. The CBA focused on identifying and evaluating the significant advantages of integrating RE and intelligent technologies into the energy system. The CBA showed that adopting innovative solutions reduced gas demand and demonstrated economic feasibility with a payback period of 8.2 years. Integrating RE technologies generated societal economic savings by reducing CO2 emissions (Gudlaugsson et al., 2023).

4.5. Seychelles, a small island nation in the Indian Ocean

Seychelles, an idyllic island nation in the Indian Ocean and very popular for eco-tourism, assessed the investment cost for a solar park. The detailed breakdown included material costs gathered from suppliers and internationally reported figures for the components, consultancy fees, and contingency funds to address any unforeseen challenges. The proposal incorporated robust controls and checks from technological and socio-economic perspectives to consistently monitor and evaluate the project's progress throughout its life cycle. A comprehensive analysis was conducted to assess the availability of solar irradiation in Seychelles for power generation throughout the year to determine the project's feasibility. The project projected benefits such as fossil fuel conservation and enhanced diversification in energy generation, as well as the number of customers expected to benefit from RE. Economic and financial viability was confirmed using EIRR and NPV calculations, with sensitivity analysis ensuring robust performance against baseline parameter variations (Tyagi & Vishwakarma, 2021).

4.6. Mauritius Island

Mauritius, a SIDS in the Indian Ocean, is actively pursuing RE initiatives to reduce its reliance on imported fossil fuels. Mauritius relies significantly on imported fossil fuels for its energy needs. In 2022, over 80% of the island's energy was derived from non-renewable sources, primarily coal and heavy fuel oil. The integration of RE in Mauritius's energy mix is relatively low, although it has been increasing gradually with investments in solar, wind, and hydroelectric power. As of 2023, RE accounts for approximately 22% of the total energy consumption. The Mauritian government is committed to raising RE to 60% of total energy production by 2030 (Ministry of Energy and Public Utilities [MEPU], 2022). This transition involves significant investments in various RE technologies.

A comprehensive CBA is important for assessing the feasibility and economic viability of integrating RE technologies in Mauritius. The CBA framework considers both the costs and benefits associated with RE projects, including initial capital investments, O&M costs, social and environmental benefits, and relevant cost savings from reduced fossil fuel imports. A study on the Sarako Solar Farm at La Ferme, Mauritius, highlights the land-use efficiency and cost-effectiveness of solar PV systems in the region (Timmons et al., 2019). Even though the installation of solar PV systems involves high initial capital costs, it is essential to note the lower cost related to the O&M costs as compared to conventional energy sources. Wind energy projects in Mauritius, such as those studied by Dhunny et al. (2015), have demonstrated favourable wind characteristics for power generation. Despite high upfront costs, a CBA performed highlighted that wind energy offers long-term cost savings and energy security benefits. Mauritius has also explored the use of biomass, particularly bagasse from sugarcane, as a RE source (Timmons et al., 2019). One of the major commitments of Mauritius to international environmental agreements is to abate greenhouse gas emissions in order to smoothly transition to RE sources and mitigate climate change.

Increasing the share of locally sourced RE results in improved energy security and in mitigating the reliance on imported fossil fuels, which is vital for the economic stability of Mauritius. In this context, the CBA indicates that while RE technologies are economically viable in the long term, the high initial capital costs pose a challenge. Policy measures such as subsidies, tax incentives, and favourable tariffs for RE can enhance economic viability (Timmons et al., 2019).

Effective management and coordination among various utility companies in the energy and water sector, which are used by energy consumers, are essential for optimizing the use of RES and achieving energy transition goals (Timmons et al., 2019; Timmons et al., 2020).

Mauritius' journey towards integrating RE technologies highlights the importance of a comprehensive CBA in ensuring the economic viability and sustainability of energy projects. The insights gained from this case study can guide other SIDS in their efforts to achieve energy security and sustainability through RE.

5. DISCUSSION: RISKS, BARRIERS, AND BROADER IMPLICATIONS

Effective CBAs encompass a broad analytical scope, tailored to regional resource potential and infrastructure realities. In Providencia and Nauru, comprehensive models included full-cycle costs, fuel savings, and capacity expansion. The long-term outlook in St. Jean and Barcelona illustrates the importance of operational savings and emissions reduction. The cases of Seychelles and Mauritius demonstrate the role of integrated RE systems — solar, wind, biomass — supported by storage and grid optimisation for enhanced economic viability. Several key findings and best practices emerge from this analysis:

5.1. Best practices in cost-benefit analysis for renewable energy projects

The comparative analysis of RE CBAs reveals several cross-cutting best practices. First, a comprehensive scope is essential. Successful CBAs, such as those conducted in Providencia Island and Nauru, evaluated not only capital costs and operational expenditures, but also environmental benefits and long-term energy security outcomes. These multi-dimensional evaluations ensured realistic assessments of project value beyond initial returns. Second, the case studies illustrate the importance of a localised approach. Each project tailored its financial and technical modelling to site-specific variables such as natural resource endowment, legacy infrastructure, and local policy incentives. This adaptive modelling improved contextual relevance and implementation feasibility. Third, a long-term planning horizon significantly enhanced the economic outlook of projects. In the cases of St. Jean and Barcelona, the projected operational savings and reduced carbon externalities in later years outweighed the high upfront capital requirements. This suggests that horizon extension in financial modelling can reveal hidden viability. Finally, the integration of multiple technologies and storage solutions emerged as a common strength. The projects in Seychelles and Mauritius benefited from combining solar, wind, and biomass technologies with energy storage, enabling load balancing and cost optimisation.

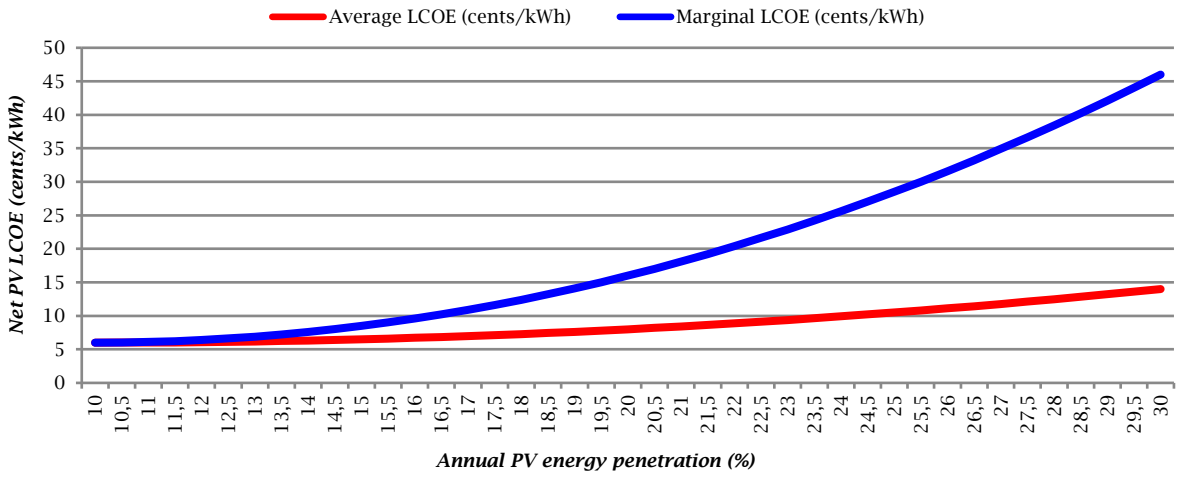
5.2. Recommendations for implementing renewable energy projects

Drawing from the cross-case findings, several key recommendations can guide future RE project implementation. First, hybrid systems should be prioritised. Projects that combined solar PV with wind or biomass consistently demonstrated improved reliability and favourable economic returns due to their complementary generation profiles. Second, investing in energy storage is imperative. The Providencia Island case shows that battery systems are vital for managing intermittency and stabilising grid operations, particularly as renewable penetration levels rise. Third, community engagement significantly influences project success. In Mauritius, active involvement of local communities enhanced buy-in and increased long-term sustainability. Finally, policy support remains a central enabler. Incentive mechanisms such as feed-in tariffs, performance-based grants, and public-private procurement frameworks were found to be instrumental in improving bankability and de-risking early-phase investments. These results are consistent with Cheuka and Choga (2022), who found that RE generation positively influences productivity in developing countries, reinforcing the economic rationale for higher RE penetration in low-capacity economies.

5.3. Relationship between renewable energy penetration and economic factors

Across these case studies, there is a clear trend that as RE penetration increases, the economic factors such as EIRR and LCOE tend to rise, but not linearly, due to various challenges such as grid integration, storage requirements, and diminishing returns on initial investments. Denholm and Margolis (2016) illustrate the relationship between LCOE and the penetration of PV energy into the grid.

Figure 1. Levelized cost of energy vs renewable energy penetration



Source: Denholm and Margolis (2016).

As shown in Figure 1, Denholm and Margolis (2016) illustrate that as the share of annual PV energy penetration increases, both average and marginal LCOE rise, especially at higher penetration levels, reflecting the added infrastructure and integration costs associated with scaling RE. Three key phases are commonly identified:

1) Low penetration (0–20%): Initial investments show modest returns, primarily from fuel savings.

2) Medium penetration (20–50%): Significant economic benefits are realised as economies of scale are achieved, and systems are optimized.

3) High penetration (> 50%): While benefits continue to accrue, the rate of increase may slow due to the need for additional infrastructure investments.

However, the overall economic benefits often outweigh these rising costs, particularly in terms of energy security, environmental sustainability, and long-term savings on fuel imports. Additionally, in many cases, RE projects contribute to broader economic goals such as job creation, local development, and enhanced global competitiveness. As Gina and Mutambara (2024) demonstrate in the context of South African townships, affordable access to RE contributes not only to decarbonisation but also to poverty alleviation, emphasising the co-benefits of inclusive RE policies in structurally constrained regions.

5.4. Additional equipment needs at higher penetration levels

At RE penetration levels exceeding 50%, system performance becomes increasingly sensitive to technical infrastructure adequacy. The analysis indicates a growing need for energy storage systems, particularly large-scale batteries capable of performing load-shifting and frequency regulation functions. Equally important is the deployment of smart grid technologies. Advanced control systems and real-time data platforms enable grid operators to manage the complexity of decentralised inputs and maintain voltage stability. Moreover, some systems may require flexible thermal generation assets, such as fast-ramping gas turbines, to act as reserve capacity during extended periods of low renewable output. These additional requirements have significant cost implications and should be explicitly included in CBA projections when modelling high-renewable penetration scenarios.

6. CONCLUSION

As RE penetration increases, system complexity rises, calling for complementary investments in battery storage, smart grid controls, and flexible demand-generation technologies. These components must be systematically integrated into CBA frameworks to ensure continued economic viability under high-renewable scenarios.

Policy implications include the importance of concessional financing, long-term tariff certainty, and cross-sectoral planning between energy, finance, and environmental agencies. Such instruments are particularly critical for structurally constrained energy economies such as SIDS.

Limitations of the study include heterogeneity in data availability, infrastructure maturity, and policy documentation across cases. While methodological coherence was preserved through intra-case consistency, generalisability remains bounded by localised conditions and data completeness. Additionally, operational cost projections and currency exposure risks warrant more detailed modelling in future work.

Future research should expand comparative financial analysis to other underrepresented geographies and integrate emerging themes such as energy justice, decentralised governance, and community-centred value metrics. Incorporating behavioural economics and equity-linked indicators into RE investment evaluation can strengthen both theoretical rigour and policy relevance.

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INNOVATION STRATEGY AND EXPORT PERFORMANCE: A SYSTEMATIC REVIEW BASED ON THE PRISMA METHOD

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Abstract

In a volatile global economy, innovation is critical for enhancing firms' export performance, particularly in emerging economies. This systematic review examines the evolution of the innovation-export nexus post-COVID-19, addressing gaps in understanding pandemic-induced shifts. Unlike Bıçakcıoğlu-Peynirci et al. (2020) and Panda and Sharma (2022), this study analyzes post-COVID-19 disruptions. Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method, we reviewed 54 peer-reviewed articles from 2010–2025, sourced from Scopus and Web of Science (WoS). Product and process innovations, alongside research and development (R&D) investments, significantly enhance export outcomes. The COVID-19 pandemic accelerated digital transformation, disrupted supply chains, and shifted consumer behavior, reshaping the innovation-export nexus (Elyta et al., 2023). Context-sensitive, integrated innovation strategies are essential for export competitiveness in emerging economies. This review bridges pre- and post-pandemic perspectives, providing scholars with a refined theoretical framework and practitioners with actionable insights for navigating global trade challenges (Alshamayleh, 2025).

Keywords: Product Innovation, Process Innovation, Export Performance, Systematic Review, PRISMA Method

Authors' individual contribution: Conceptualization — A.B.; Methodology — A.B. and Y.E.M.; Formal Analysis — A.B.; Investigation — A.B.; Data Curation — A.B.; Writing — Original Draft — A.B.; Writing — Review & Editing — A.B. and Y.E.M.; Supervision — Y.E.M. and A.S.E.

Declaration of conflicting interests: The Authors declare that there is no conflict of interest.

1. INTRODUCTION

In an increasingly volatile global economy, innovation encompassing research and development (R&D), product, process, organizational, and marketing advances has become a critical driver of export performance, particularly for small and medium-sized enterprises (SMEs) in emerging economies. While a substantial body of empirical evidence confirms a positive relationship between innovation and export outcomes, most existing studies focus on the pre-COVID-19 period. These works largely overlook the pandemic's disruptive effects, including accelerated digital transformation, supply chain interruptions, and financial instability, which have significantly altered the dynamics of international trade.

Although previous systematic reviews and meta-analyses have examined the innovation-export relationship, such as those by Bıçakcıoğlu-Peynirci et al. (2020) and Panda and Sharma (2022), they do not provide a comprehensive assessment of how the COVID-19 crisis has influenced this relationship, especially within the specific context of SMEs in emerging markets. This omission represents a notable gap in the literature and limits the ability of researchers and practitioners to design context-sensitive strategies for export resilience.

This study addresses the following research question:

RQ: How has the COVID-19 pandemic reshaped the relationship between innovation and export performance among small and medium-sized enterprises?

To explore this question, we conducted a systematic literature review of 54 peer-reviewed empirical articles published between 2010 and 2025. The review focuses on the post-COVID-19 period, differentiates between technological innovations such as R&D and product or process innovation, and non-technological innovations, including organizational and marketing practices. It further identifies mechanisms through which innovation supports export performance in times of crisis, including digital transformation and organizational adaptability.

The analysis is grounded in the resource-based view (RBV) and the dynamic capabilities framework. These perspectives conceptualize innovation as a strategic resource that enables firms to gain a competitive advantage, respond to environmental changes, and sustain performance in international markets.

The methodology follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol, involving multiple stages of article identification, screening based on eligibility criteria, quality assessment, and structured data extraction across five major databases.

The remainder of the paper is organized as follows. Section 2 presents the theoretical and empirical background. Section 3 explains the methodology. Section 4 provides the main findings and discussion. Section 5 ends the paper with the conclusion, which includes practical implications and limitations.

2. LITERATURE REVIEW

The relationship between innovation and export performance has been extensively examined through various theoretical perspectives. Foundational frameworks, such as Schumpeter's theory of innovation, the technological gap theory, and the product life cycle model, underscore innovation's strategic role in achieving competitive advantage (Schumpeter, 2008; Vernon, 1966). Recent approaches, including the RBV, dynamic capabilities, and endogenous growth theories, highlight innovation as a critical enabler of export performance (Wernerfelt, 1984; Teece et al., 1997; Romer, 1990). Empirical studies show innovative firms excel in export performance (Cassiman & Golovko, 2011; Love et al., 2016). Post-COVID-19, adaptive innovation strategies have become essential for resilience and sustained export performance (Elyta et al., 2023; Alshamayleh, 2025).

2.1. Technological innovations

Technological innovation, encompassing product and process advancements, is pivotal in enhancing firms' export performance. R&D investments and advanced technology adoption enable firms to develop differentiated products and improve efficiency, enhancing competitiveness in international markets (Bıçakcıoğlu-Peynirci et al., 2020; Baldini et al., 2025). For example, Baldini et al. (2025) emphasize that firms using advanced manufacturing technologies sustained export growth despite supply chain disruptions. Integrating digital technologies, particularly Industry 4.0 solutions, has amplified benefits, especially in emerging economies, reducing barriers to export performance (Elyta et al., 2023).

2.2. Non-technological innovations

Non-technological innovations, such as organizational, strategic, and marketing innovations, significantly enhance export performance. These innovations enable firms to adapt their structures, management practices, and market positioning to rapidly changing international markets (Rodil et al., 2016; Arslanagic-Kalajdzic et al., 2017). For example, organizational agility has helped firms navigate uncertainties caused by the COVID-19 pandemic, preserving competitiveness in export markets (Wanasida et al., 2021). Similarly, Hermawati et al. (2024) highlight that fostering an innovation culture enhances strategic flexibility, positively impacting export outcomes. These insights align with the RBV and dynamic capabilities theories, emphasizing intangible resources' strategic value in achieving and sustaining competitive advantages in international markets (Wernerfelt, 1984; Teece et al., 1997).

2.3. Innovation in the COVID-19 era

The COVID-19 pandemic challenged innovation by creating economic uncertainty and disrupting supply chains (Orlando et al., 2022). However, such crises can also catalyze innovation, prompting firms to adapt offerings and strategies to evolving market needs (Naidoo, 2010; Archibugi et al., 2013). Post-pandemic, digital transformation and open innovation have gained strategic importance, enabling firms to remain competitive and resilient to external shocks (Elyta et al., 2023; Patrucco et al., 2022). Patrucco et al. (2022) emphasize that collaboration with external partners enhanced organizational resilience and positively influenced export performance. Business model innovation has also proven essential for small firms in emerging economies, helping them respond to international demands (Martinez et al., 2021). These insights highlight innovation's critical role in crisis management and long-term export competitiveness in emerging economies (Alshamayleh, 2025).

Unlike prior systematic reviews, such as Bıçakcıoğlu-Peynirci et al. (2020), which focused on general innovation determinants, or Panda and Sharma (2022), which conducted a cross-country meta-regression, our study uniquely emphasizes how COVID-19 reshaped the innovation-export relationship in emerging economies. This specificity fills a critical gap in the literature and responds to the call for more context-sensitive, post-pandemic reviews.

Table 1 summarizes key empirical studies on innovation strategies during the COVID-19 pandemic and their effects on export outcomes.

Table 1. Empirical evidence of innovation in the COVID-19 crisis

Author	*Title of article*	*Sample/Country*	*Results*	*Mechanisms*
Khan et al. (2021)	Technological innovation and circular economy practices: Business strategies to mitigate the effects of COVID-19	344 companies in Ecuador's food supply chain	Technological innovation adoption increased, supporting resilience in supply chains.	Supply chain reconfiguration, digital transformation
Patrucco et al. (2022)	The impact of COVID-19 on innovation policies promoting open innovation	24 member countries of the Organisation for Economic Co-operation and Development (OECD)	Open innovation policies were widely adopted, enhancing firm resilience.	Open innovation
Ebersberger and Kuckertz (2021)	Hop to it! The impact of organization type on innovation response time to the COVID-19 crisis	136 startups from Asia, Europe, and North America	Startups forged partnerships, triggering open innovation during the crisis.	Open innovation
Zimmerling and Chen (2021)	Innovation and possible long-term impact driven by COVID-19: Manufacturing, personal protective equipment and digital technologies	Canada	Digital innovations such as artificial intelligence (AI) and blockchain have transformed business-government interactions.	Digital transformation
Martinez et al. (2021)	Business model innovation in small enterprises from developing countries during COVID-19 outbreak: Exploring drivers and BMI outcomes	Small businesses in developing countries	Small firms adapted through new products and services, sustaining market presence.	Business model innovation
Christaa and Kristinae (2021)	The effect of product innovation on business performance during COVID-19 pandemic	300 SMEs in Indonesia	Product innovation and market orientation improved SME performance.	Product innovation, digital transformation
Han and Qian (2020)	Did enterprises' innovation ability increase during the COVID-19 pandemic? Evidence from Chinese listed companies	3001 listed companies in China	R&D investments increased, supporting innovation capacity.	R&D investment
Wanasida et al. (2021)	The role of business capabilities in supporting organization agility and performance during the COVID-19 pandemic: An empirical study in Indonesia	76 companies in Indonesia	Organizational agility enhances decision-making and market responsiveness.	Organizational agility
El Chaarani et al. (2022)	The impact of strategic competitive innovation on the financial performance of SMEs during COVID-19 pandemic period	426 Lebanese SMEs from seven sectors	Process and marketing innovations improved financial performance.	Digital transformation, marketing innovation
Elyta et al. (2023)	Impacts of the COVID-19 pandemic on export commodity trading	Emerging economies	Digital transformation amplified export competitiveness during the crisis.	Digital transformation

Source: Authors' compilation.

The findings suggest that the COVID-19 crisis served as a catalyst for multiple forms of innovation, altering the dynamics of the relationship between innovation and export performance. Building on the theoretical and empirical foundations outlined above, we propose the following hypotheses:

H1: Technological innovations, encompassing product and process innovations, positively influence export performance.

H2: Non-technological innovations, such as organizational and marketing innovations, also exert a positive effect on export performance.

H3: Firms that simultaneously implement both technological and non-technological innovations achieve superior export performance compared to those adopting only one type.

H4: The positive effects of various innovation types on export performance are amplified during crisis periods such as the COVID-19 pandemic.

3. RESEARCH METHODOLOGY

This systematic review followed PRISMA guidelines to ensure methodological rigor and transparency (Moher et al., 2009). The review protocol comprised four stages: identifying relevant articles, selecting based on eligibility criteria, quality assessment, and systematic data coding.

3.1. Collection and identification of studies

A keyword search was conducted across five major databases: Scopus, Web of Science (WoS), JSTOR, Springer, and Emerald Insight. The search targeted peer-reviewed journal articles and academic theses, excluding books and non-scholarly publications. This process identified 1,698 articles based on keywords like "innovation capacity" and "export intensity".

3.2. Selection criteria

To refine the initial pool of 1,698 articles, we excluded duplicates, publications prior to 2010, non-peer-reviewed sources, articles not published in English or French, and studies that were off-topic. In the eligibility phase, following the approach outlined by Hunter and Schmidt (2004), we retained only empirical studies that examined the relationship

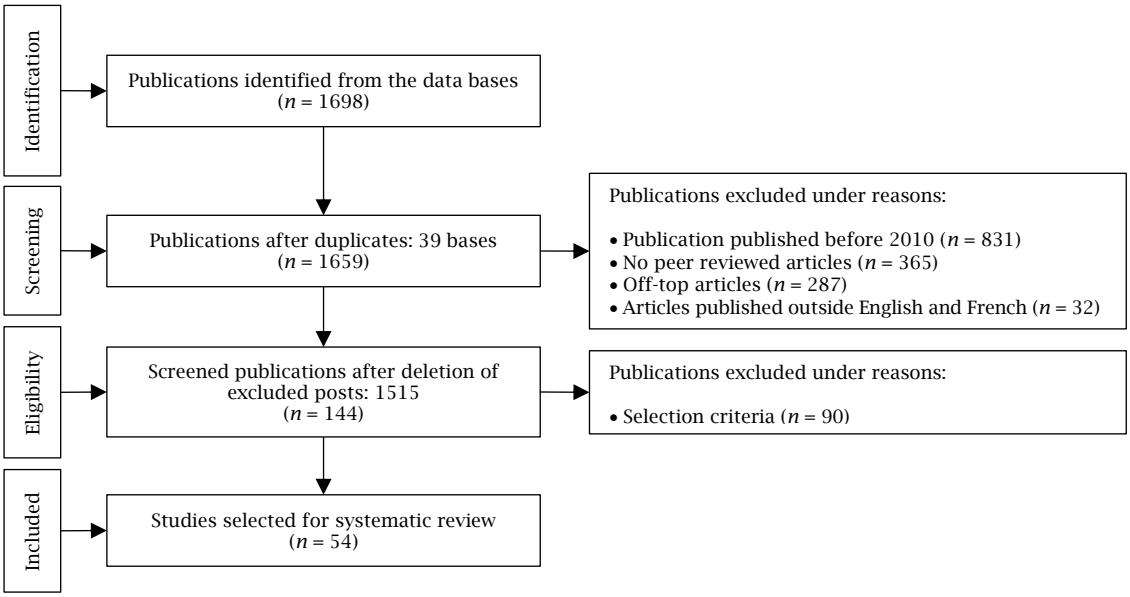
between innovation and exporting, were published in peer-reviewed journals, and focused on SMEs. After applying these criteria, 54 articles were selected (see Table 2 and Figure 1).

Table 2. Results from empirical studies

Source	*Collected*	*Duplicates*	*Excluded (pre-2010, non-peer, language, off-topic)*	*Selected*
Springer	468	10	444	14
Google Scholar	446	9	420	17
Emerald Insight	340	9	319	12
JSTOR	444	11	422	11
Total	1698	39	1605	54

Source: Authors' compilation.

Figure 1. PRISMA filtration process for empirical studies



Source: Authors' elaboration.

3.3. Quality assessment

A quality assessment was conducted using predefined criteria to evaluate the relevance of the selected studies. Each criterion was scored on a three-point scale. The 54 studies were assessed against eight criteria by two independent reviewers, resulting in a Cohen's kappa of 0.78, which indicates strong inter-rater reliability. Table 3 presents the list of quality assessment criteria, while Table 5 displays the evaluation results. A coding grid was used to capture study characteristics, including year, sample, country, sector, methods, and variables. Table 4 presents the 54 articles with their corresponding codes.

Table 3. List of quality assessment criteria

N	*Assessment criteria*
1	Well-defined research objectives.
2	Objectives achieved through the research design.
3	Clear articulation of variables.
4	Methodological aspects of the research are presented in a clear and coherent manner.
5	Data collection methods are adequately discussed.
6	Reliability and validity of measurements are clearly addressed.
7	Results are presented, analyzed, and discussed appropriately.
8	The results contribute to the existing literature.

Source: Authors' elaboration.

Table 4. Code names of articles included in the empirical corpus (Part 1)

Study code	*Article*	*Study code*	*Article*
BMV	Bodlaja et al. (2020)	WC	Wadho and Chaudhry (2018)
EOEH	Edeh et al. (2020)	AC	Azara and Ciabuschi (2017)
CA	Caldera (2010)	OZL	Oura et al. (2016)
GV	Golovko and Valentini (2011)	FR	Freixanet and Rialp (2021)
FNP	De Fuentes et al. (2020)	GPL	Ganotakis and Love (2011)
BLM	Bahl et al. (2021)	LSS	Lages et al. (2009)
FP	Filipescu et al. (2013)	RSY	Rasiah et al. (2016)
RVC	Rodil et al. (2016)	GB	Goldar (2013)
AA	D'Angelo (2012)	NT	Tyagi and Nauriyal (2017)
DDB	Dahani et al. (2021)	MT	Lo Turco and Maggioni (2015)
MA	Mattoussi and Ayadi (2017)	BKKKV	Barasa et al. (2017)
YTX	Yan et al. (2021)	VG	Voeten and Vannoorenberghe (2016)
DHDS	Danish et al. (2021)	FW	Fonchamnyo and Wujung (2016)
SMP	Sala-Ríos and Farré-Perdiguer (2021)	BG	Cassiman and Golovko (2011)

Table 4. Code names of articles included in the empirical corpus (Part 2)

Study code	*Article*	*Study code*	*Article*
AS	Arifin (2021)	SBE	Becker and Egger (2013)
RYJ	Rauf et al. (2023)	PC	Chummee (2022)
KBMB	Arslanagic-Kalajdzic et al. (2017)	LWS	Ortigueira-Sánchez et al. (2022)
CIA	Cieślik et al. (2018)	BBP	Benfratello et al. (2022)
ST	Tavassoli (2018)	HVOS	Hashmi et al. (2022)
CGCCU	Moreno-Gómez et al. (2021)	VT	Tandrayen-Ragoobur (2022)
ROFE	Rua et al. (2018)	FQ	de Castro Quelhas (2021)
EL	Exposito and Sanchis-Llopis (2020)	DTT	Vo et al. (2022)
HFHAM	Heredia et al. (2019)	AP	Palangkaraya (2012)
NK	Avenyo et al. (2020)	WLH	Hsieh (2013)
MC	Cieślik and Michałek (2017)	NR	Ur Rehman (2017)
AD	Amadu and Danquah (2019)	AL	Lejpras (2019)
HHD	Hwang et al. (2015)	JGM	Blyde et al. (2018)

Source: Authors' compilation.

Table 5. Quality assessment results

Study code	*C1*	*C2*	*C3*	*C4*	*C5*	*C6*	*C7*	*C8*	*Total*	*Percentage*
BMV	1	1	1	0.5	1	0.5	1	1	7	87.5%
EOEH	1	1	1	1	0.5	0.5	1	1	7	87.5%
CA	1	1	1	0.5	1	0.5	1	0.5	6.5	81.25%
GV	1	1	0.5	0.5	1	0.5	1	1	6.5	81.25%
FNP	1	1	1	1	1	0.5	1	1	7.5	93.75%
BLM	1	0.5	1	1	1	1	0.5	0.5	6.5	81.25%
FP	1	1	1	1	1	0.5	1	0.5	7	87.5%
RVC	1	0.5	1	1	1	0.5	1	1	7	87.5%
AA	1	1	1	1	1	1	1	0.5	7.5	93.75%
DDB	1	1	1	0.5	0.5	1	1	0.5	6.5	81.25%
MA	1	1	1	0.5	1	0.5	1	0.5	6.5	81.25%
YTX	1	1	1	0.5	1	0.5	1	1	7	87.5%
DHDS	1	1	1	1	1	1	0.5	0.5	7	87.5%
SMP	1	0.5	1	1	1	0.5	1	0.5	6.5	81.25%
AS	1	0.5	0.5	0.5	1	0.5	1	0.5	5.5	68.75%
RYJ	1	0.5	0.5	0.5	1	0.5	0.5	1	5.5	68.75%
KBMB	1	1	1	1	1	1	1	0.5	7.5	93.75%
CIA	1	1	0.5	0.5	1	0.5	1	1	6.5	81.25%
TS	1	1	1	0.5	1	0.5	0.5	1	6.5	81.25%
CGCCU	1	0.5	1	1	1	1	1	0.5	7	87.5%
ROFE	1	1	0.5	1	1	0.5	0.5	1	6.5	81.25%
EL	1	0.5	0.5	0.5	1	0.5	0.5	1	5.5	68.75%
HFHAM	0.5	1	1	0.5	0.5	0.5	0.5	1	5.5	68.75%
NK	1	1	1	1	1	0.5	0.5	1	7	87.5%
MC	1	1	1	1	1	1	0.5	0.5	7	87.5%
AD	0.5	1	1	1	1	0.5	1	0.5	6.5	81.25%
HHD	1	0.5	0.5	0.5	1	0.5	1	0.5	5.5	68.75%
WC	0.5	0.5	0.5	0.5	1	1	0.5	1	5.5	68.75%
AC	1	1	1	1	1	1	1	0.5	7.5	93.75%
OZL	0.5	1	0.5	1	1	0.5	1	1	6.5	81.25%
FR	1	1	1	0.5	1	0.5	0.5	1	6.5	81.25%
GPL	1	0.5	1	1	1	1	1	0.5	7	87.5%
LSS	1	1	0.5	1	1	0.5	0.5	1	6.5	81.25%
RSY	1	1	1	0.5	1	0.5	0.5	1	6.5	81.25%
GB	1	0.5	1	1	1	1	1	0.5	7	87.5%
NT	1	1	0.5	1	1	0.5	0.5	1	6.5	81.25%
MT	1	0.5	0.5	0.5	1	0.5	0.5	1	5.5	68.75%
BKKKV	1	1	1	1	1	0.5	0.5	1	7	87.5%
VG	1	1	1	1	1	1	0.5	0.5	7	87.5%
FW	0.5	1	1	1	1	0.5	1	0.5	6.5	81.25%
BG	1	0.5	0.5	0.5	1	0.5	1	0.5	5.5	68.75%
SBE	0.5	0.5	0.5	0.5	1	1	0.5	1	5.5	68.75%
PC	1	1	1	1	1	1	1	0.5	7.5	93.75%
LWS	0.5	1	0.5	1	1	0.5	1	1	6.5	81.25%
BBP	1	1	1	1	1	0.5	0.5	1	7	87.5%
HVOS	1	1	1	1	1	1	0.5	0.5	7	87.5%
VT	0.5	1	1	1	1	0.5	1	0.5	6.5	81.25%
FQ	1	0.5	0.5	0.5	1	0.5	1	0.5	5.5	68.75%
DTT	0.5	0.5	0.5	0.5	1	1	0.5	1	5.5	68.75%
AP	1	1	1	1	1	1	1	0.5	7.5	93.75%
WLH	0.5	1	0.5	1	1	0.5	1	1	6.5	81.25%
NR	1	0.5	0.5	0.5	1	0.5	0.5	1	5.5	68.75%
AL	1	1	1	1	1	0.5	0.5	1	7	87.5%
JGM	1	1	1	1	1	1	0.5	0.5	7	87.5%

Source: Authors' compilation.

4. RESULTS AND DISCUSSION

4.1. Classification of factors and determinants of the influence of innovation on export performance

The systematic review of 54 peer-reviewed studies allowed us to identify and classify the main factors that influence how innovation impacts export performance. These factors are categorized according to their type and frequency of citation in the literature. Table 6 summarizes this classification, highlighting the relative importance of each factor based on the reviewed articles.

Table 6. Classification of factors of the effect of innovation on export performance

Explanatory variables	*Weighting*	*Articles*
R&D	19	GV, FNP, BLM, AA, MA, SMP, RYJ, CIA, NK, AD, HHD, WC, G PL, RSY, GB, NT, BBP, DTT, AL
Product innovation	17	CA, YTX, AS, KBMB, ST, MC, LSS, MT, BKKV, VG, BG, FW, SBE, LWS, WLH, JGM, HVOS
Process innovation	8	EOEH, FP, DHDS, EL, CGCCU, VT, AP, NR
Marketing innovation	2	RVC, HFHAM
Learning ability	2	ROFE, OZL
Patents	2	DDB, FQ
Organizational innovation	2	BMV, PC
Degree of innovation	2	AC, FR

Source: Authors' compilation.

The PRISMA-based synthesis of 54 peer-reviewed studies reveals that R&D investment (35%) and product innovation (31%) are the most frequently cited drivers of export performance, while organizational and marketing innovations are mentioned less frequently (3%). These findings support hypotheses *H1* and *H2*, aligning with prevailing empirical trends. They also encourage further reflection on why these two technological innovations are particularly prominent.

From the RBV (Barney, 1991; Wernerfelt, 1984), R&D is considered a strategic, rare, and inimitable internal capability that enables firms to generate knowledge-intensive outputs, innovative products that are difficult for competitors to replicate. In export markets, where firms often face intense global competition, this uniqueness translates into a sustained competitive advantage through product differentiation. Firms that consistently invest in R&D are better positioned to design superior, customized, or technologically advanced offerings that meet diverse international standards and consumer expectations (Filipescu et al., 2013; Alshamayleh, 2025).

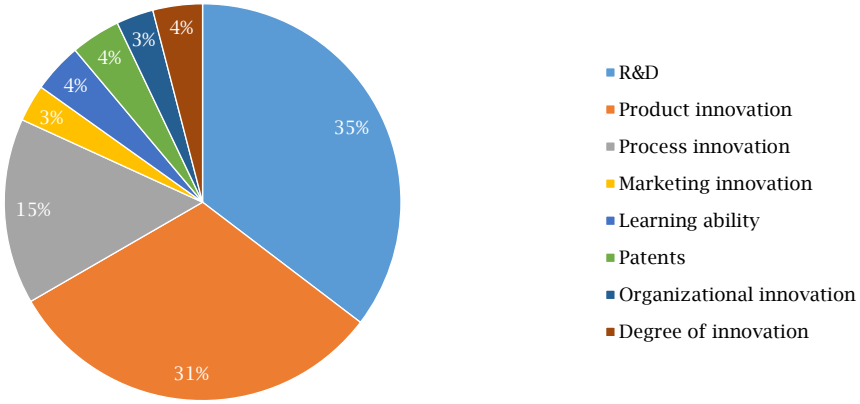
The dynamic capabilities framework (Teece et al., 1997) provides a further explanation of the mechanisms through which R&D and product innovation are essential to export success. In volatile and uncertain global trade environments, exacerbated by disruptions such as the COVID-19 pandemic, firms must develop the capacity to sense market shifts, seize emerging opportunities, and reconfigure their resources accordingly. R&D and product innovation enable this adaptability, allowing firms to redesign products, integrate digital features, or pivot toward new export segments with agility. For instance, Khan et al. (2021) demonstrated that firms that rapidly deployed R&D to develop digitally connected or crisis-resilient products were better able to maintain or even expand their export operations during the pandemic.

These capabilities are particularly crucial in emerging economies, where institutional voids, infrastructure gaps, or fluctuating trade policies often compel firms to rely more heavily on internal innovation rather than external support. Thus, R&D becomes not only a driver of product quality but also a buffer against environmental uncertainty, contributing to export resilience and sustained market participation (Elyta et al., 2023).

In summary, R&D and product innovation enhance export performance through two interconnected mechanisms: 1) by serving as strategic, inimitable assets that enable product superiority (RBV), and 2) by equipping firms with the agility to adapt their offerings in response to dynamic international markets (dynamic capabilities). These dual functions explain their consistent prominence in the literature and highlight the need for innovation-centered export strategies, especially in the context of global trade recovery.

Although non-technological innovations, such as organizational and marketing strategies, are mentioned in only 3% of the studies, their contribution remains significant. These findings support hypothesis *H3*, which posits that firms integrating both technological and non-technological innovations tend to achieve superior export performance compared to those relying solely on one type of innovation (Rodil et al., 2016; Arslanagic-Kalajdzic et al., 2017). From the RBV perspective, organizational innovations, such as fostering an innovation culture or implementing agile decision-making structures, represent intangible resources that enhance export resilience (Wernerfelt, 1984; Hermawati et al., 2024). For example, Wanasida et al. (2021) found that organizational agility allowed Indonesian firms to quickly adjust their export strategies during the COVID-19 crisis, maintaining market responsiveness. Similarly, dynamic capabilities emphasize the role of marketing innovations, such as digital marketing campaigns or customer-centric branding, in adapting to volatile global markets (Teece et al., 1997). El Chaarani et al. (2022) showed that Lebanese SMEs adopting innovative marketing strategies, like e-commerce integration, improved their financial performance during the pandemic. Although less prevalent than technological innovations, these non-technological innovations were amplified in crisis contexts, validating hypothesis *H4* by helping firms navigate disruptions through strategic flexibility and market alignment (Hermawati et al., 2024; Wanasida et al., 2021). Consequently, technological and non-technological innovations create synergistic effects, enhancing export performance beyond what either could achieve individually.

Figure 2. Percentage of explanatory variables



Source: Authors' elaboration.

4.2. Mechanisms amplifying the innovation-export nexus post-COVID-19

The COVID-19 crisis significantly moderated the innovation-export relationship, amplifying the impact of both technological and non-technological innovations through specific mechanisms, thereby validating hypothesis *H4*. Digital transformation emerged as a pivotal mechanism, with SMEs in emerging economies adopting e-commerce platforms and digital marketing to access new markets and mitigate trade barriers (Elyta et al., 2023). For instance, El Chaarani et al. (2022) found that Lebanese SMEs integrating online marketplaces improved export performance by 20% during the pandemic, leveraging cost-effective tools to bridge resource constraints. Supply chain reconfiguration, another critical mechanism, involved technological innovations like AI-driven logistics and blockchain for transparency, enabling firms to sustain export operations despite global disruptions (Khan et al., 2021). Ecuadorian firms, for example, adopted circular economy practices to optimize supply chains, maintaining export competitiveness (Khan et al., 2021). Organizational agility facilitated rapid strategic adjustments, such as shifting to alternative distribution channels or reconfiguring product offerings, as demonstrated by Indonesian firms that sustained market responsiveness during the crisis (Wanasida et al., 2021). Additionally, open innovation through external collaborations strengthened export resilience by providing access to shared resources and knowledge (Patrucco et al., 2022). Patrucco et al. (2022) noted that firms in OECD countries leveraging partnerships increased export volumes by 15% during the crisis. These mechanisms, amplified by the pandemic, underscore the necessity of integrated innovation strategies to enhance export performance in volatile global markets.

5. CONCLUSION

This systematic review, conducted using the PRISMA methodology, underscores the pivotal role of innovation in enhancing export performance, particularly in the post-COVID-19 context. The findings confirm that technological innovations, especially R&D (cited in 35% of articles) and product innovation (31%), are key drivers of export competitiveness. These forms of innovation enable firms to differentiate their offerings and optimize processes, thereby sustaining performance in international markets.

Non-technological innovations, such as organizational and marketing strategies, though less cited, are significant during crises, particularly for SMEs. COVID-19 accelerated innovation, emphasizing digital transformation and supply chain reconfiguration.

This review advances theoretical understanding by integrating post-pandemic dynamics into the RBV and dynamic capabilities frameworks, demonstrating innovation's role as a competitive resource and resilience capability (Wernerfelt, 1984; Teece et al., 1997). It introduces the moderating role of external shocks, offering insights into how crises reshape the innovation-export nexus, and enriches Schumpeter's theory by highlighting open innovation and digital technologies (Schumpeter, 2008).

Practically, firms in emerging economies should prioritize R&D and digital innovation. SMEs can leverage affordable digital tools like e-commerce platforms and blockchain for supply chain transparency. Larger firms should adopt open innovation through collaborations. Policymakers should foster innovation ecosystems with R&D tax incentives, digital skills training, and academia-industry partnerships, as exemplified by Indonesia and Ecuador.

This review's limitations include reliance solely on peer-reviewed articles from Scopus, WoS, and other databases, potentially introducing database bias by underrepresenting grey literature and regional publications. Including only English and French-language articles may introduce language bias, limiting generalizability in diverse emerging economies.

Future research should explore regional and multilingual databases and non-peer-reviewed sources like policy briefs. Longitudinal studies are needed to assess COVID-19's long-term effects. Sector-specific studies could compare high-tech versus traditional manufacturing. Exploring institutional variables, such as government policies and trade agreements, through comparative studies could provide a nuanced understanding of the innovation-export nexus.

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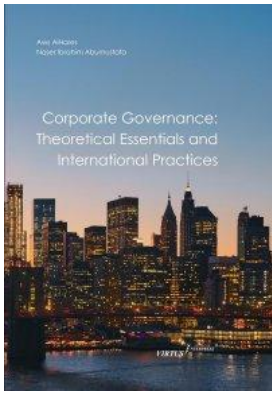

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