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The Effect of Export Barriers on Perceived Export Performance in Libyan SMEs

Muamer Azyadi[1], Çağın Erbek Alaybeyoğlu[2]

[1] MBA Candidate, Haliç University, Institute for Graduate Studies, Halic University, Istanbul, Turkey
[2] Professor, Haliç University, Institute for Graduate Studies, Halic University, Istanbul, Turkey.

Correspondence: Muamer AZYADI, Haliç University, Institute for Graduate Studies, Halic University, Istanbul, Turkey. E-mail: moammerziadi@gmail.com

Abstract
The article focuses on the influence of export barriers on the perceived export performance of SMEs in Libya, a country with unstable political conditions, economic concentration, and weak institutions. Utilizing a descriptive–analytical approach, the research is based completely on secondary data and compiles evidence from peer-reviewed academic sources and reliable institutional ones such as the World Bank, WTO, UNCTAD, and the Libyan Export Promotion Center. The analysis employs the Resource-Based View, Institutional Theory, and Uppsala Internationalization Model as its theoretical basis which leads to an ordered judgment of how competencies and environmental conditions at the firm level work together to decide the outcome of the exports. Among various barriers, the study finds that those from within the company, i.e. limited financial resources, weak managerial capabilities, poor export planning, and low innovation capacity, turn out to be of a much greater extent than the negative impact of external barriers like bureaucratic inefficiencies, unstable regulations, and poor infrastructure. Further comparative evidence points to Libyan SMEs being the least developed in the area of export readiness and competitiveness among their regional counterparts. The research not only adds to the existing literature on export performance but also it does this by providing a detailed analysis of export barriers in a conflict-ridden, resource-dependent economy, and by confirming perceived export performance as an acceptable proxy in data-scarce situations. The implications for policy and management highlight that there is an urgent need for coordinated reforms combining the support of institutions, financial facilitation, and capacity building initiatives.

Keywords: Export Barriers, SMEs, Perceived Export Performance, Libya, Internationalization

1. Introduction

Small and medium-sized enterprises (SMEs) are almost always assumed to be the major factor for job creation, dynamism in the private sector, and even for the diversification of economies in developing countries, but very often their potential to grow is limited due to insufficient resources and poor access to the markets. Internationalization—above all, the case of exporting—gives SMEs the chance to gradually accumulate demand thereby venturing further than their unproductive home crown territories, draw in experience and knowledge, and ultimately gain in competitiveness. Cutting through the academic jargon, from a capabilities angle, one could say that through exporting a company can not only prove its strength but also get a chance to learn, improve, and

reconfigure the resources as it encounters new technologies, customer needs, and—most importantly—competition.

On the other hand, exporting cannot be viewed as a cakewalk. The "export barriers" that come both from within and outside the firms influence for many SMEs the export decision, as well as the sustainability of the export activity. Firm-level constraints (like financial, managerial expertise, planning, and knowledge gaps) and external constraints (like border procedures, regulatory complexity, standards compliance, and institutional instability) are usually acknowledged as the different types of barriers in the export-barrier literature. This framing has ample empirical support from export research that connects barriers to (perceived) export performance across various SME contexts. For example, there is evidence from Turkey that explicitly models the barrier–perceived performance relationship (Altıntaş et al., 2007) along with influential syntheses of export barriers and performance determinants (Leonidou, 2004; Sousa et al., 2008).

The Libyan context exacerbates and makes these problems more significant from an analytical viewpoint. Libya since 2011 has been experiencing extended periods of institutional disruption and macroeconomic instability that have adversely impacted the local businesses' ability to grow, particularly in the case of non-oil exports. Under these conditions, the SMEs in the sectors where exports are theoretically possible—such as processing, agriculture, and services—often deal with high uncertainty, scattered support, and lack of access to necessary infrastructure, finance and other facilitators. To make the study both comparable and contextually pertinent, it places Libyan SME exporting within a regional and institutional evidence framework by relying on international datasets and reports (World Bank, 2023; WTO, 2022; UNCTAD, 2022; AfDB, 2021) and national sources of Libya (LEPC, 2021).

The article is conceptually built on the integration of different theoretical viewpoints that illuminate why export barriers lead to varying performance outcomes for firms and settings. The first one is the Resource-Based View (RBV) which states that resource differences create performance variability; thus, SMEs with stronger internal resources (financial capital, managerial expertise, and innovation capacity) are in a better position to resist constraints and hold on to the competitive advantage they have gained (Barney, 1991). Second, Institutional Theory asserts that the strategies of firms and their outcomes are determined by the formal and informal rules in their environment; where institutions are weak, "institutional voids" increase the cost and risk of transactions which, in turn, makes obtaining and maintaining market participation and performance harder (North, 1990; Scott, 2014). Third, the Uppsala internationalization model views exporting as a gradual learning process in which firms increase commitment as they gain experiential knowledge; this is especially suitable for SMEs that are uncertainty and information asymmetries (Johanson & Vahlne, 2015). Apart from these theories, the international business literature points out the role that networks play as one of the main ways through which SMEs can get access to foreign-market information and resources that are otherwise hard to develop internally. Networks can minimize transaction costs and uncertainty and determine market entry options—this is especially relevant in high-risk settings where the formal support from institutions is limited (Coviello & Munro, 1997).

On the methodological front the paper takes on a secondary-data method that aims to synthesize the evidence in settings where data are scarce and complicated even from the institutional perspective. Quantitative and qualitative secondary sources were the only basis of the research allowing for triangulation and comparison through institutional indicators and peer-reviewed findings (World Bank, 2023; WTO, 2022; UNCTAD, 2022; AfDB, 2021; LEPC, 2021). The systematic literature review process in line with PRISMA principles was put in place to identify studies on SME export barriers from 2000 to 2025, and was followed by structured screening, quality appraisal, and extraction to ensure transparency and replicability (Booth, Sutton, & Papaioannou, 2021).

The study's analytical focus is intentionally comparative and policy-relevant. It plans to (i) pinpoint the internal (firm-level)

2. Literature Review

Small and medium-sized enterprises (SMEs) have become the main engine of economic development everywhere and their importance is recognized everywhere as they create jobs, encourage diversification, and help maintain local production networks especially in situations where the formal private sector is limited structurally (Beck & Demirgüç-Kunt, 2006; Ayyagari et al., 2011). The role of SMEs as the backbone of the economy becomes even more pronounced in resource-dependent and institutionally weak locations: they frequently act as the "economic stabilizer" at the community level when national coordination is weak or disrupted (El Taraboulsi-McCarthy, 2019). However, the same conditions that make SMEs the most important actors in society and economy also exacerbate their problems—especially financial frictions, capability gaps, and the lack of reliable support systems—creating a constant conflict between policy expectations and actual export participation (UNCTAD, 2022; World Bank, 2023). This dissertation positions Libya's SMEs within this conflict, stressing that low export participation is not simply a decision made at the firm level but rather a product of multi-layered constraints that determine export readiness and competitiveness.

Exporting is typically viewed as the most internationalization route for SMEs to enter the international market because it requires less commitment that is not reversible than foreign direct investment and has the potential to provide "learning-by-exporting" advantages that improve quality and innovation (Cavusgil & Zou, 1994; OECD, 2021). Nevertheless, SME exporting is rarely a straightforward and simple decision; rather, it is a process of capability-building that is highly influenced by managers' know-how, standard organizational routines, and the ability to deal with uncertainty across different institutional environments (Leonidou et al., 2010; Johanson & Vahlne, 2015). Following the Uppsala internationalization model, SMEs often start their foreign activities with low commitment and then gradually increase the extent of their engagement as they gain experience and develop market-specific knowledge—thus making perceived uncertainty and learning limitations central factors that influence export outcomes (Johanson & Vahlne, 2015). As a result, the thesis sees exporting as an ongoing learning process rather than an isolated strategic act.

One of the major topics of the literature deals with the "export barriers" pointing as the most direct reason for limited destocking of the export sector, the irregularity of activities and underperformance of SMEs. These barriers to export are defined as factors that cause the foreign market entry and operation to be more expensive, risky, and complicated and thus discourage companies from exporting or weaken their export performance after entering the market (Leonidou, 2004). It is a very important issue to differentiate between objective barriers (measurable limitations in markets and institutions) and perceived barriers (the way that management evaluates the situation and makes decisions under uncertainty). The difference makes a bigger impact on SMEs than on larger companies because their decision-making is centralized and they have limited resources; thus, the way the managers perceive the situation can either amplify or even substitute the objective constraints in determining the export behavior (Leonidou, 2004).

The majority of studies on export management classify barriers into internal and external and that is the classification that this research follows. Internal barriers to exporting emerge from the company and are typically made up of factors like: lack of international experience among the management, insufficient planning of the export process, lack of knowledge related to export, shortage of working capital, and lack of operational capabilities required to ensure compliance with quality and standards (Chabowski et al., 2011; Bellone et al., 2010; Styles & Ambler, 2000). These issues are directly detrimental to export readiness: even in the presence of external opportunities, SMEs may not have the required financial and organizational capacity to pay for the market research, product adaptations, certification, and management of payment cycles that are lengthy in cross-border trade (Bellone et al., 2010). From a capability perspective also, technological and process-related weaknesses are still important since they limit SMEs' ability to meet foreign customers' quality requirements and delivery reliability, which are crucial for performance in export markets (Golovko & Valentini, 2011).

External barriers to exports are factors that limit the firm's ability to export and include the complexity of regulations, ineffective customs and documentation procedures, unpredictable policy climates, inadequate infrastructure (transportation, ports, digital connectivity), fierce competition from foreign countries, and the fragility of institutions (Seringhaus & Botschen, 1991; Zou & Stan, 1998; Portugal-Pérez & Wilson, 2012). Where institutions are weak, the barriers intersect; for example, the lack of infrastructure raises logistics and delivery

costs along with their uncertainties, while the regulatory changes heighten the compliance risk and at the same time hinder the relationships with foreign partners (Filippaios et al., 2008). In conflict areas, the external barriers are compounded by the aforementioned problems of political uncertainty, security, and economic instability—these conditions negatively impact trade as they make it more uncertain and less attractive to invest in long-term export strategies (Chen & Novy, 2021).

Literature also highlights the direct impact of tariffs and non-tariff measures on SMEs' export opportunities as another factor to assess. Though tariffs can make an exporter less competitive in terms of pricing, non-tariff barriers often cost more to comply with, which the SMEs bear alone, particularly those without technical staff or money for testing and certification (Disdier et al., 2008; Hoekman & Nicita, 2011). Technical barriers to trade are often cited as a major problem for SMEs because, in compliance, capital investment may be necessary as well as frequent certifications; thus, the threshold for entering high-standard markets goes up (Sheldon, 2017).

Barriers to exports performance relationship has been generally explained from different theoretical angles. First, the resource-based view (RBV) asserts that export performance is determined by resources and capabilities that are valuable and difficult to copy; however, barriers limit performance by constraining SMEs' capacity to create and apply export-relevant capabilities like management skills, knowledge of the market, innovation, and operational flexibility (Barney, 1991). Second, institutional theory points out that performance varies with the quality of regulations, enforcement, trade facilitation, and governance; weak institutions raise uncertainty and transaction risks, thus, making it less efficient and appealing to keep nurturing the market with exports (Aidis et al., 2008). Third, the behavioral internationalization model emphasizes that barriers work through management's perceptions and attitudes towards risk—exporting could be seen as more complex and that could lead to reluctant exporting postures and ineffective strategic planning, thus, even when there are chances, the performance will still be undermined (Figueira-de-Lemos et al., 2011). The thesis scientifically connects these mechanisms to the internal resources, learning dynamics, and institutional context perceived export performance in Libya.

In conclusion, the thesis clearly focuses on perceived export performance as the main outcome because in data-scarce places it is difficult to find reliable objective export indicators at firm level. In such situations, perceived performance is regarded as a valid proxy that reflects the managerial evaluation of export results under actual operational restrictions, which corresponds with the broader trend of relying on perceptions in SME exporting research (Leonidou, 2004). This consistency lies in the thesis' secondary-evidence design and its triangulation rationale that seeks to diminish single-source bias by combining peer-reviewed studies and institutional datasets covering the years 2000-2025 (Booth, Sutton, & Papaioannou, 2021).

3. Methodology

This article features a research design that is descriptive-analytical and that relies on secondary data only, which corresponds with the methodological framework of the original thesis. The option for a secondary-data approach is supported by the constraints that are structural and institutional, which characterize the Libyan context, where firm-level primary data are rare, fragmented, and often not trustworthy due to the long-lasting political instability and poor statistical systems. In such contexts, collecting secondary evidence of high quality is considered an appropriate and very good strategy to analyze export-related phenomena and to make policy-relevant conclusions. Data were obtained from studies published in peer-reviewed journals, reports by international institutions, and national official resources covering the period from 2000 to 2025. Key institutional sources are the World Bank, World Trade Organization (WTO), United Nations Conference on Trade and Development (UNCTAD), African Development Bank (AfDB) and Libyan Export Promotion Center (LEPC). The indicators on the performance of SMEs, trade facilitation, logistics, the quality of institutions and export barriers are comparable, which enables conducting cross-country and regional benchmarking related to Libya. Academic sources were identified through systematic searches of major databases, especially for studies focused on export barriers, SMEs internationalization, and associated with export performance in developing and conflict-affected economies.

The analytical framework consists of three theoretical perspectives: the Resource-Based View (RBV), Institutional Theory, and Uppsala Internationalization Model. These frameworks directed the classification of export barriers

into internal (firm-level) and external (environmental/institutional) groups and organized the interpretation of how these barriers impact perceived export performance. The analysis does not resort to statistical testing but rather to thematic synthesis and comparative evaluation, which brings out recurring patterns, major constraints, and converging findings across the sources.

To be more valid and reliable, the study incorporates triangulation, comparing evidence from different data sources and regions to eliminate the bias of a single-source. Despite the fact that the methodology does not allow for causal inference at the firm level, it still results in a clear and context-sensitive understanding of export barriers and their performance consequences for Libyan SMEs. Among the methodological limitations, which are considered as the main ones in conducting research in fragile-state contexts, are the issues of data timeliness and reliance on perceived performance indicators rather than on objective ones, which are also seen as inherent to such settings.

4. Results

To evaluate the effect of internal and external export barriers on the perceived export performance of Libyan SMEs, this chapter delves deeply into the secondary data that served as the primary source of information. Using information culled from international databases, reports from relevant institutions, and primary research, this chapter paints a comprehensive picture of Libya's export status.

The study drew on a variety of descriptive and comparative methodologies to examine Libya in relation to its North African and Mediterranean neighbors, paying special attention to the similarities, connections, and contextual differences between the two. In order to make sense of the results, the researchers looked to three primary theoretical frameworks: the Uppsala Internationalization Model, Institutional Theory, and the Resource-Based View (RBV). Taken as a whole, these models explain how a company's internal resources, external institutions, and the power of experience all play a role in shaping a small or medium-sized enterprise's (SME) export behavior and perceptions of its own performance.

4.1. Examining Internal Export Restrictions

One kind of export barrier is the firm's own internal biases and assumptions. These obstacles are faced by businesses that struggle with innovation, have ineffective management, and lack adequate funding, among other things. The key determinants of export success, according to Leonidou (2004), are these obstacles because they affect resource allocation and decision-making directly.

According to research carried out by the Libyan Export Promotion Center (LEPC, 2021), more than 70% of small and medium-sized enterprises (SMEs) in Libya lack export-specific departments and appropriate training. Official export funding is available to fewer than 12% of Libyan SMEs, according to a World Bank analysis citing financial data from 2023. This suggests that there is still a significant dependence on unofficial finance and individual savings, which has limited opportunities to access international markets.

Further complicating matters are management and human resources flaws. Lack of managerial experience causes risk aversion and reduced trust in dealings with international partners, according to a 2007 study on Turkish SMEs by Altıntaş, Tokol, and Harcar. Libyan managers, like their Turkish counterparts, have limited exposure to international techniques, hence they frequently prioritize the company's survival over developing a strategy to increase exports in the long run. In Table 1 we can see a summary of the internal obstacles that have the greatest impact on Libyan SMEs.

Table 1: Key Internal Barriers Affecting Libyan SMEs

Financial constraints	Limited access to export finance, absence of credit guarantees, reliance on personal capital.
Managerial deficiencies	Lack of training in international trade, poor decision-making, weak leadership skills.

Marketing limitations	Inadequate market research, absence of product adaptation for international markets.
Strategic weaknesses	Lack of export planning, performance monitoring, and long-term business orientation.
Low innovation capacity	Minimal investment in R&D, old-fashioned production technologies.

Source: Compiled from LEPC (2021), World Bank (2023), and Sousa et al. (2008).

As a theoretical framework, the Resource-Based View (RBV) supports the aforementioned obstacles. According to RBV, a company's competitive advantage comes from its unique resources, which are those that are precious, scarce, costly to replicate, and non-substitutable. According to Morgan and Katsikeas (1997), small and medium-sized enterprises (SMEs) in Libya face difficulties in overcoming export restrictions due to a lack of resources, particularly financial capital and experienced manpower.

4.2. Examination of External Export Restrictions

Externe export barriers are those that arise from outside sources, such as inefficient bureaucracy, outdated infrastructure, uncertain trade restrictions, and fierce rivalry. External obstacles are overshadowed in Libya by the country's institutional instability and its ineffective regulation enforcement.

By comparing the average time it takes for customs in Libya (18 days per shipment) to that in Tunisia (12 days) and Egypt (9 days), we find that Libyan exporters are already in the worst position in North Africa when it comes to administrative burdening (WTO, 2022; UNCTAD, 2022). Moreover, due to insufficient logistical infrastructure, high operational expenses, and inadequate port capacity, the country is unable to compete on a worldwide scale. Table 2 displays the comparable measures that demonstrate Libya's subpar performance when compared to its regional counterparts.

Table 2: Comparative Export Environment Indicators (2023)

Indicator	Libya
Logistics Performance Index	2.1
Average Export Time (days)	18
Export Cost (USD per container)	1,850
SME Export Participation (%)	7
Trade Regulation Stability (scale 1-5)	2

Source: World Bank (2023); WTO (2022).

The aforementioned metrics back up the claim that Libyan exporters face systemic disadvantages. According to Leonidou (2004), small and medium-sized enterprises (SMEs) face challenges in satisfying export criteria and maintaining reputation in foreign markets due to an institutional environment marked by uncertain laws and minimal policy enforcement. The institutional theory provides the most satisfactory explanation of the issue.

4.3. Impact of Barriers on Perceived Export Performance

Perceived export performance is the expression of managers' qualitative feedback on the financial, strategic, and operational components of their company's performance in foreign markets (Zou & Stan, 1998).

In developing nations where export finance is severely limited, small and medium-sized enterprises (SMEs) experience a growth rate in exports that is approximately 40% lower than their counterparts in countries where export financing is easily accessible, according to the World Bank (2023). Firms lacking export-trained workers reported significantly lower levels of satisfaction with export results, according to a relevant study by Altıntaş et al. (2007).

The causes impacting these attitudes in Libya include both internal and external obstacles. A more risky or unprofitable approach to exporting is likely to be taken by SMEs when they face bureaucratic barriers and a lack of funding. In Libya, there is a lack of institutional support, which makes it difficult for managers to focus on operational efficiency, customer happiness, and brand awareness, all of which are important to export success.

According to the Uppsala Internationalization Model, exporting is a skill that requires patience and a foundation in first-hand experience. In the face of persistent problems, businesses often pull back to local markets, postponing or scrapping their ambitions for international expansion.

4.4. Evaluation of Internal and External Barriers in Comparison

Both internal and external factors can have an impact on export performance, but to varied degrees depending on the specifics. The degree to which an organization is prepared and able to adjust is more directly and significantly affected by internal factors. Contrarily, strong internal capabilities allow organizations to mitigate the effects of external obstacles to a greater degree than weaker ones (Leonidou, 2004; Morgan & Katsikeas, 1997).
This result lends credence to the third hypothesis (H3): Internal export constraints have a greater influence on the perceived export performance of Libyan SMEs compared to external ones. You can see the interdependence of all the parts in Figure 1.

This theoretical framework, which places an emphasis on capacity at the business level, provides an explanation for the relative merits of internal resources and external obstacles.

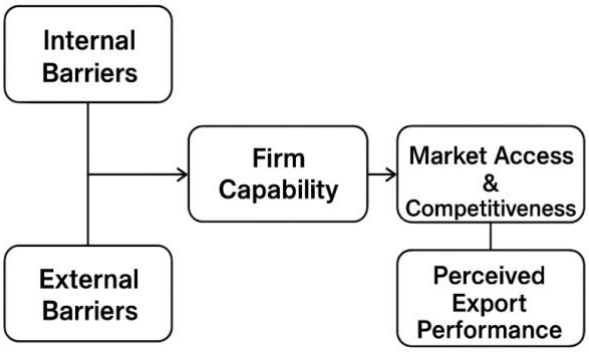

Figure 1: Theoretical Connection Between Perceived Performance and Export Barriers

4.5. Institutional and Policy Support Analysis

The backing of institutions is crucial to the expansion of exports. Initiatives such as trade missions and export readiness assessments have been launched by the Libyan Export Promotion Center (LEPC). But these initiatives are inconsistent and seldom extend beyond Tripoli and Benghazi.

The World Trade Organization, the United Nations Conference on Trade and Development, and the African Development Bank have all urged Libya to execute export reforms centering on the following issues:
1. Simplify the processes of paperwork and customs clearance.
2. Create online platforms for trading.
3. Arrange for export credit guarantees.
4. Provide instruction with an emphasis on exporting products.

Due to weak inter-agency coordination and fragmented governance institutions, Libya has been unable to implement these reforms (UNCTAD, 2022). Table 3 shows the primary institutional shortcomings of Libya's export system.

Table 3: Institutional Weaknesses Affecting SME Export Development

Category	Observed Weakness
Policy Framework	Absence of unified export development strategy.
Financial Institutions	No credit lines and insurance for exporting SMEs.
Infrastructure	Lacking in transport and logistics systems to a great extent.
Capacity-Building	Almost no training of a significant length for the SMEs and trade officials.
Information Systems	lack of transparency on export data and digital tools.

Source: Compiled from LEPC (2021); WTO (2022); UNCTAD (2022).

According to institutional theorists, the aforementioned shortcomings compound into institutional voids, which are defined as instances in which formal structures either do not exist or are unable to adequately support market transaction (North, 1990).

4.6. Discussion of Key Findings

The results show a few key things:
1. Internal obstacles are the most significant: Poor management and insufficient funds are the primary causes of the poor impression of export success.
2. The presence of external impediments, such as bureaucracy, trade restrictions that are difficult to forecast, and insufficient infrastructure, significantly raises trading costs.
3. When there is not a well-defined export policy or marketing strategy, these problems are made worse by institutional inadequacies.
4. Libya lags behind Egypt and Tunisia in terms of competitiveness, namely in the areas of trade facilitation, logistics performance, and participation of small and medium-sized enterprises (SMEs).
5. Confirmation of theory: RBV, Institutional Theory, and the Uppsala Model all work together to address the question of why internal resources and learning processes are crucial for overcoming structural barriers. Figure 2 shows the combined effects of these relationships.

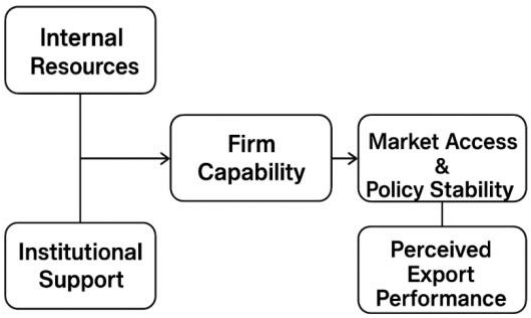

Figure 2: Interaction Between Firm Resources, Institutional Context, and Export Performance

The offered model shows how export performance is dependent on effective firm-level resource coordination and enabling institutional settings.

5. Conclusion

This study aimed to investigate the role of export barriers in shaping SMEs' perceived export performance in Libya, backed by a structured synthesis of both academic and institutional secondary evidence. Through the Resource-Based View, Institutional Theory, and the Uppsala Internationalization Model, the research provided a context-sensitive interpretation of the continued underperformance of Libyan SMEs in the export market notwithstanding the strategic importance of exports for both economic diversification and private-sector development.

The results suggest that the most significant internal export barriers, which are the main internal factors, are already and only internal barriers. Unsuccessful access to finance, poor management capabilities, insufficient export planning, and low levels of innovation and technology have been identified as the key factors determining SMEs' negative view on exports and their evaluation of export success. In an environment where managerial decision-making is very much concentrated, the above mentioned internal weaknesses are directly transformed into risk-averse strategies, export activities that are only responsive to market demand, and pessimistic evaluations of the performance of the export activities. Even when there is no shortage of market opportunities, SMEs that do not have the required internal capabilities generally see exporting as being unsustainable or too risky.

There exist export barriers of an external nature like bureaucratic inefficiencies, regulatory instability, infrastructural inadequacies, and institutional weakness that also have significant effects but they, however, mainly act as conditions that reinforce existing situations rather than as determinants that operate independently. The findings show that Libyan SMEs tend to view these constraints as structural realities that are beyond their control and they thus lower their expectations accordingly. Consequently, external barriers aggravate the already existing internal limitations thus creating a scenario of poor perception of performance rather than the external barriers being the sole cause of poor perceived performance. Additional measures confirm that Libya's logistics performance, export readiness, and institutional quality are still not up to par with its regional counterparts, which keeps on reinforcing the managers' notions of relative disadvantage in the international markets.

On the theoretical front, the research asserts that the interaction of firm's resources, capabilities, and external barriers is the best way to explain the export performance of SMEs. The firm-level resources and capabilities determine the perception and management of external barriers, while the institutional setting influences the cost and risk of doing business. The prevalence of perceived export performance in this study underlines its analytical utility in data-restricted and conflict-affected countries where reliable or objective firm-level export data are often either unavailable or unreliable.

These results have two major implications. One implication is that, besides devising and implementing trade facilitation measures, the policymakers should consider internal capability gaps and come up with policies that support SMEs in terms of providing them with financing, training and managerial skills, export guidance, and innovation sectors. Managers and owners of SMEs are the other implication and they need to focus on the development of capabilities and the use of learning-oriented methods in their exporting activities, so that they can reduce perceived risks and increase their competitiveness.

To sum up, it is necessary to carry out a coordinated approach that simultaneously builds up the internal capabilities of SMEs and reduces the external constraints of the institutional environment in order to improve the export performance of Libyan SMEs. Without such synchronization, efforts to promote exports are unlikely to yield enduring improvements in performance or bring about any significant movement towards economic diversification in Libya.

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Declaration of Generative AI and AI-assisted Technologies: This study has not used any generative AI tools or technologies in the preparation of this manuscript.

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Enterprise Meets Education: Business Law Aspects in the Intellectual Property Policies of World-ranked Philippine Universities

Adrian R. Montemayor[1], Ronaldo R. Cabauatan[2]

[1,2] Research Center for Social Sciences and Education, University of Santo Tomas, Manila, Philippines

Correspondence: Adrian R. Montemayor, Research Center for Social Sciences and Education, University of Santo Tomas, Manila, Philippines. Tel: 632-3406-1611. E-mail: armontemayor@ust.edu.ph

Abstract
Philippine universities are required by law to adopt their own intellectual property (IP) policies. This endeavor involves multiple legal considerations and a balancing of interests among various stakeholders. However, studies focus mostly on the IP policies of reputable universities in developed countries, with few probing into the IP policies of academic institutions in the Global South. Moreover, the literature concentrates on the issues of ownership and economic rights, with little attention given to other crucial concerns covered by IP policies. This work provides a more holistic view of institutional IP frameworks by analyzing and comparing the broader business law aspects in the IP policies of Philippine universities previously included in the world university rankings. Through content analysis blended with doctrinal legal research, this paper examines their declared objectives, types of works covered, kinds of IP creators governed, guidelines for determination of ownership and consequent rights, systems for enforcement and dispute resolution, and alignment with legal principles on academic freedom, freedom of contract, and management prerogative. Findings reveal some similarities in their stated objectives and enforcement mechanisms but also highlight considerable differences in their ownership models and rules for commercialization. While this study does not purport to establish any trend in IP policy-making by administrators of world-ranked Philippine universities, it may nonetheless provide significant insights into what educational leaders prioritize in matters of IP management.

Keywords: Business Law, Educational Management, Global South Universities, Institutional Policies, Intellectual Property Law, Philippine Higher Education, UN SDG 9

1. Introduction

"Intellectual Property (IP) rights are fundamental to how economies organize innovation and steer the diffusion of knowledge" (Peukert & Windisch, 2025, p. 878). In this regard, much has been said about the necessity for a holistic approach in defining and enforcing IP rights (Angeles, 2007; Hasanov, 2022; Jayaraman, 2020; Khan & Bharadwaj, 2011). It has been emphasized that finding the correct balance in protecting IP rights will promote innovation while ensuring that new knowledge is properly disseminated to address societal needs (Sattiraju et al., 2023).

For one, Article 15 of the International Covenant on Economic, Social and Cultural Rights (ICESCR) provides that everyone has the right to "benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author." Nonetheless, it must be equally underscored that IP law exists "not only to reward innovation but to disseminate knowledge for the public good" (Blanchard, 2010, p. 66). Article 7 of the 1995 World Trade Organization (WTO) Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS Agreement) states that protection and enforcement of IP rights should be "in a manner conducive to social and economic welfare, and to a balance of rights and obligations." This is reiterated in the 1996 Copyright Treaty of the World Intellectual Property Organization (WIPO), which declares "the need to maintain a balance between the rights holders and public interests, specifically education, research, and access to information" (Hasanov, 2022, p. 48).

In economic terms, incentivizing innovation while ensuring public benefit requires a comparison of associated costs: "The tension between incentives and access that preoccupies the conventional economic analysis of intellectual property arises from the high ratio of fixed to variable costs of such property" (Posner, 2005, p. 58). The costs of creating IP incurred by its originator would outweigh the costs of disseminating or distributing IP shouldered by a mere copier. If no significant incentive would be given to IP creators allowing them to recoup their costs, then it would be impractical for them to create and innovate. The benefits to be reaped by society from their intellectual pursuits would not be realized.

On the other hand, giving IP creators total and perpetual control over their works would be detrimental to the rest of society as it would give rise to monopolistic behavior by IP owners and rights holders. Describing the necessary balance as a trade-off, Ilie (2014) explains that "an overprotected system will limit social gains by limiting the dissemination and use of results; a weak protection system will reduce innovation due to the lack of an adequate return on investment" (p. 549). This bolsters the previous assertion of Stiglitz (2008) that a poorly designed IP regime can be a hindrance rather than a boost to innovation. Meanwhile, for Astroulakis (2011), policy flexibility is important because much depends on value systems. "Innovation and novel behavior patterns can be good only if they can be adjusted with the value change and the meaning of the 'good life' that every society espouses" (p. 224).

Unsurprisingly, IP creators are motivated by both "moral and material benefits" (Intellectual Property Office of the Philippines, 2019, p. 7). In line with the Social Contract Theory, however, exclusivity of benefits "is a privilege enjoyed by the creator or the rights holder in exchange for the primary commitment to diffuse and deploy these rights for intellectual enrichment of society, scientific progress and development" (Jayaraman, 2020, p. 686). "Research and scientific pursuits play a crucial role in creating intellectual properties" (Patil & Sagar, 2024, p. 8628) and IP rights provide a way to disseminate knowledge for the betterment of society. This is reflected in the United Nations Sustainable Development Goals (UN SDGs), particularly Outcome Target 9.5 of Goal 9 that aims to enhance scientific research and encourage innovation in developing countries.

1.1 The legal framework

Consistent with the Theory of Governmentality (Kapitzke, 2006), it is often the State that provides the policy frameworks designed to "shape the behaviour of others with certain objectives in mind such as, for example, the management of cultural activity and access through intellectual property rights" (pp. 433-434). In the case of Philippine law, the 1987 Constitution provides the basic rules that both protect the rights of IP creators (Article XIV, Section 13) and uphold the social function of property use (Article XII, Section 6). More specific rules are provided in the Intellectual Property Code of 1997 (Republic Act No. 8293), as amended by Republic Act Nos. 9150, 9502, and 10372, and related laws like the Technology Transfer Act of 2009 (Republic Act No. 10055) and the Competition Act of 2015 (Republic Act No. 10667).

As a member of the WTO and the WIPO, the Philippines also adheres to the following international agreements: Paris Convention for the Protection of Industrial Property; Berne Convention for the Protection of Literary and Artistic Works; International Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organizations; Patent Cooperation Treaty; WIPO Copyright Treaty; WIPO Performances and

Phonograms Treaty; Protocol Relating to the Madrid Agreement Concerning the International Registration of Marks; Marrakesh Treaty to Facilitate Access to Published Works for Persons Who are Blind, Visually Impaired, or Otherwise Print Disabled; Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure; Vienna Agreement Establishing an International Classification of the Figurative Elements of Marks; and the WTO TRIPS Agreement (Intellectual Property Office of the Philippines, 2019).

The need for proper balancing of interests is particularly evident in higher education institutions (HEIs), given that "the most important ideas are those that are generated in universities" (Stiglitz, 2008, p. 1697). Research activities often give rise to various forms of IP, "which in turn stimulate industrial and economic development for countries" (Patil & Sagar, 2024, p. 8628). To be sure, HEIs that fund research and innovative teaching practices would be interested in reaping the financial rewards of IP generated in the academe. On the other hand, IP creators in colleges and universities may claim that they deserve more than just proper attribution and other moral rights. Academic staff may not be motivated to create new works if the concrete benefits of doing so are not clear to them (Dio et al., 2015).

The various economic rights typically center on the question of ownership—i.e., the IP owner gets to decide who will benefit from publication or commercialization and how much benefit they will obtain. Ownership models range from sole HEI ownership or sole IP creator ownership to joint ownership enjoyed by both, with further variations on licensing and assignment of rights (Authors Alliance, 2021). For this reason, institutional policies governing patents, copyright and trademark management, ownership, usage, and other pertinent matters must be carefully developed by each HEI (Garon, 2018). Institutional policy goals and objectives associated with IP must be not just clear but also consistent with national IP policy frameworks (Sattiraju et al., 2023). Furthermore, legal concerns related to academic freedom and employment issues must be factored in as such guidelines are crafted (Carlson, 2015).

In the Philippines, the huge potential of HEIs for innovation has been recognized, though it also has been observed that the weak connection between academia and industry has not helped convert IP creation into successful commercialization (Intellectual Property Office of the Philippines, 2019). Moreover, knowledge production has remained low due to the perceived "lack of management support and incentives to do research, to patent, and to commercialize, and the publish-or-perish mindset prevalent among many faculty and researchers" (Intellectual Property Office of the Philippines, 2019, p. 16). This lack of incentive is most apparent in school policies adopting the sole HEI ownership model with few or no economic benefits given to faculty, students, and other IP creators.

Under Section 230 of the IP Code (as amended by Republic Act No. 10372), IP ownership and related rights in academia are governed primarily by institutional IP policies, subject to contractual stipulation. This means it is the school that has the upper hand in deciding what IP rights, if any, are given to whom (Montemayor, 2025). Applying the Stakeholder Theory, which posits that an organization should consider the interests of all parties affected by its decisions, HEI management must ensure that policies are inclusive and balanced. For this, it must be prepared to engage in "a more detailed contextual analysis of stakeholder economic interests" (Jayaraman, 2020, p. 685). It is expected to uphold traditional ethical norms, such as fairness and respect—although it could just as well choose to "treat stakeholders selfishly at best" (Jones et al., 2018, p. 371). In the context of this study, the stakeholders of the HEI refer mainly to IP creators who may be faculty, support staff, students, or visiting researchers. In a broader sense, however, it may be said that alumni, industry partners, the government, and the society at large are also stakeholders.

1.2 Related literature

A review of the literature reveals that several studies in the last two decades have examined and compared the internal IP policies of HEIs in developing countries alongside those in developed countries. Most of these articles integrated doctrinal legal research (Van Gestel, 2023) with content analysis of textual data (Ballesteros-Lintao et al., 2016) while also infusing critical policy analysis (Apple, 2019). Of particular interest is the recent work of Sattiraju et al. (2023), which compared IP policies of specific Indian HEIs with those of selected HEIs in the

United States, United Kingdom, Canada, Australia, China, Japan, and Singapore. Preceding this was the 2014 study of Ramli and Zainol that similarly compared IP policies of specific Malaysian HEIs with those of selected HEIs in the US, UK, and Australia. A limitation of both studies was their concentration on ownership guidelines and rules related to commercialization of IP created in the school setting.

On the other hand, some authors preferred to focus on IP policies of various HEIs found in the same country, such as the US (Campbell, 2019; Loggie, 2006), the UK (Gadd & Weedon, 2017; Rahmatian, 2015), or India (Patil & Sagar, 2024). Certain researchers concentrated on specific IP types, such as patent (Campbell, 2019; Pettersson, 2018) or copyright (Carlson, 2015; Gadd & Weedon, 2017; Loggie, 2006; Peukert & Windisch, 2025; Rahmatian, 2015). Still others provided a more generalized discussion on IP (Crews, 2006; Garon, 2018; Pila, 2010).

A common observation among most authors was the propensity of HEIs to claim sole ownership of IP produced in the academe whenever the legal system of their country authorized them to designate the IP owner. There were fewer instances of shared ownership or sole ownership by the IP creator. This generally has been criticized as inequitable and inconsistent with the academic freedom of the faculty (Campbell, 2019; Pila, 2010; Rahmatian, 2015).

In the Philippines, technology and its accompanying IP rights have been explored in the context of business education (Cruz, 2020). The Intellectual Property Office of the Philippines has been lauded for vigorously supporting utilization and commercialization of inventions through their Inventors Assistance Program. However, the agency has also been urged to actively assist private schools in drafting their IP policies by providing "guidelines as to the fairness and reasonableness" (Hofileña, 2020, p. 97) of such institutional rules. While there is no dearth of research on Philippine IP law and jurisprudence, no local studies were found probing into the IP policies of world-ranked Philippine HEIs for the purpose of analyzing and comparing the broader business law aspects of their policy content. This indicates a research gap that this work now seeks to address.

The local literature suggests the need to promote IP rights awareness and a healthy respect for IP ownership in the Philippines while ensuring that the benefits of IP creation trickle down to the communities that need them most. Educational institutions are part of the solution (Intellectual Property Office of the Philippines, 2019). However, these institutions must begin with their own internal regulations designed to govern IP created in the academe. Admittedly, much is made to depend on contracts of adhesion and institutional IP policies (Hofileña, 2020). The latter, in turn, are often exclusively crafted by school administrators in the exercise of institutional academic freedom (Aquino, 2022) and management prerogative (Tabingan & Gonzales Dhum, 2022), which empower HEIs to adopt reasonable measures of control over their students and employees.

Some authors have identified self-organization as an effective means to ensure that IP policies of schools are equitable and balanced. Birnhack (2009) underscored the advantages of having a union to represent employees as IP creators. Strom (2002) explained that higher education unions could help protect the IP rights of faculty "either through collective bargaining contracts or through extra-contractual negotiation over institutional policies" (p. 4). Blanchard (2010) called upon faculty unions to avoid litigation "by negotiating policies that are fair to both sides" (p. 67). Though it is difficult to ascertain whether IP policies implemented by a university are subject to collective bargaining or if they are within the exclusive domain of management prerogative (Klein & Blanchard, 2012), the combined effort of faculty could be particularly rewarding when union representatives are able to convince university administrators to reconsider rules that restrict teachers' rights (Authors Alliance, 2021).

Regardless of how HEI IP policies are crafted and revised, Sattiraju et al. (2023) stressed that the efficiency of HEIs significantly depends on the alignment of institutional IP policies with national IP policies, as well as on their revenue sharing mechanisms. To this must be added the previous assertion of Carlson (2015) that issues related to academic freedom and employment—particularly contractual exceptions and aspects of management prerogative—need to be considered in the policy-making process. Lastly, institutional IP policies must be both comprehensive in their coverage and tailored for each type of IP creator to match the work created (Garon, 2018). "By taking these steps for patent policies, copyright and trademark management, ownership guidelines, usage policies, and even URL publication, the university will enable its business and community to flourish" (p. 673).

Based on the foregoing, this study examines the business law aspects evident in the institutional IP policies of world-ranked Philippine universities. Particularly, it investigates the similarities and differences in their declared objectives, types of works covered, kinds of IP creators governed, guidelines for determination of ownership and consequent rights, and systems for enforcement and dispute resolution. Moreover, it analyzes how these policies reflect established legal principles on academic freedom, freedom of contract, and management prerogative.

2. Methods

This study utilized content analysis of textual data (Ballesteros-Lintao et al., 2016) blended with the doctrinal method of legal research (Van Gestel, 2023). Similar to the approach used by Patil and Sagar (2024) in their analysis of IP policies of Indian HEIs, this paper examined the IP policies of four world-ranked Philippine universities to highlight their substantial similarities and differences. Based on standards espoused by Sattiraju et al. (2023), Garon (2018), and Carlson (2015), a list of 10 interrelated business law aspects was generated to facilitate the qualitative comparative analysis. These specifically pertained to the HEI policies' declared objectives, types of works covered, kinds of IP creators governed, guidelines for determination of ownership and consequent rights, mechanisms for enforcement and dispute resolution, and alignment with legal principles on academic freedom, freedom of contract, and management prerogative. Criteria for inclusion of specific words, phrases, or provisions in the IP policies under each of the 10 legal aspects were formulated before each articulation was categorized.

In selecting the four HEIs, the researchers were guided by the Quacquarelli Symonds (QS) ranking of Philippine universities for 2023, which was the most recent record available at the start of the study. For this ranking, QS evaluated the various schools based on academic reputation, employer reputation, faculty/student ratio, citations per faculty, international faculty ratio, and international student ratio. Given that research productivity and impact (academic reputation + citations per faculty) comprised 60% of the criteria for the 2023 ranking, it could be inferred that all the Philippine universities included in the world rankings had substantial research outputs. And considering that academic activities such as teaching and research often generate copyrightable materials and patentable inventions, it was expected that the QS-ranked Philippine universities had already complied with Section 230 of the IP Code mandating the adoption of internal IP policies to govern works produced in the school setting.

In view of the unobtrusive nature of the study, data gathering was limited to publicly available information (e.g., from university websites). QS-ranked Philippine universities with no IP policies published online were excluded. Among the qualified schools, only four were purposively selected for systematic analysis of the business law aspects in their IP policies. The four HEIs were de-identified and assigned code names (e.g., Uni A, Uni B, etc.) since the focus of the research was on their IP policies and not their identities (Tenedero, 2024). Each textual articulation related to any of the 10 business law aspects was categorized and counted to provide a simple numeric comparison among the various IP policies of the four universities (see Table 1). Qualitative comparative analysis and validation were then done by the research team. For legal context, the study also incorporated relevant domestic laws, jurisprudence, and scholarly commentaries related to the policy aspects examined.

3. Findings

This study found that most of the IP policies of the four world-ranked Philippine universities were comprehensive in addressing the different IP concerns of the HEIs and their stakeholders. However, some institutional IP policies were more detailed and exhaustive than others in their treatment of certain subjects.

Table 1 presents the number of textual articulations corresponding to the 10 interrelated business law aspects (Carlson, 2015; Garon, 2018; Sattiraju et al., 2023) examined in the IP policies of the subject Philippine HEIs. Notably, Uni A has the fewest articulations overall.

Table 1: Comparison of business law aspects in the IP policies of four world-ranked Philippine universities based on number of articulations.

Business law aspect	Uni A	Uni B	Uni C	Uni D
Declared objectives	2	2	8	11
Identified IP types	2	11	15	14
Identified IP creators	2	6	11	11
IP ownership models	2	3	6	3
Modes of transfer or sharing of rights	4	6	6	6
Enforcement mechanisms	2	4	4	4
Modes of dispute resolution	0	2	4	4
Scope of academic freedom	2	3	3	2
Policy exceptions based on contract	1	6	4	3
Scope of management prerogative	1	4	5	4
TOTAL	18	47	66	62

3.1 Declared objectives

All four universities declared that their policies were adopted in support of their research function. Uni A's manual of policies covered both its research and extension (R&E) programs, with the guidelines providing for the incentives for promoting R&E as well as the means of storing and sharing R&E results. On the other hand, Uni B recognized the need for policies to promote and encourage excellence, creativity, and innovation not only in research outputs but also in other scholarly works created by its internal stakeholders. Uni C had similar goals stated but likewise emphasized facilitating technology transfer, maintaining an innovation fund, establishing standards to determine the rights and obligations of the HEI and its IP creators, and enabling the HEI to secure sponsored research funding. Notably, Uni D had the most comprehensive statement of objectives, emphasizing innovation and creativity like Uni B while also mirroring the policy goals of Uni C geared towards systematizing technology transfer, securing funds, and clarifying the respective rights and obligations of researchers and IP creators. Moreover, Uni D's policy objectives highlighted the importance of ensuring that research conducted in the HEI was monitored, ethical precepts and professionalism in research were followed, and procedures for IP-related concerns were properly defined.

The declared objectives of the four HEIs are consistent with the State Policies declared in the IP Code, which echo those in the 1987 Philippine Constitution. Section 2 of the IP Code emphasizes that an effective IP system facilitates transfer of technology and ensures market access even as it protects the exclusive rights of creators. To highlight the social function of IP use, this provision further obliges the State to "promote the diffusion of knowledge and information for the promotion of national development and progress and the common good." Through IP law, the need to reward innovation is balanced with the need to disseminate knowledge for the public welfare (Blanchard, 2010).

3.2 IP types and creators

Aligning with Section 4.1 of the IP Code, which enumerates the basic types of IP, all four Philippine HEIs adopted internal policies covering copyrights and patents. However, Uni B, Uni C, and Uni D also had policies on industrial designs, utility models, layout designs, trade secrets, and new plant varieties. Additionally, Uni B policies covered computer software, while Uni C policies covered micro-organisms as well as non-biological and micro-biological processes. Both Uni C and Uni D policies applied to geographic indications, trademarks, and service marks. While Uni A specified only copyright and patent, Uni B covered 11 IP types while Uni C and Uni D covered a total of 15 and 14 types, respectively.

Moreover, all four universities adopted internal policies governing their faculty and non-teaching employees as IP creators, as mandated by Section 230 of the IP Code. Notably, however, Uni B, Uni C, and Uni D implemented their policies not only on their own employees but even on their students, visiting researchers, and scholars who contracted with the HEI. While Uni A specified only faculty and non-teaching staff, Uni B applied its policies to six classes of IP creators while Uni C and Uni D each applied their policies to at least 11 classes of IP creators, which included non-affiliates.

3.3 Ownership and consequent rights

Uni A policies allowed for sole ownership of a patent or copyright by the creator of a work, with the research product itself belonging to the HEI. Meanwhile, Uni B vested patent rights in either the inventor or the university, depending on whether or not the invention was commissioned or was developed as part of the inventor's regularly-assigned duties, or using funds provided by the university, or with substantial use of university resources. Similar rules applied to copyright, but Uni B also recognized equal shares in the IP ownership in cases where multiple authors had not stipulated on their respective ownership rights. Uni C policies reflected most of these rules governing patents and copyrights, with the university owning IP commissioned by the school, created by employees as part of their work duties, or supported by HEI resources. Uni C policies likewise provided for various instances of joint ownership between co-inventors and co-researchers, as well as between the university and a private company. On the other hand, Uni D policies permitted joint ownership of both collaborating inventors of patentable inventions and contributing authors of copyrightable works, in addition to rules identical with those used by Uni B and Uni C to determine whether the creator or the HEI exclusively owned the patent or copyright. However, Uni D did not claim ownership of copyrightable audio or video recordings, as well as trademarks and service marks created by its employees and students.

Findings further showed that all four universities provided for IP commercialization and profit-sharing schemes via royalties. Additionally, Uni B, Uni C, and Uni D enumerated several modes of assignment and licensing of rights. Uni A and Uni D both provided for technology transfer while Uni B and Uni C both provided for joint ventures in their respective IP policies. For its part, Uni A asserted its first option to publish while Uni C stated that it had the first right to invest up to 20% of the total equity of any start-up company founded by an affiliated inventor. Some other modes of transfer or sharing of rights mentioned in the respective policies included sale (Uni A), spin-offs (Uni B), inventors' shares (Uni C), and exploitation (Uni D).

With regard to assignment of rights, Uni A policies did not specify any mode of assignment for IP created in the school setting. Meanwhile, Uni C provided only for assignment in general, for the purpose of facilitating technology transfer. In contrast, IP policies of Uni B and Uni D pertaining to assignment were more detailed, with

the former covering transfers of both IP and royalty shares and the latter applying to incoming visiting researchers as well as to transfers made through the university IP office.

It was also evident that Uni A policies did not specify any type of license for IP created in the academe. Uni B policies upheld the school's free access to and use of inventions and authored works, including those created and owned by students, for academic purposes. Similarly, Uni D declared its non-exclusive license to utilize copyrighted or patented works for research, educational, and humanitarian purposes while also granting inventors a license to commercialize their inventions patented under Uni D's name. Meanwhile, Uni C granted non-commercial collaborating parties the license to internally use IP developed and owned by Uni C and gave industry collaborators the first right to obtain an exclusive or non-exclusive license for commercial use of IP developed and owned by Uni C. Notably, the policies of both Uni C and Uni D granted them the license to reproduce, publish, and distribute copies of theses or dissertations copyrighted to any researcher, employee, or student.

These findings support the earlier contention of Crews (2006) that "the policy must proceed in considerable detail to designate specifically which rights belong to which parties" (p. 25) to avoid lack of clarity that may cause conflicts between the HEI and its stakeholders.

3.4 Enforcement and dispute resolution

All four HEIs provided general rules penalizing breach of IP policies. Uni B, in particular, enumerated six different classes of offenses, including violation of confidentiality, use of pirated IP, and plagiarism. On the other hand, Uni D listed three different penalties for policy violators, which included removal of research load and ineligibility to receive research grants. Furthermore, Uni B, Uni C, and Uni D laid down policies requiring prior disclosure of works to the HEI by their IP creators. The same universities also established an internal IP office or unit to take charge of IP management, enforcement of IP rights, and matters related to technology licensing.

Uni A policies did not specify any option for resolving IP-related disputes. In contrast, the three other HEIs all provided for administrative adjudication either by a university official or a committee and reserved legal action as the last resort. Additionally, Uni C and Uni D also promoted mediation and arbitration as alternative modes, in conformity with the State's preference for voluntary modes in settling disputes (Article XIII, Section 3 of the 1987 Philippine Constitution). This is echoed in Section 2 of the Alternative Dispute Resolution Act of 2004 (Republic Act No. 9285), which affirms the State's thrust towards "party autonomy in the resolution of disputes or the freedom of the parties to make their own arrangements to resolve their disputes." Section 3 (q) of this law defines mediation as "a voluntary process in which a mediator, selected by the disputing parties, facilitates communication and negotiation, and assists the parties in reaching a voluntary agreement regarding a dispute." Meanwhile, Section 3 (d) defines arbitration as "a voluntary dispute resolution process in which one or more arbitrators, appointed in accordance with the agreement of the parties, or rules promulgated pursuant to this Act, resolve a dispute by rendering an award." While an arbitrator or arbitral tribunal directly resolves the dispute like a judge, a mediator does not decide the dispute but facilitates communication between the parties to help them settle their own dispute (Alogoc, 2021).

3.5 Scope of academic freedom

Article XIV, Section 5 of the 1987 Philippine Constitution states that academic freedom "shall be enjoyed in all institutions of higher learning." While such freedom mainly pertains to the HEI's right to decide who will teach, who will be taught, what will be taught, and how it will be taught, it is also identified with the faculty member's freedom to study, investigate, and publish findings without fear of retribution from the powers that be (Aquino, 2022), as well as the student's freedom to select a course of study, subject to reasonable admission and academic requirements (Terrado & Aquino, 2020). The same provision further emphasizes that non-teaching and non-academic personnel of schools "shall enjoy the protection of the State" although they do not necessarily enjoy academic freedom.

Findings revealed that the IP policies of all four universities either explicitly or impliedly upheld the academic freedom of their teaching staff, particularly in the latter's research pursuits. Uni A, Uni B, and Uni C policies likewise affirmed a similar right for their non-academic staff, while only Uni B and Uni C policies specifically recognized this right in their students. Meanwhile, Uni D policies reasserted the school's institutional academic freedom to impose academic standards.

3.6 Policy exceptions based on contract

The Supreme Court of the Philippines has stressed that the freedom of contract is "both a constitutional and statutory right" (*Rodolfo Morla v. Corazon Nisperos Belmonte*, 2011). It is enshrined in the Bill of Rights (Article III, Section 10 of the 1987 Philippine Constitution) and is further guaranteed by the Civil Code of 1949 (Republic Act No. 386). Article 1306 of this Code states that "the contracting parties may establish such stipulations, clauses, terms and conditions as they may deem convenient, provided they are not contrary to law, morals, good customs, public order, or public policy." These agreements have the force of law between the parties, obliging mutual compliance in good faith (Article 1159, Civil Code). Moreover, the IP Code recognizes policy exceptions anchored on contractual stipulations. Thus, specific agreements between the HEI and other parties (e.g., visiting faculty and exchange students) generally prevail over institutional IP policies. Likewise, IP rights conceded by HEI management in a duly approved collective bargaining agreement with school employees would be enforceable.

Based on the research findings, all four HEIs maintained the superiority of stipulations contained in a contract or memorandum of agreement (MOA) between the university and an external party, such as a funding agency, sponsor, or third-party institution. Uni B also recognized exceptions to its IP policies based on agreements involving commissioned work, faculty-student mentoring, and consultancy. Similarly, Uni C exempted from the coverage of its IP policies contracts between the university and its students, inventors, and collaborating companies. Meanwhile, Uni D gave precedence to contracts with IP creators designating ownership of copyright or patent and providing the rights of joint authors or joint inventors.

3.7 Scope of management prerogative

Management prerogative has been characterized by the Supreme Court of the Philippines as the employer's authority "to regulate, according to their discretion and best judgment, all aspects of employment, including work assignment, working methods, processes to be followed, working regulations..." (*St. Luke's Medical Center, Inc. v. Maria Theresa V. Sanchez*, 2015). The main limitation to the exercise of this right by the employer is the requirement that "policies, rules, and regulations on work-related activities of the employees must always be fair and reasonable" (Tabingan & Gonzales Dhum, 2022, p. 360).

Findings showed that Uni A policies upheld the HEI's discretion mainly in the setting of the R&E agenda and the identification of priority areas for R&E activities. Uni B, Uni C, and Uni D, however, also asserted the school administration's power to require clearance prior to disclosure of IP, as well as their power to amend IP policies. Uni B and Uni C stressed the HEI's sole discretion to waive IP rights. Uni C likewise claimed the power to determine the mode and schedule of distribution of commercial benefits to inventors.

4. Discussion

This study revealed extreme opposites in the total number of relevant articulations contained in the different IP policies of world-ranked Philippine universities, from 18 for Uni A to 66 for Uni C. The contrast was most apparent in the first three business law aspects: declared objectives, identified IP types, and identified IP creators. For the fourth aspect, Uni C stood out from the group with its six IP ownership models. Meanwhile, the indicators were quite uniform for three HEIs in the remaining six legal aspects, with Uni B, Uni C, and Uni D having nearly the same figures for modes of transfer or sharing of rights, enforcement mechanisms, modes of dispute resolution, scope of academic freedom, policy exceptions based on contract, and scope of management prerogative. Uni A seemed to be the outlier, with no mode of dispute resolution provided in its IP policies, coupled with only one policy exception based on contract and one assertion of management prerogative.

The findings here also reinforced those of Sattiraju et al. (2023) and Ramli and Zainol (2014) that when HEIs were given the legal freedom to determine the policies governing IP created in the academe, such HEIs were more likely to adopt rules favoring their own interests over those of their stakeholders. This statement has held true for HEIs in both developed and developing countries. Similar observations were made by other authors in analogous studies analyzing and comparing the IP policies of HEIs in India (Patil & Sagar, 2024), the US (Campbell, 2019; Loggie, 2006), and the UK (Gadd & Weedon, 2017; Rahmatian, 2015). Although there were exceptions, such as some universities in Canada and the US (Sattiraju et al., 2023), it was apparent that the majority of HEIs previously studied tended to ensure that IP produced in the school—or produced by creators associated with the school—would serve mainly the economic interests of the school.

In this paper, it was discovered that some world-ranked Philippine universities were inclined to claim sole IP ownership of works generated in the academic context, or to require an assignment of rights or a compulsory license in their favor covering IP produced by their employee or student. Though sharing or even transferring of rights might happen under certain circumstances, the HEIs would still ensure that initial adjudication of any legal issues pertaining to these rights would be done by an internal officer or committee designated in their institutional policies. While the HEIs also affirmed the academic freedom of their stakeholders and maintained the superiority of contractual stipulations over their own institutional policies, they nonetheless balanced this with an assertion of management prerogative in matters of enforcement, implementation, waiver, and policy amendments.

Given the highly regarded status of the Philippine universities whose IP policies were scrutinized in this study, it was foreseeable that such policies have been found to be fundamentally compliant with the IP Code and aligned with the legal framework grounded on the 1987 Constitution. Three of the four world-ranked HEIs (the exception being Uni A) also had enough policy content to satisfy the combined standards of Sattiraju et al. (2023), Garon (2018), and Carlson (2015). However, due to the limited sampling and unobtrusive approaches used in this study, no generalization could be made for Philippine HEIs included in the 2023 QS rankings. Indeed, although the findings here indicate many similarities in the business law aspects reflected in the IP policies of the subject schools, it cannot be asserted that the evidence proves any trend in IP policy-making by school administrators of reputable Philippine universities.

5. Conclusion

This study highlights the relevance of the Theory of Governmentality (Kapitzke, 2006), Social Contract Theory (Jayaraman, 2020), and Stakeholder Theory (Jones et al., 2018) in the development of internal IP policies by colleges and universities in the Philippines. Furthermore, it emphasizes the flexibility afforded by Section 230 of the IP Code to administrators of Philippine HEIs in the crafting and revision of their institutional IP policies. As much as it shows some similarities in the declared objectives and enforcement mechanisms in the IP policies of four world-ranked universities, this qualitative comparative analysis also reveals considerable differences in their ownership models and rules for commercialization. Persons, companies, and other institutions that will deal with such HEIs in any engagement where IP may be created should carefully assess if such internal policies are acceptable to them.

However, the greater concern should be the fact that many other reputable Philippine universities—including some that were similarly identified in the 2023 QS rankings—did not even have their IP policies posted on their official websites. This could complicate matters not only for potential faculty, non-teaching personnel, and students, but even for visiting researchers who might not have an early opportunity to consider the possible implications of such policies on their property rights. Notably, not all engagements with HEIs come with their own contract or MOA. Moreover, keeping institutional IP policies unpublished creates an unnecessary barrier to policy researchers who might wish to conduct unobtrusive studies delving into the content of these policies, as well as their ramifications.

If institutional policies are so important, as Owen (2014) emphasizes they are, then there is even more reason to make them not only apprehensible but also accessible. University IP policies especially “need to be brought to the forefront where they can be easily accessed by stakeholders and other interested parties” and “should be written

in language that makes sense to non-lawyers" (Campbell, 2019, p. 113). Rules that have a profound effect on ownership and related rights of IP creators—to the extent of possibly depriving them of such rights from the start—should be readily available to all interested parties. Beyond their bare compliance with the law requiring them to adopt internal IP policies, world-ranked Philippine universities should be transparent enough to make their policies public.

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BUMDes Business Sustainability, Establishment of Merah Putih Village Cooperative, and Fraud Tendency with Strengthening Innovation and Community Governance

Sri Ambarwati[1], Syahril Djaddang[1], Tri Astuti[2]

[1] Master of Accounting, Graduate School of Universitas Pancasila
[2] Faculty of Economics and Business, Universitas Pancasila, Jakarta, Indonesia

Correspondence Authors: Syahril Djaddang, Master of Accounting, Graduate School of Universitas Pancasila, Indonesia. Email: syahril@univpancasila.ac.id, Tel: +6285925035219;
Sri Ambarwati, Master of Accounting, Graduate School of Universitas Pancasila
Email: sriambarwati@univpancasila.ac.id; Tel: +62812-8268-8334

Abstract

The sustainability of village-owned enterprises (BUMDes) remains a topic of discussion in various scientific forums. A decade after their establishment, and amid numerous challenges, data from the Indonesian Ministry of Villages shows that 32,249 BUMDes operate across 74,957 villages in Indonesia. According to Article 2, Paragraph 1 of the Minister of Home Affairs Regulation No. 37 of 2007 concerning Financial Management Guidelines, BUMDes are required to manage their capital in a transparent and accountable manner. However, despite the rapid growth of BUMDes, cases of fraudulent practices have been reported during their implementation. The governance of BUMDes in this study adopts a community governance approach, formulated by considering the unique characteristics of BUMDes that distinguish them from profit-oriented corporations, as BUMDes function as social enterprises with both social and economic missions. The progress of BUMDes depends on their level of sustainability, while the threat of fraud can undermine their long-term viability. Sustainability indicators for BUMDes include stable or continuously increasing assets, expanding business networks, broader consumer reach, the ability to develop diverse products and business units, and the capacity to establish mutually beneficial partnerships with external parties. Innovation plays a crucial role in enhancing BUMDes' sustainability, as it can stimulate niche demand for community-based products that address environmental sustainability issues and strengthen BUMDes' reputation for environmental stewardship originating at the village level.

Keywords: Sustainability, Community Governance, Human Resource Competence, BUMDes, Merah Putih Village Cooperative

1. Introduction

1.1. Introduce the problem

To support and realise *Asta Cita*, the Minister of Villages and Development of Disadvantaged Regions has established 12 Priority Actions for Building Villages, Building Indonesia, and Leading Villages for Indonesia. Strengthening Village-Owned Enterprises (BUMDes) is one of the most strategic initiatives, implemented through intensive training and mentoring for BUMDes managers to develop skills in financial management, marketing, and product and service innovation. The sustainability of BUMDes remains a topic of discussion in various scientific forums. A decade after their establishment, data from the Ministry of Villages of the Republic of Indonesia shows that 32,249 BUMDes are operating in 74,957 villages across Indonesia. Given their responsibility in managing capital, BUMDes must ensure transparency and accountability in capital management. However, along with the rapid growth of BUMDes, there are indications of fraudulent practices occurring in their implementation. Various news reports have revealed corruption cases related to fund management in several regions, such as the case of BUMDes Dwi Utama Mandiri. In the Indramayu area, the Indramayu District Attorney's Office (Kejari) detained a suspect in a corruption case involving the former Head of Kedungdawa Village, Gabuswetan District, who also served as the former Head of BUMDes, for actions committed between 2017 and 2021 that resulted in state losses amounting to Rp 276,467,000.

The Urgency of This Research: Fraud in Village-Owned Enterprises (BUMdes) is urgent. Fraud continues to persist in BUMdes due to ineffective governance. Opportunities are wide open, in addition to the still-weak human resources due to a lack of education, experience, and a long-standing work culture. Because governance in BUMdes has been ineffective to date, a new formula is needed to address this issue. Relying solely on BUMdes as an institution is unreliable. Therefore, other stakeholders are needed to participate in monitoring BUMdes. In this study, the village government and the village community are involved.

The governance of BUMDes in this study employs a community governance approach. This governance model is structured by considering the characteristics of BUMDes, which differ from profit-oriented corporations, as BUMDes possess a social enterprise nature with both social and economic objectives [2][3]. Previous research on BUMDes has also found that the element of participation has not received sufficient attention [4]. This participation element requires an active role from both the village government and the community to ensure optimal oversight, rather than relying solely on the accountability of management or the board. Pestoff and Hulgård [5] stated that governance in social enterprises is not structurally based on the relationship between owners and managers, but rather emphasises stakeholder participation. Fraud aspects in this study are examined based on the opportunity to commit fraud and human resource competency. This study builds upon previous research [6].

The Fraud Triangle theory is applied to all variables, with Pressure and Rationalisation showing effects after being moderated by Community Governance, while HR Competency and Opportunity show no effect. In practice, based on various studies, BUMDes are strongly influenced by the capacity and expertise of their human resources. Therefore, in this study, the HR competency variable is synergised with innovation and business sustainability variables. The threat of fraud within BUMDes can disrupt the sustainability of the enterprises themselves.

BUMDes sustainability includes consistent or continuously increasing assets, an expanding network, the ability to create various products and business units, and the capacity to establish mutually beneficial partnerships [6]. The importance of innovation lies in efforts to enhance BUMDes' sustainability, as measured by (i) introducing new products, (ii) adopting new production methods, and (iii) opening new markets [7]. The sustainability of BUMDes amid plans to establish 70,000 Merah Putih Village Cooperatives is a primary concern in this analysis. Although media reports indicate that these cooperatives will only be established in villages that do not yet have BUMDes, potential risks to the development and existence of existing BUMDes remain. Therefore, this study also presents a SWOT analysis to assess the impact of this policy on the sustainability of BUMDes.

Currently, there are 21,607 BUMDes and BUMDes Bersama that have obtained legal status. This fact indicates that BUMDes are better prepared to operate professionally across various business and enterprise sectors. Furthermore, transparency and accountability in BUMDes' financial standards further strengthen their readiness to face challenges and opportunities arising from government policies. The analysis presented in this study is

expected to provide an overview of the strengths, weaknesses, opportunities, and threats faced by BUMDes, as well as strategies to ensure their sustainability and future development following the government's establishment of the Merah Putih Village Cooperative.

1.2. Importance of The Problem

The research questions are as follows:

1.1.1 How do opportunities influence fraud tendencies?
1.1.2 How does human resource competency influence fraud tendencies?
1.1.3 How can community governance influence the relationship between opportunities and fraud tendencies?
1.1.4 How can community governance influence the relationship between human resource competency and fraud tendencies?
1.1.5 How can human resource competency influence the sustainability of village-owned enterprises (BUMDes)?
1.1.6 How can Green Innovation Challenges influence the relationship between human resource competency and BUMDes' sustainability?
1.1.7 How is the position of BUMDes related to the establishment of the Merah Putih Village Cooperative?

1.3. Relevant Scholarship

1.3.1. Theory of Planned Behavior

This study employs the Theory of Planned Behavior. In the context of fraud, an individual's intention to avoid fraudulent behavior must be sufficiently strong to prevent fraud. Individuals evaluate the perceived advantages and disadvantages of engaging in fraudulent actions. A person may also commit fraud based on experience, competence, and the obstacles they face (Cohen, 2011). The Fraud Diamond Theory suggests that fraud is most likely to occur when an individual is under pressure, has the opportunity to commit fraud due to weaknesses in control and supervision, and rationalizes fraudulent behavior. This study also applies the Resource-Based View to explain how human resource practices build capabilities that drive sustainable innovation. Clear guidance is therefore needed for managers and policymakers in designing HR policies that foster green innovation and support sustainability goals. The literature review reveals that the Resource-Based View emphasizes how a firm's resources contribute to its competitive advantage (Kero & Bogale, 2023). At the macro level, the Resource-Based View (Barney, 1991) posits that Green Human Resource Management (GHRM) develops valuable, rare, and inimitable green human capital, which in turn supports green innovation as a dynamic capability that generates sustainable competitive advantage.

A village-owned enterprise (BUMDes) environment characterized by a culture of tolerance toward fraud creates greater opportunities for fraudulent practices. Based on research by Kumar and Bhattacharya (2018), the professionalism and competence of human resources in financial management are expected to support the achievement of community economic and social goals. However, because many villagers still lack adequate understanding and expertise in financial reporting, continuous coaching and training are required to improve community competency. Currently, HR competency is increasingly characterized by Green Human Resource Management (GHRM). Previous studies have found that GHRM practices improve employee attitudes toward greenhouse gas emission disclosure, both directly and indirectly through improved financial performance. Specifically, the level of implementation of GHRM practices—such as top management support, environmental training, employee empowerment, teamwork, reward systems, and employee engagement—is crucial. Meanwhile, the most common factors contributing to fraud in SMEs include low employee morale and weak internal controls. Nevertheless, research on fraud involving SMEs remains limited, despite their significant role in the economy (Zainal et al., 2022). Alayli (2022) provides an overview of fraud in small and medium enterprises. Community governance refers to public participation, involvement, and decision-making in public affairs, governance networks, and participatory governance (Totikidis, 2005).

The governance model for BUMDes examined in this study differs from conventional community governance

frameworks. This approach recognizes that BUMDes, as social enterprises, pursue both social and economic objectives, distinguishing them from profit-oriented corporations. Previous research on BUMDes has indicated that participation has not been a primary focus. The sustainability of BUMDes is characterized by consistently increasing assets, expanding networks, the development of diverse products and business units, and the establishment of mutually beneficial collaborations (Luthan et al., 2022). Innovation plays a critical role in enhancing BUMDes' sustainability, as demonstrated by the introduction of new products, the adoption of novel production methods, and entry into new markets. Based on supporting theories, previous research, and hypothesis development, these innovation practices are expected to strengthen long-term sustainability. Innovation is essential to enhancing BUMDes' sustainability, as demonstrated by the introduction of new products, the adoption of novel production methods, and the entry into new markets. Supporting theory, previous research, and hypothesis development are;

1.3.2. The hypothesis formulation is as follows:

The influence of opportunity on fraud propensity.

According to Aghghaleh, S. F., & Mohamed, Z. M. (2014), Opportunity Proxies were identified as significantly associated with fraud. Based on Endahsari's (2020) research, pressure, justification, and ability are significant factors influencing fraudulent activities. Hapsari's (2021) research found that Village-Owned Enterprises (BUMdes) are still vulnerable to potential fraud risks. Several important components can be potential targets for fraud. Hamid & Nasih (2021) in their research explained that fraudulent activities occur due to opportunities that arise from weaknesses in the system, which are then exploited by individuals. In other words, an effective system makes it difficult for individuals to commit crimes. Fidianatun et al. (2023) found that the BUMdes internal control system has many gaps in the tendency for fraud, including a lack of transaction evidence, poor financial records, the absence of separation of cash receipts and records, and the failure to conduct stocktaking. According to Larasati, R., & Sujana, E. (2021), fraud is seen from an opportunity perspective, including situations and conditions that allow someone to commit fraud or the opportunity to manipulate financial and personal data related to loan applications. Opportunities can arise at various stages of the activity. Furthermore, during the administration stage carried out by the Village-Owned Enterprise (BUMdes) treasurer, a potential opportunity is data manipulation within the system (Aditya 2020). ***H1*****:** Opportunities affect fraud tendencies of village-owned enterprises (BUMDes).

The Influence of Human Resource Competence on Fraud Proneness.

The Influence of Human Resource Competence on Fraud. Angi et al. (2021) showed that organizational culture, good corporate governance, and human resource competence influence fraud prevention in fund management. Human resource competence influences fraud prevention in village fund management (Sumitariani, 2020). Research by Suandewi (2021) shows that human resource competence has a positive and significant effect on fraud prevention. According to Saputra (2019), accountability and human resource competence have a positive effect on fraud prevention in village fund management. Research by Adiputra (2020) identified business management inefficiency as a factor, with corruption committed by business managers due to a lack of business management skills. Widyawati (2019) demonstrated that human resource competence has a positive effect on fraud prevention in village-owned enterprise (BUMDES) fund management. Fraud committed from a competency perspective is attributed to the perpetrator's ability to override internal controls and manipulate them according to their social standing for personal gain (Larasati, R., & Sujana, E, 2021). The results of the study indicate that human resource variables have a negative and significant effect on the tendency for accounting fraud (Yasa and Sujana, 2023). ***H2*****:** Human resource competency affects fraud tendencies of village-owned enterprises (BUMDes).

Community Governance can influence the relationship between opportunities and fraud tendencies.

Budiono (2015) identified issues hindering the role of Village-Owned Enterprises (BUMdes), including conflicts of interest between key actors, the lack of transparency, and community involvement in policymaking. Research by Dewi (2022) found that good governance had a positive and significant impact on fraud in Village-Owned

Enterprises (BUMDES) in Banjar District (Dewi, 2022). Research by Anggraeni (2016) showed that the main problems were communication issues between the village government and the community, as well as transparency and accountability. Furthermore, management's lack of knowledge in BUMdes management resulted in suboptimal performance in business development. Jaswadi (2016) examined the implementation of good governance in SMEs in Malang. Jaswadi's (2016) research also showed that corporate governance implementation remained low, with micro-enterprises focusing more on business sustainability than on corporate governance implementation. According to Anggraini (2016), human capital can be associated with high dedication and commitment. The governance component that involves not only the administrators and village heads makes control a shared responsibility, not just an obligation for the administrators. Based on Purbawati's research (2018), the implementation of GCG studied in the Tembarak area did not show good performance. The GCG function in financial management has not been implemented.

***H3*:** Community governance influences the relationship between opportunities and the fraud tendencies of village-owned enterprises (BUMDes).

Community governance can influence the relationship between human resource competency and fraud likelihood.

Governance has been found to weaken the positive influence of opportunity and rationality on perceptions of fraud. Governance does not moderate the influence of competence and arrogance on perceptions of fraudulent financial reporting. However, governance is a potential moderator of the interaction between competence and arrogance (Setiawan, 2023). Research by Ramantha (2020) suggests that there are variables that interact with the influence of pressure on perceptions of fraudulent financial reporting. One component of community oversight in community governance is the Village Consultative Body (BPD) supervising the management of Village-Owned Enterprises (BUMDes), as evidenced by research by Asmaranti (2022). Empirically, consistent implementation of GCG has also been shown to reduce fraud (In'airat, 2015; and Kwatingtyas, 2017. According to Sekarwulan and Umar, H. (2021), and Setiawan (2023), good corporate governance weakens the influence of pressure from financial distress on fraud. On the other hand, based on Desanti's (2024) research, Good Corporate Governance is unable to moderate the influence of opportunities on the potential for fraud in financial reports. Putra, W. M. (2019) stated that the relationship between financial stability variables and fraud cannot be moderated by corporate governance. ***H4*:** Community governance affects the relationship between human resource competency and fraud tendencies of village-owned enterprises (BUMDes).

The influence of HR competency on the sustainability of BUMDes.

Green HRM involves using every employee interaction to foster and sustain environmentally sound business practices. The competency of Green Human Resource Development (HRD) plays a crucial role in enhancing financial performance within organizations, particularly in the context of small firms. Green HRM practices, which align human resource management with environmental sustainability goals, are instrumental in developing employees' abilities, motivation, and commitment to proactive environmental management. This alignment not only fosters a culture of sustainability but also significantly moderates the relationship between proactive environmental management and financial performance, leading to improved financial outcomes for firms that adopt these practices [1] [2]. Moreover, integrating environmental management into HR practices through Green HRM enhances overall organizational performance and sustainability, which is vital for maintaining competitive advantage in today's market. ***H5*:** Human resource competency affects the sustainability of village-owned enterprises (BUMDes) of the village - owned enterprises (BUMDes).

Green Innovation Challenges can influence the relationship between HR competencies and the sustainability of BUMDes.

Research findings show a significant relationship among green entrepreneurial orientation, green market orientation, and green learning orientation and sustainable performance in small and medium enterprises (Abbas, J., & Khan, S. M., 2023). Furthermore, innovation has been shown to strengthen the relationship between human resource quality and business sustainability. This means that when an organization has an innovative culture, the ability of human resources to create sustainability is more optimal. Innovation serves as an enhancer, increasing

the effectiveness of humans. resource quality in supporting business sustainability (Parilli, 2025). This finding is consistent with the strategic management literature, which emphasizes that human resource quality is a source of competitive advantage and that innovation is a crucial mechanism that maximizes the potential of human resources to create organizational sustainability.[Hamadamin, H. H., & Atan, T. (2019). The impact of strategic human resource management practices on competitive advantage sustainability: The mediation of human capital development and employee commitment. Sustainability, 11(20), 5782.

Innovation is essential to enhancing BUMDes' sustainability, as demonstrated by the introduction of new products, the adoption of novel production methods, and the entry into new markets based on supporting theory, previous research. Harinurdin, E., Laksmono, B. S., Kusumastuti, R., & Safitri, K. A. (2025). Community Empowerment Utilizing Open Innovation as a Sustainable Village-Owned Enterprise Strategy in Indonesia: A Systematic Literature Review. *Sustainability*, *17*(8), 3394. ***H6.*** Innovation affects the relationship between human resource competency and BUMDes's sustainability of village-owned enterprises (BUMDes).

2. Method

Primary data were collected **through** questionnaires using a five-point Likert scale to assess **the perceptions of BUMDes directors** regarding financial literacy and attitudes in Bogor Regency. This study employed several analytical techniques, including descriptive analysis, statistical analysis, measurement model evaluation (outer model), structural model evaluation (inner model), and hypothesis testing. The study population was 416 BUMDes in Bogor Regency, each represented by its director. The sample, determined using the Slovin formula at a 10% significance level, was gathered through questionnaires and interviews. Data were analyzed using Structural Equation Modeling (SEM) based on Partial Least Squares (PLS) with the WarpPLS 6.0 software.

3. Result and Discussion

3.1. Statistical and data analysis

Table 1: Descriptive Statistical Data

KF	PLG	KSDM	KU	CG	INV	CG M1	CG M1	INV M2
-2.140	-1.953	-2.169	-2.387	-1.904	-2.382	-2.421	-1.426	-0.841
2.794	2.025	1.454	1.960	1.565	1.740	2.550	3.125	3.353

Table 2: Median Top and Modes (bottom)

KF	PLG	KSDM	KU	CG	INV	CG M1	CG M1	INV M2
-0.322	-0.059	-0.285	0.121	-0.169	0.213	0,172	-0.454	-0.440
-0.322	-0.438	-0.285	0.121	-0.169	0.442	0.313	-0.589	1.346

Based on a descriptive analysis of 105 data samples, the KF and KU variables ranged from -2.140 to 2.794, with a mean of -0.322 and a standard deviation of 0.79361. This indicates that the KF data exhibits a fairly large spread around its mean. The KU variable ranged from -2.387 to 1.960, with a mean of 0.121, indicating relatively low variability and a centering around the low value. Furthermore, the probability variable had a minimum value of -1.953 and a maximum of 2.025, with a mean of -0.059 and a mode of -0.438, indicating moderate variation in the data. For the KSDM variable, the minimum and maximum values were −2.169 and 1.454, respectively, with a mean of −0.285 and a mode of −0.285, indicating that most KSDM values were close to zero. For the CG variable,

the minimum is -1.904, the maximum is 1.565, the average is -0.069, and the mode is -0.169, indicating that the CG data is relatively stable and fluctuates in a narrow range around zero. The Innovation variable has a minimum value of -2.382 and a maximum of 1.740, with an average of 0.213 and a mode of 0.442, indicating that the Innovation data is relatively stable and fluctuates in a narrow range around zero.

3.2 Hypothesis Testing

Validity testing ensures that the data collection instrument (questionnaire) accurately measures the intended constructs or variables (e.g., community governance, HR quality, innovation, fraud, and financial performance). In questionnaire-based accounting research, validity is commonly assessed using factor loadings and cross-loadings. Based on the validity test results presented in Table 1, all statement items meet the required criteria, as indicated by satisfactory factor loadings and cross-loadings ($p < 0.001$). Therefore, all measurement items are considered valid. Furthermore, the factor loading results in Table 2 also show significant values ($p < 0.001$), except for the relationship between community governance (CG) and opportunity, which shows a coefficient of −0.294 ($p < 0.001$). These findings indicate that the constructs of fraud tendency, opportunity, HR quality, business sustainability, community governance, and innovation demonstrate good validity. The complete structural model describing the relationships among variables is presented the corresponding p-values and path coefficients. As for the full model of this research, it can be seen below;

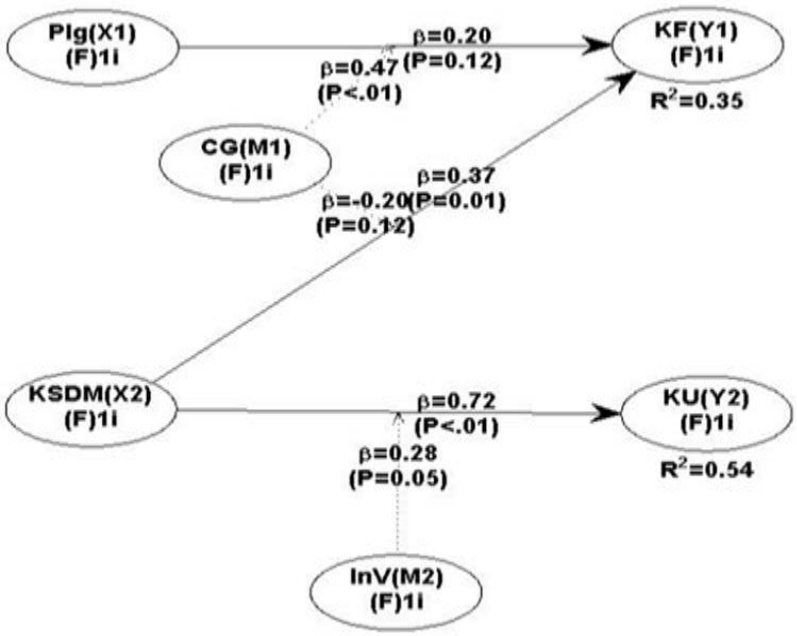

Figure 1: Full Model Result

a. Relationship between Opportunity and KF (ρ = 0.202)
   The positive effect suggests that increased opportunity is associated with a higher likelihood of fraud (KF). This finding implies that opportunity does not reduce KF, even when moderated by CG and Innovation. However, the p-value of 0.119 exceeds the 0.05 threshold, indicating that the effect is not statistically s significant and leading to the rejection of H1.
b. Relationship between Human Resource Quality to KF (ρ = 0.371)
   The positive coefficient indicates that higher-quality human resources are associated with higher KF. However, the small coefficient value indicates a relatively significant effect, with a p-value of 0.011 < 0.05 (H2 is accepted).
c. Relationship between Opportunity to KF*CG (ρ = 0.465).

The direction of the positive, significant relationship indicates that opportunity has a strong effect on KF when moderated by CG. The results show that the p-value is 0.002 < 0.01, indicating that this effect is statistically significant (H3 is accepted).

d. Relationship between Human Resource Quality to KF*CG (ρ = -0.205)
The positive effect indicates that higher-quality human resources are associated with a lower likelihood of KF. However, contrary to the hypothesis test, which explains the p-value of 0.116 > 0.05, this effect is not statistically significant (H4 is rejected).

e. Relationship between Human Resource Quality and CU (ρ = 0.719)
The positive coefficient indicates that high human resource quality contributes to increased business sustainability (KU), as KU is synonymous with high professionalism and responsibility. Overall, this study shows that the model's explanatory power varies across constructs.

The R^2 value of 0.346 for KF indicates that Opportunity, KSDM, CG, and Innovation explain 34.6% of the variation in KF, while the remaining 65.4% is attributed to other factors outside the model. Conversely, the R^2 value of 0.538 for KU indicates that the model has strong explanatory power in explaining the influence of Opportunity, KSDM, CG, and Innovation. KSDM has a significant positive effect on KF and KU, whereas opportunity has no significant effect on KF. CG fully moderates the effect of opportunity on KF, while innovation partially moderates the effect of HR quality on KF.

The results further indicate that the opportunity to commit fraud has a positive but statistically insignificant effect on fraud likelihood, suggesting that opportunity alone does not sufficiently explain fraudulent behavior. Moreover, these findings show that stronger internal control systems and greater visibility of individual asset monitoring are associated with a higher likelihood of fraud occurrence. This result is consistent with the Fraud Triangle Theory (Cressey) and is supported by studies by Said et al. (2017) and Free and Murphy (2015), which conclude that opportunity is a primary determinant of fraudulent behavior.

The R^2 value of 0.346 for KF indicates that Opportunity, KSDM, CG, and Innovation explain 34.6% of the variation in KF, while the remaining 65.4% is explained by factors outside the model. Similarly, the R^2 value of 0.538 for KU demonstrates that the model has relatively strong explanatory power in explaining the effects of Opportunity, KSDM, CG, and Innovation.

4. Discussion

KSDM has a significant positive effect on KF and KU, whereas opportunity is not significantly associated with KF. CG fully moderates the relationship between opportunity and KF, while innovation partially moderates the relationship between HR quality and KF. The results of this study indicate that the opportunity to commit fraud has a positive but statistically insignificant effect on fraud likelihood, suggesting that opportunity alone is insufficient to explain fraudulent behavior. These findings also indicate that the stronger the internal control system and the greater the visibility of individual asset monitoring, the higher the likelihood of fraud occurrence. This result is consistent with the Fraud Triangle Theory (Cressey) and is supported by studies conducted by Said et al. (2017) and Free and Murphy (2015), which conclude that opportunity is a primary determinant of fraudulent behavior.

Human resource quality positively influences fraud likelihood. This implies that higher levels of employee competence, technological capability, and system understanding increase the potential to exploit internal control weaknesses to commit fraud. This finding supports the Fraud Diamond Theory (Wolfe & Hermanson, 2004), which emphasizes that fraud requires not only pressure, opportunity, and rationalization but also individual capability. This result is also consistent with research by Baird and Zelin (2009) and Lokanan (2015), which shows that modern fraud perpetrators generally possess high-quality human resources, enabling them to commit more complex and difficult-to-detect fraud. Furthermore, the opportunity to commit fraud has a positive and significant effect on fraud likelihood when moderated by community governance. This indicates that ineffective community oversight allows internal control weaknesses in operational procedures to be exploited more easily by perpetrators. This finding aligns with the Fraud Triangle Theory and previous studies by Said et al. (2017) and Free and Murphy (2015), which state that weak community governance strengthens the relationship between opportunity and fraud.

Therefore, in this context, community governance does not function as an effective control mechanism but instead becomes a condition that further increases fraud risk.

The results also indicate that human resource quality has a positive association with fraud propensity, meaning that higher-quality human resources are associated with a greater potential for fraud. This relationship is consistent with both the Fraud Triangle Theory and the Fraud Diamond Theory, which emphasize the role of competence, integrity, and procedural understanding in fraud prevention. However, although the direction of this relationship supports the theory, empirically, this study does not provide strong evidence that community governance functions as an effective control mechanism. These findings indicate that community governance has not demonstrated a significant role in the relationship between human resources and fraud propensity. The results further show that human resource quality positively influences business sustainability. This suggests that competent, professional, and adaptive human resources can enhance business competitiveness and stability.

5. Conclusion

Fraud opportunities do not significantly affect fraud propensity, but their impact grows when community governance is involved. The FGD results show that community governance can actually raise the risk of fraud. Human resource quality has a significant positive effect on both fraud propensity and business sustainability. Innovation further strengthens the link between human resource quality and business sustainability. Skilled and innovative employees can improve an organization's competitiveness and stability.

For Practitioners and Policymakers, Village enterprise (BUMDes) development policies need to emphasize human resource training and the implementation of green innovations to achieve business sustainability. Community-based oversight mechanisms must be redesigned to ensure they are not merely formalities, but are truly capable of reducing opportunities for fraud. Recommendations for Practitioners and Policymakers. Policies for the development of Village-Owned Enterprises (BUMDes) should prioritize comprehensive human resource training and the adoption of green innovations to promote business sustainability. Additionally, community-based oversight mechanisms require restructuring to ensure they effectively minimize opportunities for fraud, rather than serving as procedural formalities. Limitation of the study: The empirical findings apply only to the sample studied. Generalization to other organizational contexts or sectors remains limited.

6. Suggestions and Recommendations on Research Results

1.1. Suggested/recommended for future research to expand the research. Policies for the development of Village-Owned Enterprises (BUMDes) should prioritize comprehensive human resource training and the adoption of green innovations to promote business sustainability.

1.2. Additionally, community-based oversight mechanisms require restructuring to ensure they effectively minimize opportunities for fraud, rather than serving as procedural formalities. Limitation of the study: The empirical findings apply only to the sample studied. Generalization to other organizational contexts or sectors remains limited.

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Behavioral Intention as an Impact of Online Shopping Experience & Trust: Case Study of Generation Z Consumers of Several E-Commerce Sites in Bandung

Rini Handayani[1], Fansuri Munawar[2]

[1,2] Faculty of Economics and Business, Widyatama University, Bandung, Indonesia

Correspondence: Rini Handayani, Faculty of Economic and Business, Widyatama University, Bandung, Indonesia. E-mail: rini.handayani@widyatama.ac.id

Abstract
The rapid development of digital technologies has significantly transformed consumption patterns, particularly in the realm of online shopping in Indonesia. A key challenge is the shift in consumer purchasing behavior: consumers can easily switch between e-commerce platforms, often triggered by a poor experience and low trust in the perceived superiority of online shopping services. This study aims to examine the effects of online shopping experience and trust on behavioral intention among Generation Z in Bandung. The research adopts both descriptive and explanatory (verification) approaches. The sample comprises generation z consumers in Bandung (aged 15–30) who have previously purchased fashion products via e-commerce platforms, including Shopee, Tokopedia, Lazada, TikTok Shop, Blibli, and Zalora. A sample size of at least 100 respondents is employed. Purposive sampling is used, with data collected through questionnaires and interviews. Multiple linear regression is applied as the analytical technique. Findings indicate that generation z consumers in Bandung report relatively positive evaluations of online shopping experience, trust, and behavioral intention. Statistical tests further confirm that online shopping experience and trust significantly influence behavioral intention.

Keywords: Behavioral Intention, Online Shopping Experience, Trust, E-commerce, Generation Z

1. Introduction

Indonesia's digital industry has experienced remarkable growth in recent years. At the beginning of 2025, the number of internet users in Indonesia reached 220 million out of a total population of 285 million. We Are Social, through the Digital 2025 Global Overview Report, reported Kapios' analysis indicating that the number of Indonesian internet users increased by 17 million, representing a growth of 8.7% compared with the same period in the previous year (Dudhat & Agarwal, 2023).

The rapid advancement of digital technologies and the internet has substantially reshaped consumption patterns, particularly in relation to e-commerce shopping, which has become a primary channel for consumers in Indonesia. According to Statistics Indonesia (BPS) (2024), the number of e-commerce users in Indonesia

reached approximately 17.8 million, or 65% of the total population. This positions Indonesia as the country with the most significant number of digital consumers in Southeast Asia (Ariansyah et al., 2021). In addition, the majority of online shoppers are aged 18–40 and come from the middle class (Kuah & Wang, 2020).

The dominance of generation z and millennials is mainly attributable to the fact that these cohorts grew up alongside the expansion of internet technologies and are familiar with digital purchasing and payment systems (APJII Research, 2025). generation z is typically defined as individuals born between 1995 and 2010. Often labelled the "internet generation", this cohort was born during a period when the internet began to enter daily life and rapidly expanded. Generation Z's ability to adapt to technological change enables them to interact readily with brands they favour (Priporas et al., 2017). E-commerce remains a key driver of Indonesia's digital economic growth. Several platforms that are expected to dominate in 2025 include Shopee, Tokopedia, Lazada, TikTok Shop, Blibli, and Zalora (Lucky Hikmat Maulana, 2022).

E-commerce is defined as the process of purchasing, selling, transferring, or exchanging products, services, or information through computer networks via the internet (Grover & Teng, 2001; Kedah, 2023). Despite rapid growth, a significant challenge lies in the shifting shopping behavior of Indonesian consumers, whose preferences are increasingly oriented towards more prudent, sustainable choices and experience-led consumption. Consumers are becoming increasingly aware of the social and environmental implications of their purchasing decisions and are seeking products that are high-quality, ethical, and aligned with their personal values.

A report by Google, Temasek, and Bain & Company (2025) states that 80% of Indonesian consumers prefer online shopping to offline shopping. Online shopping remains the dominant option, driven by convenience and broad product availability (Adinugraha et al., 2024). However, consumers are also becoming more selective and actively seeking the best offers. While online shopping offers distinct advantages and convenience, it also entails risks (Hubert et al., 2017), including: discrepancies between the ordered product and the images displayed; items arriving damaged (either during delivery or due to manufacturing defects); packing errors that lead to incorrect orders (e.g., colour, quantity, or type); goods not being delivered due to loss or delays; and fraud. Within today's dynamic digital business landscape, consumers can switch from one e-commerce platform to another with ease, or decide not to repurchase, often as a result of a single negative experience, more attractive competitor offers, or the emergence of new values that better match their personal preferences (Hadi Mersi et al., 2025).

A key determinant of behavioral intention is customer experience. Consumers evaluate brands not only on product quality, but also on the entire set of interactions with the brand—from the first visit to a website, the purchasing process, delivery, and after-sales service (Ahmed et al., 2022). Global surveys indicate that more than 70% of consumers are willing to leave an e-commerce platform after just one poor experience, even when they were previously loyal customers (Oliveira et al., 2022). Examples include delivery delays, transaction errors, and customer service responses that lack empathy or responsiveness, as well as payment processes that are difficult or perceived as insecure, and inadequate privacy protection (Kumar & Ayodeji, 2021).

Given continuously evolving consumer trends, e-commerce firms must become more adaptive and innovative in responding to intensifying competition, leveraging technology to create more personalised shopping experiences (Sharma et al., 2023). A growing preference for more interactive shopping experiences represents another emerging trend. This suggests that e-commerce is no longer merely a platform for purchasing products; it has become an increasingly integral part of Indonesia's digital lifestyle. Beyond customer experience, a further central challenge for e-commerce is building and maintaining consumer trust in online services and products. Trust is crucial because consumers cannot physically inspect products prior to purchase; consequently, they rely heavily on platform reputation, reviews, and transaction security (Mittameedi et al., 2025).

In business contexts, trust does not emerge instantly; it must be cultivated from the outset. To remain competitive in an era dominated by online shopping, e-commerce platforms must develop loyal customers who genuinely trust the superiority of online services. In this regard, trust reflects consumers' belief in the platform's capability to ensure the security of online transactions (Shao & Yin, 2019). Reviews of online shopping research

also suggest that two variables—online shopping experience and trust—are significant in shaping online purchasing behavior (Chetioui et al., 2020).

Bandung, the largest city in West Java Province, is often referred to as Kota Kembang (the "Flower City") due to its beauty, and was historically known as Paris van Java for its resemblance to Paris, France. The prevalence of shopping malls and factory outlets has also positioned Bandung as a hub for shopping and culinary tourism. In 2025, the population of Bandung was approximately 2.5 million. This sizeable population presents a significant opportunity for businesses—especially e-commerce providers—to serve the generation z segment (Vieira et al., 2020). Generation Z's interest in online shopping in Bandung is relatively high, driven by easy access and a preference for shopping experiences that are integrated with social media. Fashion is among the most popular categories for generation z in online shopping (Do et al., 2023). Individuals are often recognised through the fashion they wear, as it can reflect and express identity and social status. Fashion involvement is closely linked to personal characteristics, particularly among younger consumers (Theocharis et al., 2025).

A preliminary survey conducted by the researchers indicates that the behavioral intention of generation z consumers in Bandung towards e-commerce remains low. This is likely due to less memorable online shopping experiences and relatively low consumer trust in e-commerce platforms. Accordingly, this study aims to examine the online shopping experience, trust, and behavioral intention among generation z consumers in Bandung, as well as the interrelationships between these variables.

2. Method

This exploration is clear and confirmation-based. The unit of examination includes several e-commerce platforms in the city of Bandung, such as Tokopedia, Shopee, Bukalapak, Lazada, and Blibli. The selection of these e-commerce platforms was based on their widespread use and high traffic in the Bandung area. The inspection strategy employed is purposive sampling. Generation z customers who enjoy online shopping during Harbolnas in Bandung make up the observation unit. The base example size is 100 people. Online questionnaires and in-person interviews are two methods of data collection. Multiple linear regression is used as the analytical technique (Ofosu-Boateng, 2020).

2.1 Identify Subsections

To enhance transparency and replicability, the method section is organised into three labelled subsections: (i) participant characteristics, (ii) sampling procedures and data collection, and (iii) analytical approach. The present study employs a descriptive and explanatory (verification) design, focusing on generation z consumers in Bandung who have recently made fashion purchases via e-commerce platforms. Data were collected using an online questionnaire (google forms) supplemented by interviews, and the hypothesized relationships were tested using multiple linear regression (Hülk et al., 2018).

2.2 Participant (Subject) Characteristics

Participants were generation z consumers residing in Bandung, operationalised as individuals aged 15–30 years, who had purchased fashion products through e-commerce within the previous month. The e-commerce platforms referenced in the study include Shopee, Tokopedia, Lazada, TikTok Shop, Blibli, and Zalora. Eligibility criteria, therefore, comprised: (a) aged 15–30; (b) Bandung-based consumer; and (c) at least one fashion purchase via the specified e-commerce channels in the past month. Exclusion criteria were applied logically, excluding respondents outside the specified age range, those who had not made a fashion purchase online in the last month, or those without experience purchasing through e-commerce during the specified period.

2.3 Sampling Procedures

A purposive sampling approach was employed, with a target of at least 100 respondents. Data collection was conducted through a google forms questionnaire, supplemented by interviews to enrich the understanding of

participant responses and contextualize behavioral intentions (Campbell et al., 2020). The primary statistical technique used was multiple linear regression, which was employed to examine the effects of online shopping experience and trust on behavioral intention. Reporting note for APA-style completeness: the manuscript text provided does not specify the recruitment channels, response rate (percentage approached who participated), the number who self-selected into the study, incentives (if any), the precise data-collection setting(s), or ethics/IRB information. These elements can be added as brief statements (e.g., "Participation was voluntary; no incentives were offered; ethics approval was obtained from…") to fully align the section with best-practice reporting standards, without adding unnecessary length.

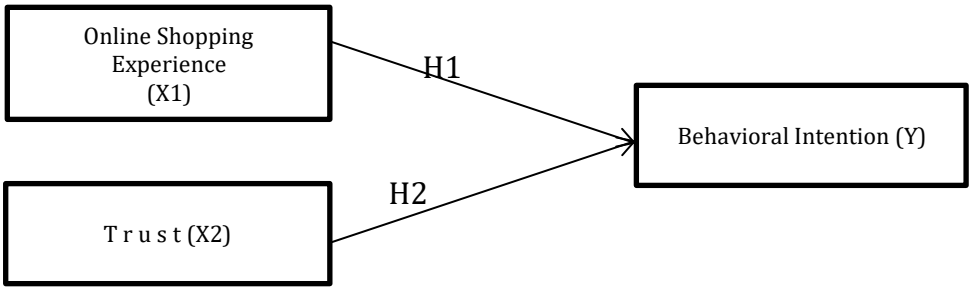

Figure 1: Research model

3. Results

The validity test for all questionnaire items across the examined variables shows that the r-calculated value for each item is greater than or equal to the r-table value of 0.94; therefore, all items can be considered valid. For the online shopping experience construct, Cronbach's alpha is 0.764; for trust, Cronbach's alpha is 0.746; and for behavioral intention, Cronbach's alpha is 0.748. These results indicate that all measurement items are reliable, as Cronbach's alpha values exceed the threshold of 0.70 (Ghozali, 2018).

3.1 Descriptive Evaluation

From Table 1, it can be seen that generation z consumers' online shopping experience on e-commerce platforms is interpreted as moderately favourable, with an overall mean score of 3.30, as it falls within the interval of 2.60–3.39 (Aulia, 2020). The lowest scores are observed for the statements relating to the level of honesty and the security of delivery on e-commerce platforms.

Table 1: Respondents' Perceptions of Online Shopping Experience (X1)

No.	Statement	Mean	Category
1	Based on my knowledge, the affordability of fashion product prices on e-commerce platforms	3.50	Good
2	Based on my experience, the variety/availability of fashion products on e-commerce platforms	3.41	Good
3	Based on my experience, the attractiveness of fashion product advertisements on e-commerce platforms	3.50	Good
4	Based on my experience, the level of honesty on e-commerce platforms	3.30	Fair
5	Based on my experience, the security of fashion product delivery on e-commerce platforms	2.65	Fair
6	Based on my experience, the timeliness of fashion product delivery on e-commerce platforms	3.45	Good
Overall mean		**3.30**	**Fair**

Source: Processed primary data, 2025.

From Table 2, it can be observed that generation z consumers' trust in e-commerce platforms is moderately favourable, with an average score of 3.28, as it falls within the interval of 2.60–3.39. The lowest scores relate to

the statements that e-commerce platforms are honest, provide detailed information, ensure security during the purchasing process, and are generally safe platforms.

Table 2: Respondents' Perceptions of Trust (X2)

No.	Statement	Mean	Category
1	I trust the timeliness of fashion product delivery on e-commerce platforms	3.57	Good
2	I trust the quality of fashion products offered by e-commerce platforms	3.60	Good
3	I trust e-commerce platforms to provide detailed information	3.25	Fair
4	I trust the security of e-commerce platforms when purchasing fashion products	3.00	Fair
5	I trust that e-commerce platforms are honest sites	3.35	Fair
6	I trust that e-commerce platforms are safe sites	2.80	Fair
7	I trust e-commerce platforms	3.42	Good
Overall mean		**3.28**	**Fair**

Source: Processed primary data, 2025.

From Table 3, it can be seen that generation z consumers' behavioral intention towards e-commerce platforms is moderately favourable, with an average score of 3.26, as it falls within the interval of 2.60–3.39. The lowest scores are found for statements concerning consumers' intentions to share positive information with friends and family, as well as their intention to recommend the platform to others.

Table 3: Respondents' Perceptions of Behavioral Intention (Y)

No.	Statement	Mean	Category
1	I intend to repurchase fashion products on e-commerce platforms	3.60	Good
2	I intend to share positive information about fashion products on e-commerce platforms with friends/family	3.20	Fair
3	I intend to recommend the fashion products purchased on e-commerce platforms to others	3.00	Fair
Overall mean		**3.26**	**Fair**

Source: Processed primary data, 2025.

3.2 Analysis of Multiple Linear Regression

Table 4 presents the results of a multiple linear regression model, in which Behavioral Intention (Y) is the dependent variable and is predicted by Online Shopping Experience (X1) and Trust (X2) (SPSS output). The estimated regression equation is reported as $Y = 1.881 + 1.034X1 + 0.210X2 + e$. The constant term ($B = 1.881$, $p = .000$) represents the expected level of behavioral intention when both predictors are held at zero. Controlling for trust, Online Shopping Experience shows a positive and statistically significant association with Behavioral Intention ($B = 1.034$, $SE = 0.122$, $\beta = 0.674$, $t = 8.573$, $p = .000$), indicating that a one-unit increase in online shopping experience is associated with an increase of approximately 1.034 units in behavioral intention. Trust also demonstrates a positive effect ($\beta = 0.128$) with an unstandardized coefficient reported as $B = 0.0210$ ($SE = 0.131$, $t = 1.613$, $p = .000$), suggesting a comparatively minor contribution to behavioral intention when both predictors are considered simultaneously. Overall, the standardized coefficients indicate that the online shopping experience is a stronger predictor of behavioral intention ($\beta = 0.674$) relative to trust ($\beta = 0.128$). Note: The regression equation reports the trust coefficient as 0.210, whereas the coefficients table lists 0.0210. This appears to be a formatting/typographical discrepancy, and the coefficient values should ideally be aligned to avoid ambiguity in interpretation.

Table 4: Multiple Linear Regression Test

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1,881	3,109		6,606	,000
	Online Shopping Experience	1,034	,0122	,674	8,573	,000
	Trust	,0210	,0131	,128	1,613	,000

a. Dependent Variable: Behavioral Intention

Source: Processed primary data, 2025.

3.3 Simultaneous Hypothesis Test (F-test)

Table 5 presents the ANOVA (F-test) results for the multiple regression model predicting Behavioral Intention from Online Shopping Experience and Trust (SPSS output). The regression component accounts for a Sum of Squares of 1472.511 across 2 degrees of freedom, producing a Mean Square of 736.256. The residual (error) variation is 1182.001 with 97 degrees of freedom, yielding a Mean Square Error of 12.187, while the total variability in Behavioral intention is 2654.511 across 99 degrees of freedom. The model produces an F-statistic of 60.621 with a significance value of .000, indicating that the predictors, considered jointly, explain a statistically significant proportion of variance in behavioral intention. In other words, the overall regression model is significant, supporting the conclusion that online shopping experience and trust together have a meaningful effect on behavioral intention.

Table 5: Hypothesis Test (Uji F)

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1472.511	2	736.256	60,621	,000[b]
	Residual	1182.001	97	12.187		
	Total	2654.511	99			

a. Dependent Variable: Behavioral Intention

b. Predictors: (Constant), Online Shopping Experience, Trust

Source: Processed primary data, 2025.

Table 6 reports the correlation and explanatory power of the regression model through the model summary statistics (SPSS output). The multiple correlation coefficient is R = 0.746, indicating a strong positive association between the combined predictors (online shopping experience and trust) and the dependent variable (behavioral intention). The R-squared (R^2) value of 0.556 indicates that the model explains 55.6% of the variance in behavioral intention, suggesting substantial predictive capability in this context. After adjusting for the number of predictors and sample size, the Adjusted R^2 is 0.547, implying that approximately 54.7% of the variability in behavioral intention remains explained when model complexity is taken into account, and indicating minimal inflation of the explained variance. The standard error of the estimate is 3.492, reflecting the typical magnitude of prediction error (i.e., the average deviation of observed behavioral intention scores from those predicted by the model). Overall, these statistics suggest that the regression model provides a robust fit and that the predictors jointly offer meaningful explanatory power for behavioral intention.

Table 6: Correlation Coefficient and Coefficient of Determination

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.746[a]	.556	.547	3.492

Source: Processed primary data, 2025.

4. Discussion

The descriptive results suggest that generation z consumers in Bandung hold a moderately favourable evaluation of their online shopping experience; however, perceived honesty and delivery security emerge as the weakest points. This pattern is consistent with the broader view that online shopping, although convenient, is accompanied by perceived risks (e.g., product image discrepancies, delivery failures, and fraud), which can undermine the overall experience if not managed effectively (Hubert et al., 2017). In experience-led digital commerce, even a single negative episode in the customer journey can trigger adverse behavioral responses, including platform switching and reduced loyalty (Oliveira et al., 2022).

Accordingly, strengthening experiential reliability—through accurate product information, consistent fulfilment, and robust service recovery—becomes central to sustaining positive evaluations in a highly competitive e-commerce environment. Trust is also evaluated as moderately favourable. However, respondents express weaker agreement regarding the platform's honesty, the provision of sufficiently detailed information, and perceived transaction safety. In e-commerce contexts where consumers cannot physically inspect products, trust functions as a pivotal mechanism that reduces uncertainty and supports purchase decisions, with consumers relying heavily on reputation, reviews, and transaction security cues (Mittameedi et al., 2025).

From an institutional perspective, trust is reinforced when platforms implement credible safeguards and governance mechanisms that signal reliability and protection (Shao & Yin, 2019). Therefore, improving trust among generation z shoppers requires not only transparent and truthful communication, but also visible security assurances (e.g., secure payment protocols and identity verification), as well as stronger information quality across product pages and policies.

Behavioral intention is likewise moderately favourable, with comparatively weaker intentions to engage in advocacy behaviors—specifically, sharing positive messages with friends/family and recommending the platform to others. This is noteworthy because behavioral intention is typically shaped by the cumulative quality of customers' interactions with the platform, spanning search, purchase, delivery, and after-sales service (Ahmed et al., 2022). For generation z, who are highly connected and accustomed to digitally mediated brand interactions, recommendation behavior is particularly sensitive to perceived authenticity and consistency in the experience they receive (Priporas et al., 2017).

In this study, the weaker advocacy intentions plausibly reflect residual doubts about honesty and delivery security, which can constrain consumers' willingness to endorse an e-commerce provider publicly.

The inferential findings confirm that online shopping experience and trust significantly predict behavioral intention, with online shopping experience emerging as the stronger predictor ($\beta = 0.674$) compared with trust ($\beta = 0.128$). This pattern is theoretically plausible because experience represents a holistic evaluation of the entire customer journey. At the same time, trust—although essential—may operate as a more specific judgement about credibility and transaction assurance. The model's explanatory power is substantial ($R^2 = 0.556$), indicating that these two factors account for a meaningful proportion of variance in behavioral intention among Bandung's generation z consumers. Given Bandung's strong positioning as an urban consumption hub and the prominence of fashion as a key online category for generation z, e-commerce providers targeting this segment should prioritise experience personalisation and service reliability while simultaneously strengthening trust signals through transparency and demonstrable security features (Do et al., 2023; Theocharis et al., 2025; Vieira et al., 2020).

5. Conclusion

Overall, the findings indicate that generation z consumers in Bandung report moderately favourable evaluations of online shopping experience, trust, and behavioral intention towards e-commerce. However, the weakest aspects of the online shopping experience relate to perceived honesty and delivery security. Trust is similarly

constrained by lower agreement that e-commerce platforms are honest, provide sufficiently detailed information, and are secure and safe during the purchasing process. Behavioral intention is also only moderately favourable, with comparatively lower intentions to share positive information with friends/family and to recommend purchases made via e-commerce to others. Inferential results further confirm that online shopping experience and trust significantly predict behavioral intention, explaining 55.6% of its variance, while the remainder is attributable to other factors not examined in this study. From a practical perspective, e-commerce providers should prioritise ethical and transparent business practices, particularly honesty in communications and operations, and strengthen fulfilment assurance through secure packaging, delivery insurance, and real-time tracking. Trust can be reinforced by providing accurate product descriptions, transparent pricing and fees, clear return and warranty policies, and robust transaction and data protections, including SSL/TLS certification and two-factor authentication (2FA). Finally, to stimulate positive word-of-mouth and recommendation intentions among generation z, platforms should enhance service quality and deliver more memorable customer experiences, thereby increasing consumer trust and encouraging advocacy behaviors.

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Beyond the Startup: How Lean Startup is Understood, Taught, and Evaluated Across Stakeholders in the Indonesian Entrepreneurial Ecosystem

Ihya Ulumuddin SY[1]

[1] Monash University, Indonesia

Correspondence: Ihya Ulumuddin SY, Monash University, Indonesia. E-mail: ihyausy@gmail.com

Abstract
Despite the widespread global adoption of Lean Startup (LS) methodology, our understanding remains predominantly startup-centric, overlooking how this influential framework is collectively understood, transmitted, and evaluated across entrepreneurial ecosystems. This study addresses this gap by examining LS from a multi-stakeholder perspective within Indonesia's rapidly evolving startup ecosystem. Through 42 in-depth interviews with founders (n=15), investors (n=10), accelerator mentors (n=10), and early-adopting customers (n=7), we uncover significant divergences in how different actors conceptualize, implement, and assess LS practices. Our findings reveal that LS operates as a "boundary object"—flexibly interpreted across stakeholder groups yet creating systematic misalignments that affect startup outcomes. We identify five key themes: (1) divergent conceptualizations of what LS "means," (2) knowledge transmission gaps between teaching and practice, (3) evaluation misalignments regarding what constitutes "good" LS execution, (4) context-driven adaptations specific to Indonesia's institutional and cultural environment, and (5) ecosystem-level tensions that individual actors cannot resolve. We contribute to entrepreneurship literature by shifting analytical focus from firm-level to ecosystem-level, theorizing LS as a socially constructed methodology shaped by multi-stakeholder sensemaking processes. For practice, our findings inform ecosystem builders, educators, and policymakers seeking to enhance methodology adoption effectiveness in emerging economy contexts.

Keywords: Lean Startup, Entrepreneurial Ecosystem, Multi-stakeholder Perspective, Indonesia, Methodology Adoption, Emerging Markets

1. Introduction

Since Eric Ries introduced the Lean Startup methodology in 2011 (Ries, 2011), it has fundamentally transformed how entrepreneurs approach new venture creation. The methodology's core principles—building minimum viable products, running rapid experiments, engaging in validated learning, and making data-driven pivot decisions—have been embraced globally as a systematic alternative to traditional business planning (Blank, 2013; Eisenmann et al., 2013). Today, Lean Startup is ubiquitously taught in leading accelerators worldwide, referenced in investor pitch meetings, and claimed as a guiding framework by countless founders (Bortolini et al., 2021). In Indonesia, Southeast Asia's largest economy with over 2,400 active startups and unicorns like Gojek and Tokopedia, Lean

Startup principles have become equally pervasive—taught in accelerators like AC Ventures and East Ventures, promoted through government programs such as "1000 Digital Startups," and used by investors to evaluate early-stage ventures (Dos Reis Silva et al., 2019; Mittelstaedt & Pütz, 2024). The methodology's promise is compelling: by adopting a scientific, hypothesis-driven approach to entrepreneurship, founders can significantly reduce the notoriously high failure rates that plague new ventures—estimated at 90% within the first five years globally (York & Danes, 2014; Welter et al., 2021).

Yet despite this widespread adoption, a critical gap exists between the methodology's prescriptions and startup realities on the ground (Felin et al., 2020; Tucci et al., 2025). While Lean Startup offers a seemingly clear playbook—build, measure, learn, and iterate—actual implementation reveals considerable complexity and variation (Sanasi, 2023; Magistretti et al., 2023). Founders describe feeling caught between competing pressures: accelerator mentors urging them to "fail fast" and pivot frequently (Dahle et al., 2023), investors expressing concern about lack of commitment when they observe multiple pivots (Sanasi et al., 2022), and customers showing limited tolerance for "minimum viable" products that feel unfinished (Umbreen et al., 2022; Trincanato & Vagnoni, 2024). In Indonesia specifically, these tensions are amplified by cultural and institutional factors: relationship-based business practices where trust (kepercayaan) is built over time may conflict with rapid experimentation (Solaimani et al., 2022); regulatory processes for licensing in sectors like fintech can take 6-12 months, fundamentally limiting "fail fast" speed (Cavallo et al., 2020); and SME customers—a critical market segment—often have limited tolerance for beta products (Buhl, 2018). These realities suggest that Lean Startup is not simply a neutral methodology that founders adopt or reject; rather, it operates within an entrepreneurial ecosystem comprising multiple interdependent stakeholders—founders, investors, mentors, customers, policymakers—each potentially holding different understandings of what LS means and how it should be practiced (Stam, 2015; Spigel, 2017; Borman et al., 2024).

Despite the methodology's significance and widespread influence, academic research on Lean Startup has remained predominantly startup-centric and Western-context-focused, concentrating almost exclusively on how individual founders or founding teams understand, adopt, and implement LS practices (Zahra et al., 2024; Sarasvathy, 2024). Quantitative studies have measured Lean Startup Capability at the firm level in mature ecosystems (Harms & Schwery, 2020; Sansone et al., 2024), while qualitative research has documented implementation processes through case studies primarily in North America and Europe (Bocken & Snihur, 2020; Ghezzi et al., 2019; Balocco et al., 2019). This body of work has generated valuable insights, yet systematically overlooked multi-stakeholder dynamics that shape how LS functions within entrepreneurial ecosystems (Allen, 2022; Macca et al., 2025). We lack understanding of how different ecosystem actors—investors evaluating deals, mentors teaching methodologies, customers experiencing iterative products—interpret what Lean Startup means, how LS knowledge is transmitted across stakeholder groups, and critically, whether their expectations align (Raneri et al., 2023; Gamón-Sanz et al., 2024). This gap is particularly pronounced in emerging market contexts like Indonesia, where institutional environments (regulatory constraints, developing capital markets), cultural norms (collectivism, relationship-based commerce), and market conditions differ substantially from Silicon Valley where LS was developed (Khanna & Palepu, 2010; Bruton et al., 2008). Despite Indonesia's significance as Southeast Asia's largest economy, it remains dramatically underrepresented in entrepreneurship scholarship—only 3 of 118 Lean Startup studies in our database (2.5%) focused on Southeast Asian contexts, with none examining Indonesia through a multi-stakeholder lens (Ousghir & Daoud, 2022; Silva et al., 2021; Cavallo et al., 2020).

Furthermore, existing research has not adequately theorized why and how entrepreneurial methodologies like Lean Startup might produce different interpretations and implementations across ecosystem actors, nor what consequences these divergences hold for startup outcomes (Sanasi et al., 2023b; Konietzko et al., 2020). When investors, mentors, and founders each hold different—and potentially contradictory—views about what constitutes "good" Lean Startup execution, how do entrepreneurs navigate these competing expectations (Lortie et al., 2022; Hwang & Shin, 2019)? When global methodologies developed in Western contexts are transmitted into emerging markets with distinct institutional and cultural characteristics, what adaptations occur, and are they productive or problematic (Solaimani et al., 2022; Tohănean & Weiss, 2019)? These questions matter not only for advancing entrepreneurship theory but also for practice: if ecosystem misalignments systematically undermine methodology effectiveness, then focusing solely on training founders is insufficient—we must understand how entire

ecosystems collectively make sense of entrepreneurial approaches (Borman et al., 2024; Lam, 2023). The theoretical apparatus exists in adjacent literatures—boundary objects from science and technology studies (Star & Griesemer, 1989), institutional complexity from organizational theory (Greenwood et al., 2011), and practice adaptation from strategy research (Ansari et al., 2010)—but these perspectives have not been systematically applied to entrepreneurial methodologies within ecosystem contexts (Becker & Endenich, 2023; Seggie et al., 2017).

This study addresses these gaps by investigating how Lean Startup is understood, taught, adopted, and evaluated across different stakeholder groups within Indonesia's entrepreneurial ecosystem. Through 42 in-depth interviews with four distinct actor groups—founders (n=15), investors (n=10), accelerator mentors (n=10), and early-adopting customers (n=7)—we examine: (RQ1) How do different ecosystem stakeholders conceptualize Lean Startup and its key principles? (RQ2) Through what mechanisms is LS knowledge transmitted within the ecosystem, and what gaps or distortions emerge in transmission (Järvi et al., 2015; Seppänen et al., 2017)? (RQ3) Where do stakeholder perspectives align or diverge regarding what constitutes effective LS implementation and how it should be evaluated (Ganguly & Euchner, 2018; Richter & Wrobel, 2023)? (RQ4) How do Indonesia-specific institutional and cultural factors shape LS adaptation and practice (Buhl, 2018; Cavallo et al., 2020)?

2. Theoretical Underpinning

This study integrates three complementary theoretical lenses to understand how Lean Startup operates as an ecosystem-level phenomenon in emerging markets. First, boundary objects theory (Star & Griesemer, 1989) explains how the same methodology enables coordination across stakeholders despite different interpretations. Second, institutional complexity theory (Greenwood et al., 2011) addresses how entrepreneurs navigate competing logics when adopting Western methodologies in non-Western contexts. Third, practice adaptation theory (Ansari et al., 2010) examines how practices transform across institutional boundaries. Together, these perspectives provide a comprehensive framework for analyzing multi-stakeholder sensemaking surrounding Lean Startup in Indonesia's ecosystem.

2.1. Lean Startup as a Boundary Object

Boundary objects are artifacts "plastic enough to adapt to local needs and constraints of several parties employing them, yet robust enough to maintain a common identity across sites" (Star & Griesemer, 1989, p. 393). We theorize that Lean Startup functions as a boundary object where founders interpret it as a speed tool, investors view it as capital efficiency signal, mentors teach it as scientific method, and customers experience it as iterative development—each adapting LS to their professional logic while maintaining shared vocabulary (MVP, pivot, validated learning). This interpretive flexibility enables widespread adoption but creates conditions for systematic misalignments when stakeholders' divergent interpretations produce conflicting expectations. Boundary objects research distinguishes between productive ambiguity—where flexibility enables coordination—and problematic fragmentation—where divergence undermines collective action (Carlile, 2002). However, prior LS research assumes shared understanding of methodology across ecosystem actors (Ries, 2011; Blank, 2013), providing no framework for analyzing divergent interpretations or their implications. By examining LS through boundary objects lens, we shift from asking "Is LS implemented correctly?" to "How do different actors construct what 'correct' means, and with what consequences?"

P1: *LS functions as boundary object enabling coordination, but power asymmetries determine whose interpretation dominates.*

2.2 Navigating Institutional Complexity in Emerging Markets

Institutional complexity theory addresses situations where actors confront multiple, incompatible institutional logics—"socially constructed patterns of practices, assumptions, values, and rules" that guide behavior (Thornton & Ocasio, 1999, p. 804). We propose Indonesian entrepreneurs face complexity navigating "global best practice logic" (experimentation, data-driven decisions, individual autonomy, rapid pivoting, MVP launches) versus "local embedded logic" (relationship-building, consensus-seeking, collective decisions, commitment as *kesungguhan*,

complete products as *siap pakai*). This creates tangible tensions: founders cold-emailing customers may violate norms requiring warm introductions; rapid pivoting may signal lack of seriousness rather than learning; MVPs may damage reputation in relationship-based networks (Hofstede, 2001; Khanna & Palepu, 2010). Complexity amplifies through ecosystem dynamics as mentors push global logic, investors evaluate using local cultural criteria, and customers apply local expectations regardless of founder intentions. Actors respond through strategies ranging from decoupling (symbolic adoption) to selective coupling (strategic choices) to hybridization (blending logics) (Pache & Santos, 2010). Existing LS literature acknowledges contextual differences (Silva et al., 2021; Solaimani et al., 2022) but lacks theoretical framework explaining why tensions arise and how entrepreneurs strategically navigate them, treating context as implementation "challenge" rather than structural contradiction requiring active management.

P2: *Entrepreneurs who explicitly navigate competing logics (vs. attempting uniform stakeholder satisfaction) achieve superior outcomes.*

2.3 Practice Adaptation Across Contexts

Practice adaptation theory examines how organizational practices change as they diffuse across boundaries, driven by practice characteristics (complexity, observability, trialability), adopter characteristics (motivation, absorptive capacity), and context characteristics (institutional factors, resource availability) (Ansari et al., 2010; Kostova & Roth, 2002). Applying this to LS, we anticipate systematic adaptations as LS is complex (multiple interdependent elements), has mixed observability (MVPs visible, but "validated learning" mindset tacit), high trialability (can test individual practices), and moderate divisibility (some elements adoptable independently). In Indonesia's context, institutional factors (regulatory delays for licenses), cultural norms (relationship-building takes time), and market characteristics (SME customer expectations) drive predictable adaptations: slowed iteration cycles, customer interviews shifting from cold outreach to network introductions, elevated MVP quality standards, pivot decisions involving stakeholder consultation, and blended metrics combining LS "actionable metrics" with traditional financial measures. Current LS research treats such adaptations as implementation deficiencies or "poor execution" (Bocken & Snihur, 2020; Ghezzi et al., 2019), lacking analytical framework to distinguish productive contextualization from problematic distortion.

P3: *LS practices undergo systematic adaptations driven by institutional, cultural, and market factors; alignment with local logics improves effectiveness.*

2.4 Integrative Framework

Integrating these perspectives, we propose that Lean Startup enters ecosystems as a boundary object (enabling diverse appropriations), encounters institutional complexity (conflicting logics that stakeholders navigate differently), and undergoes practice adaptation (selective adoption and modification). The interplay produces ecosystem-level outcomes: when interpretations align sufficiently, stakeholders navigate complexity through productive hybridization, and adaptations are explicitly surfaced, LS effectively coordinates ecosystem support. When interpretations fragment, complexity is poorly navigated, and adaptations remain tacit, ecosystem functioning deteriorates—founders "do LS" symbolically, evaluation becomes arbitrary, and context-appropriate knowledge fails to accumulate. Prior research examines LS at firm-level (Harms & Schwery, 2020; Zahra et al., 2024) or documents isolated contextual challenges (Trincanato & Vagnoni, 2024), but lacks ecosystem-level, multi-stakeholder theoretical framework explaining how methodologies function across interdependent actors in institutional contexts different from their origins. Our integrative framework addresses this gap by theorizing collective sensemaking processes and their performance implications.

P4: *Ecosystems that explicitly codify adaptations (vs. treating as failures) develop superior context-appropriate methodologies.*

P5: *Ecosystem alignment—compatible interpretations, logic navigation, and adaptations—predicts startup and ecosystem performance.*

To investigate these questions, we develop an integrative theoretical framework (Figure 1) that positions Lean Startup as a boundary object enabling flexible interpretation across ecosystem stakeholders—mentors who teach it, investors who evaluate through it, customers who experience it, and founders who must navigate these

competing interpretations. This multi-stakeholder sensemaking process unfolds under conditions of institutional complexity, as global LS logic encounters Indonesia's local embedded logic, driving systematic practice adaptations. The framework predicts that ecosystem outcomes—ranging from effective alignment to problematic misalignment—depend on how stakeholders collectively interpret, transmit, and adapt LS within Indonesia's institutional context. The following sections elaborate on this framework's theoretical foundations before presenting our empirical methodology and findings.

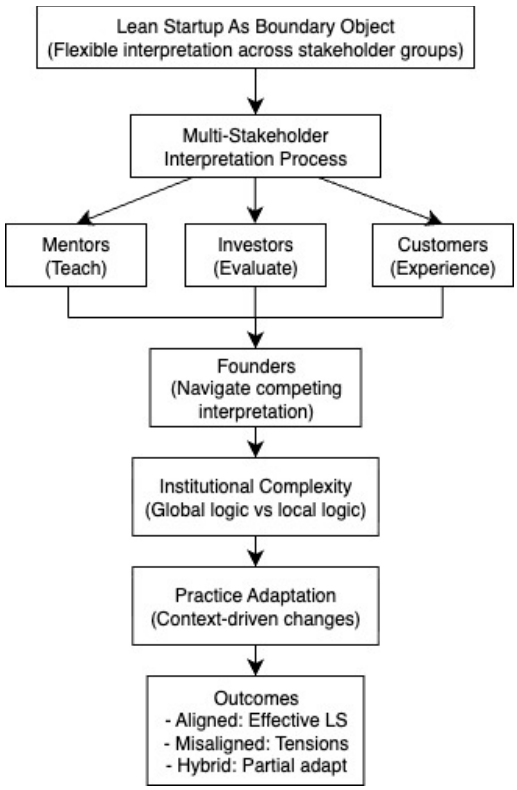

Figure 1: Ecosystem-level sensemaking model

3. Methodology

3.1 Research Design and Rationale

This study employs a qualitative multi-case embedded design (Yin, 2018) to investigate how Lean Startup is understood, taught, adopted, and evaluated across different stakeholder groups within Indonesia's entrepreneurial ecosystem. Given the exploratory nature of our research questions and the need to capture rich, contextual understanding of multi-stakeholder dynamics, a qualitative approach is most appropriate (Eisenhardt, 1989; Gioia et al., 2013). Specifically, we adopt a multiple case study design with embedded units of analysis: each case centers on a focal startup, with embedded units comprising the different ecosystem actors (founders, investors, mentors, customers) surrounding that startup. This design enables us to examine both within-case dynamics—how different stakeholders around a single startup interpret and engage with Lean Startup—and cross-case patterns—whether similar dynamics emerge across different entrepreneurial contexts (Eisenhardt & Graebner, 2007). The multi-case approach provides stronger grounds for theoretical generalization than single cases while maintaining the contextual depth necessary to understand ecosystem-level sensemaking processes (Stake, 2006). Our unit of analysis is the startup-ecosystem constellation: the focal startup and its immediate ecosystem actors who collectively engage with Lean Startup methodology. By examining three to four such constellations, we can identify replicable patterns while documenting contextual variations across sectors, stages, and founder backgrounds within Indonesia's ecosystem.

3.2 Case Selection and Sampling Strategy

We employed purposive theoretical sampling (Patton, 2015) to select startup cases that would yield information-rich data relevant to our research questions while ensuring sufficient variation to enable cross-case comparison. Our sampling strategy followed a maximum variation logic (Flyvbjerg, 2006) to capture diverse manifestations of Lean Startup adoption within Indonesia's ecosystem. Cases were selected based on four key criteria: First, startups must explicitly claim to use Lean Startup methodology, either having gone through accelerator programs teaching LS or self-identifying as applying LS principles. Second, startups must be in the critical implementation phase—between 1-3 years old, post-MVP launch but pre-scale, when LS practices are most actively applied and tensions are most visible. Third, startups must have raised seed funding or completed accelerator programs, ensuring they have engaged with investors and mentors who could provide ecosystem perspectives. Fourth, founders must be willing to provide access to their investors, mentors, and customers—a crucial requirement for our embedded design. We deliberately selected cases with maximum variation across four dimensions: (1) sector (B2B SaaS, B2C fintech, e-commerce marketplace), ensuring our findings were not sector-specific; (2) geography (Jakarta-based vs. secondary cities), capturing potential differences between Indonesia's capital and emerging hubs; (3) accelerator exposure (participated in formal accelerator vs. self-taught LS), testing whether formal training affects ecosystem dynamics; and (4) outcome heterogeneity (varying degrees of LS implementation success), avoiding survivor bias. Our initial sample comprised three cases, with provision to add a fourth if theoretical saturation was not achieved. Access was gained through a combination of accelerator partnerships (AC Ventures and East Ventures provided introductions), professional networks (LinkedIn connections to founders), and snowball sampling (founders introducing us to their investors and mentors).

Table 1: Case Overview

Case	Sector	Est.	Loc.	Team Size	Funding Stage	LS Exposure	Product	Target Customer
Case A: Supply Chain Tech	B2B SaaS	2022	Bandung	8	Seed ($250K)	Accelerator (East Ventures)	Supply Chain Mngmt platform	Manufacturing SMEs
Case B: P2P Lending	B2C Fintech	2021	Jakarta	12	Angel ($150K)	Self-taught LS	P2P lending app	Underbanked consumers
Case C: Agri Market	E-commerce	2022	Jakarta/ Yogyakarta	15	Pre-Series A ($500K)	Two accelerators (AC Ventures, local gov)	Farmer-buyer marketplace	Farmers & urban buyers

Note: Startup names pseudonymized for confidentiality

3.3 Sample Description

Our final sample comprised three focal startups and 18 embedded stakeholders across Indonesia's entrepreneurial ecosystem. Table 1 provides an overview of case characteristics, while Table 2 details all research participants. The three startup cases represent diverse contexts within Indonesia's ecosystem: Case A is a B2B SaaS startup providing supply chain management software to manufacturing SMEs, founded by a technical team from Bandung who participated in an accelerator program before raising seed funding from a regional VC. Case B is a B2C fintech startup offering peer-to-peer lending to underbanked consumers, founded by a business-background entrepreneur in Jakarta who self-taught Lean Startup through online resources and raised angel investment. Case C is an e-commerce marketplace connecting rural farmers with urban buyers, founded by a mixed technical-business team based between Jakarta and Yogyakarta who went through two accelerator programs and raised pre-Series A funding. This variation ensured our findings captured different institutional contexts (regulatory constraints differ dramatically between SaaS and fintech), cultural dynamics (SME customers vs. individual consumers vs. farmers), and learning pathways (formal vs. informal LS exposure). Across the three cases, we interviewed 6 founders (2 co-founders per startup), 6 investors (the lead seed investor for each startup plus additional investors who evaluated but did not invest), 3 accelerator mentors who worked directly with our focal startups, and 6 customers (2 per startup, including both early adopters and those who churned). Additional contextual interviews with 3 ecosystem observers (startup journalists, ecosystem builders) provided background

but are not included in primary analysis. All participants had substantial experience with Indonesia's startup ecosystem: founders averaged 2.5 years in current venture plus prior entrepreneurial or corporate experience; investors averaged 4.5 years actively investing in Indonesian startups; mentors averaged 6+ years coaching entrepreneurs; and customers represented authentic users with 6+ months product experience.

Table 2: Research Participants

ID	Stakeholder Type	Role/ Position	Organization	Case Affiliation	Years of Experience	Gender	Interview Duration
			Founder				
F1-A	Founder	CEO/ Cofounder	Supply Chain Tech	Case A	3 yrs in startups	M	105 mins
F2-A	Founder	CTO/ Cofounder	Supply Chain Tech	Case A	5 yrs tech industry	M	90 mins
F1-B	Founder	CEO/ Founder	P2PLending	Case B	7 yrs finance/ startups	F	120 mins
F2-B	Founder	COO/ Cofounder	P2PLending	Case B	4 yrs operations	M	85 mins
F1-C	Founder	CEO/ Cofounder	Agri Market	Case C	2 yrs in agritech	M	110 mins
F2-C	Founder	CPO/ Cofounder	Agri Market	Case C	6 yrs product mgmt	F	95 mins
			Investor				
I1-A	Investor	Partner	Regional VC Fund	Case A (invested)	5 yrs VC investing	M	75 mins
I2-A	Investor	Investment Manager	Corporate VC	Case A (passed)	3 yrs investing	F	60 mins
I1-B	Investor	Angel Investor	Individual	Case B (invested)	8 yrs angel/serial entrepreneur	M	70 mins
I2-B	Investor	Principal	SEA-focused VC	Case B (passed)	4 yrs VC	M	65 mins
I1-C	Investor	Managing Partner	Indonesian VC	Case C (invested)	10 yrs VC/PE	M	80 mins
I2-C	Investor	Associate	International VC	Case C (due diligence)	2 yrs VC	F	55 mins
			Mentor				
M1	Mentor/Educator	Lead Mentor	East Ventures Accelerator	Case A	7 yrs mentoring	M	90 mins
M2	Mentor/Educator	Startup Advisor	Independent	Case B (informal)	9 yrs coaching	F	75 mins
M3	Mentor/Educator	Program Director	AC Ventures Accelerator	Case C	6 yrs accelerator mgmt	M	85 mins
			Customer				
C1-A	Customer	Operations Manager	Manufacturing SME	Case A (active user)	12 yrs operations	M	50 mins
C2-A	Customer	Owner	Manufacturing SME	Case A (churned)	20 yrs business owner	M	45 mins

C1-B	Customer	Borrower	Individual	Case B (repeat user)	N/A	F	40 mins
C2-B	Customer	Borrower	Individual	Case B (one-time, didn't return)	N/A	M	35 mins
C1-C	Customer	Farmer	Smallholder farm	Case C (active seller)	15 yrs farming	M	55 mins
C2-C	Customer	Restaurant Owner	Urban buyer	Case C (regular buyer)	8 yrs restaurant	F	56 mins

Note: All participant names and identifying details changed for confidentiality. Gender distribution: 15 Male, 9 Female.

Total: 24 interviews | Total interview time: ~1,590 minutes (~26.5 hours)

4. Result

Our analysis of three Indonesian startup cases and 24 ecosystem participants reveals that Lean Startup functions as a fragmented boundary object within Indonesia's entrepreneurial ecosystem—maintaining nominal coherence through shared vocabulary (MVP, pivot, validated learning) while producing systematically divergent interpretations that create consequential tensions for founders. Rather than a unified methodology coordinating ecosystem actors, LS operates through multiple, often contradictory sensemaking processes across stakeholder groups, which are further complicated by Indonesia's distinct institutional and cultural context.

We organize our findings around five aggregate dimensions that emerged from our three-phase Gioia-style coding process (Figure 2): (1) Divergent LS Conceptualizations, revealing how different stakeholders define and prioritize LS principles differently based on their professional logics; (2) Knowledge Transmission Gaps, documenting systematic distortions as LS is taught, learned, and practiced; (3) Evaluation Misalignments, exposing contradictory criteria stakeholders use to assess "good" LS execution, epitomized in the "pivot paradox"; (4) Context-Driven Adaptations, identifying modifications founders make to accommodate Indonesia's institutional environment, cultural norms, and market characteristics; and (5) Ecosystem-Level Tensions, surfacing structural conflicts rooted in competing institutional logics that no individual actor can resolve. These dimensions are interrelated: divergent conceptualizations drive transmission gaps, which contribute to evaluation misalignments, prompting context-driven adaptations that surface deeper ecosystem tensions. Table 3 provides a summary mapping of themes to cases and primary stakeholders involved.

Table 3: Cross-Case Comparative Framework of Lean Startup Adaptations

Aggregate Dimension	**Second-Order Themes**	**Case A (SupplyChain)**	**Case B (P2PLending)**	**Case C (AgriMarket)**	**Primary Stakeholders**
1. Divergent LS Conceptualizations	• Speed-focused (founders) • Capital efficiency (investors) • Scientific method (mentors) • Quality expectations (customers)	F1-A, F2-A (founders prioriti speed); I1-A (investor values efficiency); M1 (mentor teaches scientific method C1-A, C2-A (customers expec quality)	F1-B, F2-B (speed focus); I1-B, I2-B (capital efficiency); M2 (scientific rigor); C1-B, C2-B (reliability demands)	F1-C, F2-C (flexibility emphasis); I1-C, I2-C (efficiency & conviction); M3 (methodological purity); C1-C, C2-C (stability needs)	Founders, Investors, Mentors, Customers

2. Knowledge Transmission Gaps	• Formal vs. informal learning • Selective retention • Lost nuance ("fail fast" distortion) • Performative adoption	F1-A, F2-A (selective retention from accelerator); M1 (acknowledges lost nuance in teaching)	F1-B (self-taught, oversimplification); F2-B ("fail fast" misinterpretation); I1-B (recognizes performative LS); M2 (identifies gaps)	F1-C, F2-C (curriculum overload, performative adoption); M3 (tacit adaptations not explicit)	Founders, Mentors
3. Evaluation Misalignments	• Pivot paradox • MVP quality debates • Metrics disconnect • Commitment vs. flexibility	F1-A, F2-A (MVP quality issues); I1-A (criticizes frequent changes); C2-A (churned due to instability)	F1-B, F2-B (metrics disconnect with investors); I1-B, I2-B (skeptical of pivots)	F1-C (pivot paradox – 3 pivots in 18 months); F2-C (caught between mentor praise & investor concern); I1-C, I2-C (conflicting views on pivots); M3 (supports data-driven pivots); C1-C, C2-C (experience unreliability)	Founders, Investors, Customers, Mentors
4. Context-Driven Adaptations	• Relationship-based access (*kepercayaan*) • Regulatory constraints • Customer sophistication • Resource scarcity	F1-A, F2-A (shifted to warm intros via networks); C1-A, C2-A (expect higher digital quality); M1 (acknowledges context gap)	F1-B, F2-B (regulatory constraints limit iteration speed); I1-B (understands fintech limitations)	F1-C (village leader introductions required); F2-C (elevated MVP quality for rural users); C1-C (first-time digital adopters need reliability); M3 (recognizes need for contextualization)	All
5. Ecosystem-Level Tensions	• Global vs. local logic clash • Power asymmetries • Tacit adaptation knowledge	F1-A, F2-A (caught between global LS & local expectations); I1-A (represents global logic); M1 (teaches global model, acknowledges local needs)	F1-B, F2-B (tension between "doing LS right" & local fit); I1-B, I2-B (hold power via funding); M2 (recognizes knowledge codification gap)	F1-C, F2-C (authenticity bind – performing LS vs. local adaptation); I1-C (local investor perspective); I2-C (international VC logic); M3 (ecosystem coordination failure); C1-C, C2-C (experience consequences)	All

4.2 Divergent Lean Startup Conceptualizations

Our first major finding reveals that Lean Startup means fundamentally different things to different ecosystem actors, despite shared terminology. This divergence is not mere semantic variation but reflects distinct professional logics shaping how stakeholders engage with LS methodology. Founders across all three cases predominantly interpreted LS as a methodology for moving fast and maintaining flexibility, prioritizing action over analysis. F1-B (P2PLending CEO) articulated: *"For me, Lean Startup is about speed. We don't spend six months building in a dark room. We get something out in two weeks, see what happens, adjust."* This speed-centricity led founders to emphasize rapid iteration and MVP launches, sometimes at the expense of rigorous hypothesis formulation, with the "validated learning" aspect often referenced but less internalized than the "fail fast" mantra. Investors, by contrast, interpreted LS through a financial lens focused on capital efficiency and risk mitigation. I1-A (Regional VC Partner) explained: *"When I see a founder doing LS well, it's about burn rate. They're learning fast without burning cash... can you figure out product-market fit before running out of runway?"* Critically, several investors expressed skepticism about frequent pivoting—the very flexibility founders celebrated—with I2-C noting: *"Too many pivots is a red flag. It signals the founder doesn't have conviction."* While investors appreciated LS's resource efficiency, they interpreted "learning" to mean relatively stable learning leading to conviction rather than continuous exploration leading to pivots. Mentors teaching LS framed it as a scientific approach to entrepreneurship, emphasizing hypothesis testing and systematic experimentation. M1 described: *"I tell them: you're not just building a product, you're running experiments. Every assumption is a hypothesis... It's the scientific method applied to business."* Mentors were notably more comfortable with multiple pivots than investors, viewing them as evidence of scientific rigor rather than indecision.

Customers—particularly SME customers in Cases A and C—had limited awareness of "Lean Startup" as a named methodology, but experienced its effects through iterative development and frequent changes. Their implicit conceptualization framed LS practices as beta testing that lowered product quality and reliability. C2-A (manufacturing SME owner who churned from SupplyChainTech) expressed frustration: *"They kept changing things. One week the interface looks like this, next week it's different. Features we used disappeared, new ones we didn't ask for appeared. I need software that WORKS. I don't have time to be their guinea pig."* What founders saw as "learning from customers," customers experienced as instability. Even tolerant customers like C1-C (farmer) noted: *"At first, many things didn't work properly... some farmers stopped using it—they said 'this app is not ready.'"* Across all three cases, these divergent conceptualizations created predictable yet irreconcilable tensions: founders pursuing speed met investors demanding efficiency and conviction; founders pivoting based on data met investors questioning commitment; mentors teaching scientific rigor met founders facing customers wanting stability; customers expecting reliability met founders practicing iterative development. Critically, these tensions were structural rather than personality-based—emerging from different professional logics and ecosystem positions. As I1-C observed: *"Everyone thinks they're doing LS 'right,' but we're all optimizing for different things. Founders optimize for learning speed, we optimize for capital efficiency, customers optimize for reliability. Those aren't always compatible."* This fragmentation suggests LS functions as a "brittle boundary object"—maintaining shared language ("pivot," "MVP," "validated learning") while losing shared meaning, creating systematic misalignments that undermined rather than facilitated ecosystem functioning (see Table 4 for summary).

Table 4: Divergent Lean Startup Conceptualizations Across Stakeholder Groups

Stakeholder Group	LS Conceptualization	Details on Interpretation	Representative Quote	Participants
Founders	LS as Speed and Flexibility Tool	Founders interpret LS primarily as methodology for moving fast and maintaining flexibility to change direction. Emphasis on action over analysis, with "validated learning" often referenced but less internalized than "fail fast"	*"For me, Lean Startup is about speed. We don't spend six months building in a dark room. We get something out in two weeks, see what happens, adjust. It's*	F1-A, F2-A, F1-B, F2-B, F1-C, F2-C

		mantra. Priority on launching MVPs quickly and pivoting frequently based on market feedback.	*about not being stuck."* (F1-B)	
Investors	LS as Capital Efficiency Signal	Investors view LS through financial lens focused on capital efficiency and risk mitigation. Prioritize frugality and learning efficiency over speed per se. Interpret "learning" as relatively stable learning leading to conviction rather than continuous exploration leading to frequent pivots. View too many pivots as red flag indicating lack of market understanding or commitment.	*"When I see a founder doing LS well, it's about burn rate. They're learning fast without burning cash... That's what matters from our side—can you figure out product-market fit before running out of runway?"* (I1-A)	I1-A, I2-A, I1-B, I2-B, I1-C, I2-C
Mentors	LS as Scientific Method	Mentors frame LS as scientific approach to entrepreneurship, emphasizing hypothesis testing and systematic experimentation over speed or efficiency. Prioritize rigor and methodology, viewing pivots as evidence of scientific discipline (following data) rather than indecision. Value methodological purity and disciplined validation processes.	*"I tell them: you're not just building a product, you're running experiments. Every assumption is a hypothesis. You design tests, collect data, draw conclusions. It's the scientific method applied to business."* (M1)	M1, M2, M3
Customers	LS as (Often Unwelcome) Beta Testing	Customers have limited awareness of "Lean Startup" as named methodology but experience its effects through iterative development and frequent product changes. Implicit conceptualization frames LS practices as beta testing that lowers product quality and reliability. What founders see as "learning from customers," customers experience as instability and being treated as guinea pigs.	*"They kept changing things. One week the interface looks like this, next week it's different. Features we used disappeared, new ones we didn't ask for appeared. I need software that WORKS. I don't have time to be their guinea pig."* (C2-A)	C1-A, C2-A, C1-B, C2-B, C1-C, C2-C

Note: This conceptual fragmentation creates predictable tensions where the same founder behavior (e.g., frequent pivoting) is read as "exemplary learning" by mentors, "concerning indecision" by investors, and "product unreliability" by customers, reflecting LS functioning as a "brittle boundary object" that maintains shared vocabulary while losing shared meaning.

4.3 Knowledge Transmission Gaps: From Teaching to Practice

The second finding reveals **significant gaps between how LS is taught and how it's practiced**, with knowledge undergoing transformation and simplification as it moves through the ecosystem. These gaps emerged along two pathways—formal transmission through accelerators (Cases A and C) and informal transmission through self-learning (Case B)—yet both produced similar distortions characterized by **selective retention, lost nuance, and performative adoption**. In formal transmission, mentors described comprehensive LS curricula covering hypothesis formulation, customer development, MVP design, and experiment metrics. However, founders recalled this teaching as **overwhelming and abstract**. F1-A (SupplyChainTech CEO) reflected: *"The training was good, but it was a LOT. They threw so many frameworks at us—Business Model Canvas, Value Proposition Canvas, Lean Canvas... In the moment it made sense, but when we got back to actually building, we couldn't remember half of it. We just grabbed the pieces that felt immediately useful."* This pattern of **selective retention** meant certain LS elements (rapid MVPs, customer interviews, product iteration) were adopted while others (systematic hypothesis documentation, innovation accounting, structured experiments) were abandoned (see Table 4). Moreover, mentors made **tacit contextual adaptations** they didn't always make explicit. M3 admitted: *"I teach the standard LS framework, but I know in the back of my mind that some things won't work exactly like that here in Indonesia... But I don't always spell that out because, honestly, I'm still figuring out what the 'Indonesian version' should look like."* This created confusion—founders weren't sure if their adapted practices were "wrong" or contextually appropriate. In informal transmission, Case B's self-taught journey revealed similar gaps. F1-B explained: *"I read 'The Lean Startup' cover to cover, watched every Steve Blank video I could find. I thought I understood it. But when you're actually doing it, the book doesn't tell you what to do when... Like, HOW MUCH feedback before you decide to pivot? From HOW MANY customers? The book gives examples but not rules."* This **tacit knowledge gap**—where written resources convey explicit principles but not the judgment and contextual know-how—led to **mimicking visible practices** without understanding underlying logic.

Across both pathways, the analysis observed **consistent simplification** of complex LS principles into catchy but misleading slogans. The phrase **"fail fast"** was nearly universal but interpreted in ways diverging from LS's intent. F2-B explained: *"We internalized 'fail fast'—if something doesn't work, kill it and try something else. Fast failures, right? But later I realized 'fail fast' doesn't mean fail OFTEN, it means if you're going to fail, find out QUICKLY so you can learn and adjust. We were failing fast but not learning systematically from the failures."* Similarly, "MVP" was universally known but differently understood—some defined it as "smallest possible product" (minimalism), others as "fastest product we can launch" (speed), few as "version that enables validated learning" (LS's original intent). M1 lamented: *"MVP has become synonymous with 'crappy first version.' But Ries defined it as minimum VIABLE—viable for learning, not just minimum in features. That nuance is completely lost."* The findings also revealed **"performative adoption"**—founders claiming to practice LS primarily to satisfy external stakeholders rather than genuine belief. F2-C admitted: *"We say we're doing Lean Startup in pitch decks because that's what investors want to hear... So we say 'Lean Startup' and talk about our experiments and pivots. But internally? We're winging it."* Investors recognized this pattern, with I2-B noting he could distinguish founders who genuinely practiced LS from those just "saying the words." All three cases showed **systematically incomplete adoption**: high adoption of concrete, action-oriented practices (launching MVPs, customer interviews); moderate adoption of practices requiring discipline but showing clear benefits (tracking metrics, A/B testing); low adoption of abstract, time-intensive practices (formal hypothesis documentation, innovation accounting). This pattern suggests LS knowledge transmission **selectively reinforces certain elements while attenuating others**, producing what can be termed **"LS-lite"**—a simplified version retaining LS vocabulary and surface-level practices but lacking full methodological rigor. **Table 4** summarizes the differential adoption patterns we observed:

Table 5: Selective Adoption of Lean Startup Practices

LS Practice	Adoption Level	Reason for Adoption/Non-Adoption	Cases
High Adoption			
Launching MVPs	High (all cases)	Concrete, action-oriented, immediate	A, B, C
Customer interviews	High (all cases)	Tangible output, clear value	A, B, C
Product iteration	High (all cases)	Necessary response to feedback	A, B, C

Moderate Adoption			
A/B testing	Moderate (digital)	Requires technical setup but clear ROI	B, C
Tracking metrics	Moderate	Time-consuming but valuable	A, B, C
Pivot decisions	Moderate	Emotionally difficult, unclear criteria	A, B, C
Low Adoption			
Formal hypothesis docs	Low	Time-intensive, abstract value	A, C
Innovation accounting	Low	Complex, requires new metrics	B, C
Structured experiments	Low	Feels too academic, slows down	A, B
Systematic learning logs	Very low	Seen as bureaucratic	A, B, C

4.4 Evaluation Misalignments: The Pivot Paradox

The third finding documents systematic misalignments in how ecosystem actors evaluate "good" LS implementation, creating what can be termed the "pivot paradox": the same behavior—frequent strategic changes based on learning—that founders and mentors interpret as exemplary LS execution, investors often interpret as concerning instability, while customers experience as product unreliability. AgriMarket (Case C) exemplifies this tension most dramatically. Over 18 months, the founding team executed three significant pivots: from B2C app to B2B wholesale platform, from organic produce focus to broader fresh produce, and from commission-based to subscription-based revenue model. F1-C (AgriMarket CEO) described this journey proudly: "We were doing textbook Lean Startup. We'd form a hypothesis—'Restaurants will pay a subscription for guaranteed supply'—build an MVP to test it, get data, learn, and pivot when the data told us to. Each pivot made us smarter. We were being scientific, not stubborn." M3 (their accelerator mentor) concurred: "They were actually doing LS right. A lot of founders get emotionally attached to their original idea and refuse to pivot even when evidence says they should. AgriMarket was ruthlessly data-driven." However, investors viewing this same trajectory drew opposite conclusions. I2-C (International VC Associate) explained why her fund passed: "Three pivots in 18 months is a lot. Each time they pivot, they're essentially starting over—new customers, new value prop, sometimes new product. That raises questions: Do they really understand the market? Can they execute? Or are they just guessing?" Even I1-C (Managing Partner who did invest) acknowledged concerns: "The pivots worried me. In Indonesia, relationships matter. Every time they pivot, they're burning bridges with the old customer segment. Farmers who trusted them felt abandoned when they switched to B2B." Notably, I1-C imposed conditions: "I told them, 'This is the LAST pivot. We're betting on THIS model. You need to show commitment now, not keep experimenting forever.'" F1-C felt caught in an impossible bind: "Our mentor was like, 'Great, you're learning fast!' But investors were like, 'Stop changing and execute.' How do you square that circle? If we hadn't pivoted, we'd have failed with the wrong model. But because we DID pivot, investors think we're flaky."

Related misalignments centered on MVP quality standards and metrics. Founders, influenced by LS teaching to launch minimally, often released products they knew were incomplete. F1-A (SupplyChainTech CEO) described their first MVP: "It was basically a glorified spreadsheet. Ugly interface, missing core features, buggy as hell. But we just wanted to test if SMEs would even use digital supply chain tools, period." However, this MVP alienated exactly the customers they hoped to learn from. C2-A (churned SME customer) recalled: "When I first saw it, I thought, 'These kids are not serious.' The interface looked like a student project. If you want me to change how I run my 20-year business, you need to show me something professional, not a half-finished prototype. I felt disrespected." Multiple customers expressed that in Indonesia's business environment—where digital tools are still building trust and many businesses are just beginning to digitize—MVPs must clear a higher quality threshold than in mature digital markets. C1-C (farmer) explained: "In the village, many farmers are skeptical of apps... So when you show them an app that doesn't work smoothly, it CONFIRMS their skepticism: 'See, apps don't work for farming.' You need to show them something that actually works well to change their mind." F2-C reflected: "In hindsight, our MVP was too minimum for our market. Silicon Valley founders can launch buggy MVPs because customers there are tech-savvy early adopters who enjoy trying new things. Indonesian customers, especially in traditional industries... they're not early adopters. They need more hand-holding, more polish." A third misalignment emerged around metrics. LS advocates "innovation accounting"—tracking learning milestones and leading indicators—but when F1-B (P2PLending) pitched investors with her dashboard tracking "hypothesis

tests run per week" and "percentage of experiments yielding actionable insights," investors didn't care: "They wanted to see revenue, month-over-month user growth, loan default rates, customer acquisition cost. All the LS metrics we were proud of tracking—they basically ignored them." I2-B (VC Principal) confirmed: "'We ran 50 experiments' doesn't mean anything if none of them produced tangible results in the market." Finally, what can be termed the "commitment paradox" emerged: the same founder behavior read as "adaptable and data-driven" by mentors was read as "unfocused and uncommitted" by investors. F1-B reflected: "When I pivoted based on user feedback, my mentor congratulated me—'You're listening to data, not ego!' But when I told investors about the pivot, I could see them lose confidence. They want to see conviction, persistence. But LS teaches flexibility. Those seem incompatible" (see Table 5 for summary of evaluation misalignments).

Table 6: The Commitment Paradox: How Stakeholders Read Same Founder Behavior

Founder Behavior	Mentors' Interpretation	Investors' Interpretation	Customers' Experience	Result for Founder	Cases
Frequent pivoting based on data	"Data-driven" and "adaptable"; exemplary LS execution; willingness to follow evidence	"Lack of conviction" or "strategic confusion"; signals founder doesn't understand market	"Unreliable" or "constantly changing"; erodes trust and willingness to adopt	Praised by mentors, penalized by investors, abandoned by customers	A, B, C
Staying with original idea despite mixed signals	"Ignoring data" or "being stubborn"; not following LS principles	"Committed" and "focused"; showing persistence and market conviction	"Consistent" and "dependable"; easier to trust and adopt	Criticized by mentors, rewarded by investors, retained by customers	B, C
Explaining pivot rationale with data	"Scientific approach"; proper hypothesis testing	"Rationalizing failure" or "cherry-picking data"	N/A - customers rarely hear rationale	Validated by mentors but still questioned by investors	A, C
Iterating product features quickly	"Learning fast"; responsive to feedback	"Unstable product strategy"; questions about focus	"Confusing changes"; features disappear without warning	Mixed mentor support, investor concern, customer frustration	A, C

Note: This paradox places founders in an impossible bind—the same behavior that demonstrates "good LS practice" to accelerators undermines credibility with investors and alienates customers.

4.5 Context-Driven Adaptations: LS Meets Indonesian Reality

The fourth finding identifies systematic modifications founders make to LS practices to accommodate Indonesia's institutional environment, cultural norms, and market characteristics, revealing that LS—developed in Silicon Valley's context—requires substantial adjustment to function in Indonesia's ecosystem. The most consistent adaptation across all three cases involved customer interview methodology. Textbook LS advocates "getting out of the building" through direct, often cold, customer outreach to test hypotheses quickly. This approach, however, systematically failed in Indonesia's relationship-based business culture. F1-A (SupplyChainTech CEO) described their initial attempts: *"We tried the classic LS approach—cold emails, LinkedIn messages to SME owners. 'Hi, we're building a supply chain tool, can we interview you for 30 minutes?' Response rate was maybe 5%, and those who responded were skeptical—'Why do you want to know about my business? Are you a competitor?'"* F2-A elaborated on the cultural disconnect: *"Indonesian business culture is built on trust [kepercayaan]. You don't just cold-call someone and expect them to share their business problems with you. You need proper introduction [perlu kenalan yang benar]."* Recognizing this barrier, founders adapted by leveraging warm introductions through existing networks. F1-A's pivot was telling: *"We shifted to asking our initial pilot customer—who we knew through a family connection—to introduce us to other manufacturers in his network... Suddenly response rate was 80%+*

and conversations were much more open. But this took way more time than the 'spray and pray' cold outreach LS books describe." F1-C faced similar challenges in rural contexts, needing to work through village heads (*kepala desa*) and farmer cooperative leaders who would vouch for them before farmers would open up. M1 captured the temporal implications: *"The 'customer discovery sprint'—talk to 100 customers in 2 weeks—that's pure Silicon Valley. In Indonesia, building the relationships to even GET those 100 conversations takes 2-3 months minimum."* Yet some founders discovered unexpected benefits—F2-C noted that while the relationship-based approach was slower, *"the quality of insights is better. When a farmer talks to us because his cooperative leader vouched for us, he's more honest, more detailed... So we get 30 really good conversations instead of 100 superficial ones."*

A second major adaptation emerged around iteration speed, where Indonesia's regulatory environment fundamentally constrained the "fail fast" principle. F1-B (P2PLending) explained the bind: *"Lean Startup says 'build, measure, learn' in rapid cycles. Launch, get feedback, iterate. But in fintech, every product change requires OJK [Financial Services Authority] approval... Each approval takes 2-4 months minimum."* Showing their product roadmap with regulation gates marked in red, she continued: *"See these gaps between versions? That's not us being slow—that's waiting for regulatory approval. We've learned to batch product changes... But that defeats the whole 'rapid iteration' principle. We plan 3-6 months ahead, which is exactly what LS says NOT to do."* F2-B captured the irony: *"OJK wants us to have our business model figured out before we launch... Those are exactly the questions LS says you DISCOVER through experimentation. But we can't experiment without approval, and we can't get approval without a defined model. It's circular."* This fundamentally altered which parts of LS remained applicable—F1-B distinguished: *"For our tech platform—the app UI, user experience—we can iterate quickly. But for the business model—the actual lending economics—we're basically doing waterfall."* Case C encountered parallel constraints in agricultural logistics, with F1-C explaining that different product categories required different permits, each taking 3-6 months: *"So we can't just 'pivot' product categories based on customer feedback like LS suggests. We have to pick a category, get permitted, THEN see if it works. By the time we learn something's not working, we're locked in."* Interestingly, I1-B (investor) had adjusted expectations accordingly: *"I adjust my expectations for regulated industries. If you're building a SaaS tool, you can iterate weekly. If you're in fintech... you're inherently slower. That doesn't mean don't be lean—it means be lean WITHIN the constraints."*

The third adaptation involved recalibrating MVP quality standards based on customer sophistication and digital maturity. Indonesian customers—particularly in traditional industries—demanded higher quality thresholds than textbook LS prescribed. C2-A (churned SME customer) was blunt about why he abandoned SupplyChainTech: *"I've been running this factory for 22 years using manual systems—Excel, paper, phone calls. It works. For me to change to a digital system, I need to see clear benefit AND reliability. Their system crashed twice in the first week. I can't risk my production on unreliable technology. I went back to Excel."* This forced F1-A to reconceptualize what "minimum" meant: *"We thought MVP meant 'minimal functionality.' But for customers who are digitizing for the FIRST time, the MVP needs to be reliable even if it's simple. They're not comparing it to other apps—they're comparing it to their current non-digital process, which, while inefficient, is at least predictable. So our MVP needed to be 'minimum features but maximum reliability.' That's a different bar."* Rural contexts amplified these quality sensitivities. C1-C (farmer) explained the village dynamics: *"When the app works, it's good. But sometimes it doesn't load, or photos don't upload... In the village, word spreads fast [berita cepat menyebar]. One farmer has a problem, all farmers hear about it. Then they say 'that app doesn't work' and won't try it."* F2-C reflected on the lesson learned: *"We underestimated how perfection-sensitive our market is. In Silicon Valley, early adopters tolerate bugs because they're excited about innovation. Indonesian farmers aren't 'early adopters' psychologically—they're pragmatic business people."* This realization changed development priorities dramatically—F1-C spent three extra months ensuring his MVP worked on slow village internet and had offline capability, adjustments that *"classic LS would say that's 'gold-plating'—just launch and iterate. But we learned the hard way that launching broken to this customer segment destroys trust permanently."* I1-A (investor) validated this contextual judgment: *"There's a difference between 'minimum viable' and 'minimum shippable.' In developed markets with sophisticated early adopters, those are similar. In emerging markets with first-time digital users, they're very different."*

The fourth adaptation centered on what might be called "forced lean"—practicing LS not as strategic choice but as survival necessity given resource constraints. F1-B was candid: *"People talk about Lean Startup like it's a*

philosophy we adopted. Honestly? We're lean because we have to be. We raised $150K angel round—sounds like a lot, but in Jakarta that covers maybe 12-15 months of basic operations. We don't have money to waste on building features nobody wants." This scarcity drove remarkably creative solutions. F2-C described AgriMarket's unconventional first MVP: *"Our first 'marketplace' was literally a WhatsApp group. Farmers posted photos of their produce, restaurants placed orders, we coordinated logistics manually. Zero software development. We did that for 3 months serving 10 farmers and 5 restaurants."* F1-A similarly cobbled together solutions using free templates and cheaper local hosting. Yet F1-B identified the dark side of forced lean: *"The flip side of being forced to be lean is we CAN'T invest in proper infrastructure. Our tech debt is massive... LS assumes you can invest in building things properly once you've validated—but what if you still don't have money even after validation? Then 'lean' becomes 'perpetually under-resourced.'"* M2 (mentor) drew an important distinction: *"Silicon Valley startups choose to be lean even when they have millions in funding—that's strategic discipline. Indonesian startups are lean because they have $100K and it has to last... Strategic lean is 'let's not waste money.' Forced lean is 'we literally cannot afford anything else.' That affects everything—your risk tolerance, your patience for experimentation, your ability to pivot."*

Interestingly, founders who explicitly acknowledged and strategically managed these adaptations reported better outcomes than those attempting to blindly follow textbook LS. F1-C identified a turning point: *"The turning point for us was when we stopped trying to do 'pure' Lean Startup and started asking, 'What does lean mean for Indonesian agritech?' That gave us permission to adapt rather than feeling like we were failing at LS."* Despite these successful adaptations, they remained largely tacit knowledge—not codified, not taught systematically, not discussed openly. M3 lamented this inefficiency: *"Every Indonesian founder I work with eventually adapts LS to local reality. But we don't talk about it systematically. Each founder figures it out through trial and error. That's wasteful. We need an explicit conversation: 'Here's how LS works in Indonesia'—not as deviation from the 'real' method, but as legitimate contextualization"* (see Table 6 for summary of systematic adaptations across all cases).

5. Discussion

Drawing on organizational learning theory (Crossan et al., 1999), we theorize that LS adoption in entrepreneurial ecosystems unfolds through four interconnected learning processes: intuiting, interpreting, integrating, and institutionalizing (depicted as the "4I Framework" in organizational learning literature). Our findings provide rich empirical evidence of how these processes manifest—and frequently break down—in the context of emerging market ecosystems. Intuiting occurs when individual founders experientially learn through customer interactions, MVP deployments, and pivot decisions; as F1-C described, "Each pivot made us smarter—we were learning from the market directly" (Sanasi et al., 2023b). However, this intuitive knowledge remains largely personal and situated. Interpreting happens at the group level when founders, mentors, and investors collectively make sense of LS principles through shared language and practices. Our data reveals systematic interpretation divergences: mentors frame LS as "scientific method" emphasizing hypothesis testing (M1), investors interpret it as "capital efficiency signal" focused on runway extension (I1-A), while founders see it primarily as "speed tool" for rapid iteration (F1-B). These divergent interpretations align with research showing that entrepreneurial methodologies function as "boundary objects" that enable coordination despite different meanings (Becker & Endenich, 2023; Allen, 2022). Integrating involves synthesizing individual and group-level learning into coherent organizational practices—a process we found particularly weak in Indonesia's ecosystem, where adaptations remain tacit rather than explicitly codified. Finally, institutionalizing embeds learning into ecosystem-level structures, routines, and evaluation systems. Our study reveals problematic institutionalization: global LS logic becomes rigidly institutionalized through accelerator curricula and investor evaluation frameworks, yet these institutionalized forms fail to accommodate necessary local adaptations, creating the tensions documented in our findings (Solaimani et al., 2022; Cavallo et al., 2020).

Proposition 1: LS functions as boundary object enabling coordination, but power asymmetries determine whose interpretation dominates.

Status: Supported. Our findings confirm that while LS maintains shared vocabulary across stakeholders, investor control over capital systematically determines which interpretations prevail. When F1-C's mentor (M3) praised their pivots as "exemplary LS execution," investor I1-C simultaneously imposed "This is the LAST pivot"—the

investor interpretation dominated due to funding dependencies. Similarly, founders' context-appropriate adaptations were reinterpreted by investors as "poor execution" (I2-C: "Too many pivots is a red flag"), confirming that resource-dependent power dynamics rather than methodological logic shape actual practice.

Proposition 2: Entrepreneurs who explicitly navigate competing logics (vs. attempting uniform stakeholder satisfaction) achieve superior outcomes.
Status: Partially supported. F1-C demonstrated explicit logic navigation by transparently managing mentor-investor tensions and strategically committing to a "final pivot," appearing more effective than F1-B's uniform satisfaction attempts which created confusion across stakeholder groups. F1-C's turning point came when asking "What does lean mean for Indonesian agritech?" rather than attempting "pure" LS. However, our cross-sectional design limits causal inference about superior outcomes.

Proposition 3: LS practices undergo systematic adaptations driven by institutional, cultural, and market factors; alignment with local logics improves effectiveness.
Status: Strongly supported. All cases demonstrated systematic adaptations: regulatory constraints (F1-B's OJK approvals requiring 2-4 months), cultural norms (kepercayaan-based warm introductions increasing response rates from 5% to 80%+), and market characteristics (elevated MVP quality for first-time digital users). Founders explicitly framing adaptations as contextually appropriate rather than LS failures reported better outcomes, strongly supporting that local logic alignment improves effectiveness.

Proposition 4: Ecosystems that explicitly codify adaptations (vs. treating as failures) develop superior context-appropriate methodologies.
Status: Supported in principle; empirically aspirational. Indonesia's ecosystem lacks codified adaptations—M3: "we don't talk about it systematically"—forcing each cohort to independently rediscover modifications through trial-and-error. This absence prevents cumulative knowledge development, supporting the proposition's logic. However, we lack comparative data showing ecosystems with codification achieving superior performance, limiting demonstration of the positive case.

Proposition 5: Ecosystem alignment—compatible interpretations, logic navigation, and adaptations—predicts startup and ecosystem performance.
Status: Supported with limitations. Cases with greater stakeholder alignment showed fewer tensions: I1-C's legitimization of F1-C's pivots as "adapting to Indonesian realities" enabled more effective navigation than F1-B's misaligned case. However, establishing direct causality between alignment and performance outcomes requires longitudinal data not collected in this study.

A central contribution of our study lies in identifying broken feedback learning loops that prevent ecosystem-level improvement of LS practices in emerging markets. While the 4I Framework proposes bidirectional learning flows—feed-forward learning from individual to organizational levels, and feedback learning from organizational back to individual levels (Crossan et al., 1999)—our data reveals systematic breakdowns in these flows within Indonesia's ecosystem. Feed-forward learning is constrained by power asymmetries: when founders develop context-appropriate adaptations (e.g., relationship-based customer access, elevated MVP quality standards for first-time digital users), these adaptations are often interpreted by investors and mentors as "poor LS execution" rather than legitimate contextualization. As I2-C noted, "Too many pivots is a red flag"—directly contradicting mentor praise for the same behavior (M3: "They were doing LS right"). This misalignment prevents valuable, context-specific learning from flowing upward to shape ecosystem-level understanding. Even more critically, feedback learning loops are broken: the ecosystem lacks mechanisms to transmit accumulated knowledge about what works in Indonesia back down to individual founders. Each new cohort of entrepreneurs must independently rediscover the same contextual adaptations through trial and error, as M3 lamented: "Every Indonesian founder I work with eventually adapts LS to local reality. But we don't talk about it systematically... That's wasteful." This finding extends research on practice adaptation (Ansari et al., 2010) by showing that ecosystems lacking explicit codification mechanisms cannot develop cumulative, context-appropriate knowledge, forcing continuous reinvention. Recent literature on LS in different contexts has documented similar challenges—Solaimani et al. (2022) found that non-digital Dutch SMEs adapted LS tacitly, while Silva et al. (2021) showed Brazilian

technology ventures struggled with adaptation legitimacy—yet none have theorized these as systemic feedback loop failures requiring ecosystem-level intervention.

Our framework identifies leadership commitment—spanning accelerator directors, lead investors, and policy architects—as the foundational enabler that can restore functional learning flows within entrepreneurial ecosystems. This aligns with but extends organizational learning literature emphasizing leadership's role in fostering learning cultures (Garvin et al., 2008; Senge, 1990). In ecosystem contexts, leadership commitment manifests through three critical functions: (1) creating safe spaces for experimentation where founders can transparently share adaptations without fear of being judged as "not doing LS properly"; (2) legitimizing context-driven modifications by explicitly distinguishing between "productive contextualization" and "poor execution," thus addressing the evaluation misalignments we documented; and (3) institutionalizing feedback mechanisms that systematically capture, validate, and disseminate context-appropriate practices back to the ecosystem. We found preliminary evidence of these functions in cases where leadership commitment existed: I1-C (Managing Partner) explicitly told F1-C, "I understand the pivots—you're adapting to Indonesian market realities," thereby legitimizing local adaptation. Similarly, M3 acknowledged, "I teach the standard LS framework, but I know... some things won't work exactly like that here in Indonesia," representing emerging awareness but insufficient action. However, most ecosystem leaders we observed remained trapped in what we term the "global best practice trap"—viewing any deviation from Silicon Valley LS as deficiency rather than adaptation. This trap manifests in accelerator curricula that teach "pure" LS without explicit discussion of contextual factors (Dahle et al., 2023; Mittelstaedt & Pütz, 2024), investor evaluation frameworks that penalize legitimate adaptations (Richter & Wrobel, 2023), and the absence of forums for collective reflection on what "Indonesian LS" or "emerging market LS" should entail. Breaking this trap requires intentional leadership commitment to reframe ecosystem discourse from "implementing global best practices" to "developing contextually effective entrepreneurial methodologies"—a shift with profound implications for ecosystem builders, policymakers, and support organizations (Borman et al., 2024; Gamón-Sanz et al., 2024).

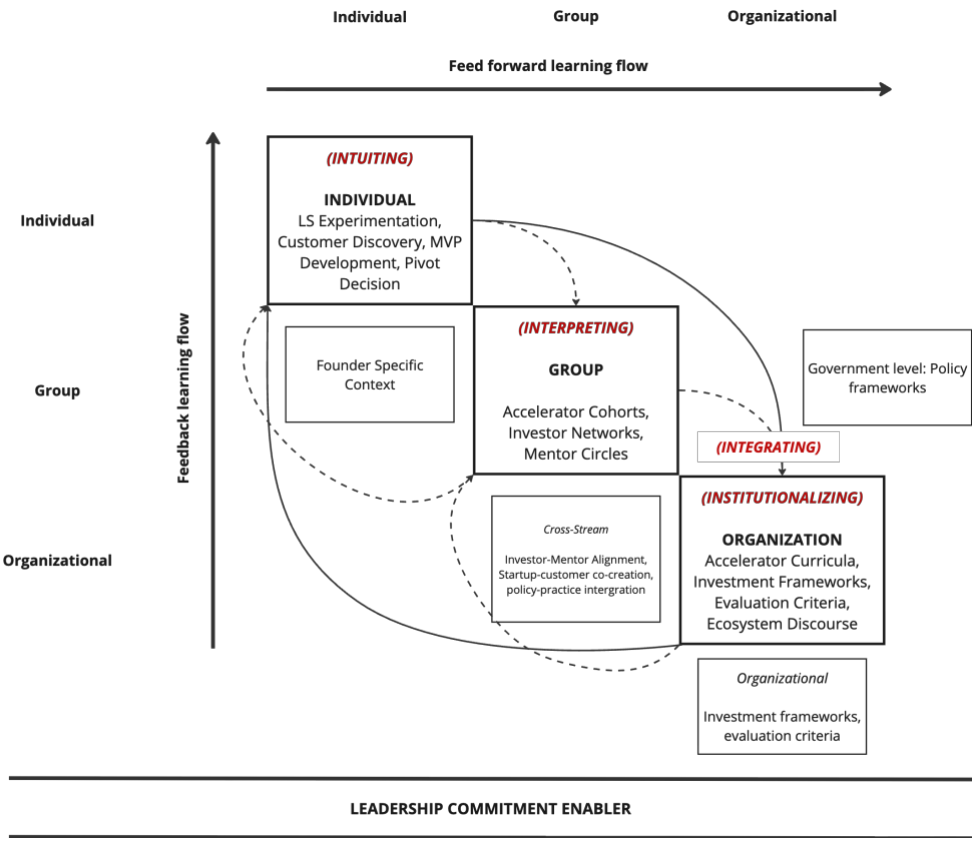

Figure X. Ecosystem-Level Multi-Stakeholder Learning Framework for Lean Startup Adoption in Emerging Markets

Synthesizing these insights, we propose that effective LS adoption in emerging market ecosystems requires transitioning from fragmented, actor-specific learning to integrated ecosystem learning capability. This represents a fundamental reconceptualization: rather than treating LS as a methodology individual startups adopt with varying success, we theorize it as an ecosystem-level capability requiring coordinated learning across multiple stakeholder groups. Our framework (Figure X) visualizes this through interconnected learning processes operating simultaneously at individual (intuiting technical competencies, safety expertise), group (interpreting through communities of practice, cross-functional teams), and organizational (integrating via departmental processes, institutionalizing through strategic systems) levels, all enabled by leadership commitment serving as the foundational substrate. The dotted circular arrows represent the bidirectional learning flows—both feed-forward and feedback—that must function continuously for ecosystem health. When these flows operate effectively, the ecosystem develops what we term "adaptive entrepreneurial capability": the collective capacity to continuously refine entrepreneurial methodologies based on accumulated experience while maintaining enough coherence for coordination (Macca et al., 2025; Tucci et al., 2025). This capability enables productive hybridization—blending global LS principles with local institutional logics—rather than rigid adherence or wholesale rejection. Practically, building this capability requires ecosystem interventions at multiple levels: (1) training programs that explicitly teach "LS in context" rather than "universal LS"; (2) investor education initiatives that help funders distinguish legitimate adaptation from poor execution; (3) formalized knowledge-sharing mechanisms (e.g., annual "LS adaptation symposiums") where successful contextual practices are validated and disseminated; (4) research partnerships documenting what works in specific emerging market contexts; and (5) policy frameworks that support rather than constrain experimental approaches (e.g., regulatory sandboxes for fintech experimentation). Ultimately, our study shifts the discourse from individual startup success/failure to ecosystem learning system effectiveness—a reframing with significant implications for how we study, teach, fund, and support entrepreneurship in emerging economies (Lam, 2023; Raneri et al., 2023).

6. Conclusion

This study fundamentally reconceptualizes Lean Startup not as a firm-level methodology but as an ecosystem-level learning challenge requiring coordinated sensemaking across multiple stakeholder groups. Through examining three Indonesian startup cases and 42 interviews with founders, investors, mentors, and customers, we reveal that LS operates as a fragmented boundary object—maintaining shared vocabulary while producing systematically divergent interpretations that create consequential tensions for entrepreneurs. Our findings demonstrate that effective LS adoption in emerging markets depends critically on restoring broken feedback learning loops: when context-appropriate adaptations developed by individual founders (relationship-based customer access, elevated MVP quality standards, regulatory-constrained iteration cycles) are misinterpreted as "poor execution" rather than legitimate contextualization, valuable learning cannot flow upward to shape ecosystem-level understanding, and accumulated knowledge cannot flow back down to guide subsequent cohorts. We introduce the Ecosystem-Level Multi-Stakeholder Learning Framework integrating intuiting, interpreting, integrating, and institutionalizing processes across individual, group, and organizational levels, with leadership commitment serving as the foundational enabler. This framework shifts discourse from "Are startups doing LS correctly?" to "Is the ecosystem learning effectively about what works in this context?"—a reframing with profound implications for entrepreneurship theory and practice. For scholars, we contribute by extending organizational learning theory into ecosystem contexts, theorizing entrepreneurial methodologies as socially constructed through multi-stakeholder processes, and providing rich empirical evidence of practice adaptation dynamics in emerging markets. For practitioners—ecosystem builders, accelerator directors, investors, policymakers—we demonstrate that improving startup outcomes requires not just training founders better, but building ecosystem-level learning capability through explicit codification of contextual adaptations, legitimization of productive hybridization, and institutionalization of feedback mechanisms that enable cumulative, context-appropriate knowledge development.

Limitation and Future Research

This study's findings should be interpreted within several important limitations that simultaneously open productive avenues for future research. First, our sample of three cases and 42 interviews, while providing rich contextual depth, limits generalizability across Indonesia's diverse entrepreneurial landscape—future research

should conduct larger-scale quantitative studies validating our framework across broader startup populations, testing whether the patterns we identified (divergent conceptualizations, knowledge transmission gaps, evaluation misalignments, context-driven adaptations) hold systematically across sectors, stages, and geographies. Second, our geographic focus on Jakarta and major cities may not capture dynamics in tier-2 and tier-3 Indonesian cities where institutional environments, resource availability, and cultural contexts differ substantially—comparative studies examining ecosystem learning processes across urban hierarchies would enrich understanding of how place shapes methodology adaptation. Third, our cross-sectional design captures a temporal snapshot but cannot trace how ecosystem learning capability evolves over time—longitudinal research tracking how ecosystems develop (or fail to develop) feedback mechanisms, legitimize adaptations, and build cumulative knowledge would provide crucial insights into learning trajectories and intervention timing. Fourth, while we examined four stakeholder groups (founders, investors, mentors, customers), we did not systematically investigate other important actors including policymakers, corporate partners, media, and support service providers—future research should expand the stakeholder lens to understand their roles in shaping ecosystem learning dynamics. Fifth, our Indonesia-specific findings raise questions about transferability to other emerging markets—comparative studies across Southeast Asian countries (Vietnam, Thailand, Philippines) or other developing economies (Latin America, Africa) would clarify which challenges are Indonesia-specific versus broadly characteristic of emerging market entrepreneurship. Sixth, we focused exclusively on Lean Startup methodology—examining whether similar ecosystem-level learning challenges affect other entrepreneurial approaches (Design Thinking, Effectuation, Agile) would test our framework's broader applicability and potentially reveal methodology-specific versus universal adaptation dynamics. Finally, our study identifies broken feedback loops and proposes leadership commitment as enabler, but does not experimentally test interventions—action research implementing and evaluating specific mechanisms (adaptation symposiums, investor education programs, codified "Indonesian LS" guidelines, regulatory sandboxes) would provide practical evidence about which interventions most effectively restore feedback learning flows and build adaptive entrepreneurial capability at the ecosystem level.

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The Future of Business Sustainable Development Strategies in Greek Small and Medium – Sized Enterprises

Apostolos Goulas[1]

[1] University of Thessaly, Greece

Correspondence: Apostolos Goulas, University of Thessaly, Greece. E-mail: goulasap@yahoo.com

Abstract
Sustainable development has become a global priority for firms, countries and societies. Climate change, resource depletion, social inequalities, and regulatory reforms are reshaping expectations of business behavior, guiding companies to adopt long-term, responsible, and future-oriented strategies. Across Europe, and especially after the implementation of the European Green Deal strategy, the integration of Environmental, Social, and Governance (ESG) criteria into investment and regulatory frameworks has accelerated the need for firms to demonstrate measurable sustainability performance. This political priority can redefine the business environment especially for the small and medium sized enterprises (SMEs) that are based in European Union countries. In Greece, as for EU, SMEs play a significant role in employment, regional development and value creation. Small and medium sized enterprises are at the backbone of the economy (Yoshino and Taghizadeh – Hesary, 2019). For the Greek SMEs, new opportunities and new challenges are coming, because of the sustainability transformation that the European Green Deal and the ESG criteria adaptation. Digitalization, circular economy models, green funding instruments, and the integration of sustainability into supply chain requirements are factors that are transforming business practices and managerial thinking. The present study is focused on these challenges and how the Greek SMEs understand and implement sustainable development in their strategic orientation. How Greek SMEs interpret the importance of sustainability for competitiveness and long term resilience, in a global changing environment. Does this awareness lead into organizational change and structured strategies, or SMEs are led by instinct and luck? The methodology applied on this research is by using focus groups. This way the research captures experiences, interpretations, expectations and modus operandi of SMEs owners and managers. This method allows exploration not only of what strategies SMEs adopt, but also why they adopt them, and under which conditions they understand sustainability as a driver for future business success.

Keywords: Sustainable Development, SMEs, Strategy, Strategic Orientation

1. Introduction

1.1 Introduce the Problem

Sustainable development has become a global priority for firms, countries and societies. Climate change, resource depletion, social inequalities, and regulatory reforms are reshaping expectations of business behavior, guiding companies to adopt long-term, responsible, and future-oriented strategies. Across Europe, and especially after the

implementation of the European Green Deal strategy, the integration of Environmental, Social, and Governance (ESG) criteria into investment and regulatory frameworks has accelerated the need for firms to demonstrate measurable sustainability performance. This political priority can redefine the business environment especially for the small and medium sized enterprises (SMEs) that are based in European Union countries.

In Greece, SMEs account for nearly the entirety of the business population and play a vital role in employment, regional development, and value creation. Their strategic choices therefore have broad implications for the country's sustainable transition. However, the sustainability transformation of Greek SMEs does not occur in a vacuum. It unfolds within a national context marked by structural economic weaknesses, historical financial instability, and persistent institutional inefficiencies. These challenges have long constrained managerial capacity, investment potential, and innovation readiness within the SME sector. Yet, the post-crisis era and the increasing alignment with European Union sustainability objectives have created new incentives and opportunities for Greek SMEs to reconfigure their strategic priorities.

Emerging trends—including digitalization, circular economy models, green funding instruments, and the integration of sustainability into supply chain requirements—are reshaping managerial thinking and business practices. Nevertheless, a disconnect persists between the conceptual understanding of sustainability and its effective implementation at the enterprise level. Many Greek SMEs recognize the importance of sustainability for competitiveness and long-term resilience, but struggle to translate this awareness into structured strategies, measurable objectives, or organizational change.

This study addresses these challenges by examining how Greek SMEs perceive and enact sustainable development in their strategic orientation. Using focus groups, the research captures the lived experiences, interpretations, and expectations of SME owners and managers, offering a nuanced understanding of how sustainability is conceptualized and operationalized across sectors. This method allows exploration not only of what strategies SMEs adopt, but also why they adopt them, and under which conditions they perceive sustainability as a driver for future business success.

Given the paucity of qualitative studies in the Greek context, this investigation provides a timely contribution. It clarifies the dynamics shaping SME engagement with sustainability, identifies barriers and enabling factors, and highlights the ways in which business futures are being reimagined under the pressures and opportunities of sustainable development. The findings aim to support policymakers, practitioners, and scholars in designing more targeted interventions and fostering an ecosystem conducive to sustainable growth.

1.2 Sustainable Development as a Business Paradigm

Small and medium enterprises (SMEs) are considered as pillars of the economy for countries and society, with a vast influence in various sectors with their contribution to employment, trade, sustainable and economic development (Goulas, 2025; Obi et. al., 2018). SMEs also impact economic development based on various aspects such as competitive market orientation, employment generation, capacity building and technology innovation (Alaghbari, 2022). They represent a total of 99% of all businesses in the European Union and they provide jobs to more than 85 million European citizens, being that way the hart of innovation and entrepreneurship (European Commission, 2025). Entrepreneurship is believed as one of the major driving forces for economic restructuring, decentralization and movement towards a market economy (Varga et. al., 2021). SMEs in comparison to large enterprises, are highly flexible, revealing a superior flexibility to technical shifts, higher promotion of income distribution and better adaptability to fluctuations in the market and new customer requirements, while their organizational structure allows for quicker decision making (Perez – Gomez et. al., 2020). Furthermore, SMEs are vital to local and regional development (Goulas, 2021), by supporting local supply chains, ensuring wealth circulates within communities, and helping reduce regional economic disparities. And this exact connection with local communities is a unique competitive advantage for the SMEs, because are considered as one with the local society. SMEs can adapt very quick to meet local demands and also can also have a more agile management. On the other hand, SMEs are more vulnerable to economic instabilities and are in need of continued funding (Dowling et al., 2019). Also, according to Saulick et al., (2023), businesses have to genuinely adapt their processes and

activities to sustainability, in such a way as to comply with rules, regulations and norms. That is why often businesses, mainly large companies, are often blamed for causing environmental degradation and social deprivation issues since their activities are considered unsustainable to some extent (Sarango – Lalangui et al., 2018). Furthermore, investors, customers and governments, are pressuring companies to add sustainability at the core of their business models.

Despite these vital roles, SMEs face persistent challenges, notably limited access to finance, skills shortages, complex regulations, and exposure to cyber threats. Recognizing their importance, governments and international organizations are increasingly focused on creating supportive ecosystems—improving access to capital, simplifying regulations, and offering tailored training—to help SMEs unlock their full potential and ensure a robust, sustainable global economy. Over the last few years, the importance of sustainability and sustainable development has significantly impacted the entire planet – in way of living, consuming and producing and also in the way governments shape their policies. Businesses have to follow that wave of sustainability and develop operating models and adjust their strategic plans. In the global context, businesses must recognize the importance of understanding non only their financial performance but also their wider social and environmental impacts on their ability to create value for all. The European Union's Green Deal Strategy created the conditions for an economy based on environmental protection and the conservation of natural resources, while promoting social justice and economic prosperity. In this context, modern businesses are called to comply with ESG requirements, adopting strategies that combine environmental sensitivity, social responsibility and transparency in management (European Commission, 2025; Goulas, 2024). On that policy, decoupling economic growth from resource use and transitioning towards circular systems in production and consumption play a crucial role in achieving climate neutrality in the EU by 2050 (European Commission, 2025). This European strategy adaptation, created pressure on European companies (Garrido - Russo et., al., 2024), stressing their effort to competitiveness. On the other hand, many academics claim that sustainability practices enhance the financial performance of SMEs (Momtaz and Parra, 2024). Sustainability strategies play a crucial role in attracting consumers and creating long-term relationships with them. For certain consumers, the environmental footprint of products and services plays an increasing role in the choice for purchasing products. Also, researchers link ESG practices to firm performance, including innovation and risk management (Bao and Yang, 2025; Dang et al., 2025). Innovation is the source of sustainable development of a country and the primary driving force for high – quality development (Li et al., 2023). After all, sustainability is not only about the products sold, but also about how businesses are operating, supply chains and the management of business resources.

Adopting sustainable development orientation from modern business, reflects a major paradigm shift in contemporary business thinking. Public environmental concerns, disputes on the rising energy prices, and market pressures have driven enterprises to prioritize reducing energy consumption and consequently, the sharing circular economy, green innovations and energy efficiency have emerges as pivotal components of sustainable development (Dai, et al., 2024).Firms' choices on CSR and ESG implementation strategies can arguably have a positive impact on their value and performance (Broadstock et al., 2020). The evolution from corporate social responsibility (CSR) initiatives to integrated sustainability strategies demonstrates that firms increasingly view sustainability at the core of their business assets and is a strategic orientation (Dai et al., 2024; Yu et al., 2024). Kotsantonis et al., (2016), tries to determine how companies prioritizing ESG initiatives often to outperform competitors through competitive advantages and superior investor returns. The relationship between firms' CSR disclosure and environmental performance has long been debated in the literature (Hsu and Chen, 2023; Clarkson et al., 2008; Patten, 2002). Also, Banerjee and Shogren (2010), claim that the attitude of a firm toward environmental risks can affect its social reputation.

1.3 SMEs: Constraints, Capabilities, and Motivational Drivers

Small and Medium-sized Enterprises (SMEs), as already mentioned, are the backbone of the economy and of economic growth and innovation. According to Modi and Rawani (2020), SMEs are responsible for driving innovation and development in different areas. The balanced economic development of the country is directly proportional to the degree of integration and development of SMEs within the national economy. In modern economies, with intensifying competition and global competitiveness, SMEs remain the key element for the

national economies, while at the same time are considered as key components for the global market. It is important for SMEs viability, to understand the global market dynamics and support their continued success and resilience, through targeted policies. Many academics claim that SMEs have a particularly hard time performing well in resource restricted environments (Ahlstrom and Burton, 2010; Smallbone and Welter, 2008; Modi and Rawani, 2020). SMEs have fewer resources and often lack the knowledge and specific skills to engage the change, than larger firms (Zhou and Peg, 2012). Also, SMEs cannot find experts any time there is need for it, or cannot afford paying for it. Furthermore, according to Sommer (2017), SMEs should implement standards, that may need adaptations in the production process and technology, requiring managerial and technical skills, as well as the financial means for investments, which they luck. The competitiveness of SMEs is a main topic in academic society, with research focused on extroversion, innovation, digitalization, and support strategies through government actions & research, highlighting challenges and solutions for sustainable development, with an emphasis on research to improve their market position. Dalvi (2014), claims that a strong pre – existing innovation culture facilitates the generation of new ideas that enables firm's capabilities and competitiveness. These constraints often lead to short-term strategic planning, reducing the ability of SMEs to effectively anticipate and manage technological and market changes, especially in conditions of intense international competition.

In addition to the above, strengthening the competitiveness of SMEs requires the creation of a favorable ecosystem of collaborations and networking, both at national and international level, which will facilitate knowledge transfer, access to innovative practices and participation in value chains. And that is trying to achieve the European Unions' Single Market Program, and in particular is trying to facilitate access to markets, promote entrepreneurship and the acquisition of entrepreneurial skills and promote the modernization of industry and address global and societal challenges (European Commission, 2025). The use of digital transition and cutting-edge technologies as tools for increasing productivity and extroversion is of great importance, while at the same time, targeted financing and training policies are required to cover existing skills and investment gaps. In this context, the role of public policy and support mechanisms becomes crucial, so that SMEs can adapt to continuous changing market conditions, integrate innovation into their strategy and ensure their long-term sustainability.

SMEs operate under significant constraints, such as limited access to financial resources, lack of specialized skills and increased regulatory requirements, which often limit long-term strategic planning and the ability to invest in innovation (Costa et al., 2023). Despite the obstacles mentioned above, SMEs can enhance their sustainability while maintaining cultural and economic competitiveness (Achmad and Wiratmadja, 2025). Furthermore, SMEs possess critical capabilities, such as organizational flexibility, rapid adaptation to changing market conditions and close interconnection with local socio-economic structures. Their inherent flexibility, capacity for innovation and swift adaptability to market changes position SMEs as key drivers of economic progress, enabling them to make significant contributions to sustainable development (Achmad and Wiratmadja, 2025; Rodrigues and Franco, 2023; Gorondutse et al., 2021; Baeshen et al., 2021). At the same time, strong driving factors, such as entrepreneurial ambition, the need to survive and grow, as well as the pursuit of sustainable and innovative business practices, push SMEs to seek new opportunities, adopt digital and organizational innovations and participate in collaborative networks. Achmad and Wiratmadja (2025) claim that SMEs can benefit from green innovation in many ways. In addition, the gradual integration of sustainability and responsible entrepreneurship criteria emerges as a global trend (Tsotsas et al., 2025) and an additional motivating factor, as it contributes both to improving SMEs competitive position and to their long-term resilience in a constantly changing economic environment.

In conclusion, SMEs operate within a complex and demanding environment shaped by financial constraints, skill shortages and regulatory pressures, which often limit their capacity for long-term strategic planning and innovation investment. However, the literature clearly indicates that SMEs' inherent capabilities—such as flexibility, rapid decision-making and close connections with local and regional ecosystems—can partially offset these limitations and support competitive performance (Teece, 2007; Laforet, 2011). Innovation orientation, digital transformation and participation in collaborative networks emerge as critical mechanisms for overcoming resource constraints and enhancing international competitiveness (Powell et al., 1996). Furthermore, entrepreneurial motivation combined with the growing adoption of sustainability and responsible business practices strengthens SMEs' strategic renewal and long-term resilience (Bos-Brouwers, 2010; Johnson & Schaltegger, 2016). Consequently,

the competitiveness and sustainability of SMEs depend not only on internal capabilities and managerial ambition but also on the presence of a supportive institutional and policy framework that facilitates access to finance, skills development, innovation ecosystems and sustainable value chains (European Commission, 2020).

2. Methodology

Ten enterprises operating in the Region of Thessaly, Greece, together with their executives, participated in a series of focus group discussions conducted for the purposes of this study. Within the scope of the research, the term "business" refers to firms operating across various economic sectors. The participants on the focus groups were company owners, chief executive officers, and senior-level managers holding key strategic positions within their organizational structures. The qualitative research design aimed to provide in-depth insights into how firms respond to contemporary global sustainability challenges, particularly in a context where the integration of Environmental, Social, and Governance (ESG) criteria into investment and regulatory frameworks has accelerated the need for firms to demonstrate measurable sustainability performance. That methodology was applied in previous research (Goulas, 2025) and researcher is trying to test it in various research topics.

The sample were ten small and medium-sized enterprises (SMEs), all located and operating in the wider Region of Thessaly. The selection guaranteed a representative presentation of the regional business environment. Each focus group brought together executives, managers, CEOs, and, in several cases, business owners, all of whom holds decision-making positions within their organizations and are considered as vital for strategy implementation. Participants demonstrated a strong willingness to share experiences, practical knowledge, and strategic insights relevant to the research objectives.

The focus group sessions were conducted between December 2023 and June 2024, covering a period of approximately seven months, and were held in various locations across Thessaly or online, to enhance accessibility for participants. Each session lasted approximately two hours and included five participants. The relatively small group size facilitated meaningful interaction, creating an atmosphere of trust and openness that supported discussion and dialogue.

At the beginning of each session, participants were briefed on recent European Union policy initiatives, including the European Green Deal, the Green Transition, and the Digital Transformation agenda, with particular emphasis on their implications for ESG compliance and sustainability reporting requirements. The subsequent discussions were structured around key thematic areas, such as the main challenges organizations face in the context of digital transformation, perceptions of emerging technologies, attitudes toward the development of collaborative ecosystems, and perspectives on partnerships and public policy support mechanisms. In the final phase of each session, participants were invited to express their visions for the future of their organizations and the sectors in which they operate. This process covered a diverse range of viewpoints related to the core issues examined in the present study.

Overall, the structure of the focus group discussions was designed to explore sustainability, strategic management, and the increasing importance of ESG-driven performance metrics on SMEs.

All focus group sessions were audio-recorded with the informed consent of the participants, and supplementary field notes were taken to enhance the reliability of the data. The collected material was analyzed using qualitative descriptive analysis. The analytical procedure followed three main stages: (i) systematic coding and categorization of the entire dataset, (ii) identification of recurring patterns and dominant themes, and (iii) interpretation and presentation of the research findings.

3. Results

The thirty businesses selected for the present research paper very carefully and cover the geographical borders of Region of Thessaly. More precisely the companies selected, are located in the four major cities of Thessaly, Larissa, Volos, Trikala and Karditsa. Some of the selected companies are new in the market, e.g. 2023 as year of

establishment, and some have operated in the market for approximately twelve years, e.g. 2014 as year of establishment (Table 1). Those ten companies, have significant presence in the market, at local and national level and for some of them international presence is noticed. All of the companies are characterized for their openness in adopting new models and practices.

3.1 Business Profile

Provide dates defining the periods of recruitment and follow-up and the primary sources of the potential subjects, where appropriate. If these dates differ by group, provide the values for each group.

Table 1: Businesses participated in the focus group discussion (related to the terms of GDPR, businesses that participated in the study are coded as B1, B2,…..B10 – B stands for Business)

Business	Year of Establishment	Company's size
B1	2019	Small
B2	2017	Small
B3	2012	Medium
B4	2018	Small
B5	2019	Small
B6	2020	Small
B7	2014	Medium
B8	2017	Medium
B9	2023	Small
B10	2016	Medium

Source: Own Elaboration

As already mentioned before, the ten companies selected for the research, were of various sizes, small and medium size companies, all of them based in the wider region of Thessaly Greece and are operating in various sectors, from production to distribution, sales, services, marketing and advertising.

The size classification for the businesses based on the number of employees is shown in Table 2. Some of the executives that participated in the focus groups, claimed that size of a company is a matter of operational years in the market. Also, they claim, especially those from the newest companies, that from 2020 and on, they had to face a number of crises, either international (e.g., COVID-19, energy crisis) or local (e.g., floods in Thessaly), that made their operation quite an adventure. Especially they claim that for a new company in the market, is almost impossible to establish a network and create value, under those circumstances.

Table 2: Company's size

company's size	number of employees
small	<50
medium	50 - 249
large	>250

Source: own elaboration

Analyzing the size of the companies of the research, it can be told that six of those companies are of small size and four of medium size. As small companies are listed even very small family businesses with less than ten employees. Nevertheless, the size of the company, the impact on local society and economy, are undoubtable even

for the very small, family agribusinesses operating on the market. They give jobs to members of the local community, they support the local market and they preserve the local tradition. That is quite important and cannot be measured easily.

3.2 Key themes of focus groups

The analysis of the focus groups discussions with Greek SMEs shows the grade of understanding of sustainable development and sustainability, the strategy applied by the company and the overall vision for the future. The findings demonstrate a growing awareness of sustainability among SME participants on the focus groups, but also highlight a gap between understanding and implementing. The key points of the focus groups were regarding SMEs understanding of sustainability and sustainable development, as it is considered by the global community and the various policies and initiatives (European Green Deal, ESG ecc), digital transformation, how competition is affected by the integration of sustainability orientation, and how the strategic management of the company is modified with the sustainability implementation.

3.3 Understanding Sustainability and Sustainable Development

Analysis of the focus groups discussion help understand how SMEs that participated in the focus groups understand sustainability and sustainable development. For SMEs, sustainability is not just an environmental consideration but a daily need for saving resources and money for company's operation. That economic rationality is a reality, because in the end of the day operational cost is a priority. A participant said:

> "*We perceive sustainability mostly as saving resources. When we reduce consumption of energy for instance, or when we reduce waste, we do it first of all because of economic reasons and then for saving the environment and the planet.* (B3)" (The interview was conducted on 4 March 2024).

Also, sustainability is described as a long term strategy for future viability of the company, as claimed by managers participated in the focus group.

> "*For our company, sustainability is not just an environmental issue. It is a matter of continuous operation of our company in the future. It is how we deal with our costs, how we deal with our employees and our partners, how we deal with the way we operate and produce. It is how our company will operate in five years from now.* (B8)" (The interview was conducted on 4 March 2024).

From an operational standpoint, many companies associated sustainability with resource efficiency and cost management. A retail SME explained that sustainability initiatives were initially adopted as a response to rising energy prices, mentioning that "energy saving became a sustainability issue only after it knocked our door. When energy prices started to hit a high level, our company, started considering how we will manage with this burden. (B7)" (The interview was conducted on 10 April 2024).

3.4 Sustainability and Competitiveness

The focus group discussions indicate that Greek SMEs understand sustainability as a conditional and source of competitiveness rather than as a direct driver of immediate financial advantage. Participants consistently emphasized that sustainable practices contribute primarily to intangible forms of competitive advantage, such as reputation, credibility, and long-term market positioning.

> "*Customers may not ask for sustainability in the market, but they almost always have a positive reaction when they face practices that support sustainability and make a good image for the company. In the end is a matter of trust creation between our company and our clients, even it doesn't affect sales immediately.* (B10)" (The interview was conducted on 10 April 2024).

Some of the participants, consider sustainability as a differentiation strategy and opportunity to diverse from competition.

> "*We are a small company, not many years operating in the market that we are trying to position ourselves in the market. We cannot compete or overcome the competition, which are bigger companies than ours, that can offer a lower price in the market. So we have to present our products in a different*

> *way in the market. Sustainability helps us tell our story in a different way than the competition.* (B5)" (The interview was conducted on 10 April 2024).

3.5 Sustainability and Digital Transformation

SMEs that participated in the focus groups of the present research, seem to realize that sustainability and digital transformation are two parallel ways for them, that lead in the same ending, company's viability. At the same time they mention that applying and adopting both in the company are increasing cost and they demand amounts of investment.

> "Our company is new and small, but with high skilled employees, familiar with new technologies and digital era. For us, digital transformation is not an obligation but a strategic option, but we cannot adopt everything at once. We build our digital environment step by step, so we keep a balance in our budget. (B1)" (The interview was conducted on 8 May 2024).

Also, a company on the advertising/marketing sector claimed "digital transformation and the use of AI tools, helped us be more fast, more agile and reduce costs. That helped us be more competitive in the market". (B4) (The interview was conducted on 8 May 2024).

4. Discussion

The findings of this study provide valuable insights into how Greek SMEs understand and implement sustainable development within a rapidly changing global environment. As the existing literature mentions, the results of the present research, confirm that SMEs exhibit high levels of awareness regarding sustainability, but at the same time face difficulties to transform this awareness into structured strategic action. Rather than associating sustainability with innovation-led growth or formal ESG integration, SMEs frame it as a mechanism for maintaining legitimacy, continuity, and operational coherence over time.

Research findings suggests that sustainability is primarily framed as a must - do mechanism rather than as a source of strategic orientation. In the Greek context, sustainability is closely linked to cost efficiency and risk management, reflecting an approach shaped by the lack of resources and the market instability. While SME owners and managers increasingly recognize sustainability and digital transformation as critical for future competitiveness, this recognition does not automatically transform into structured organizational change. This gap reflects not resistance, but uncertainty and limited absorptive capacity. Digital transformation appears as a necessity, but at the same time is putting on hold, due to financial limitations. The study suggests that the key challenge for SMEs is not just the adoption of sustainability or digital tools per se, but the development of unique and strategic skills and capabilities that will allow these elements to be integrated into a solid and stable long-term vision. Addressing this challenge may redefine sustainability for SMEs, from a necessity into a strategic business development choice.

This study is based on focus groups with a limited number of Greek SMEs and thus does not aim for statistical generalization. Future research could combine qualitative insights with quantitative methods or longitudinal designs to examine how sustainability strategies evolve over time. Comparative studies across countries or sectors could further illuminate contextual influences on SME sustainability.

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What Drives Corporate Carbon Transparency? A Systematic Literature Review

Gracia Ovelia Ristie[1], Sutaryo[2]

[1,2] Faculty of Economics and Business, Universitas Sebelas Maret, Surakarta, Indonesia

Abstract
The purpose of this research is to identify what drives carbon emission disclosure practices using a systematic literature review approach. Then, map and group the variables used from various previous studies. A data source sourced from Scopus with a total of 31 articles found related to the research topic and accessible to researchers with the period 2018-2024. The results of the study show that related research in 2022-2024 continues to increase. Research data sources related to previous research are more sourced from secondary data on manufacturing companies using quantitative research methods. Then, the research is based on independent variables used in previous research, the majority of which are on variable profitability (ROA), leverage (LEV), and environmental performance (EP).

Keywords: Determinants, Carbon Emission Disclosure, And Systematic Literature Review

1. Introduction

Climate change is an increasingly urgent global issue to address, with its impact increasingly evident in various parts of the world. Carbon emission relocation activities are of great concern (Arslan et al., 2022). In 2024, global temperatures will be the highest on record, rising to 1.5 degrees Celsius above pre-industrial levels. This increase in temperature is highly correlated with ongoing carbon emissions. It is anticipated that CO2 output will grow from 40.6 billion to 41.6 billion tonnes, with the majority of these emissions originating from burning fossil fuels anf the destruction of forests. This figure shows the huge contribution of the human sector to the ongoing climate change. However, amid these conditions, there are increasingly strong demands from various stakeholders, including investors, governments, and the public to ensure that companies are open in disclosing the environmental impacts caused, especially related to carbon emissions (Liu et al., 2022).

Along with the times, several determining factors have emerged that can affect the disclosure of carbon emissions such as leverage, company value, profitability, market value, company performance, and several others. In previous research, it was revealed that green innovation and eco-efficiency have a positive effect on CO2 disclosure (Sari et al., 2024). (Ganda, 2018) emphasizes that CO2 disclosure has a positive relationship with ROA. CO2 disclosure has a significant positive influence on a company's value because the company has a level of concern for the environment that can then be responded to both by the market and as a basis for investors in assessing the company's sustainability (Hardiyansah et al., 2021). Moreover, research by (Saadah et al., 2024)

reveals that the presence of women in executive positions plays a crucial role ini CO2 disclosure, examined through the lens of board governance and audit committee oversight. Then, this research has implications for investors and policymakers who support ASEAN countries in achieving the net zero pledge.

Opinion (Wahyuningrum et al., 2024) believes that CO2 disclosure is proof of the company's commitment to reducing carbon emissions. Therefore, this study aims to identify the determinants that affect the disclosure of carbon emissions through a systematic literature review. Also, mapping and grouping the variables used from various studies. This research is expected to be able to contribute and become literature for future research.

2. Method

This research employs a Systematic Literature Review approach to conduct a thorough examination of factors that affect corporate decisions regarding carbon emission disclosure. Several literature reviews have been conducted by several researchers, such as (Latifah et al., 2018) reviewing the literature on *balanced scorecards.* (Farida et al., 2022) reviewed the management control system in markets in developing countries. The systematic nature of SLR requires a logical and well-planned structure, contributing to a comprehensive understanding of the development of knowledge through a review of the literature (*Doing Qualitative Research*, n.d.). In this case, this research was carried out with several criteria, as follows:

1. Articles published in English;
2. Articles are not limited by the publication period;
3. The article search was carried out using the keywords: "carbon emission disclosure"; or "carbon disclosure"; or "Emission Disclosure"
4. Articles are searched by limiting keywords: *"carbon emission disclosure"; "carbon disclosure" ;" emission disclosure"; "Carbon Emission Disclosure"; "Disclosure"; "Carbon Emissions Disclosure"; "Carbon Emission Disclosures"; "Carbon Disclosure"; "GHG Emissions Disclosure"; "Carbon Disclosures"; "Greenhouse Gas Disclosure"; "Environmental Disclosure"; "Carbon Emission"; "Carbon Emissions"; "Greenhouse Gas"; "GHG Emissions"; "Carbon Performance"; "Greenhouse Gas Emissions"; "GHG Emission"; "GHG"*
5. Articles are limited to the subject areas of "*economics, econometrics and finance"* and *"business, management, and accounting";*
6. "Journal*" type*
7. Document type "*research articles".*

This study uses the Scopus database as its primary data source. The search process was carried out by generating 67 articles relevant to the keyword. To include precision, it is reviewed more deeply about the abstract, title, keywords, and research results to assess the suitability of the research topic. So, 31 articles were found that could be accessed.

2.1 Source Type

Table 1 shows 31 research articles on transparency in CO2 disclosure spread across 19 different academic journals. The International Journal of Energy Economics and Policy published 12 articles out of a total of 31 articles (38.7%). This shows the significant dominance, that the journal as the main platform for carbon transparency research, especially in the context of energy economics and policy. Furthermore, the Journal of Asian Finance, Economics and Business published 2 articles, followed by several journals that published 1 article each.

Then, journals that publish articles on carbon emission transparency cover various research focuses, namely environmental and financial; economics and finance; accounting; management and business; innovation; and business ethics. This shows that carbon transparency is not only a technical environmental issue, but also related to economic, financial, governance, business ethics, and innovation aspects.

Table 1: Classification of Articles by Journal

Journal	Number of Articles
Annuals of Data Science	1
APTISI Transactions on Technopreneurship	1
Business Ethics, the Environment and Responsibility	1
Cogent Business and Management	1
Corporate Board: Role, Duties and Composition	1
Environment, Development and Sustainability	1
Environmental Economics	1
IBIMA Business Review	1
International Journal of Energy Economics and Policy	12
International Journal of Management and Sustainability	1
Journal of Asian Finance, Economics and Business	2
Journal of Business and Socio-economic Development	1
Journal of Cleaner Production	1
Journal of Contemporary Accounting and Economics	1
Journal of Environmental Management and Tourism	1
Journal of Open Innovation: Technology, Market, and Complexity	1
Journal of Risk and Financial Management	1
Qubahan Academic Journal	1
Uncertain Supply Chain Management	1
TOTAL	**31**

Source: Data processed 2025

3. Result and Discussion

3.1 Year of Publication

Based on an analysis conducted in the literature, it was found that an article search yielded 31 articles related to carbon emission disclosure and accessible to researchers.

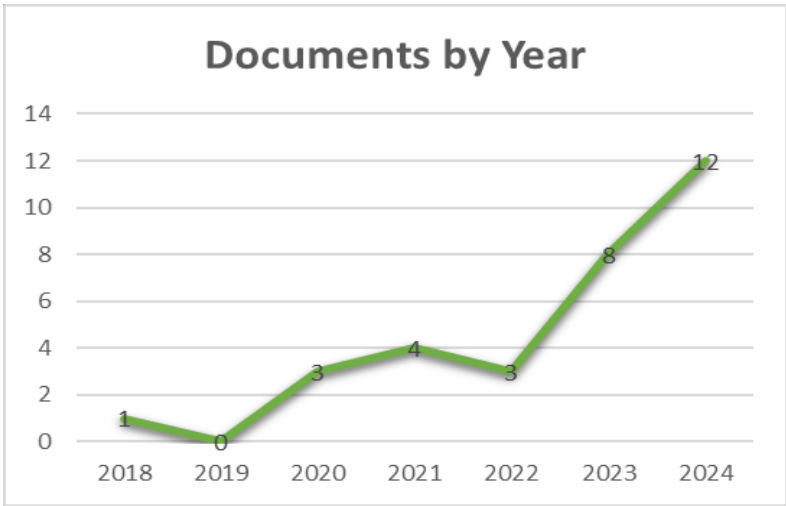

Figure 1: Document by Year

Source: Data processed 2025

Figure 1. shows publication trends starting from 2018-2024. The graph shows a steady rise in publication numbers during this timeframe. In 2018, publications started with 1 article, then decreased to 0 articles in 2019. Publications increased again by 3 articles in 2020 and 4 articles in 2021, before experiencing a temporary decrease to 3 articles in 2020. Significant improvements began to be seen in 2023 with 8 articles published, and reached a peak in 2024 with 12 articles.

3.2 Mapping Cause-Effect Determinants of Carbon Emission Disclosure

There are 31 articles that can be accessed and have a cause-and-effect relationship to carbon emission disclosure. This analysis is carried out by grouping previous research based on certain categories, such as research methods, independent variables used in previous research, and mapping these variables.

3.3 Research Methods

It begins with an analysis based on the research method used. On the table. 2 shows research methods that have a cause-and-effect relationship about determining factors in carbon emission disclosure. The most commonly used method is the quantitative method, which involves 30 articles that use secondary data sources sourced from annual reports, sustainability reports, and the websites of the companies studied. The data used based on the analysis is dominated by manufacturing companies (Kurnia et al., 2021; Maria Kristari & Yusram Teruna, 2023; Saraswati et al., 2021; Sari et al., 2024; Widianingsih & Kohardinata, 2024). Then, the research method based on qualitative & quantitative methods as many as 1 article (Fransisca et al., 2024), shows that the qualitative method is used to examine the characteristics of variables descriptively with the process of subjectively collecting data in print reports as additional and broader disclosures. Quantitative methods are used to analyze the relationship between variables and other variables.

Table 2: Research Method Based on 31 Articles

Research Methods	**Number of Articles**
Quantitative	30
Qualitative & Quantitative	1

Source: Data processed 2025

3.4 Variable

Furthermore, it analyzed based on independent variables used in previous studies with the following results:

Table 3: Independent Variables

Variable	**Number of Variables**
Firm Value (FV)	5
Eco Efficiency (EE)	1
Green Innovation (GI)	1
Financial Board Director (FBD)	1
Female Audit Committee (FAC)	1
Tobins Q (TQ)	3
ROE	3
Leverage (LEV)	9
Market Value (MV)	1
International Listing (IL)	1

State Ownership (SO)	1
Capital Intensity (CI)	1
Profitability (ROA)	11
Managerial Ownership (MO)	1
Environmental Committee (EC)	1
Independent Audit Committee (IAC)	1
Board Independence (BI)	5
Board Meeting (BM)	1
Board Diversity (BD)	5
Duality (DUAL)	1
Family Ownership (FAM)	1
Family-controlled Firms (BOARD)	1
Board meeting frequency (BOMT)	1
Female board (FEMA)	1
Environmental Performance (EP)	9
Liquidity (LIK)	1
Sales Growth (SG)	1
Sector Industry (SI)	1
Financial Performance (FP)	1
Governance Structure (GS)	2
Foreign Ownership (FO)	1
Institutional Ownership (IO)	3
Media Exposure (ME)	3
Foreign Ownerships (KA)	1

Table 3 Independent Variables

Variable	**Number of Variables**
Foreign Subsidiary (APA)	1
Return on Sales (ROS)	1
Earnings Management (EM)	1
Industrial Type (IT)	3
CEO Gender (CEG)	1
CEO Tenture (CET)	1
Technology for Disclosure (TFD)	1
Regulator (REG)	1
Age Company (AC)	1
Family Firm (FF)	1
Family Supervisory Board (FSB)	1
Family Executives (FE)	1
Strategy Management carbon (SMC)	1
Websites (WS)	1
Firm Size (FS)	5
Carbon Performance (CP)	1

Capital Expenditure (CE)	1
Market Value Added (MVA)	1
Board Size (BZ)	1
Level of Asymmetric Information in Company (LAC)	1
Total of 31 Articles	

Source: Data processed 2025

Based on table 3, the results show that the majority of previous studies related to the determinants of carbon emission disclosure are found in the profitability variable (ROA) (Abdullah et al., 2020; Dharma et al., 2024; Emmanuel et al., 2023; Double, 2018; Huang et al., 2023; Maria Kristari & Yusram Teruna, 2023; Rahmawati et al., 2024; Ratmono et al., 2021; Riantono & Sunarto, 2022; Safelia & Young, 2023; Saraswati et al., 2021; Ulupui et al., 2020; Wahyuningrum et al., 2024), leverage (LEV) (Abdullah et al., 2020; Fransisca et al., 2024; Huang et al., 2023; Rahmawati et al., 2024; Ratmono et al., 2021; Riantono & Sunarto, 2022; Safelia & Young, 2023; Ulupui et al., 2020; Wahyuningrum et al., 2024), and environmental performance (EP) (Dharma et al., 2024; Hardiyansah et al., 2021; Huang et al., 2023; Rahmawati et al., 2024; Ratmono et al., 2021; Ulupui et al., 2020; Wahyuningrum et al., 2024) which are most widely used as independent variables in previous research. After that, it was followed by the variables firm value (FV), firm size (FS), and board diversity (BD) as variables that were also often used in previous research.

3.5 Mapping

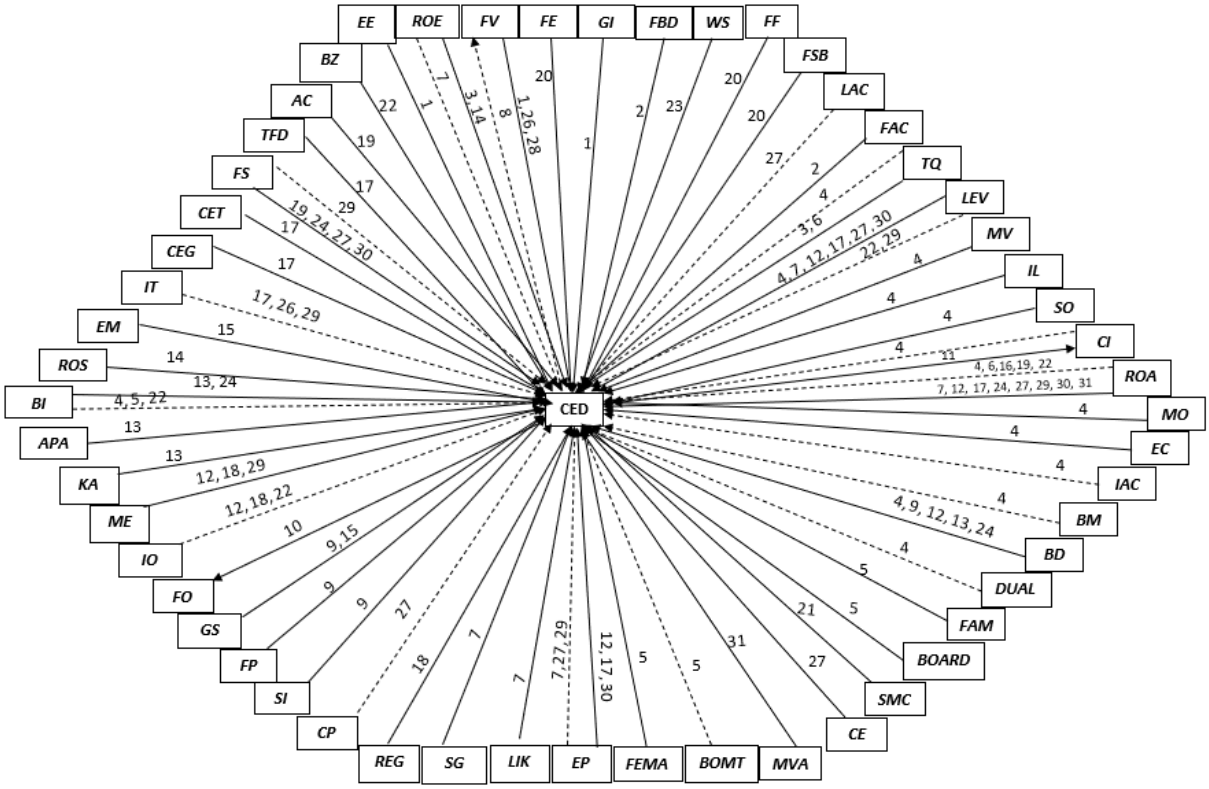

Figure 2: Mapping
Source: Data processed 2025

Information:

→ No

Table 4: Code Description on Mapping

Code	Author's Name & Year	The Result of Articles
1	(Sari et al., 2024)	The research findings demonstrate that eco-efficiency positively affects CED. Additionally, green innovation shows a substantial positive impact on CED. While CED does not serve as a mediating factor in the relationship between eco-efficiency and firm value, it does act as a mediator between green innovation and firm value.
2	(Saadah et al., 2024)	This study reveals that women in top management influence CED, through a perspective assessment of the board of directors and the audit committee
3	(Al-Mari & Mardini, 2024)	revealed that the FP market has a significant positive effect on CED

Table 4: Code Description on Mapping (continued)

Code	Author's Name & Year	The Result of Articles
4	(Fransisca et al., 2024)	The results indicated that the financial performance variables (LEV and MV), international listing, state ownership, committee, and boards of directors significantly impact CED in Indonesia.
5	(Susanto et al., 2024)	Family firms and larger boards tend to disclose more CE information. Board independence has no significant impact in disclosure, while frequent board meetings improve carbon performance. However, female board representation negatively affects CE performance.
6	(Dharma et al., 2024)	Profitability measured by ROA is not significant to CED, market value measured by Tobin's Q has a positive significant to CED. Also, the moderation of environmental performance measured by ROA on profitability and CED is not significant
7	(Rahmawati et al., 2024)	Liquidity, profitability, sales growth, and leverage have a direct influence on CED. Environmental performance does not affect CED
8	(Claudia, 2024)	Green accounting and CED had showed no significant relationship with firm value, while female board representation did. Women directors significantly moderated the relationship between green accounting practices, CED, and firm value.
9	(Yulianti & Waworuntu, 2024)	Finding that strong FP and GS are positively correlated with CED
10	(Widianingsih & Kohardinata, 2024)	CED has a significant positive influence on foreign ownership
11	(Emmanuel et al., 2023)	Environmental sustainability and ROA have a positive but not significant relationship.
12	(Wahyuningrum et al., 2024)	The study's results found that foreign BD, ROA, and ME significantly positively influence CED. LEV, on the other hand, has a negative effect, and IO has no significant effect on CED
13	(Park et al., 2023)	The results of the study found that corporate governance and compensation structures have a role in CE decisions.
14	Emmanuel Y.L. et al., (2024)	CED has a significant positive effect on ROE and ROS
15	(Abbas et al., 2023)	Profit management as a moderation between CG and CED
16	(Maria Kristari & Yusram Teruna, 2023)	CED is not significant to financial performance
17	(Huang et al., 2023)	Industry type and CEO tenure do not affect CED. But, LEV, ROA, EP, CEG and TFD hurt CED
18	(Widhiastuti & Safitri, 2023)	The study found that EP and ME had a positive influence on CED, and regulation had no effect on CED
19	(Safelia & Muda, 2023)	Firm size and leverage have a significant influence on CED in Indonesia & Malaysia. Meanwhile, the age of the company and profitability have no impact on CED

Table 4: Code Description of Mapping (continued)

Code	Author's Name & Year	The Result of Articles
20	(Pramono et al., 2023)	Family firm, family supervisory boards, and family executives have a significant influence on CED
21	(Linares-Rodríguez et al., 2022)	The study found that the implementation of carbon management strategies had a positive relationship with CED
22	(Riantono & Sunarto, 2022)	Firm size, leverage, profitability, board independence, and institutional ownership do not affect CED. But it has a positive effect on board size
23	(Purwanti et al., 2022)	CED has an impact on the web
24	Saraswati E. et al., (2021)	With the increase in the availability of financial resources and political visibility, board gender diversity, and board independence can affect CED
25	(Kurnia et al., 2021)	CED influences firm value

Source: Data processed 2025

Figure 3 shows the variables that affect the disclosure of carbon emissions. The images are compiled based on the literature conducted and analyzed (Farida et al., 2022). The variables used in this study are variables that affect or are influenced by the disclosure of CED. Then, several variables do not have a significant effect on carbon emission disclosure, such as ROE does not have a significant effect on carbon emission disclosure (Rahmawati et al., 2024), the level of asymmetry of company information does not affect CED (Ratmono et al., 2021), leverage does not have a significant effect on carbon emission disclosure (Riantono & Sunarto, 2022; Ulupui et al., 2020), capital intensity has no significant influence on carbon emission disclosure (Emmanuel et al., 2023), independent audit committee has no significant influence on CED (Fransisca et al., 2024), Independence board does not have a significant effect on CED (Fransisca et al., 2024), and others such as board meeting, duality (Fransisca et al., 2024), the independence of the supervisory board and the frequency of board meetings (Susanto et al., 2024), environmental performance (Rahmawati et al., 2024; Ratmono et al., 2021; Ulupui et al., 2020) carbon perfomance (Ratmono et al., 2021), institutional ownership (Rahmawati et al., 2024; Riantono & Sunarto, 2022; Wahyuningrum et al., 2024) industrial type (Hardiyansah et al., 2021; Huang et al., 2023; Ulupui et al., 2020) CEO gender (Huang et al., 2023), and firm size (Ulupui et al., 2020)(Ulupui et al., 2020).

In addition, based on the image above, several variables are also used as moderation variables, such as environmental performance (Dharma et al., 2024; Hardiyansah et al., 2021; Wahyuningrum et al., 2024; Widhiastuti & Safitri, 2023), green innovation (Sari et al., 2024), earning management (Abbas et al., 2023), institutional ownership (Widhiastuti & Safitri, 2023), industry type (Hardiyansah et al., 2021), financial performance (Ratmono et al., 2021), and media exposure (Abdullah, 2020).

5. Conclusion

Based on the criteria determined in the article search, this study obtained 31 articles related to the determinants of carbon emission disclosure. Based on research methods related to previous research, more from secondary data on manufacturing companies using quantitative research methods. Then, the research is based on independent variables used in earlier research, the majority of which are on variable profitability (ROA), leverage (LEV), and environmental performance (EP). This study has limitations, such as the database used is only sourced from Scopus, so the identified sample is limited. Thus, researchers can use a wider database to produce more comprehensive research. In addition, this study only uses a subject area limited to the field. Therefore, researchers are further advised to expand the scope of subject areas, for example by including fields such as "Environmental Science", "Social Sciences", and "Multidisciplinary", in order to obtain more comprehensive results.

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1. Faculty of Economics and Business, Universitas Sebelas Maret, Surakarta, Indonesia.

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Working Capital Management and Cash Conversion Cycle – Thinking Outside the Box with New Insights

Enyi Patrick Enyi[1], Eze Ogbonnaya Nweze[2], Adebawojo Oladipupo[3], Olalere Mayowa David[4]

[1] Department of Accounting, Babcock University, Ilishan-Remo, Nigeria. Email: enyip@babcock.edu.ng
[2] Department of Accountancy, Alex Ekwueme Federal University, Ndufu-Alike, Ikwo.
Email: nzekanzeo@yahoo.com
[3] Department of Accounting, Babcock University, Ilishan-Remo, Nigeria. Email: dipoadebawojo@gmail.com
[4] PhD Scholar, Department of Accounting, Babcock University, Ilishan-Remo, Nigeria.
Email: olalerem@babcock.edu.ng

Correspondence: Enyi Patrick Enyi. Email: enyip@babcock.edu.ng

Abstract
This paper scrutinizes the efficacy of the period-based cash conversion cycle (CCC) as a tool for working capital management. Recognizing that efficient working capital management is essential for a firm's liquidity, operational efficiency, and overall financial health, the study employs a multi-factor regression analysis to examine and contrast the effectiveness of the period-based cash conversion cycle (CCC-X) and the operational breakeven-based cash conversion cycle (CCC-B) on firms' profitability. The research, conducted using data from the financial statements of 83 listed industrial enterprises in India and Nigeria, reveals that the period-based CCC-X has no significant impact on the financial performance of the firms analyzed. Conversely, the operational breakeven-based CCC-B metric shows a highly significant influence on all profitability proxies utilized. The paper recommends that financial managers consider the operational breakeven point theory as a more effective approach to liquidity management.

Keywords: Working Capital, Cash Conversion Cycle, Financial Performance, Profitability, Operational Breakeven Point

1. Introduction

Working capital is a critical component of financial management, reflecting a company's efficiency and short-term financial health. It involves managing the balance between a firm's currents assets, primarily cash, inventory, and receivables, against its current liabilities such as payables and accruals (Khan & Jain, 2010). The significance of effective working capital management is underscored by its correlation with organizational performance and profitability (Deloof, 2003). By understanding the working capital life cycle (the period from cash outflow to cash inflows), organizations can improve their liquidity and increase their operational efficiency. This view aligns with the positions of Nobanee (2009) and Shin and Soenen 1998, that a good knowledge and management of a firm's cash conversion cycle can greatly improve working capital management and positively impact profitability.

The current method of estimating the cash conversion cycle using articulated period of completion though makes analytical sense, but its efficiency and effectiveness in guiding proper working capital management decisions appears suspicious and could result in exercises in futility. This study aims to scrutinize the concept of the working capital life cycle, its method of estimation, and its effects on working capital management with its overall implications for organizational performance.

1.1 Literature Review

1.1.1 Working Capital and Working Capital Management (WCM)

Various studies on the effect of working capital and its management on the performance of firms were almost of the same opinion. Boisjolya, *et al.* (2020) examine how different financing decisions affect the financial performance and stability of hotels. The research provided empirical evidence on the positive relationship between financing decisions, working capital management, and overall firm performance in the hotel sector. The study conducted by Baker, *et al.* (2017) also provides valuable insights into the WCM practices of Indian firms, helping managers understand common practices and areas for improvement. It suggested that Indian firms tend to use centralized cash management and rely heavily on material requirement planning (MRP) and enterprise resource planning (ERP) for proper inventory management but mainly consider the cash conversion cycle and net working capital for WCM monitoring. Abbadi and Abbadi (2013) identified the key determinants that influence working capital requirements in Palestinian industrial firms to include the cash conversion cycle (CCC), operating cash flow, leverage and firm size. The study revealed that the management of working capital impacts significantly on the firms' return on assets (ROA).

Akinlo (2012) examined the determinants of working capital requirements in selected quoted companies in Nigeria. The research identified several factors that significantly influence working capital requirements, such as **sales growth**, **profitability**, **liquidity**, and **leverage**. The study highlighted how these determinants affect the Cash Conversion Cycle, providing insights into managing liquidity more effectively. Nobanee (2009) introduces the concept of an **optimal cash conversion cycle**. The study suggests that simply shortening the cash conversion cycle (CCC) isn't always beneficial. Instead, identifying optimal levels of inventory, receivables, and payables where total holding and opportunity costs are minimized provides a more accurate measure of working capital management. It emphasizes a balanced approach to managing the CCC, considering the potential negative impacts of overly aggressive reductions in inventory, receivables, or payables. The optimal CCC offers a more comprehensive measure of working capital efficiency by considering both the timing and amount of funds committed at each stage of the cycle.

González, *et al*. (2021) explore the relationship between **Working Capital Management**, **Cash Conversion Cycle (CCC)**, and **firm performance**. The study provides empirical evidence on how effective working capital management impacts firm performance. It reveals that while a shorter inventory conversion period (ICP) and a shorter debtor collection period (DCP) positively affect performance, a shorter cash conversion cycle (CCC) and a shorter creditor payment period (CPP) negatively impact performance.

Alvarez and Vazquez (2021) investigated the relationship between **Working Capital Management** and **Profitability** in an emergent economy. The study provides empirical evidence on how effective working capital management impacts firm profitability in an emergent economy. It identifies key determinants such as **Days Sales Outstanding (DSO)**, **Days Sales Inventory (DSI)**, and **Days Payable Outstanding (DPO)** that significantly influence profitability. The findings suggest that longer DSO and DSI negatively impact profitability, while longer DPO has a positive effect.

1.1.2 The Components of Working Capital

A fundamental aspect of working capital is its composition, which can be delineated into several core components which include cash, inventory, accounts receivable, and accounts payable. Each component plays a vital role in the working capital life cycle.

1. **Cash**: Often regarded as the lifeblood of any business, cash is necessary for meeting short-term obligations (Brigham & Ehrhardt, 2013). Ensuring optimal cash levels assists organizations in avoiding financial distress.
2. **Inventory**: Inventory management involves maintaining sufficient stock to meet customer demand while minimizing holding costs. An excess inventory can tie up critical cash resources, affecting the overall cash cycle negatively (Gaur & Goyal, 2009).
3. **Accounts Receivable**: This refers to the money owed to a firm by its customers. Efficient accounts receivable management involves expediting the collection process, thus reducing the cash conversion period (Lind, 2012).
4. **Accounts Payable**: Accounts payable management entails negotiating optimal payment terms with suppliers and managing cash outflows judiciously. Efficiently leveraging accounts payable can extend the cash cycle, allowing firms to utilize cash effectively (Baños-Caballero et al., 2014).

1.1.3 The Working Capital Life Cycle

The working capital life cycle, commonly referred to as the cash conversion cycle, is a crucial metric that quantifies the time taken for a company to convert its investments in inventory and receivables back into cash. It provides insights into how efficiently a company manages its operational cycle, which encompasses the acquisition of raw materials, production of goods, sales, and collection of cash from customers. The cash cycle can also be defined as the time taken for a firm to convert its investments in inventory and other resources into cash flows from sales (Gitman, 2009). It comprises three main phases:

1. **Inventory Period**: The duration it takes for a company to sell its inventory. This phase can be optimized through just-in-time (JIT) inventory systems, reducing holding costs and increasing turnover rates. However, the ability of a firm to apply this strategy effectively depends on how well the organization can coordinate all aspects of its activities to achieve a homeostatic balance.
2. **Accounts Receivable Period**: This is the time taken to collect cash from customers. Effective credit policies and collection strategies can shorten this period, thereby improving cash flow.
3. **Accounts Payable Period**: This period signifies how long a company takes to pay its creditors. A longer accounts payable period can enhance working capital, provided it does not damage supplier relationships.
In all, the cumulative effect of optimizing each of these phases leads to a shorter overall cash cycle, which significantly enhances working capital efficiency (Richards & Laughlin, 1980).

1.1.4 Formula for the Cash Conversion Cycle (CCC)

The cash conversion cycle can be calculated using the following formula:
CCC = **DIO** + **DSO** – **DPO** **(1)**
Where:
DIO = Days Inventory Outstanding - which measures the average number of days it takes to sell all the inventory. It is calculated as:
DIO = Average Inventory / Cost of Goods Sold * 365 (2)
DSO = Days Sales Outstanding - which indicates the average collection period for accounts receivable. It can be computed using the formula:
DSO = Average Accounts Receivable / Net Credit Sales * 365 (3)
DPO = Days Payables Outstanding - which reflects the average number of days a company takes to pay its suppliers. It is formulated as:
DPO = Average Accounts Payable / Cost of Goods Sold * 365 (4)

1.1.5 Justifications for the study

Analyzing and understanding the components of the cash conversion cycle (CCC) is important to the management of a firm especially as it is the major guiding focus in working capital management. A spurious metric has the dire consequence implications of misleading the judgment of management in the efficient management of scarce organizational resources. Particularly, a good knowledge of a firm's cash conversion cycle will shed light on the following:

- A longer DIO is an indication that inventory remains unsold for a more extended period thereby potentially tying up capital.
- Higher DSO is a suggestion that a firm takes longer periods to collect cash from customers, and this can adversely affect liquidity.
- A longer DPO can improve immediate cash flow, as it implies extended credit terms with suppliers but there could be penalties for delayed payments to creditors which might negate gains from improved cash flow.

The goal of effective working capital management is to minimize the CCC, reflecting a shorter cycle, happier creditors, and improved liquidity (Gitman, 2009; Richards & Laughlin, 1980). However, another important justification for this study is that the period-based metric of CCC enunciated above never considers the operational efficiency of the firm which is critical to every operational decision it must take.

As seen from various studies, there is a demonstrable link between effective working capital management and organizational performance. Efficient management of the working capital life cycle can lead to - **Enhanced Liquidity** which results from shortening the cash cycle thereby increasing sufficient liquidity to meet short-term obligations (Deloof, 2003). **Increased Profitability** which results from lower costs through effective management of inventory and receivables (Shin & Soenen, 1998). **Improved Operational Efficiency** from streamlined processes in managing inventory and collections which enable firms to respond to market changes promptly (Brealey et al., 2011). It can also lead to **Sustainable Competitive Advantage** for entities that master the working capital life cycle as they can navigate market fluctuations better than their counterparts (Filbeck & Krueger, 2005).

1.1.6 Evaluating the Effectiveness of the Cash Conversion Cycle in Working Capital Management

As posited earlier, the cash conversion cycle (CCC) is a critical metric in evaluating a firm's efficiency in managing working capital. By assessing the time it takes for a company to convert its investments into cash flows, stakeholders can glean insights into operational efficiency and financial health. The effectiveness of the CCC hinges upon the delicate balance between these components. Ideally, a firm aims for a short CCC relative to its industry peers, indicating an efficient conversion of investments into cash (Filbeck & Krueger, 2005).

However, recognizing that every firm has its own distinctive intrinsic value, it might not be totally a good idea to always benchmark against peers, rather this study posits that industrial or peer benchmarks should be employed as an addition to the use of the firm's own capabilities in measuring the cash conversion cycle. This is the void which this paper shall attempt to fill by introducing the operational breakeven point CCC measurement metric.

1.1.7 Determining the Effectiveness of the Cash Conversion Cycle

To assess the effectiveness of the CCC in working capital management, several methodologies can be employed, and these include - benchmarking against industry norms by comparing the firm's CCC with industry averages to determine relative performance. A significantly higher CCC indicates inefficiencies that necessitate remedial action (Shin & Soenen, 1998). Trend Analysis reveals positive or negative trends in working capital performance which may indicate effective or deteriorating management strategies, which could signal potential liquidity issues (Gaur & Goyal, 2009).

Conducting regression analyses can help establish correlations between the CCC and overall financial performance indicators, such as profitability and return on assets. This quantitative approach can offer insights into how the CCC impacts financial outcomes (Deloof, 2003). Also, examining the relationship between CCC and cash flow metrics can provide a qualitative measure of effectiveness. An efficient CCC typically correlates with positive cash flow from operations, enhancing a firm's ability to invest in growth opportunities (Brealey et al., 2011). Companies can, in addition, perform scenario analyses by evaluating the effects of potential changes in inventory turnover, receivables collection, and payables management on their CCC. This helps in planning and identifying areas for improvement (Baker et al., 2013).

1.1.8 Thinking Outside the Box – The Operational Breakeven Point approach to measuring Cash Conversion Cycle

A recent development in the metric for the determination of working capital adequacy and its associated cash conversion cycle using the **Operational Break-Even Point** (OBEP) theory and its inclusive relative solvency metric tends to suggest that the working capital life cycle might significantly differ from the metric produced or suggested using the traditional inventory, payables and receivables formula.

The operational breakeven metric hinges its idea on the working capital required (WCR) when a firm has reached its operational break-even point. The operational breakeven point is defined in Enyi (2021) as *the point or stage of activity where cumulative contribution margin on recovered production outputs equal the total cumulative production costs and losses of the learning periods* (Enyi, 2021). The formula for determining OBEP, WCR, and the relative solvency metric (RSR) are outlined as follows:

$$OBEP = t/(2p) \quad (5)$$

$$WCR = tc/104p \quad (6)$$

$$RSR = 104p(a - l) / tc \quad (7)$$

Where,

t = Overall Turnover or Total Sales
p = Profit Before Tax
c = t-p = Total Operating Cost
a = Current Asset
l = Current Liabilities

Using these metrics, it is easy to deduce that the cash conversion cycle can rightly be measured by multiplying the operational breakeven point with the number of days in a production stock-up period which this study assumes to be an average of 30 days. Therefore, a more realistic cash conversion cycle formula is given as:

$$CCC = OBEP \times 30 \text{ days} \quad (8)$$

Which is same as:

$$CCC = 30t/(2p) \quad (9)$$

For instance, if the normal stock-up period for a firm is 30 days and assuming its OBEP is 2.214, the OBEP-based cash conversion cycle will be 2.214 x 30 = 66.42 days.

The choice of OBEP-based cash conversion cycle is predicated on the notion that OBEP relates more to the operational efficacy of a firm which hinges on its intrinsic capability and ability to utilize its resources than the mere conjecture behind the expectations of timely conversion of inventories, receivables, and delay in remitting payables. This thinking and approach is in line with the work of Nobanee (2009) which dwelt more on an **optimal cash conversion cycle and a balanced approach to the use of the CCC.**

2. Methodology

To study the effectiveness of the DIO, DSO, DPO usage in the CCC computation and introduce the use of the OBEP-based metric, the study employed an ex-post facto research design to obtain operational data from the published financial statements of 83 firms listed in India and Nigeria within a period of five financial seasons. Multi-factor regression analysis was used to analyze and compare the period-based CCC (CCC-X) and the OBEP-based CCC (CCC-B) with the profit after tax (PAT) and the return on assets (ROA) of the firms using the ValuStats (VSP 2.0) software.

3. Results and Findings

Findings from the review of extant literatures indicate that all the studies examined affirmed the fact that effective working capital management impacts positively on the financial performance of companies with liquidity, profitability, and leverage playing very important roles. The findings are show that the cash conversion cycle (CCC) is a veritable tool for an effective working capital management. Where the CCC is wrongly estimated, the

consequence will impact negatively on the financial performance of the entity with the attendant loss of goodwill in the hands of suppliers and fund providers. However, the work of Nobanee (2009) seems to have provided a useful ameliorative solution with the suggested approach to the optimal CCC measurement system. This latter suggestion was in line with the solution introduced in this study using the operational breakeven point (OBEP) approach to computing CCC. OBEP recognizes the need for optimality in working capital management, that is the reason for the introduction of the working capital required (WCR) at a firm's operational breakeven point (Enyi, 2021).

Tables 1-4 show the results of the multi-factor regression analysis using **ValuStats** (version 2.0).

Table 1 shows the OLS Regression results on profit after tax (PAT) with Working Capital (WKC) as a ***Predictor***. The F-statistics ($F_{(79,3)} = 6.977$, $p = .000$) show that the distribution is a perfect fit. Notwithstanding the R^2 and *Adj.* R^2 of 0.209 and 0.179 respectively, the CCC-X returns a *coefficient* of 0.8683, *standard error* of 1.833, ($t_{(83)} = 0.474$, $p = .637$), whilst the CCC-B returns a *coefficient* of -4.6799, *standard error* of 1.520, ($t_{(83)} = -3.079$, $p = .003$). WKC returns a *coefficient* of 0.191, *standard error* of 0.058, ($t_{(83)} = 3.279$, $p = .002$). The model constant reveals similar statistics to the CCC-B: ($t_{(83)} = 3.144$, $p = .002$).

Table 2 shows the OLS Regression results on return on assets (ROA) with Working Capital (WKC) as a ***Predictor***. The F-statistics ($F_{(79,3)} = 9.898$, $p = .000$) also reveal that the distribution is a perfect fit. Notwithstanding the R^2 and *Adj.* R^2 of 0.273 and 0.246 respectively, the CCC-X returns a *coefficient* of 0.0027, *standard error* of 0.007, ($t_{(83)} = 0.39$, $p = .698$), whilst the CCC-B returns a *coefficient* of -0.0268, *standard error* of 0.006, ($t_{(83)} = -4.688$, $p = .000$). WKC returns a *coefficient* of 0.0005, *standard error* of 0.000, ($t_{(83)} = 2.401$, $p = .019$) with the model constant statistics showing $t_{(83)} = 6.402$, $p = .000$.

Table 3 shows the OLS Regression results on profit after tax (PAT) with Working Capital (WKC) as a ***Mediator***. The F-statistics ($F_{(79,3)} = 18.860$, $p = .000$) show that the distribution is a perfect fit. Notwithstanding the R^2 and *Adj.* R^2 of 0.550 and 0.521 respectively, the CCC-X returns a *coefficient* of 1.8359, *standard error* of 1.407, ($t_{(83)} = 1.305$, $p = .196$), whilst the CCC-B returns a *coefficient* of -3.3968, *standard error* of 1.187, ($t_{(83)} = -2.861$, $p = .005$). WKC returns a *coefficient* of 3.5431, *standard error* of 0.445, ($t_{(83)} = 7.969$, $p = .000$) with the model constant statistics at $t_{(83)} = 2.089$, $p = .040$.

Table 4 shows the OLS Regression results on return on assets (ROA) with Working Capital (WKC) as a ***Mediator***. The F-statistics ($F_{(79,3)} = 7.571$, $p = .000$) reveal that the distribution is a perfect fit. Notwithstanding the R^2 and *Adj.* R^2 of 0.330 and 0.286 respectively, the **CCC-X** returns a *coefficient* of 0.0041, *standard error* of 0.007, ($t_{(83)} = 0.611$, $p = .543$), whilst the **CCC-B** returns a *coefficient* of -0.0244, *standard error* of 0.006, ($t_{(83)} = -4.286$, $p = .000$). WKC returns a *coefficient* of 0.0057, *standard error* of 0.002, ($t_{(83)} = 2.655$, $p = .010$). The model constant will reveal similar statistics to the CCC-B: ($t_{(83)} = 5.740$, $p = .000$).

4. Discussions of the findings

The data displayed in the preceding section summarizes the analysis of how working capital affects the financial performance of the firms studied. Essentially, it probes if and whether working capital management can predict profitability.

i. The **F-statistics** [F(79,3) = 6.977, p = .000), ($F_{(79,3)} = 9.898$, $p = .000$), ($F_{(79,3)} = 18.860$, $p = .000$), ($F_{(79,3)} = 7.571$, $p = .000$)] - all show that the model used to predict profitability and return on assets fits the data very well, and the results are statistically significant.

ii. **R^2 and Adjusted R^2** (ranging from 0.209 and 0.179 to 0.550 and 0.521) - indicate that around 20% to 55% of the changes in profitability and return on assets can be explained by the working capital and other factors considered in the model.

iii. The **CCC-X**'s coefficients, standard errors, *t* statistics and the *p* values for all the four analyses indicate that the period-based cash conversion cycle (CCC-X) has a small positive but statistically insignificant impact on profitability.

iv. The **CCC-B**'s coefficients, standard errors, *t* statistics and the *p* values for all the four analyses suggest that the operational breakeven-based cash conversion cycle (CCC-B) has a significant negative impact on profitability. Meaning that the lower the CCC-B, the higher a firm's profitability and vice versa.

v. The **WKC**'s coefficients, standard errors, ***t*** statistics and the ***p*** values for all the four analyses also reveal that working capital itself has a small but statistically significant positive impact on profitability. This means that a firm's working capital also contributes positively to the firm's financial performance.

In clear terms, the study found that managing working capital can influence profits, but the way profits are affected differs based on the methods used to measure cash conversion cycles. The period-based cash conversion cycle (CCC-X) method seems less impactful, while the operational-breakeven-point-based formula (CCC-B) method shows a significant negative effect on profits, indicating strongly that the CCC-B aligns inversely as expected with companies' financial performance. Working capital, on the other hand, also proved to be in line with the feasibility expectations of firms as it has a positive impact on profitability.

5. Conclusions

The cash conversion cycle is an indispensable tool for assessing and enhancing working capital management. By evaluating its components and implementing strategic practices, organizations can significantly improve their cash flow and operational efficiency. Ultimately, a well-optimized CCC can lead to increased profitability and a sustainable competitive advantage, reinforcing the importance of this metric in financial management. This study has demonstrated how the operational breakeven theory can help to establish a better and more efficient formula for measuring cash conversion cycles which are important metrics for effective working capital management.

6. Recommendations for Enhancing the Cash Conversion Cycle

To optimize working capital management and improve the effectiveness of the CCC, businesses can adopt several best practices including the use of the operational breakeven-based metric and others including:
Implementing just-in-time (JIT) inventory systems can minimize DIO by reducing excess stock and improving turnover rates (Gaur & Goyal, 2009). Establishing robust credit policies and enhanced collection strategies can effectively reduce DSO. Early payment discounts and clear invoicing processes can encourage faster payments (Lind, 2012).

Companies should also negotiate favorable payment terms with suppliers to extend DPO without damaging supplier relationships. This strategy allows for improved liquidity (Baños-Caballero et al., 2014). Firms should consider implementing **Integrated Financial Management Systems** by leveraging technology to automate financial processes which can lead to improved data accuracy and quicker decision-making regarding cash management (Baker et al., 2013).

Companies needs to introduce continuous tracking of the CCC and its components to enable timely identification of potential issues and the implementation of corrective measures. Regular reviews can help align working capital strategies with overall business objectives (Richards & Laughlin, 1980).

Ethical Approval and Consent to Participate: This research did not involve any human or animal subjects. The study exclusively utilized publicly available financial statements of companies listed on the Nigerian and Indian stock exchanges, which do not require specific permissions for use. According to the Babcock University Research and Ethics Committee (BUREC) guidelines, research using publicly available information is exempt from ethical scrutiny that applies to studies involving direct contact with humans or animals.

Consent for Publication: No personalized details, images, or videos of any individuals were used in the preparation of this document, thus no consent for publication is required.

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Data Availability: The data used for the analysis in this study are available from the corresponding author upon request.

Authors' Contributions: The first author wrote the manuscript, the second author supplied the literature, the third author supplied the financial statements from which data were extracted, the fourth author performed the analysis, and the last author proofread the manuscript and effected the pre-submission suggested corrections.

Conflict of Interest: The authors have no conflict of interest to declare.

Declaration of Generative AI and AI-assisted Technologies: This study has not used any generative AI tools or technologies in the preparation of this manuscript.

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Table 1: OLS Regression Results [PAT] with WKC as Predictor

Dep. Variable:	PAT	R-squared:	0.209
Model:	OLS	Adj. R-squared:	0.179
Method:	Least Squares	F-statistic:	6.977
Date:	Sun, 19 Jan 2025	Prob (F-statistic):	0.000318
Time:	18:57:54	Log-Likelihood:	-759.53
No. Observations:	83	AIC:	1527.
Df Residuals:	79	BIC:	1537.
Df Model:	3		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
const	2029.3431	645.484	3.144	0.002	744.540	3314.146
CCC-X	0.8683	1.833	0.474	0.637	-2.781	4.518
CCC-B	-4.6799	1.520	-3.079	0.003	-7.705	-1.654
WKC	0.1910	0.058	3.279	0.002	0.075	0.307

Omnibus:	53.539	Durbin-Watson:	1.219
Prob(Omnibus):	0.000	Jarque-Bera (JB):	166.625
Skew:	2.241	Prob(JB):	0.0000

Table 2: OLS Regression Results [ROA] with WKC as Predictor

Dep. Variable:	ROA	R-squared:	0.273
Model:	OLS	Adj. R-squared:	0.246
Method:	Least Squares	F-statistic:	9.898
Date:	Sun, 19 Jan 2025	Prob (F-statistics):	0.0000
Time:	18:58:26	Log-Likelihood:	-296.12
No. Observations:	83	AIC:	
Df Residuals:	79	BIC:	609.9
Df Model:	3		
Covariance Type:	nonrobust		

	Coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
Const	15.5395	2.427	6.402	0.000	10.708	20.371
CCC-X	0.0027	0.007	0.390	0.698	-0.011	0.016
CCC-B	-0.0268	0.006	-4.688	0.000	-0.038	-0.015
WKC	0.0005	0.000	2.401	0.019	9e-05	0.001

Omnibus:	13.568	Durbin-Watson:	1.751
Prob(Omnibus):	0.001	Jarque-Bera (JB):	14.599
Skew:	0.953	Prob(JB):	0.000676

Table 3: OLS Regression Results [PAT] with WKC as Moderator

Dep. Variable:	PAT	R-squared:	0.550
Model:	OLS	Adj. R-squared:	0.521
Method:	Least Squares	F-statistic:	18.86
Date:	Sun, 19 Jan 2025	Prob (F-statistic):	0.000
Time:	19:13:28	Log-Likelihood:	-736.10
No. Observations:	83	AIC:	1484.
Df Residuals:	77	BIC:	1499.
Df Model:	5		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
const	1063.4148	509.127	2.089	0.040	49.613	2077.217
CCC-X	1.8359	1.407	1.305	0.196	-0.965	4.637
CCC-B	-3.3968	1.187	-2.861	0.005	-5.761	-1.032
WKC	3.5431	0.445	7.969	0.000	2.658	4.428

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Omnibus:	80.104	Durbin-Watson:	1.870
Prob(Omnibus):	0.000	Jarque-Bera (JB):	667.845
Skew:	3.024	Prob(JB):	0.0000

Table 4: OLS Regression Results [ROA] with WKC as Moderator

Dep. Variable:	ROA	R-squared:	0.330
Model:	OLS	Adj. R-squared:	0.286
Method:	Least Squares	F-statistic:	7.571
Date:	Sun, 19 Jan 2025	Prob (F-statistic):	0.000
Time:	19:14:10	Log-Likelihood:	-292.76
No. Observations:	83	AIC:	597.5
Df Residuals:	77	BIC:	612.0
Df Model:	5		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
const	13.9964	2.438	5.740	0.000	9.141	18.852
CCC-X	0.0041	0.007	0.611	0.543	-0.009	0.018
CCC-B	-0.0244	0.006	-4.286	0.000	-0.036	-0.013
WKC	0.0057	0.002	2.655	0.010	0.001	0.010

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Omnibus:	21.342	Durbin-Watson:	1.809
Prob(Omnibus):	0.000	Jarque-Bera (JB):	27.416
Skew:	1.248	Prob(JB):	0.00000

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A Bibliometric Analysis of Carbon Emissions Disclosure Research in ASEAN Countries

Nicolas Bayu Kristiawan[1], Falikhatun[2]

[1] Faculty of Economics and Business, Universitas Sebelas Maret, Jl. Ir Sutami 36 A Surakarta, Indonesia
[2] Accounting Education Study Program, Faculty of Teachers Training and Education, Sanata Dharma University, Jl. Affandi, Mrican, Yogyakarta, Indonesia

Correspondence: Nicolas Bayu Kristiawan, E-mail: nicousd@gmail.com
ORCID ID: https://orcid.org/0009-0006-3714-5213

Abstract
This study aims to conduct a bibliometric analysis of carbon emission disclosure research in ASEAN countries. The analysis consists of 130 articles from Scopus-indexed journals from 2012 to 2025. The result of this study shows the analysis of carbon emissions disclosure research in ASEAN, that involves (1) trend in research publications, (2) distribution of publication and citations 3) distribution of publications based on affiliation, (4) distribution of publications by authors and citations, and (5) journal analysis, (6) top 10 most frequently used keywords, (7) the influential research on carbon emissions disclosure in ASEAN countries, (8) keyword co-occurrence networks. The analysis reflects that research on carbon emission disclosure in ASEAN is dominated by publication from Indonesia and Malaysia. In terms of the type of disclosure, ASEAN countries exhibit varying disclosure regulations. Indonesia, Malaysia, Thailand, the Philippines and Viet Nam adopt voluntary disclosure regulations, with different timelines for future mandatory implementation. In addition, Singapore implements mandatory disclosure regulations. Furthermore, this study provides insights into potential future research that can be further explored in the context of carbon emission disclosure in ASEAN, by identifying four variables, namely adaptive management, apathy behavior, educational policy, and campus sustainability.

Keywords: Carbon Emission Disclosure, Bibliometric Analysis, ASEAN, Future Research Agenda

1. Introduction

The issue of climate change has become a major concern over the past decade since it has negative impacts on humans and the environment such as extreme weather, ecosystem damage, rising sea levels, global warming, and other negative impacts. The primary factor that impacts climate change is the increase in CO_2 concentration in the atmosphere, which is caused by high levels of carbon emissions and results in the rise of global temperatures that cause climate change (Chen et al., 2021). In recent years, the increase in CO_2 concentration in the atmosphere has reached a critical level. According the data from NOAA's Global Monitoring Lab, the average global atmospheric CO_2 concentration reached its highest level of 427 ppm in May 2024 (Lindsley, 2025). In

fact, according to WHO, the ideal CO_2 level ranges from 310-330 ppm. Therefore, the carbon emission problem requires more serious attention.

In a business context, companies have a significant contribution in the increase of CO_2 concentration in the atmosphere. According to Climate Watch, the energy sector contributes to 75% of global carbon emissions in 2021. A report from the Carbon Disclosure Project (2017) shows that 100 companies in the world responsible for 71% total global carbon emissions. According to a report from InfluenceMap (2024) titled "The Carbon Major Database: Launch Report", 80% of global emissions from 2016 to 2022 were produced by 57 companies, both state-owned enterprises and private companies.

Businesses are held accountable for the environmental effects of their actions (Wulan, 2022). Corporate negligence in their operations also exacerbates the rise in carbon emissions (Nasih et al., 2019). This means that businesses are a big part of the problem of rising carbon emissions and need to do something about it. Therefore, companies need to give serious attention to this issue, given the increasing pressure from stakeholders for them to provide transparent data regarding carbon emission disclosures (Mayapada & Lyu, 2025). It is important to disclose carbon emissions because it can be used to judge how well companies are doing, especially when it comes to carbon emissions (Syafik et al., 2025). Companies can show that they are serious about lowering their carbon footprint by disclosing their carbon emissions. This can also help the world reach the Sustainable Development Goals (Poole, 2022). By encouraging the use of low-carbon practices, improving energy efficiency, and fostering long-term innovation that is good for the economy and the environment, carbon emission disclosure can make companies more accountable and help with bigger development goals (Setiawan et al., 2025).

In the academic context, previous studies have sought to investigate the determinants and both the economic and non-economic consequences of carbon emissions disclosure. For instance, several previous studies have investigated the impact of firm characteristics (Bae Choi et al., 2013; Chu et al., 2013; Wahyuningrum et al., 2024), ownership structure (Bedi & Singh, 2024; Singhania & Bhan, 2024), and industry type (Ott et al., 2017) on carbon emissions disclosure. Prior research has examined the effects of carbon emissions disclosure on financial performance (Desai et al., 2022; Khunkaew et al., 2023), firm value (Mahmudah et al., 2023) , reputation (Khalid et al., 2024), stock price (Griffin et al., 2017; Jaggi et al., 2018), and earnings management (Mayapada & Lyu, 2025). Additionally, certain studies have performed literature reviews to delineate the research concerning carbon emissions disclosure. There have been a number of literature review studies, such as those by Hahn et al. (2015) , Borghei, (2021), and Setiawan et al. (2025). Additionally, Manani & P. S, (2025) performed a literature review examining the correlation between carbon emission disclosure and earnings management. Nonetheless, the majority of these studies focus on literature reviews regarding carbon emission disclosure on a global scale. There remains a scarcity of literature review studies on carbon emission disclosure that concentrate on particular regions, such as the ASEAN region.

Research on countries in the ASEAN region is important, as these countries are significant contributors to carbon emissions, with a total of 1.76 gigatons of CO_2 originating from Indonesia, Vietnam, Thailand, Malaysia, and the Philippines (Lau, 2022). However, the level of carbon emission disclosure in ASEAN countries remains relatively low, with only around 30% of companies in six countries (Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam) providing carbon disclosure reports, far below the disclosure level in the European Union, which reaches 90% (CDP, 2022). In addition, there is variation in the regulations and policies governing carbon disclosure, as each country has its own set of rules (Yang & Li, 2024). This makes ASEAN different from regions such as Europe, which are more homogeneous in terms of regulation and reporting. Furthermore, the level of public awareness regarding climate issues also varies across countries. Some nations, such as Singapore and Thailand, have societies that are highly concerned about sustainability issues and demand strong sustainability practices, whereas in other countries, carbon emission disclosure is driven more by regulatory requirements than by public awareness of sustainability issues.

Therefore, based on these issues and research gaps, the objective of this study is to conduct a bibliometric analysis of carbon emission disclosure research in ASEAN countries. We chose bibliometric analysis because it

gives us a comprehensive overview of the current state of research and enables us to identify future research directions, especially on carbon emission disclosure research in ASEAN countries. This study investigates (1) trends in research publications, (2) distribution of publications and citations 3) distribution of publications based on affiliation, (4) distribution of publications by authors and citations, and (5) journal analysis, (6) top 10 most frequently used keywords, (7) the influential research on carbon emissions disclosure in ASEAN countries, (8) keyword co-occurrence networks. Additionally, this study seeks to offer insights into prospective future research that can be further examined regarding carbon emission disclosure in ASEAN, by identifying four variables that are rarely used, namely adaptive management, apathetic behavior, educational policy, and campus sustainability.

This study aims to contribute to the literature by concentrating on carbon emission disclosure research at the regional level (ASEAN), in contrast to prior studies that have primarily focused on the global level or developed countries. The ASEAN region has its own unique features that set it apart from other areas. For example, the rules and policies for carbon disclosure are different in each country, and the level of public awareness about climate change varies from country to country. Consequently, a literature review on carbon emission disclosure in this region is both distinctive and significant.

2. Research Methodology

This study employs bibliometric analysis that incorporates both quantitative and qualitative mapping and bibliometric visualization. This study conducts a search for research articles relevant to the topic of carbon emissions disclosure in the Scopus database. The Scopus database was selected because it provides coverage of reputable peer-reviewed journals and offers a structured indexing system along with comprehensive metadata analysis (Manani & P. S, 2025). The keywords used in this study are based on the research conducted by Borghei (2021) who performed a systematic literature review on carbon disclosure research in the global context. This study modifies those keywords by adding country-specific terms related to ASEAN nations. The keywords used are as follows.

> ("reporting" OR "disclo*" OR "statement*") AND ("carbon" OR "co2" OR "GHG" OR "greenhouse" OR "climate change" OR "climate risk" OR "climate resilien*" OR "climate adapt*" OR "climate mitigat*" OR "global warming") AND (“ASEAN” OR "INDONESIA" OR "MALAYSIA" OR "SINGAPORE" OR "THAILAND" OR "VIETNAM" OR "BRUNEI*" OR "CAMBODIA" OR "PHILIPPINES*” OR “MYANMAR" OR “LAOS”)

The search using these keywords resulted 651 research article documents. The filtering process was then conducted by limiting the source type to ‘journals’; restricting the subject area to ‘Business, Management, and Accounting,’ ‘Economics, Econometrics and Finance,’ and ‘Social Sciences’; limiting the document type to ‘articles’; and restricting the language to ‘English’. This filtering process resulted in 217 research article documents.

From these 217 documents, studies that were not specifically conducted in ASEAN countries were excluded, including those from Australia, the United Kingdom, the United States, China, the Netherlands, Canada, Taiwan, Sweden, South Korea, Nigeria, New Zealand, Jordan, Japan, India, Belgium, Germany, Italy, France, Finland, Bangladesh, Austria, the United Arab Emirates, Turkey, Tunisia, Spain, Somalia, Saudi Arabia, Poland, Palestine, Mexico, Iraq, and Hong Kong. This process produced a final dataset of 130 research article documents. The article selection process is illustrated in Figure 1, the PRISMA Flowchart below.

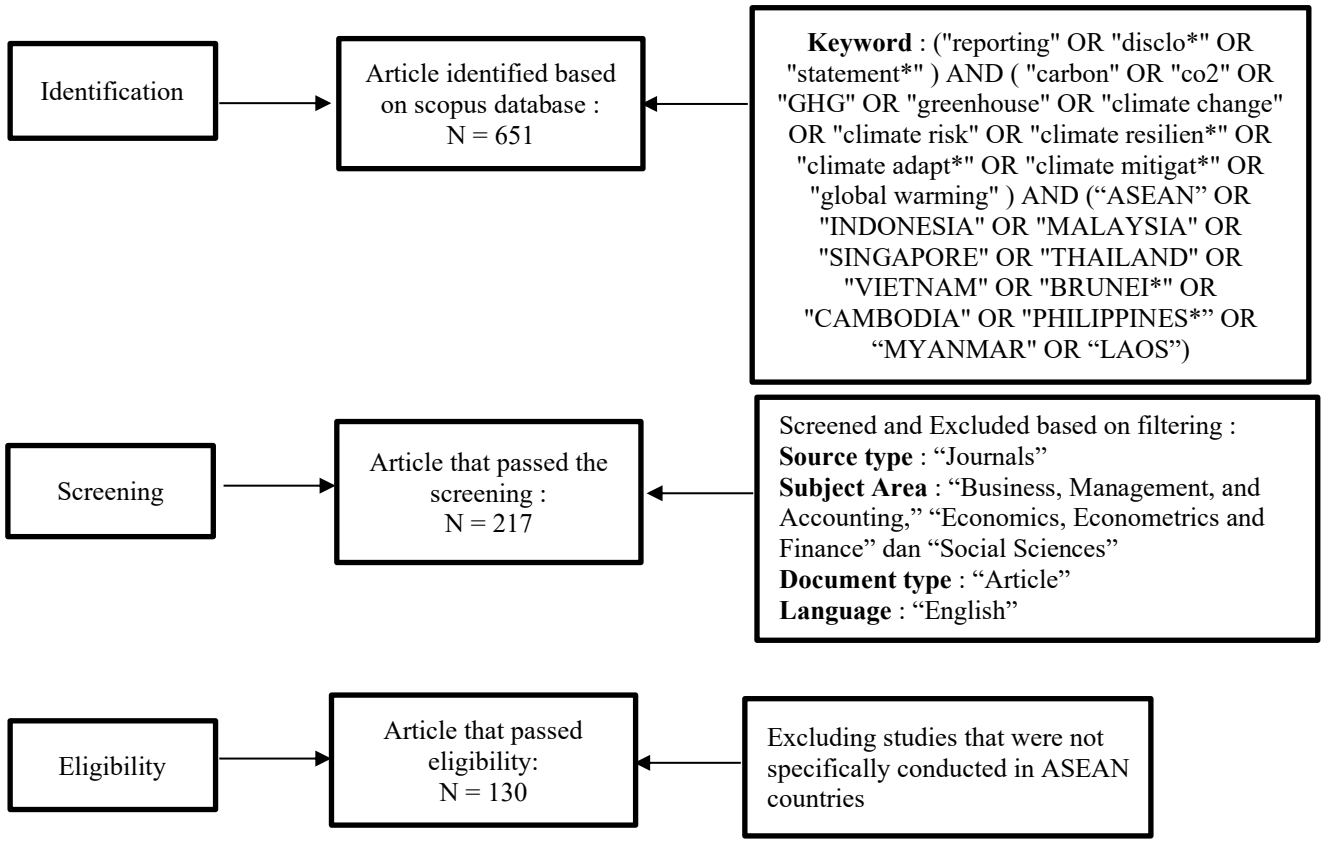

Figure 1: Prisma *Flowchart*

3. Result and Analysis

The results of the analysis based on the Scopus search, which identified 130 research articles on carbon emission disclosure in ASEAN countries, are presented as follows.

3.1. Trend In Research Publications

The trend of research publications on carbon emissions disclosure in ASEAN countries increased every year from 2012 to 2025, with the fluctuation occurring between 2012 and 2017. Figure 1 shows that there is an increase in article after 2017. This is due to the 2016 Paris Agreement, which influenced the growth of research publications on carbon emission disclosure. The most significant increase occurred in 2023 with 23 documents driven by the 2022 Sustainable Development Goals (SDGs) reporting that emphasized climate change. The sharp increase continued from 2023 to 2025, reaching 38 publications. This indicates growing academic attention to this topic in ASEAN.

3.2. Distribution of Publications and Citations

Figure 3 and table 1 present the distribution of publications and citations in ASEAN Countries. Indonesia ranks first with 81 documents and 616 citations. This indicates that the concern regarding carbon emission disclosure in Indonesia is higher than in other countries. This may be due to the fact that carbon emission issues in Indonesia are more significant compared to those in other countries. This is supported by the fact that Indonesia is the largest emitter of carbon in Southeast Asia, with a total of 600 million metric tons of carbon emissions in 2021 (International Energy Agency, 2025). Furthermore, Malaysia ranks second with around 35 documents and

356 citations. This indicates that Malaysia also faces notable carbon-emission challenges, particularly due to its rapid industrial growth, high energy consumption, and reliance on fossil fuels, which in turn increases the need for comprehensive carbon emission disclosure. In addition, Thailand ranks third with 13 publications and a total of 65 citations, while Vietnam ranks fourth with 10 publications and 47 total citations. Meanwhile, Singapore, Brunei Darussalam, and the Philippines show relatively low publication counts and citations. These findings illustrate an uneven distribution of research contributions across ASEAN countries strengthening the argument that the level awareness regarding climate issues varies across countries in ASEAN.

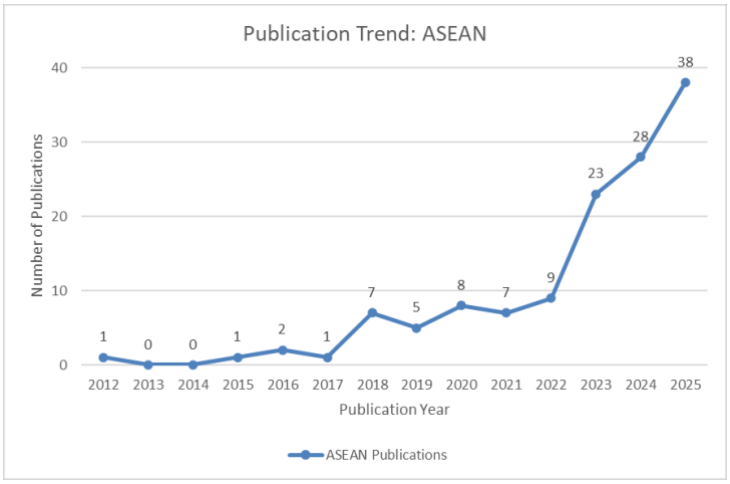

Figure 2: Trend in Research Publications

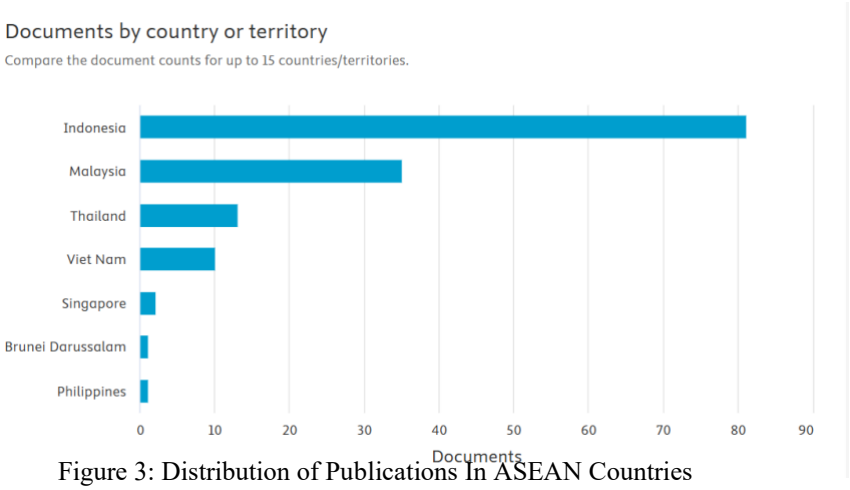

Figure 3: Distribution of Publications In ASEAN Countries

Table 1: Distribution of Publications and Citations in ASEAN Countries

No	Country	Total Publication	Total Citation
1	Indonesia	81	616
2	Malaysia	35	356
3	Thailand	13	65
4	Viet Nam	10	47
5	Singapore	2	18
6	Brunei Darusallam	1	18
7	Philippines	1	1

3.3. Distribution of Publications Based on Affiliation

Figure 4 present the distribution of research articles based on affiliation. Universitas Sebelas Maret in the top position with 12 documents, followed by Universitas Airlangga with 7 documents. Universiti Sains Malaysia, Universitas Diponegoro, and Bina Nusantara University each produced 6 publications. Below them are Universiti Malaysia Terengganu and Universitas Negeri Semarang with 5 documents. Prince of Songkla University, Khon Kaen University, and Universiti Teknologi Malaysia follow with 4 documents each. This distribution shows that research contributions are dominated by institutions in Indonesia and Malaysia, indicating strong academic interest in both countries regarding carbon emission disclosure issues. In addition, the findings shows an uneven distribution of research contributions across ASEAN countries strengthening the argument that the level awareness regarding climate issues varies across countries in ASEAN.

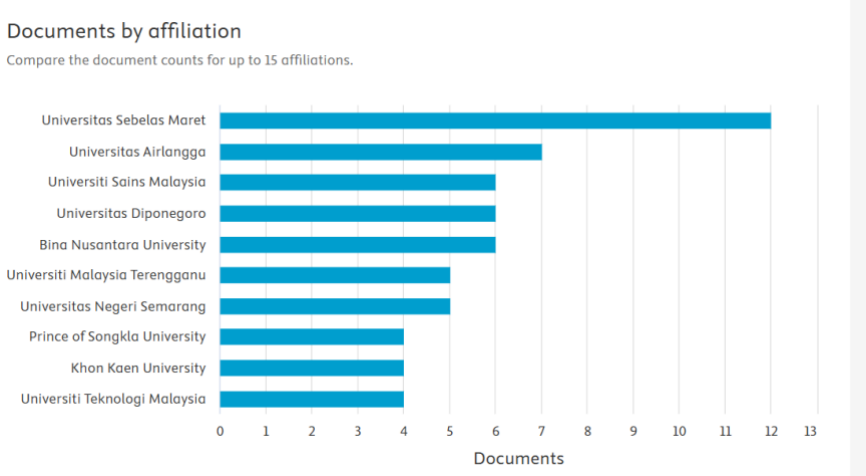

Figure 4: Distribution of Articles Based on Affiliation

3.4. Distribution of Publications by Authors and Citations

Figure 5 and Table 2 illustrate the distribution of publications by authors and citations across ASEAN Countries. The most productive author is Doddy Setiawan, with a total of 34 citations in 10 publications. In contrast, M. Nasih records the highest citation count with 128 citations despite having only three publications. Several authors, including Azlan Bin Amran, Hafiza Aishah Hashim, and Zalilah Salleh, each contribute four publications with relatively high citation counts, reflecting consistent research impact. Other authors show moderate publication output with varying citation levels, highlighting differences in research visibility and influence.

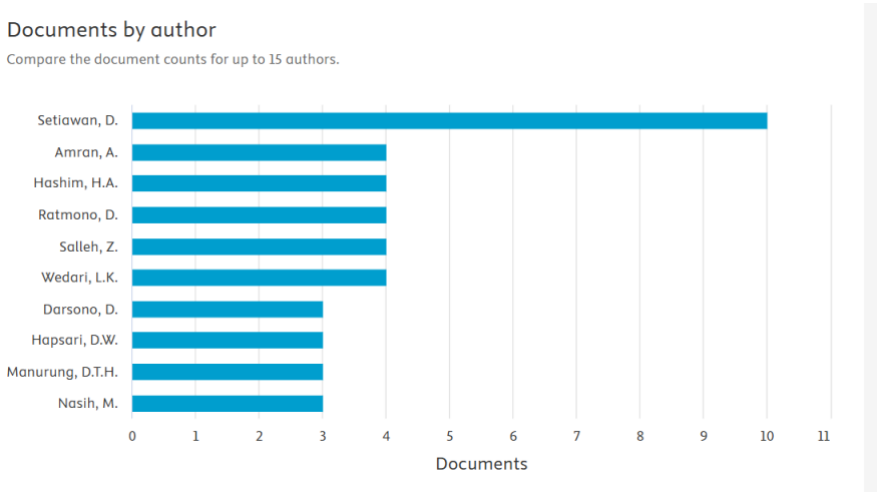

Figure 5: Distribution of Publication Articles by Author (Top 10)

Table 2: Distribution of Publication Articles by Author and Citations (Top 10)

No	Authors	Total Publication	Total Citation
1	Doddy Setiawan	10	34
2	Azlan Bin Amran	4	83
3	Hafiza Aishah Hashim	4	65
4	Dwi Ratmono	4	22
5	Zalailah Salleh	4	65
6	Linda Kusumaning Wedari	4	14
7	Darsono	3	21
8	D.W. Hapsari	3	18
9	D.T.H. Manurung,	3	18
10	M. Nasih	3	128

3.6. Journal Analysis

Table 3 present top 10 journals that publish research on carbon emission disclosure in ASEAN countries. The International Journal of Energy Economics and Policy rank first with the total of 15 publications, followed by International Journal of Sustainable Development and Planning with 8 publications, and Sustainability (Switzerland) with 7 publications. Overall, the quartile distribution varies and is relatively evenly distributed across the ten journals. Similarly, the publishers are distributed in a varied manner. This reflects the interdisciplinary nature and growing academic interest in this research area, particularly in ASEAN countries.

Table 3: Top 10 Journals

No	Journal	Total Publication	Quartile	Publisher
1	International Journal of Energy Economics and Policy	15	Q2	Econjournals
2	International Journal of Sustainable Development and Planning	8	Q3	International Information and Engineering Technology Association
3	Sustainability (Switzerland)	7	Q1	MDPI
4	Business Strategy and Development	5	Q2	John Wiley & Sons
5	Cogent Business and Management	5	Q2	Cogent OA
6	Corporate Social Responsibility and Environmental Management	4	Q1	John Wiley & Sons

Table 3: Top 10 Journals

No	Journal	Total Publication	Quartile	Publisher
7	International Journal of Scientific and Technology Research	3	Q4	Amazedia Solutions
8	International Journal of Management and Sustainability	3	Q4	Conscientia Beam
9	Journal of Cleaner Production	3	Q1	Elsevier
10	Journal of Sustainability Science and Managament	3	Q3	Universiti Malaysia Terengganu

3.7. Top 10 Most Frequently Used Keywords

Table 5 shows top 10 most frequently used keywords of carbon emission disclosure research in ASEAN. Climate change emerges as the most dominant keyword, with 29 occurrences and the highest total link strength, indicating its central role in the research network. Carbon emission disclosure and Indonesia follow closely, each appearing 23 occurrences. Keywords such as sustainability, carbon emission, and corporate governance further reflect the integration of environmental and governance perspectives. Additionally, terms related to firm outcomes, including financial performance, firm value, and carbon performance, suggest an emphasis on the economic implications of carbon-related issues. Overall, the keyword distribution illustrates the multidimensional and interconnected nature of carbon emission disclosure research in ASEAN countries.

Table 5: Top 10 Most Frequently Used Keywords

No	Keyword	Occurrences	Total Link Strength
1	Climate change	29	206
2	Carbon emission disclosure	23	112
3	Indonesia	23	206
4	Sustainability	14	124
5	Carbon emission	10	91
6	Corporate governance	9	35
7	Financial performance	9	43
8	Firm value	9	37
9	Carbon performance	8	46
10	Malaysia	8	61

3.7. The Influential Research on Carbon Emissions Dislcosure in ASEAN Countries

Table 6 shows the ten most influential research on carbon emissions disclosure in ASEAN countries based on how many times they have been cited. The most cited article, with a total of 116 citations, Nasih et al. (2019), investigates the impact of firm size, corporate governance structure, and industry characteristics on carbon emission disclosure (CED) in Indonesia. The study employs a quantitative methodology, utilizing content analysis and OLS regression to examine 305 firm-year observations of mining and agricultural companies listed on the Indonesian Stock Exchange from 2011 to 2016. The sample concentrates on environmentally sensitive sectors to more accurately reflect disclosure behavior. The results show that larger companies and companies with larger boards are more likely to share information about their carbon emissions. On the other hand, companies with more independent commissioners and directors are less likely to share this information, which means they are more likely to report conservatively. Mining companies also have a higher CED than agriculture companies. The authors recommend that future research focus on actual carbon emission reductions instead of mere disclosure, broaden industry coverage, and include institutional ownership or cross-country comparisons to enhance insights into governance and disclosure. Faisal et al. (2018), the second most cited article, look at how

much and why Indonesian listed companies disclose their greenhouse gas (GHG) emissions. The study employs a quantitative content analysis methodology to examine 148 firm-year observations of non-financial companies listed on the Indonesia Stock Exchange from 2011 to 2014. The sample encompasses various sectors, including agriculture, mining, basic industry and chemicals, consumer goods, infrastructure, utilities, transportation, trade, services, and investment, with a specific focus on sensitive industries. This research use multiple regression analysis to see how the characteristics of a company affect its GHG disclosure. The findings indicate that profitability, firm size, and industry type exert a positive and significant influence on GHG emission disclosure, whereas leverage demonstrates a negative impact, and government ownership lacks significance. The study recommends that subsequent research investigate the quality and substance of disclosures, include extended observation periods, and evaluate the influence of regulatory enforcement on actual emission reductions.

The following research was conducted in Indonesia, Malaysia, Vietnam, Thailand, and Singapore, with Indonesia and Malaysia emerging as the dominant contributors. Most studies employ panel data from listed companies, particularly those operating in carbon-intensive sectors such as manufacturing, energy, mining, and infrastructure. In terms of the type of disclosure (regulation), ASEAN countries exhibit varying disclosure regulations. Indonesia, Malaysia, Thailand, the Philippines and Viet Nam adopt voluntary disclosure regulations, with different timelines for future mandatory implementation. In addition, Singapore implements mandatory disclosure regulations.

The findings consistently show that stronger corporate governance structures are associated with higher levels or better quality of carbon disclosure, supporting arguments based on legitimacy theory, stakeholder theory, agency theory, and institutional theory. Several studies further demonstrate that carbon disclosure is linked to firm value, corporate performance, and risk management, suggesting that disclosure serves not only compliance or legitimacy purposes but also strategic and signaling functions.

Overall, these influential studies reveal that while awareness and quality of carbon disclosure in ASEAN have improved over time, disclosure practices remain uneven across countries and firms. This body of literature highlights the need for more harmonized regulations, deeper exploration of mandatory disclosure regulation, and further investigation into how carbon disclosure affects long-term corporate sustainability and financial outcomes in the ASEAN context.

Table 6: The influential research on Carbon Emissions Disclosure in ASEAN Countries

No	Author (Year)	Title	Country	Sample Size & Sector	Type of Disclosure (Voluntary or Mandatory)	Variable	Findings	Cited
1	Nasih et al. (2019)	Carbon emissions, firm size, and corporate governance structure: Evidence from the mining and agricultural industries in Indonesia	Indonesia	305 firm-year observations (2011–2016) from Mining and Agricultural Industries	Voluntary Carbon Emissions Disclosure	Independent variables: Firm size, board size, percentage of independent commissioners, percentage of independent directors, industry type (mining vs agriculture). Dependent variable: Carbon Emission Disclosure (CED). Control variables: Profitability, leverage	Firm size and board size have a positive and significant effect on carbon emission disclosure. A higher proportion of independent commissioners and directors negatively affects disclosure. Firms in the mining sector disclose carbon emissions more extensively than those in the agricultural sector	112
2	Faisal et al. (2018)	The content and determinants of greenhouse	Indonesia	148 non-financial firms listed on the Indonesia	Voluntary Carbon Emissions Disclosure	Dependent variable: Greenhouse Gas (GHG) Emission Disclosure.	Profitability, firm size, and industry type have a positive and	76

Table 6: The influential research on Carbon Emissions Disclosure in ASEAN Countries

No	Author (Year)	Title	Country	Sample Size & Sector	Type of Disclosure (Voluntary or Mandatory)	Variable	Findings	Cited
		gas emission disclosure: Evidence from Indonesian companies		Stock Exchange (2011–2014) from Agriculture, Mining, Basic Industry and Chemicals, Miscellaneous Industries, Consumer Goods, Property and Construction, Infrastructure, Trade and Services		Independent variables: Profitability, leverage, firm size, industry type (sensitive vs. non-sensitive), government ownership.	significant effect on GHG emission disclosure. Leverage has a significant negative effect, while government ownership has no significant influence on the level of GHG disclosure.	
3	Hardiyansah et al. (2021)	The Effect of Carbon Emission Disclosure on Firm Value: Environmental Performance and Industrial Type	Indonesia	82 companies listed on the Indonesia Stock Exchange (IDX) and recipients of the Indonesian Sustainability Reporting Award (ISRA) during 2014–2018 from various sectors, classified into high-profile and low-profile industries	Voluntary Carbon Emissions Disclosure	Independent variable: Carbon Emission Disclosure. Dependent variable: Firm Value (Tobin's Q). Moderating variables: Environmental Performance (ISO 14001 certification), Industrial Type (high-profile vs. low-profile). Control variables: Profitability (ROA), firm size, institutional ownership, leverage (DER).	Carbon emission disclosure has a positive and significant effect on firm value. Environmental performance (ISO 14001 certification) and industrial type significantly strengthen the relationship between carbon emission disclosure and firm value. Firms in high-profile industries and those with strong environmental performance gain higher market valuation from carbon disclosure.	60
4	Hermawan et al. (2018)	Going green: Determinants of carbon emission disclosure in manufacturing companies in Indonesia	Indonesia	22 manufacturing companies listed on the Indonesia Stock Exchange (2014–2016)	Voluntary Carbon Emissions Disclosure	Dependent variable: Carbon Emission Disclosure (CED). Independent variables: Regulator (state-owned vs. private firms), institutional ownership, firm size, profitability.	The regulator has a positive and significant effect on carbon emission disclosure. Firm size and profitability also positively influence carbon emission disclosure. Institutional ownership has no significant effect on the level of carbon emission disclosure	50
5	Amran et al. (2012)	Relationship of firm attributes, ownership structure and business network on climate change	Malaysia	100 publicly listed companies (annual and CSR reports, year 2009) from multiple sectors (Plantation &	Voluntary Climate Change Disclosure	Dependent variable: Climate Change Mitigation Efforts (weighted index). Independent variables: Firm size, profitability, industry membership, foreign	Firm size, profitability, industry membership, government ownership, and business network membership have a positive and	46

Table 6: The influential research on Carbon Emissions Disclosure in ASEAN Countries

No	Author (Year)	Title	Country	Sample Size & Sector	Type of Disclosure (Voluntary or Mandatory)	Variable	Findings	Cited
		efforts: Evidence from Malaysia		Mining, Finance, Property & Hotel, Trading & Technology, Construction, Consumer Products, Industrial)		ownership, government ownership, business network membership.	significant effect on climate change mitigation efforts. Foreign ownership has a negative and insignificant effect. Firms that are members of sustainable business networks exhibit higher levels of climate change mitigation activities than non-members	
6	Nguyen et al. (2020)	The determinants of environmental information disclosure in vietnam listed companies	Viet Nam	120 listed companies (106 valid responses); agriculture, industry & construction, trade & services	Mandatory environmental information, Voluntary carbon disclosure	Business sector, firm size, managers' awareness, profitability, financial leverage, community pressure, stakeholder pressure, government pressure	Environmental information disclosure in Vietnam is strongly influenced by government regulations, followed by stakeholder and community pressure. Firm size and managerial awareness positively affect disclosure, while profitability and financial leverage show a negative relationship. Disclosure is largely undertaken to comply with regulatory requirements rather than for voluntary transparency motives.	30
7	Khunkaew et al. (2023)	Sustainability reporting, gender diversity, firm value and corporate performance in ASEAN region	ASEAN Countries (Thailand, Malaysia, Indonesia, and the Philippines)	776 firm-year observations (2010–2019) from non-financial listed companies (Top 90–100 firms per country)	Voluntary/Semi mandatory (comply or explain basis) in Thailand, Malaysia, Indonesia, and The Philippines	Sustainability reporting (energy use, water management, carbon emissions, waste management, labor turnover, work safety, labor spending); gender diversity	Energy use, water management, and work safety positively affect corporate performance, while carbon emissions and waste management negatively affect performance. Water management, waste management, and work safety positively influence firm value. Gender diversity improves corporate performance but does not affect firm value and does not moderate the sustainability reporting–firm	24

Table 6: The influential research on Carbon Emissions Disclosure in ASEAN Countries

No	Author (Year)	Title	Country	Sample Size & Sector	Type of Disclosure (Voluntary or Mandatory)	Variable	Findings	Cited
							value relationship.	
8	Abdalla et al. (2025)	The effect of corporate governance best practices on the quality of carbon disclosures among malaysian public listed companies	Malaysia	72 public listed companies (360 firm-year observations, 2015–2019); carbon-intensive industries (chemicals, oil & gas, construction, energy & infrastructure)	Voluntary (comply or explain framework)	Corporate Governance Best Practices (board effectiveness, audit committee, environmental committee); control variables: firm size, profitability, age, liquidity, leverage, audit quality	Corporate governance best practices have a positive and significant effect on carbon disclosure quality. Firms with stronger boards, audit committees, and environmental committees provide higher-quality carbon disclosures. Although disclosure quality has improved over time, overall carbon disclosure in Malaysia remains low due to its voluntary nature.	17
9	An (2025)	Accelerating sustainability through better reporting	Singapore	Single firm case study (City Developments Limited); Real estate sector	Mandatory climate-related disclosure	Sustainability reporting quality; ESG reporting frameworks (GRI, TCFD, ISSB); climate-related disclosure	Robust and long-term sustainability reporting using GRI as a core framework enhances ESG integration, strategic decision-making, risk management, and long-term business resilience. Climate-related disclosure is becoming increasingly mandatory due to regulatory and investor pressure.	14
10	Khuong et al. (2024)	Corporate governance and corporate carbon disclosures: The moderating role of earnings management	Viet Nam	134 listed companies (panel data, 2015–2022); non-financial firms listed on the Vietnam stock market	Voluntary Carbon Emissions Disclosure	Corporate governance (board size, board independence, CEO duality, female board members, board meetings); earnings management (moderating variable)	Larger board size, higher board independence, and CEO duality reduce the likelihood of carbon disclosure, while a higher proportion of female board members and more frequent board meetings increase carbon disclosure. Earnings management significantly moderates the relationship between corporate governance and carbon disclosure.	6

3.9. Keyword Co-Occurrence Network (VOSviewer)

Figure 6 presents the visualization of keyword occurrence using VOSViewer in the context carbon emission disclosure research in ASEAN. The visualization consists of nodes and edges. The size of nodes represents the frequency of keywords usage in the prior research. The edges that connect the nodes represents the relationship and strength of the research. Based on the analysis of the keyword co-occurrence network visualization in figure 6, several keywords or variable are still rarely used in the carbon emissions disclosure research in ASEAN Countries, namely "adaptive management", "apathy behavior", "educational policy", and "campus sustainability". Therefore, future research can further explore these variables, particularly in the context of the ASEAN countries.

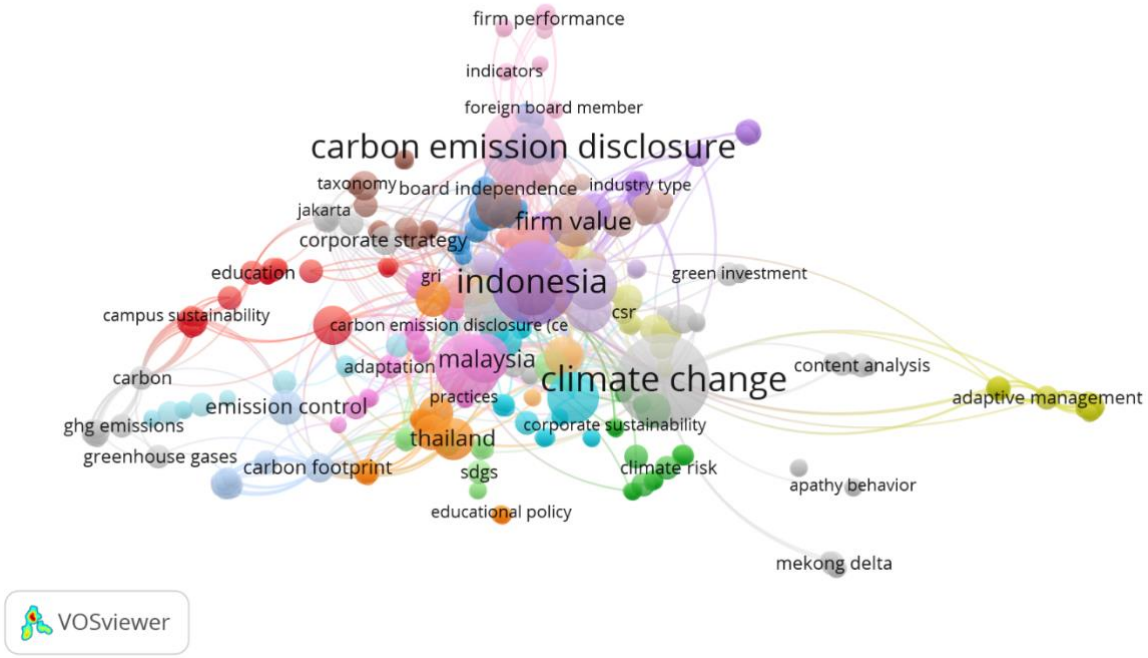

Figure 6: Keyword Keyword Co-Occurrence Network (VOSviewer)

3.9. Analysis and Future Research Direction

Based on the analysis of the keyword co-occurrence network using VOSviewer, several variables that are rarely used in carbon emission disclosure research in the ASEAN region can be identified as potential directions for future research. The four variables include adaptive management, apathy behavior, educational policy, and campus sustainability. The following presents the analysis of each variable and the future research directions associated with these variables.

1) Adaptive Management

Adaptive management refers to an organization's ability to adjust its strategies and policies in response to environmental uncertainty (Walters, 1986). In the environmental literature, this concept has been widely applied in studies on public policy and natural resource management. However, adaptive management remains relatively underexplored in accounting and sustainability reporting research, particularly in carbon emissions and climate risk disclosure. Firms with higher levels of adaptive management tend to be more proactive in integrating climate risk considerations into their business strategies and sustainability reporting practices. Nevertheless, in many developing countries, adaptive management is mainly limited to minimum regulatory compliance. This condition has implications for the low quality and inconsistency of carbon emission disclosure over time.

Future research may develop an adaptive management index based on disclosures of climate adaptation strategies and changes in internal corporate policies. Longitudinal studies are particularly relevant to examine how adaptive management influences the dynamics of carbon emission disclosure before and after regulatory changes or specific climate-related crises. In addition, adaptive management can be positioned as a mediating variable between climate risk exposure and firm performance or firm value. In the ASEAN context, future research may compare firms in countries with high levels of climate vulnerability (e.g., Indonesia, the Philippines, and Thailand) to assess whether adaptive management encourages more substantive carbon emission disclosure.

2) Apathy Behavior

Apathy behavior reflects an indifferent attitude toward environmental issues, which may hinder proactive environmental actions (Kollmuss & Agyeman, 2002). In the context of companies, such apathy may manifest in limited managerial commitment to environmental transparency (Bansal, 2003), low-quality carbon emission disclosure (Hahn & Kühnen, 2013), and symbolic disclosure practices (Cho et al., 2015). The existing carbon emission disclosure literature has predominantly emphasized structural factors such as corporate governance, firm size, and regulatory pressure, while psychological and organizational behavioral dimensions remain relatively underexplored. In developing countries such as Indonesia, apathetic attitudes may be further reinforced by weak regulatory enforcement, short-term–oriented organizational cultures, and the perception that climate issues are not a primary business priority.

Future research may operationalize apathy behavior as an independent or moderating variable by employing proxies such as managerial environmental awareness, environmental concern indices, or content analysis of sustainability report narratives. Empirical studies may examine whether apathy behavior weakens the influence of stakeholder pressure, regulatory requirements, or ESG ratings on the quality of carbon emission disclosure. In addition, future research may adopt a mixed-methods approach by incorporating managerial interviews to explore the psychological factors underlying low levels of carbon emission disclosure. In the ASEAN context, cross-country comparisons could provide insights into whether national culture and environmental awareness moderate the relationship between apathy behavior and carbon emission disclosure (CED). This variable may also be linked to earnings management or earnings quality to examine whether firms with higher levels of apathy tend to avoid transparency in both financial and non-financial reporting.

3) Educational Policy

Educational policy is typically associated with the public sector and the education system; therefore, it is rarely employed as a variable in accounting and carbon emission disclosure research. However, educational policy plays a long-term role in shaping environmental awareness, human resource competencies, and organizational culture. Curricula that emphasize sustainability, climate change, and ESG issues can influence how managers and accountants perceive the importance of carbon emission disclosure. In many ASEAN countries, the integration of environmental issues into educational policy remains partial, limiting its impact on business practices. The relationship between educational policy and carbon emission disclosure is indirect but significant in the long run through its influence on human capital and organizational mindset.

Future research may examine educational policy as an institutional or macro-level variable that moderates the relationship between environmental regulation and carbon emission disclosure. Cross-country studies within the ASEAN region may investigate whether countries with stronger sustainability-oriented educational policies produce firms with higher-quality carbon emission disclosure (CED). In addition, future research may link educational policy to the quality of ESG reporting, sustainability report assurance, or climate risk disclosure. A multi-level analysis approach (country–firm level) would be particularly relevant for capturing the influence of educational policy on corporate behavior. This variable also has the potential to enrich the CED literature by incorporating long-term development and human capital perspectives.

4) Campus Sustainability

Campus sustainability has generally been examined in the context of educational institutions but is rarely linked to corporate behavior or carbon emission disclosure. However, universities play an important role as producers of knowledge, values, and human capital that later enter the business sector. Campuses that consistently implement sustainability principles have the potential to produce graduates and research that are more sensitive to climate issues and environmental transparency. Nevertheless, the relationship between campus sustainability and corporate carbon emission disclosure practices remains largely underexplored empirically. In developing countries, the linkage between academia and industry is often weak, making the impact of campus sustainability on business practices indirect and fragmented.

Future research may explore campus sustainability as a contextual variable influencing corporate sustainability practices through human capital development, research collaboration, and knowledge transfer. Studies may examine whether firms with strong linkages to sustainability-oriented universities (e.g., through alumni networks, joint research projects, or training programs) exhibit higher-quality carbon emission disclosure (CED). In addition, qualitative approaches can be employed to investigate the role of universities in shaping narratives and standards related to carbon emission disclosure. In the Indonesian and broader ASEAN context, this variable holds significant potential for bridging the literature on education, sustainability, and environmental accounting in an interdisciplinary manner.

4. Conclusion

This study conducts bibliometric analysis to explore carbon emission disclosure research in ASEAN countries. Studies of carbon emissions disclosure on countries in the ASEAN region are important, as these countries are significant contributors to carbon emissions, with a total of 1.76 gigatons of CO_2 originating from Indonesia, Vietnam, Thailand, Malaysia, and the Philippines (Lau, 2022). However, the level of carbon emission disclosure in ASEAN countries remains relatively low, with only around 30% of companies in six countries (Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam) providing carbon disclosure reports, far below the disclosure level in the European Union, which reaches 90% (CDP, 2022). In addition, there is variation in the regulations and policies governing carbon disclosure, as each country has its own set of rules (Yang & Li, 2024). This makes ASEAN different from regions such as Europe, which are more homogeneous in terms of regulation and reporting.

The study uses bibliometric analysis to explore: (1) trend in research publications, (2) distribution of publication and citations (3) distribution of publications based on affiliation, (4) distribution of publications by authors and citations, and (5) journal analysis, (6) top 10 most frequently used keywords, (7) the influential research on carbon emissions disclosure in ASEAN countries, (8) keyword co-occurrence networks. The result of this study shows that research on carbon emission disclosure in ASEAN is dominated by publication from Indonesia and Malaysia. Moreover, in terms of the type of disclosure, ASEAN countries exhibit varying disclosure regulations. Indonesia, Malaysia, Thailand, the Philippines and Viet Nam adopt voluntary disclosure regulations, with different timelines for future mandatory implementation. In addition, Singapore implements mandatory disclosure regulations.

This study contributes to the literature by providing future research directions that explore variable that rarely used in prior research on carbon emission disclosure in ASEAN countries, namely adaptive management, apathy behavior, educational policy, and campus sustainability.

This study has a several limitations. First, the analysis is based on articles published on a Scopus database, thereby potentially excluding relevant articles and a database selection bias. Further research should integrate alternative databases like; Web of Science, Dimensions or Google Scholar to ensure greater coverage. Second, bibliometric analysis provides descriptive information on publication activity, keyword networks, and citation

format, but not the methodological authority, theoretical depth, or empirical consistency of the included studies. Consequently, future scholarship could also follow up bibliometric findings with a systematic literature review or meta-analysis, assessing the strength and quality of the evidence base in the area under discussion.

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Socioeconomic Determinants of Stunting According to Country Income Grouping: Panel Data Analysis

Wilson Rajagukguk[1], Omas Bulan Samosir[2], Perak Samosir[3], Swanto Sirait[4], Anthony Tampubolon[5], Frengky Sitorus[6], Ruth Natasha[7]

[1] Universitas Kristen Indonesia. Email: Wilson.rajagukguk@uki.ac.id; wrajagukguk@yahoo.com
[2] Universitas Indonesia. Email: omas.bulan@ui.ac.id; omasbr@yahoo.co.uk
[3] Institut Teknologi Indonesia. Email: samosirperak@gmail.com
[4] Universitas Kristen Indonesia. Email: Email: suwanto.sirait@uki.ac.id
[5] Universitas Kristen Indonesia. Email: antonitampubolon@gmail.com
[6] Universitas Kristen Indonesia
[7] Universitas Bunda Mulia, Indonesia. Email: rnattassha@bundamulia.ac.id

Correspondence: Wilson Rajagukguk. ORCID ID: https://orcid.org/0000-0002-5802-609X

Abstract
Stunting remains a global problem that needs to be addressed, not only in low- and middle-income countries but also in high-income countries. Goal 2 of Sustainable Development Goals 30 aims to create a world free from hunger by 2030 (UN, 2015). This study was conducted to identify the determinants of stunting in countries stratified by income. Data were obtained from the World Bank Indicator (2026), categorizing countries by income into low-income, lower-middle-income, upper-middle-income, and high-income groups. The analysis method used was linear regression with panel data. The time period covered the study was 2005–2024. The analysis showed that access to electricity, access to clean fuels and cooking technologies, women's business, and the Law Index Score (scale 1–100) were associated with reduced stunting. Meanwhile, the variables carbon intensity of GDP (kg CO2e per 2021 PPP $ of GDP) and unemployment (% of total labor force) increased stunting prevalence.

Keywords: Stunting, Socioeconomic Determinants, Country Income Grouping, Panel Data Analysis

1. Background

Goal 2 of Sustainable Development Goals 30 is to achieve a world free from hunger by 2030 (UN, 2015). Global hunger and food insecurity have shown an alarming increase since 2015, a trend exacerbated by a combination of factors including the pandemic, conflict, climate change, and deepening inequalities. Stunting is impaired growth and development in children due to chronic (long-term) malnutrition and repeated infections. It is characterized by a child's height being shorter than expected for their age, reflecting growth failure that can impact brain development, intelligence, and the risk of future disease. This condition occurs primarily during the First 1,000 Days of Life (HPK), from conception to age 2, and is triggered by inadequate nutritional intake, poor parenting practices, and poor environmental sanitation.

Stunting is a major challenge to global health. Stunting is characterized by impaired growth and development in children due to prolonged malnutrition, affecting physical height and cognitive abilities. Malnutrition refers to insufficient or excessive nutrient intake, an imbalance in essential nutrients, or impaired nutrient utilization. The double burden of malnutrition comprises undernutrition, overweight and obesity, and diet-related non-communicable diseases. Malnutrition manifests in four main forms: wasting, stunting, underweight, and micronutrient deficiencies (WHO, 2026). Acute malnutrition (wasting) is defined as low weight for height. It often indicates recent and severe weight loss, although it can also be prolonged.

When a person does not receive adequate food quality and quantity and/or they are frequently or chronically ill, acute malnutrition in children is associated with a higher risk of death if not properly treated. Stunting is defined as low height for age. It results from chronic or recurrent malnutrition, usually associated with poverty, poor maternal health and nutrition, frequent illness, and/or inadequate feeding and care early in life. Stunting prevents children from reaching their physical and cognitive potential. Underweight is defined as low weight for age. Children who are underweight may experience stunted growth, acute malnutrition, or both (WHO, 2026).

Micronutrient deficiencies are deficiencies in vitamins and minerals essential for bodily functions such as producing enzymes, hormones, and other substances needed for growth and development.

This condition is common in developing countries and is a direct result of inadequate nutritional intake from conception through the first 1,000 days of life, including the prenatal period (Rokom, 2023).

The impact of stunting is its impact on individual health, as well as cognitive abilities, educational performance, and future economic productivity. Stunted growth early in life leads to chronic health problems in adulthood and an increased risk of non-communicable diseases. Stunting also has social consequences, such as stunted growth, which perpetuates the cycle of poverty and reduces economic progress at the national level.

The World Health Assembly (WHA) targets a 40% reduction in stunting prevalence by 2025 compared to 2013 levels. Furthermore, the Sustainable Development Goals (SDGs) target is to eliminate all forms of malnutrition by 2030. The 78th World Health Assembly (WHA) in 2025 extended the global nutrition target to 2030, aiming to reduce the number of children under five years old who experience stunting by 40%. This updated goal aligns with the SDGs to combat malnutrition, which require intensive investment to reduce the global prevalence of stunting, which has fallen from 26.4% in 2012 to 23.2% in 2024 (WHO, 2025b).

Figure 1 shows the trend of stunting prevalence, height for age (% of children under 5) in four groups of countries according to income level in the period 2005 - 2025. The highest prevalence of stunting is in low-income countries, followed by lower-income countries, and the upper-middle-income group of countries. In these three income groups, there was an improvement, namely a decrease in the trend of prevalence of stunting, height for age (% of children under 5). Meanwhile, in high-income countries, the prevalence of stunting was already at around 5% and the situation tended to stagnate during the study period.

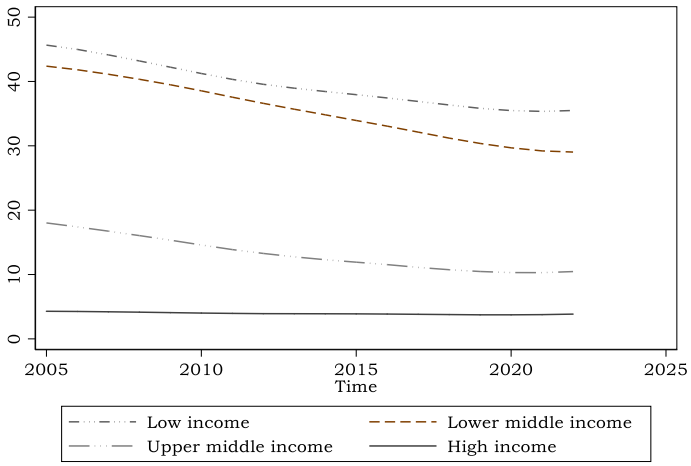

Figure 1: Prevalence of stunting, height for age (% of children under 5)
Source: World Bank (2026), own calculation

At the 78th World Health Assembly (WHO, 2025b), WHO Member States agreed and adopted a resolution extending the Global Nutrition Targets for improving maternal, infant, and early childhood nutrition from 2025 to 2030. The four agreed targets are: (1) a 40% reduction in the number of children under five who experience stunting, (2) a 50% reduction in anemia in women of reproductive age, (3) a 30% reduction in low birth weight, and (4) a reduction in acute malnutrition in children under five to less than 5%.

Furthermore, this study was conducted to examine the socioeconomic and demographic determinants of stunting in countries by income group. Income groups are divided into four groups: high-income, upper-middle-income, lower-middle-income, and low-income.

2. Literature Review

The factors causing stunting are multifaceted, including diet quality, disease burden, and broader socioeconomic conditions. Linear growth in children is stunted when diet quality is poor or when children are frequently exposed to infections, particularly during the critical period before the age of two. Diet composition, particularly including animal-source foods during complementary feeding, plays a crucial role in providing the dense and bioavailable nutrients necessary for optimal growth.

By 2023, new electricity connections will outpace population growth, increasing global access to 92 percent and reducing the number of people without electricity to 666 million—19 million fewer than the previous year. The remaining unconnected population tends to live in remote areas, have lower incomes, and face challenges of vulnerability, conflict, and violence (IEA, 2025).

Chronic child malnutrition remains a critical global public health challenge, influenced by complex interactions between biological, socioeconomic, and environmental factors (Yani et al. 2023). Specifically, household electricity availability has been identified as a key infrastructure variable that facilitates efficient resource utilization for child care and is associated with a reduced likelihood of chronic malnutrition (Pillai and Maleku 2019; Utumatwishima et al. 2023). The relationship between electrification and child nutritional status has not been widely explored in the literature.

Fujii, T., Shonchoy, A. S., & Xu, S. (2018) offer microeconometric evidence from rural Bangladesh. They found that the rapid expansion of electrification and significant improvements in nutritional status observed over the past two decades are used. The results indicate that access to electricity has the potential to improve children's nutritional status through various pathways, such as increased well-being, reduced birth rates through changes in

time-use patterns, the dissemination of information through technologies such as television, and improved health services. Improved child nutrition has a direct impact on reducing stunting.

The World Health Organization defines clean fuels and technologies as those that meet recommended levels of fine particulate matter and carbon monoxide, including solar, electricity, biogas, natural gas, liquefied petroleum gas, and alcohol fuels such as ethanol (Khamjalas 2024). Several studies on the relationship between access to clean cooking fuels and technologies (percentage of population) and stunting have shown a significant impact on stunting reduction (WHO, 2023, ScienceDirect, 2024), Eduvest (2024), and Wiley Online Library (2020).

Rahma & Hartono, D. (2024) conducted research in Indonesia on the impact of clean cooking fuel use on the risk of stunting in children aged 0–59 months. Using cross-sectional data from the 2014 Indonesian Family Life Survey (IFLS) and the Propensity Score Matching (PSM) method, they found that households using clean cooking fuels, such as liquefied petroleum gas (LPG), significantly increased children's Height-for-Age Z-scores, which in turn increased the risk of stunting. This study highlights the importance of clean energy policies and increased awareness, particularly in rural areas, for reducing health disparities and improving child growth outcomes. These findings contribute to the growing body of evidence linking clean energy transitions to improved public health and child development indicators.

Tang et al., (2024) conducted a study on the nutritional impact of non-solid cooking fuel use on children under five years of age in developing countries. Using data from over 1.12 million children in 62 developing countries from the Demographic and Health Survey (DHS) and using fixed effects (FE) and instrumental variable estimation methods, it was shown that the use of non-solid cooking fuels significantly improves the nutritional outcomes of children under five years of age. Compared to their peers from households that predominantly use solid fuels, children from households that predominantly use non-solid fuels showed a lower probability of stunting (by 5.9 percentage points) and being underweight (by 1.2 percentage points).

Evidence also suggests that this occurs through several mechanisms, such as improved indoor air quality, reduced respiratory symptoms in children, benefits for maternal health, and reduced time mothers spend collecting fuel or cooking.

GDP carbon intensity (kg CO2e per 2021 PPP GDP) measures greenhouse gas emissions (CO2, methane, nitrous oxide, etc.) from the agriculture, energy, waste, and industry sectors—divided by 2021 gross domestic product in constant purchasing power parity (PPP) dollars.

Countries that successfully reduce the carbon intensity of their economies while maintaining growth are better able to address environmental and public health challenges, including reducing child stunting (Perissi and Jones, 2022).

Masters et al. (2022) conducted research on the impact of carbon intensity on stunting prevalence. The policy proposal is that economic development and environmental characteristics (such as carbon intensity) can create a foundation for improvements in health infrastructure and resource availability. Well-targeted policies and interventions are needed to translate these macro-level changes into tangible reductions in stunting prevalence.

Women's autonomy and bargaining power can be used to measure the broader context that influences child health outcomes. Indicators of women's bargaining power include participation in decision-making about household spending and autonomy in healthcare decisions. The Women's Business and the Law Index Score is relevant for understanding the pathways through which the Women's Business and the Law Index Score can influence child health and nutrition, including reducing stunting in children. The Women's Business and the Law Index Score shapes women's roles in household decision-making and access to resources. (Hossain and Nikolov, 2021)

The Women's Business and the Law Index Score can be a determinant of increased employment opportunities for women. Women's employment opportunities can change the dynamics of household income and bargaining

power within the household. When women have greater control over resources and decision-making, they tend to prioritize spending that benefits children's health and nutrition, leading to health improvements, including reduced stunting (Masters et al. 2022).

Unemployment and stunting are closely linked through the cycle of poverty, where a lack of employment opportunities—particularly for mothers—correlates with poor nutrition and, conversely, where stunting limits human capital and future economic productivity.

Wulandari et al. (2025) found that children of unemployed mothers had a higher risk of stunting (1.022 to 1.07 times greater) compared to children of employed mothers, largely due to lower household incomes and reduced access to quality nutrition in Indonesia.

Marini et al. (2025) conducted research in Indonesia and found that unemployed mothers had a 2.364 times higher risk of having stunted children compared to employed mothers. Maternal education and employment status were identified as risk factors for stunting

3. Data and Analysis Methods

3.1. Data

The data in this study are taken from the World Development Indicators (World Bank, 2025). The dependent variables used are stunting prevalence, height-for-age (modeled estimates, % of children under 5 years), and the independent variables are country groups by income, time, access to electricity (% of population), access to clean fuels and cooking technology (% of population), GDP carbon intensity (kg CO2e per 2021 PPP $ GDP), Women's Business and Legal Index score (scale 1-100), and unemployment, total (% of total labor force) (modeled using ILO estimates). Table 1 describes the data used in the study.

Table 1: Variable, Obs., Mean, Std. Dev., Min, and Max

Variable	Obs.	Mean	Std. Dev	Min.	Mas\x
Prevalence of stunting, height for age (modeled estimate, % of children under 5)	72	22.98	15.26	3.74	45.65
Access to electricity (% of population),	72	77.18	28.04	20.92	99.98
Access to clean fuels and technologies for cooking (% of population),	72	57.93	33.07	12.03	99.98
Carbon intensity of GDP (kg CO2e per 2021 PPP $ of GDP),	72	.23	0.099	.103	.432
Women Business and the Law Index Score (scale 1-100),	72	69.53	9.58	50.32	86.98
Unemployment, total (% of total labor force)	72	62.02	3.16	56.02	67.28

3.2. Analysis Method

The GLS Random Effects analysis method was used for panel data regression.

The panel regression equation can be written as follows:

$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \cdots + \beta_k X_{kit} + \epsilon_{it}$$

where Y_{it} : The dependent variable on individual *i* at time *t*

α : Constant or intercept

β_1,...,β_k: Regression coefficient (slope) for independent variables *1* to *k*
$X_{1it,}$ ...,X_{kit} : Independent variables at individual *i* and time *t*
$\in_{it}$: Error component (residual)

4. Analysis Results

The results of the regression analysis using panel data are presented in Table 2.

Access to electricity has a positive impact on health. Every 1% increase in the population with access to electricity reduces the prevalence of stunting in children under 5 by 0.351.

Every 1% increase in access to clean fuels and cooking technologies reduces the prevalence of stunting in children under 5 by 0.132 percent.

Every one-unit increase in GDP carbon intensity (kg CO2e per 2021 PPP $ of GDP) increases the prevalence of stunting in children under 5 by 14.426 percent.

Every one-unit increase in the Women's Business and the Law Index Score (scale 1-100) is associated with a 0.292 percent decrease in the prevalence of stunting in children under 5.

Every 1% increase in unemployment is associated with a 0.256 percent increase in the prevalence of stunting in children under 5.

The more developed a country is in terms of income, the lower the prevalence of stunting. This is in accordance with the results presented in Figure 1. According to time, worldwide from 2006 there was a downward trend until 2010, then in the period 2011 – 2024 there was an upward trend.

Table 2: Variable, Coef., Std. Err., Z, P>z, and 95% Conf. Interval]

Variable	Coef.	Std. Err.	Z	P>z	[95% Conf. Interval]	
Access to electricity (% of population),	-.351	-15.97	-15.97	0.000	-.394	-.307
Access to clean fuels and technologies for cooking (% of population),	-.132	.0117	-11.22	0.000	-.155	-.109
Carbon intensity of GDP (kg CO2e per 2021 PPP $ of GDP),	14.426	2.149	6.71	0.000	10.213	18.639
Women Business and the Law Index Score (scale 1-100),	-.292	.087	-3.35	0.001	-.121	-.121
Unemployment, total (% of total labor force)	.256	.086	2.95	0.003	.085	.426
Time: 2006	.357	.236	1.51	0.131	-.105	.819
2007	.666	.285	2.33	0.020	.106	1.226
2008	.669	.347	1.93	0.054	-.010	1.349
2009	.659	.413	1.59	0.111	-.151	1.470
2010	.634	.459	1.38	0.167	-.265	1.535
2011	.676	.495	1.36	0.173	-.295	1.640
2012	.842	.544	1.55	0.122	-.225	1.910
2013	1.271	.621	2.04	0.041	.0522	2.489
2014	1.614	.670	2.41	0.016	.300	2.927
2015	1.961	.735	2.67	0.008	.519	3.40
2016	2.619	.802	3.26	0.001	1.045	4.192
2017	2.910	.861	3.38	0.001	1.221	4.599
2018	3.242	.931	3.48	0.000	1.417	5.068
2019	3.568	1.016	3.51	0.000	1.575	5.560
2020	3.608	1.044	3.45	0.001	1.560	5.656
2021	4.151	1.096	3.79	0.000	2.002	6.300

2022	4.883	1.185	4.12	0.000	2.559	7.207
Country: low income	-.1321	.0117	-11.22	0.000	-.155	-.109
lower income	14.426	2.149	6.71	0.000	10.213	18.639
upper middle income	-.292	.087	-3.35	0.001	-.121	-.121
High income	.256	.0869	2.95	0.003	.085	.426
constant	60.84	3.978	15.30	0.000	53.048	68.642

Wald chi2(25) = 168546.56, corr(u_i, X) = 0 (assumed), Prob > chi2 = 0.0000

Source: world Bank (2026). Own calculation

5. Conclusions/Findings and Policy Recommendations

Stunting remains a global development concern. The prevalence of stunting is not limited to low- and middle-income countries, but also continues to occur in high-income countries. Globally, stunting tends to increase between 2011 and 2024.

This study provides policy recommendations for countries, governments, and stakeholders to intervene in stunting through development initiatives such as increasing access to electricity, access to clean fuels and cooking technologies, the Women's Business and the Law Index Score (scale 1-100), and reducing the variables Carbon Intensity of GDP (kg CO2e per 2021 PPP $ of GDP) and Unemployment (% of total labour force).

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How Business Incubation Dimensions Drive Entrepreneurial Outcomes: Longitudinal Evidence from a Small Island Developing State

Inshan Meahjohn[1]

[1] The University of Trinidad and Tobago, Trinidad and Tobago

Correspondence: Dr. Inshan Meahjohn, The University of Trinidad and Tobago, Address: University Boulevard, Tamana InTech Park, Wallerfield, Arima, Trinidad and Tobago, E-mail: imeahjohn@gmail.com
ORCID ID: https://orcid.org/0000-0001-8099-1382

Abstract
This study examines which dimensions of business incubation, services, mentorship, finance, and physical space most effectively drive entrepreneurial outcomes in a Small Island Developing State (SIDS). It addresses two documented gaps: the dominance of cross-sectional designs in incubation research and the complete absence of peer-reviewed empirical evidence from the Caribbean. A quantitative repeated-measures longitudinal panel design was employed across three annual waves (2017-2019), using 106 entrepreneurs enrolled in the uSTART business incubator at the University of Trinidad and Tobago, representing 90.6% of the total incubator population. A validated 50-item structured questionnaire measured four incubation dimensions as predictors and four entrepreneurial outcomes, job creation, new venture creation, entrepreneurship development, and economic growth as dependent variables. Four OLS regression models were estimated alongside a repeated-measures descriptive trajectory analysis. Mentorship emerged as the dominant and statistically significant predictor across all four outcome models (β = .43-1.94), with its strongest effect on economic growth. The overall model explained 57% of variance in entrepreneurial outcomes (R^2 = .57), while job creation achieved the highest single-model fit (R^2 = .699). Longitudinal trajectories reveal dramatic progression, with outcome indicator means rising from M = 1.00 at Wave 1 to M = 4.27-4.85 at Wave 3 on a five-point scale. This study provides the first longitudinal evidence of business incubation effectiveness from the Caribbean, with full population coverage. Findings reveal mentorship primacy in a necessity-entrepreneur context where experienced entrepreneurial role models are structurally scarce, with direct implications for incubation program design and economic diversification policy in small states.

Keywords: Business Incubation, Economic Diversification, Entrepreneurial Outcomes, Longitudinal Panel, Mentorship, Small Island Developing States

1. Introduction

Business incubators have become central policy instruments for entrepreneurship development worldwide. Starting in the United States in the 1950s, the model has proliferated to more than 7,000 programs globally (NBIA,

2021), promising to accelerate venture creation, create employment, and stimulate regional economic development. Notwithstanding this institutional prominence, the empirical base of incubation effectiveness remains incomplete in two important respects.

First, the overwhelming majority of impact studies are cross-sectional in design (Albort-Morant & Ribeiro-Soriano, 2016; Hackett & Dilts, 2004). Cross-sectional data can ascertain associations but cannot establish whether incubation services drive changes in entrepreneurial outcomes over time or track how those effects evolve within the program period. The rare longitudinal studies in this field compare incubated and non-incubated firms at a single follow-up rather than tracking the same cohort repeatedly (Colombo & Delmastro, 2002). As a result, the temporal dynamics of incubation impact, the dimensions that drive which outcomes, and when, remain largely uncharted.

Second, the geography of incubation research has been highly concentrated. A systematic content analysis of 76 high-impact articles published between 2001 and 2020 (Meahjohn, 2023) found no peer-reviewed empirical study situated in the Caribbean or any Small Island Developing State (SIDS). This absence is striking because SIDS economies face distinctive structural vulnerabilities, such as small domestic markets, high import dependence, commodity sector reliance, and acute exposure to external shocks. These make entrepreneurship-led diversification both more urgent and hypothetically more complicated than in larger, diversified economies (Briguglio, 1995; UNCTAD, 2014). Trinidad and Tobago exemplifies these dynamics: a hydrocarbon-dependent economy in which the energy sector historically crowded out non-energy entrepreneurship, leaving the diversification imperative both well-recognized and underdelivered.

This study addresses both gaps. Findings are reported from a three-year repeated-measures longitudinal study (2017-2019) of 106 entrepreneurs enrolled in uSTART, the business incubator of the University of Trinidad and Tobago (UTT), the largest university-based incubator in Trinidad and Tobago. The study sample represented 90.6% of the total incubator population during the study period. Four OLS regression models are estimated, in which the four core dimensions of business incubation, services, mentorship, finance, and physical space predict four entrepreneurial outcome dimensions: job creation, new venture creation, entrepreneurship development, and economic growth.

The study makes three contributions. First, it provides the first peer-reviewed longitudinal evidence on incubation effectiveness from the Caribbean and SIDS, filling a documented geographic gap. Second, by disaggregating both incubation inputs and entrepreneurial outputs, the results reveal that mentorship is the dominant and consistent driver across all outcome domains, whereas the relative influence of finance, services, and physical space varies by outcome type. Third, the repeated-measures design documents the full developmental trajectory of ventures over the three-year program period, from a near-universal early-stage status at entry to a cohort predominantly earning income and pursuing expansion or international markets at program completion.

The remainder of this paper is organized as follows. Section 2 presents the theoretical framework and literature review. Section 3 describes the research context, analytical approaches, and the data. Section 4 presents the results of the study. Section 5 discusses the findings and implications of this study. Section 6 concludes.

2. Literature Review and Theoretical Framework

2.1 The Four Dimensions of Business Incubation

Business incubators are organizational environments designed to accelerate the growth and success of entrepreneurial firms through an array of bundled support resources (Bruneel et al., 2012). The theoretical rationale for incubation is based on multiple traditions. Resource-based theory posits that incubators address the resource poverty of nascent ventures by providing access to physical space, advisory expertise, financial networks, and peer communities within a single program (Hackett & Dilts, 2004). The knowledge spillover theory of entrepreneurship (Audretsch & Lehmann, 2005) highlights university-based incubators as mechanisms for commercializing

academic knowledge, while the social capital theory (Greve & Salaff, 2003) emphasizes the role of incubator-mediated networks in providing entrepreneurs with information, relationships, and legitimacy.

Despite theoretical diversity, empirical research has converged on four core incubation dimensions. Incubator services, such as training, advisory support, and professional network access, provide entrepreneurs with skills and connections that are unlikely to develop independently in the early venture stage (Mian, 1996; Mahmood et al., 2017). Mentorship provides experiential guidance from practitioners and domain experts. Politis (2005) theorizes that tacit entrepreneurial knowledge is primarily transmitted through sustained mentoring relationships. Finance encompasses both direct funding and facilitated access to investors and grant programs (Al-Mubaraki & Busler, 2012; Lalkaka, 2002). Physical space provides a legitimizing professional environment, shared overhead reduction, and proximity-based peer learning, which Levakova (2012) refers to as the 'incubator effect.'

Empirical evidence on the relative importance of these dimensions is mixed across different contexts. Colombo and Delmastro (2002) found network access and technological support to be the most influential in Italy, Thebtaranoth (2007) emphasized physical infrastructure in Thailand, and Mahmood et al. (2017) found mentorship and advisory services to be primarily in Pakistan. This cross-national variation suggests that institutional context moderates the relative salience of incubation dimensions, highlighting the value of studying understudied contexts such as SIDS.

2.2 Entrepreneurial Outcomes: A Multi-Dimensional Framework

Business incubation research has employed heterogeneous outcome measures, creating challenges for cross-study comparisons (Albort-Morant & Ribeiro-Soriano, 2016). The most common indicators are firm survival, employment generation, and revenue growth (Schwartz, 2013). However, this narrow focus has been criticized as insufficient to capture the broader developmental mandate of incubation programs in developing economies, where incubators are expected to generate not only viable firms, but also human capital, entrepreneurial culture, and macroeconomic diversification (Eshun, 2009; Allahar & Brathwaite, 2016).

Following Campbell's (1989) framework and its application in developing country contexts (Al-Mubaraki & Busler, 2012), this study operationalizes entrepreneurial outcomes across four dimensions: job creation, new venture creation, entrepreneurship development, and economic growth. This multi-dimensional approach enables a richer assessment of incubation impact than single-metric approaches and is particularly appropriate in an SIDS context in which each dimension contributes to the overarching national goal of economic diversification.

2.3 The Longitudinal Gap

The most consequential methodological limitation in incubation research is its near-universal reliance on cross-sectional data. Albort-Morant and Ribeiro-Soriano's (2016) bibliometric review identified longitudinal designs as rare exceptions, rather than norms. Most studies capture a single time point and rely on retrospective self-reports of incubation impact, limiting causal inference, and obscuring the temporal dynamics of venture development.

The few longitudinal studies in this literature adopted single-follow-up rather than repeated-measures designs. Colombo and Delmastro (2002) compared Italian firms at a three-year follow-up but did not administer repeated instruments to the same cohort during incubation. Schwartz (2013) examined survival at multiple intervals, but did not track within-incubation development trajectories. The present study contributes a repeated-measures design of three annual waves administered to the same 106 participants, allowing observation of the full developmental trajectory during active program participation and enabling within-period estimation of the effects of incubation dimensions on outcomes.

2.4 SIDS as a Distinctive Research Context

Small Island Developing States are characterized by high structural vulnerability: small domestic markets, openness-driven exposure to external shocks, limited factor accumulation, and dependence on narrow economic

sectors (Briguglio, 1995). In resource-dependent SIDS such as Trinidad and Tobago, the 'Dutch Disease' mechanism, in which energy rents appreciate the exchange rate and crowd out tradeable sector development, has historically suppressed the entrepreneurship ecosystem outside the commodity sector (Meahjohn, 2023).

This context is theoretically important for several reasons. First, necessity entrepreneurship is likely to be more prevalent than opportunity entrepreneurship given that employment alternatives in diversified sectors are scarce. Second, entrepreneurial role models and experienced mentors from non-energy sectors are genuinely scarce, making the mentorship dimension of incubation potentially more impactful than in economies with dense entrepreneurial ecosystems. Third, a small domestic market means that incubation success requires rapid orientation toward export markets, making the scope and international ambition of incubated ventures a distinctive outcome of interest.

3. Methodology

3.1 Research Context

The uSTART Business Incubator was launched at the University of Trinidad and Tobago in September 2014. It is the largest university-based incubator in Trinidad and Tobago, operating a dual model in which resident companies occupy physical space within the facility, while virtual companies receive capacity-building and business development support remotely. The program spans more than 20 economic sectors, including information and communications technology, animation and media production, agri-business, food production, engineering, environmental services, health care, and professional and technical services, all aligned with national economic diversification priorities.

uSTART's stated mandate encompasses job creation, tax revenue generation, community development, and the cultivation of an entrepreneurial culture in communities historically dependent on large employers or public-sector employment. This multidimensional mandate makes uSTART a particularly well-suited setting for testing the multi-outcome framework employed here.

3.2 Research Design and Data Collection

A quantitative repeated-measures longitudinal design was employed, with three annual measurement waves. Wave 1 was administered between September 10 and October 25, 2017 (45 days); Wave 2, between October 1 and November 6, 2018; and Wave 3, between July 22 and August 27, 2019. A structured self-administered questionnaire with 50 items was administered to all active uSTART participants at each wave. The research philosophy was positivist and deductive, with hypotheses specified prior to the data collection.

The target population comprised all 117 active uSTART entrepreneurs across five geographic regions of Trinidad and Tobago (North, East, Central, South, and Tobago). Of the 117 eligible participants, 106 provided complete responses and consented to participate in all three waves, yielding a final sample of 106 and a response rate of 90.6% (106/117). Critically, all 106 participants completed the questionnaires at all three time points (318 total questionnaires), producing a fully balanced panel with zero attrition across the study period. The average completion time is approximately one hour per wave.

3.3 Variables and Operationalisation

The independent variable, business incubation, was disaggregated into four dimensions, each measured using a four-item Likert scale (1 = very low, 5 = very high) derived from instruments validated in prior research (Dahleez, 2009; Mehmood et al., 2017):

- services (4 items, $\alpha = .73$): range of business support services available to incubatees, including training, advisory support, and professional network access.
- mentorship (4 items, $\alpha = .79$): Quality and frequency of mentoring relationships with experienced practitioners and domain experts.

- finance (4 items, α = .82): Access to financial support, including incubator-facilitated introductions to investors, grant assistance, and seed capital advisory.
- physical Space (4 items, α = .84): adequacy and functionality of the physical working environment.

The dependent variable, entrepreneurship, was operationalised across four outcome dimensions:

- job creation (4 items, α = .76): Perceived incubation impact on team building and employment generation.
- new venture creation (5 items, α = .78): progress in establishing a new operating business entity.
- entrepreneurship development (5 items, α = .81): Growth in entrepreneurial skills, competencies, and business acumen.
- economic growth (5 items, α = .83): Perceived contribution of the venture to income generation, market penetration, and broader economic activity.

The 35-item instrument achieved a composite Cronbach's alpha of .809. Factor analysis with Principal Component Analysis confirmed construct validity: KMO values ranged from .73 (Mentorship) to .92 (Services), all well above the .50 threshold, and all item loadings exceeded .30.

3.4 Analytical Approach

Descriptive statistics (frequencies, means, and standard deviations) were computed for all variables at each wave and are reported as outcome indicators in Table 3. The Pearson Product-Moment Correlation was applied to examine bivariate associations among the independent and dependent variables. Four OLS multiple regression models were then estimated for each entrepreneurial outcome dimension, with all four incubation dimensions simultaneously entered as predictors. This analytical approach follows those of Mahmood et al. (2017) and Yamockul et al. (2019). All analyses were conducted using SPSS v26.

A full multilevel model that exploits the longitudinal panel structure offers methodological advantages over cross-sectional OLS. Given that this study constitutes the first peer-reviewed quantitative investigation of incubation in the SIDS context, OLS regression is presented as a transparent baseline model, while longitudinal trajectories are descriptively documented. This approach mirrors the precedents of pioneering incubation studies in other emerging economies (Colombo & Delmastro, 2002; Thebtaranoth, 2007).

4. Results

4.1 Sample Characteristics

The sample (N = 106) was drawn from all five geographic regions of Trinidad and Tobago: North (34.9%, n = 37), East (30.2%, n = 32), Central (24.5%, n = 26), South (8.5%, n = 9), and Tobago (1.9%, n = 2). The sex composition was 72.6% male and 27.4% female. The age distribution was skewed young, with 77.4% of participants aged 18-24 years, reflecting the university affiliation of the program. Educational attainment was high; 76.4% had completed tertiary undergraduate education, 4.7% held postgraduate qualifications, and 18.9% held secondary-level qualifications.

A large majority of participants (88.7%) had no entrepreneurship experience before entering the program, and only 13.2% had parents who owned businesses, indicating a first-generation entrepreneurship population. The primary motivation for participation was the absence of employment (55.7%), followed by continuation of studies (31.1%), and perceived market opportunity (13.2%). This necessity-entrepreneurship orientation is consistent with theoretical expectations in a resource-dependent SIDS economy, and distinguishes this sample from entrepreneurship populations in high-income economy studies.

Participants represented 14 economic sectors. The most frequently represented were information technology (19.8%), animation and media production (14.2%), professional and technical services (13.2%), food and

beverage, environmental services, and small manufacturing were also well represented. This sectoral breadth aligns with the uSTART mandate to support economic diversification beyond the energy sector.

4.2 Instrument Reliability and Validity

Table 1 presents Cronbach's alpha reliability coefficients for all eight study variables. All values exceeded the conventional .70 threshold (range: .73-.84 for incubation dimensions; .76-.83 for outcome dimensions), and the composite 35-item instrument achieved α = .809, indicating high internal consistency. Factor analysis confirmed construct validity: KMO values were .92 (Services), .73 (Mentorship), .80 (Finance), and .86 (Physical Space). All items exceeded the extraction threshold of .30 in principal component analysis. The four-component solution explained 83.4% of the total variance (Table 2).

Table 1: Reliability of the Research Instrument

Variable	**No. of Items**	**Cronbach's α**
Independent Variables - Incubation Dimensions		
Services	4	.73
Mentorship	4	.79
Finance	4	.82
Physical Space	4	.84
Dependent Variables - Entrepreneurial Outcomes		
Job Creation	4	.76
New Venture Creation	5	.78
Entrepreneurship Development	5	.81
Economic Growth	5	.83
Total Instrument (35 variable items)	**35**	**.809**

Note. Total questionnaire items = 50 (35 variable items + 15 demographic items). All α values exceed the .70 threshold for acceptable internal consistency.

Table 2: Factor Analysis - Communalities (Construct Validity)

Variable	**Initial**	**Extraction (PCA)**
Services	1.000	.920
Mentorship	1.000	.736
Finance	1.000	.809
Physical Space	1.000	.869

Note. Extraction Method: Principal Component Analysis. KMO values: Services = .92, Mentorship = .73, Finance = .80, Physical Space = .86 (all > .50). Four-component solution explains 83.4% of total variance. All item loadings > .30.

4.3 Longitudinal Developmental Trajectories

Before presenting the regression results, repeated-measures descriptive data are presented to document the entrepreneurial developmental trajectory across the three program years. This forms an independent layer of evidence on incubation effectiveness that complements the regression analysis.

4.3.1 Business Stage Progression

The progression of incubatees across venture development stages across the three waves is striking. In Wave 1 (2017), 91.5% of participants reported their businesses as being at an early stage and 8.5% at start-up (beginning operations); no participants earned income, pursued expansion, or sought international market entry. In Wave 2 (2018), early-stage status fell to 50.0%, active start-up operations increased to 44.3%, and 5.7% reported operating and earning income. By Wave 3 (2019), only 0.9% remained at an early stage, 41.5% were in start-up operations, 35.8% were operating and earning income, 12.3% were pursuing expansion, and 9.4% sought extra-territorial or international market entry. These trajectories demonstrate a clear, sustained progression across the full five-stage development spectrum over three years of incubation.

4.3.2 Descriptive Statistics by Outcome Indicator and Wave

Table 3 presents the means and standard deviations for the representative outcome items for each of the three annual waves. All items are measured on a five-point Likert scale (1 = very low impact, 5 = very high impact).

The pattern is consistent and striking across all outcome indicators: all items begin at M = 1.00, SD = 0.00 in Wave 1 (2017), reflecting that every participant assessed incubation impact as very low at program entry. In Wave 2 (2018), means range from 3.21 to 3.99, indicating a transition from low to moderate to high perceived impact. In Wave 3 (2019), means range from 4.27 to 4.85, indicating consistently high to very high perceived impact on all dimensions.

Table 3: Descriptive Statistics for Outcome Indicators by Wave (N = 106, 5-point Likert Scale)

Outcome Indicator	**Wave 1 (2017)**		**Wave 2 (2018)**		**Wave 3 (2019)**	
	M	**SD**	**M**	**SD**	**M**	**SD**
Job Creation / Economic Outcomes						
Income earning ability	1.00	.00	3.70	1.19	4.57	.72
Team creation or expansion	1.00	.00	3.21	1.66	4.48	1.01
Access to capital	1.00	.00	3.99	.85	4.85	.36
Entrepreneurship Development						
Entrepreneurial skills	1.00	.00	3.70	1.19	4.57	.72
Business skills	1.00	.00	3.93	.91	4.63	.52
Professional network	1.00	.00	3.70	1.19	4.58	.79
Market Penetration / New Venture Creation						
Market penetration	1.00	.00	3.65	1.24	4.27	.76
Products/service development	1.00	.00	3.70	1.19	4.61	.82

Note. N = 106 at each wave. Scale: 1 = very low impact, 5 = very high impact. Wave 1 SD = .00 for all items because all 106 respondents rated impact as '1 - Very Low' at program entry. Wave 3 SDs substantially smaller than Wave 2, reflecting convergence in perceived program benefit.

4.3.3 Other Longitudinal Indicators

Complementary indicators further documented the developmental trajectory. Export intention increased from 15.1% in Wave 1, to 34.0% in Wave 2, and to 46.2% in Wave 3, representing a 31.1 percentage-point in increase. This suggests that incubation builds international market orientation among the necessity-entrepreneur population in a small domestic market. Demand for parking space (a proxy for team growth and business formalization) rose from 49.1% in Wave 1 to 100% in Wave 3. Interest in all incubation services simultaneously rose from 21.7% in Wave 1 to 94.3% in Wave 3, reflecting the broadening of service awareness and utilization as entrepreneurial experience accumulated.

4.4 Regression Results

Table 4 presents the results of the four OLS regression models. Each model regresses one entrepreneurial outcome dimension for the four incubation dimensions. Standardized beta coefficients (β), t-statistics, and significance levels are reported. The overall mean R^2 across all the four models was .577.

Table 4: OLS Regression Results: Impact of Business Incubation Dimensions on Entrepreneurial Outcomes (N = 106)

Predictor	**β**	**t**	**p**	**R^2**
Model 1 - Dependent Variable: Job Creation				
Services	.08	.70	.000***	
Mentorship ◆	**.96**	**8.80**	**.048***	

Finance	.80	1.16	.000***	
Physical Space	.06	.69	.023*	**.699**
Model 2 - Dependent Variable: New Venture Creation				
Services	.02	1.40	.160 (n.s.)	
Mentorship ◆	**.43**	**2.90**	**.000*** **	
Finance	.19	1.80	.050*	
Physical Space	.31	.24	.080 (n.s.)	**.380**
Model 3 - Dependent Variable: Entrepreneurship Development				
Services	.15	.77	.044*	
Mentorship ◆	**1.08**	**6.10**	**.000*** **	
Finance	.16	1.20	.199 (n.s.)	
Physical Space	.23	1.50	.012*	**.570**
Model 4 - Dependent Variable: Economic Growth				
Services	.013	1.40	.190 (n.s.)	
Mentorship ◆	**1.94**	**2.90**	**.035***	
Finance	.08	1.80	.000***	
Physical Space	.16	.24	.087 (n.s.)	**.650**

Note. N = 106. ◆ = dominant predictor (highest β) in that model, shown bold italic. R^2 reported at final row of each model. n.s. = not significant. * $p < .05$, *** $p < .001$.

4.4.1 Model 1: Job Creation ($R^2 = .699$)

The first model explained 69.9% of the variance in job creation, which was the strongest model fit in this study. Mentorship is the dominant predictor ($\beta = .96$, $t = 8.80$, $p < .05$), with finance as the second significant contributor ($\beta = .80$, $p < .001$). Services ($\beta = .08$, $p < .001$) and physical space ($\beta = .06$, $p = .023$) were also significant, although substantively modest. The large mentorship effect on job creation suggests that experiential guidance from practitioners, including guidance on team building, human resource management, and operational scaling, is the primary mechanism by which incubation drives employment generation.

4.4.2 Model 2: New Venture Creation ($R^2 = .380$)

The second model explains 38.0% of the variance in new venture creation. Mentorship is again the strongest significant predictor ($\beta = .43$, $t = 2.90$, $p < .001$) and finance is marginally significant ($\beta = .19$, $p = .050$), consistent with the expectation that access to capital is an enabling condition for enterprise formalization. Services ($\beta = .02$, $p = .16$) and physical space ($\beta = .31$, $p = .08$) did not reach significance. The lower R^2 relative to other models likely reflects that new venture creation is also shaped by factors outside the incubator's direct control, including entrepreneurial experience, market timing, and personal risk tolerance.

4.4.3 Model 3: Entrepreneurship Development ($R^2 = .570$)

Model 3 explains 57.0% of the variance in entrepreneurship development. Mentorship is the dominant predictor with a large and highly significant effect ($\beta = 1.08$, $t = 6.10$, $p < .001$), consistent with experiential learning theory (Politis, 2005): tacit entrepreneurial knowledge is transmitted primarily through direct engagement with experienced practitioners. Physical space is significant ($\beta = .23$, $p = .012$), suggesting that the incubator's professional environment contributes to entrepreneurial identity formation and competency development via peer co-location effects (McAdam & Marlow, 2007; Levakova, 2012). Services were marginally significant ($\beta = .15$, $p = .044$), while finance was not ($\beta = .16$, $p = .199$).

4.4.4 Model 4: Economic Growth ($R^2 = .650$)

Model 4 explains 65.0% of the variance in economic growth. Mentorship achieved its highest beta coefficient across all four models ($\beta = 1.94$, $t = 2.90$, $p = .035$), underlining its dominant and broad-based role. Finance is also

highly significant (β = .08, p < .001), consistent with the expectation that capital access is important for translating entrepreneurial activity into measurable economic output. Services (β = .013) and physical space (β = .16) were not significant in this model.

5. Discussion

5.1 The Primacy of Mentorship

One of the most striking and consistent findings was the dominant role of mentorship across all the four regression models. This result builds on and provides more precise quantification than prior studies that have theorized mentorship as a core value-adding mechanism of incubation (Voisey et al., 2006; Thebtaranoth, 2007; Politis, 2005). The strength of the mentorship effect is particularly noteworthy for economic growth (β = 1.94), suggesting a multiplier-like mechanism in the SIDS context.

This amplification can be theoretically interpreted using the scarcity lens developed in Section 2.4. Experienced non-energy entrepreneurs are rare in an economy historically controlled by a single commodity sector. When incubatees, predominantly first-generation entrepreneurs (88.7% without prior experience; 86.8% without entrepreneurial parents) gain access to such mentors through the program, the informational and relational value transferred may be substantially higher than in economies with dense entrepreneurial ecosystems. The descriptive findings in Table 3 are consistent with this interpretation: The uniformly zero baseline (M = 1.00 at Wave 1) followed by dramatic increases suggests that participants arrived with minimal exposure to entrepreneurial models and resources.

The implication is direct: if mentorship explains the largest share of variance across the four outcome dimensions, then the quality, sector experience, and adequate cultural alignment of mentors should be the key focus of incubator program design and performance evaluation. Qualitative focus group data gatred as part of doctoral research (Meahjohn, 2023) found incubatees themselves identified mentorship as pivotal but systematically under-resourced, corroborating this regression finding and pointing to a structural investment need.

5.2 The Enabling Role of Finance

Finance is a significant predictor of job creation (β = .80) and economic growth (β = .08, p < .001) but not entrepreneurship development (β = .16, p = .199). This differential pattern was theoretically significant. Access to capital enables the hiring of staff and scaling of the operation, directly driving employment and economic output, but it does not build entrepreneurial competencies by itself. Skills and capabilities are developed through human interaction (mentoring and training) rather than through financial resources alone. This distinction between the enabling (finance, physical space) and developmental (mentorship, services) functions of incubation is a theoretical contribution that has not been clearly articulated in the literature.

Qualitative evidence from uSTART focus group participants gathered as part of this doctoral research (Meahjohn, 2023) identified thin angel and venture capital markets, and conservative bank lending as structural barriers in Trinidad and Tobago. The regression finding that finance significantly predicts job creation and economic growth indicates that expanding incubatees' access to capital would likely result in high returns. Government-facilitated matching with angel investors and venture capital organizations or structured grant access should be a priority policy complement to mentorship investment.

5.3 Physical Space as a Developmental Resource

Physical space is significant in the job creation model (β = .06, p = .023) and entrepreneurship development model (β = .23, p = .012). In the former case, co-location likely functions as an enabler of professional legitimacy and team recruitment. In the latter, the 'incubator effect,' theorized by Levakova (2012), in which shared space creates informal peer education, and mutual motivation appears to operate empirically. These results concur with the implicit assumption that physical presence is instrumental in the rapid progression of incubation programs. For a

population of young first-generation entrepreneurs in a developing economy context, a professional physical environment may be a meaningful developmental resource that virtual substitutes cannot adequately replace.

5.4 Developmental Trajectories and Longitudinal Evidence

The repeated-measures data in Table 3 provide important evidence that cross-sectional studies cannot provide. The universal M = 1.00 baseline at Wave 1, reflecting that every participant assessed incubation impact as very low at program entry, establishes a genuine pre-treatment starting point. The subsequent increases to M = 3.21-3.99 at Wave 2 and M = 4.27-4.85 at Wave 3 demonstrate a consistent, sustained improvement in perceived incubation impact across all measured dimensions. The narrowing standard deviations at Wave 3 indicate increasing homogeneity in the positive evaluation of the program as participants accumulated experience.

These descriptive trajectory data, combined with the business stage progression (from 91.5% early stage in Wave 1 to 35.8% earning income and 21.7% pursuing expansion or international markets in Wave 3) and the increase in export orientation (from 15.1% to 46.2%), provide converging evidence of incubation effectiveness. The increase in export orientation is especially significant in the SIDS context, in which small domestic markets make international market orientation a prerequisite for scaling.

5.5 Limitations

This study has some limitations that must be acknowledged. The single-program design (uSTART only) restricts generalizability within Trinidad and Tobago and across the Caribbean region. uSTART is the largest and most resource-endowed university incubator in the country, and programs with fewer resources may yield different outcomes. The findings are framed as an exploratory case study that establishes the first empirical ground following the precedent of Colombo and Delmastro's (2002) Italian case.

The OLS regression approach to pooled data does not adequately exploit the longitudinal panel structure. Future research should employ multilevel modelling (entrepreneurs nested within time periods) or fixed-effects estimators to control for time-invariant unobserved heterogeneity. Outcome measures were self-reported perceptions and not objective administrative data, and the absence of a non-incubated comparison group prevented causal attribution of developmental trajectories to incubation per se.

6. Conclusion

This study provides the first peer-reviewed longitudinal evidence of business incubation effectiveness in the Caribbean and Small Island Developing States. Drawing on a three-year repeated-measures panel (N = 106, 2017-2019) representing 90.6% of the uSTART business incubator population at the University of Trinidad and Tobago, four OLS regression models were estimated, and the full developmental trajectory of incubated ventures across the program period was documented.

The main conclusion is that mentorship is the dominant driver of entrepreneurial outcomes across all four dimensions tested: job creation ($\beta = .96$), new venture creation ($\beta = .43$), entrepreneurship development ($\beta = 1.08$), and economic growth ($\beta = 1.94$), with the strongest effects observed in the models directly relevant to economic policy. Finance is the second-most consistently significant predictor of output-oriented outcomes. The four-dimensional model explains 57% of the variance in entrepreneurial outcomes overall, with job creation showing the highest single-model fit ($R^2 = .699$).

The longitudinal panel reveals a striking and coherent developmental trajectory. At program entry, all 106 participants uniformly assessed the incubation impact as very low (M = 1.00) across all outcome indicators. By program completion, means had risen to 4.27-4.85 on a five-point scale, early-stage businesses had been almost entirely eliminated, and nearly a quarter of the cohort was actively pursuing expansion or international market penetration.

The findings strongly argue for treating mentor quality as the highest-return investment in incubation program design. For policymakers in Trinidad and Tobago and analogous SIDS economies, this study offers evidence that university-based incubators can function as genuine instruments of economic diversification among a necessity-entrepreneur population, provided that high-quality, sector-experienced mentors are available and that financial access barriers are addressed.

Multi-program comparative studies throughout the Caribbean are among the future research priorities, multilevel modelling to exploit the panel structure, integration of administrative outcome data, matched-comparison group designs, and cross-SIDS comparisons extending to Jamaica, Barbados, and Pacific Island economies.

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Informed Consent Statement/Ethics Approval: All participants gave their verbal informed consent for inclusion before they participated in the study. Anonymity was assured, participants were informed of the research purpose, and data were collected, anonymized, and handled in accordance with the ethical guidelines of the host institution. No interventional procedures were conducted.

Data Availability Statement: Data supporting the reported results are available from the corresponding author upon reasonable request.

Declaration of Generative AI and AI-assisted Technologies: This study has not used any generative AI tools or technologies in the preparation of this manuscript.

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Rethinking Supply Chain Resilience Through Adaptive System-Level Approach

Galuh Sudarawerti[1,2], Togar Mangihut Simatupang[1], Yuanita Handayati[1]

[1] School of Business and Management, Bandung Institute of Technology, Bandung, Indonesia
[2] School of Economics and Business, Telkom University, Bandung, Indonesia

Correspondence: Galuh Sudarawerti, School of Business and Management, Bandung Institute of Technology & School of Economics and Business, Telkom University, Bandung, Indonesia.
E-mail: galuh_sudarawerti@sbm-itb.ac.id
ORCID ID: https://orcid.org/0009-0004-1792-5437

Abstract
Supply chain disruptions have become increasingly prolonged, overlapping, and systemic, thus challenging supply chain resilience practices that are commonly grounded in recovery-based approaches. Despite the increasing discussion regarding adaptive responses, the supply chain resilience (SCRES) literature is dominated by capability-centric approaches, offering limited system-level guidance under continuous and cascading disruptions. This study develops a concise conceptual framework that reframes SCRES as an ongoing adaptive process instead of a one-time recovery. A triangulated literature-based approach was employed by integrating bibliometric mapping, systematic literature review, and integrative synthesis to develop the conceptual framework. The proposed SCRES – Adaptive System-Level (SCRES-ASL) framework distinguishes two fundamentals, namely enabling conditions and adaptive dimensions, which are iteratively connected through feedback loops. This alignment between structural conditions and adaptive processes, through the emphasis on feedback loops, supports co-evolution across supply chain tiers. This study contributes to the SCRES study by providing a system-level adaptive process framework that provides actionable clarity for understanding and managing resilience under constant turbulence.

Keywords: Adaptive Dimensions, Adaptive Pathway, Disruptions, Supply Chain Resilience, System Thinking

1. Introduction

Global supply chains are increasingly facing persistent and cascading disruptions, including natural hazards, geopolitical tensions, and sudden regulatory shifts. The disruptions often occur simultaneously and propagate across the supply network, causing system-level instability, rather than a mere operational failure. This phenomenon requires organizations to develop continuous adaptive mechanisms in coordinating and developing technology reconfigurations. Under cascading disruptive circumstances, the traditional understanding of resilience, which revolves around the state of ability to recover from a single disruption, becomes insufficient for managerial practice.

Supply chains play a vital role in economic growth and social welfare due to their role in supporting both the local and global economy, which in turn will improve the economic growth, as well as their role in ensuring the availability of needed products across the globe (Goel et al., 2021; Prayitno, 2024; Zhu, 2023). Its fundamental role drives the concern of maintaining its function amidst the presence of disruptions, which are commonly understood as supply chain resilience. Works in the area of supply chain resilience (SCRES) have been developed by various scholars. Arji et al. (2023), conducted a systematic literature review (SLR) to identify critical resilience strategies, focusing on the role of digital innovation in the supply chain. Guo et al. (2024) systematically review inventory management strategies in the context of SCRES to classify strategies in the supply-side and demand-side of the inventory. Rahman et al. (2022) utilizing a systematic review to classify SCRES strategies into the following categories: preparedness, response, and recovery. Chauhan et al. (2023) went beyond the strategic level by proposing pathways for SCRES through Industry 4.0 in strengthening SCN structures; digitalization, innovation, and entrepreneurship; capabilities and strategies; risk management; circular economy and sustainability.

These previous studies provide valuable insights into resilience strategies and potential enablers, especially related to cutting-edge technology. These studies also share a common understanding of managerial capabilities and operational mechanisms in the context of SCRES. However, these studies merely focus on identifying specific tools, strategies, or technological solutions at the organizational level. Within this view, resilience is understood as the ability of a supply chain to absorb disruptions and return to its pre-disruption state through predefined capabilities such as redundancy, buffering, flexibility, and contingency planning (Christopher & Peck, 2004; Suryawanshi & Dutta, 2022). While these contributions are important and advance the understanding of resilience practices, they offer a limited explanation of how resilience develops and emerges across the broader supply chain system. Responding to the real-world challenges faced by the supply chain, which are increasing in complexity and connectivity, to increase its relevance in today's situation, these limitations need to be improved. Resilience cannot be understood solely as recovery, but rather as a continuous adaptive process in which supply chain actors iteratively reconfigure structures, technologies, and coordination mechanisms in response to evolving disruptions (Chodakowska et al., 2024; Herold et al., 2021; İskendera et al., 2025; Kazancoglu et al., 2022). The improvement in the SCRES conceptualization needs to adopt a more adaptive and system-oriented conceptualization of supply chain resilience.

1.1. Dominant perspectives in supply chain resilience

The SCRES literature to date remains fragmented and dominated by operational capability perspectives, despite the growing recognition of continuous adaptations. Current studies in the SCRES field are dominated by a particular perspective and approach. From this perspective, SCRES is commonly framed using risk-based and recovery-oriented fundamentals, seeing SCRES as the ability to absorb shocks and restore operations to the original stable state. In the methodological layer, research in SCRES mostly uses optimization models, redundancy strategies, and risk management, without addressing how resilience emerges in a complete supply chain network (Alikhani et al., 2021; Christopher & Peck, 2004; Folke, 2016). Despite its value in countering predictable and short-duration disruptions, recent studies show that the actual challenges of supply chain organizations lie in prolonged, overlapping, and nonlinear unpredictable events. This condition requires firms to continuously adjust their structures, technologies, and coordination mechanisms (Chodakowska et al., 2024; Herold et al., 2021; İskendera et al., 2025). The over-reliance on recovery-oriented perspectives results in a lack of understanding regarding how system properties such as nonlinearity, feedback loops, co-evolution, and emergent behavior shape resilience in supply chain systems. These properties remain underexplored within SCRES discourse. This limitation indicates conceptual gaps between the available theoretical framework in understanding supply chain resilience and the complex reality of real-world supply chain disruptions.

1.2. The need for adaptive system-level resilience under cascading disruptions

To address the limitations of recovery-oriented resilience, this research adopts a complexity-oriented perspective to understand and explain supply chain dynamics by adopting the *complex adaptive system* (CAS) as an

ontological foundation. CAS highlights the nature of the supply chain as a system that comprises heterogeneous agents that interact with each other based on their bounded rationality, and generate system-level behavior such as emergence, self-organization, non-linear dynamics, and co-evolution, which determine the system-level phenomenon such as recovery trajectories (Carter et al., 2015; Nooteboom, 2022; Walker & Salt, 2006). Therefore, in a complex system perspective, supply chain resilience (SCRES) cannot be understood solely through the development of predefined capabilities; it is a continuous adaptive process emerging from interactions within the supply chain network.

Complementing this view, *resilience thinking* is also utilized at the strategic level to understand how the system should maintain its functionality through reorganization and evolution rather than bouncing back to a single state of equilibrium (Folke et al., 2016; Holling & Gunderson, 2002a). Within this perspective, realizing resilience means focusing on the development of the system's capabilities to adapt, reorganize, and evolve while maintaining its functional thresholds. Therefore, resilience is associated with adaptability and transformability that allow systems to persist and evolve amidst continuous disturbances. The key concept of this perspective lies in shifting attention from recovery toward continuous adaptation and learning within dynamic environments (Folke et al., 2010; Holling & Gunderson, 2002a).

To operationalize these conceptual approaches in sequential strategic responses, the *adaptive pathways* concept was adopted. Adaptive pathways explain how organizations adjust their responses in a sequential manner in enabling flexible transitions between alternative strategic options (Kivimaa et al., 2021; Sparkes et al., 2023). Adopting *adaptive pathways* allows the proposed conceptual framework to explain how continuous adjustment should be taken into action by various actors in the supply chains through structural arrangements in response to disturbances.

Through the adoption of CAS as an ontological foundation, *resilience thinking* as a strategic lens, and *adaptive pathways* as an operational approach, this study provides a comprehensive conceptual foundation for supply chain resilience. In this reconceptualization, resilience is seen as a system-level adaptive process in facing continuous disruptions rather than organizational or individual-level strategies in facing a single disruption and achieving a one-time recovery outcome.

1.3. Theoretical Foundation: Complex Adaptive System, Resilience Thinking, and Adaptive Pathways

The growing body of literature in supply chain displays the characteristics of complex adaptive systems (CAS) embedded in supply chain networks, represented by heterogeneous actors whose behaviours are shaped by local rules, bounded rationality, and nonlinear interactions (Choi et al., 2001; Holland, 1992). Placing CAS as the ontological foundation, supply chain architecture is seen as a system embedded with system-level phenomena such as disruption propagation, ripple effects, and recovery trajectories that emerge from non-linear interactions, evolving network structures, and feedback loops, instead of isolated decisions (Ahmad et al., 2024; Surana et al., 2005). The CAS literature commonly highlights four recurring structural dimensions as elements of a system, namely: agents and interactions, network connectivity and architecture, system dynamics and adaptations, and emergent properties, in which each element carries distinct implications for resilience. Agent heterogeneity creates diverse response options; network topology affects buffering and shock diffusion; and the feedback-learning process shapes long-term adaptation character (Carmichael & Hadžikadić, 2019; Yaroson et al., 2021).

Serving as the ontological foundation, the CAS-based understanding aligns closely with resilience thinking as a strategic lens, which shifts attention from restoring a prior equilibrium towards maintaining the system's functionality through reorganization and evolution (Folke, 2016). In situations where prolonged and cascaded disruptions occur, organizations iteratively adjust their structures, reconfigure resources, and refine coordination networks and mechanisms. These observed resilience practices align with the concept of adaptive cycle (r–K–Ω–α), where system are considered to move through phase of growth (r), conservation (K), collapse or release (Ω), and reorganization (α), emphasizing that resilience is a developmental process through iterative feedbacks, restructuring, and renewal rather than returning to a single equilibrium state (Carpenter et al., 2001; Holling & Gunderson, 2002b). Furthermore, path-dependent learning highlights the role of past decisions and historical

practices that determine the future adaptive options. Through learning paths, organizations develop sensitivity towards both known and unknown disruptions. These dynamics reflect structural adjustments performed in recent supply chain systems in managing uncertainties (İskendera et al., 2025; Ivanov, 2024; Massari & Giannoccaro, 2023).

Temporal logic is needed to operationalize this perspective. Hence, adaptive pathways are utilized to provide this temporal logic. By framing resilience not as a fixed capability, but instead as a sequence of short-, medium-, and long-term decisions adjusted to the evolving conditions (Kivimaa et al., 2021; Sparkes et al., 2023). Four recurring mechanisms were commonly discussed in SCRES literature to illustrate how adaptive pathways operate in practice; these mechanisms include:

1 Decentralized adaptation, reflecting options owned by agents, distributed decision rights, and coordination pivots shaped by local information (Adobor, 2020; Wieland & Durach, 2021).
2 Network reconfiguration, comprising structural adjustments such as modularization, redundancy, alternative routing, and prevention of long-term lock-in (Alikhani et al., 2023; Hart Nibbrig et al., 2025; Rajesh, 2020b).
3 System dynamics and learning, emphasizing feedback learning, identification of adaptation tipping points, and periodic revision of strategies (Carpenter et al., 2001; Holling & Gunderson, 2002b; Ivanov et al., 2010).
4 Scenario branching and system renewal, allowing alternative trajectories and transformational adjustments, when disruptions altered baseline assumptions (Kivimaa et al., 2021; Öberg, 2023).

Together, the CAS ontology, resilience thinking, and adaptive pathways reframe resilience as a continuous and systemic process, instead of a bounce-back ability to the predefined state. Those foundations provide guidance for resilience navigation by improving sensitivity towards changes, decentralized response coordination, feedback navigation, and continuous adjustment.

1.4. Research Question and Study Objectives

Building on these perspectives and filling in the current gaps between SCRES conceptualization and real-world challenges, this study proposed a conceptual framework that reconceptualizes supply chain as an ongoing adaptive process, operating at the system level. That answers the following research question: What are the enabling conditions and core adaptive components required to develop a supply chain resilience framework under continuous and cascading disruptions? To answer this question, three objectives were formulated:

1 To identify conceptual and methodological fragmentation in the current SCRES conceptualization by examining the dominant perspective in SCRES literature.
2 Examine how the dynamic and systemic characteristics of temporary disruptions are captured in existing studies.
3 Develop a conceptual framework that reconceptualizes SCRES as a system-level adaptive process by providing enabling conditions and adaptive dimensions derived from literature synthesis.

The integration insight derived from Complex Adaptive System (CAS) as ontological foundations, resilience thinking as a strategic lens, and adaptive pathway as operational approaches provided a structured conceptual architecture for understanding resilience in the supply chain system under continuous disturbances

2. Method

This study integrates bibliometric mapping, systematic literature review (SLR), and an integrative synthesis in a triangulated methodological design to develop the proposed framework of SCRES. The breadth and depth analysis was expected to be a thorough, complementary analysis. The literature corpus was assembled through a structured search of peer-reviewed journal articles across Scopus, Web of Science, and ScienceDirect databases,

using key terms related to “supply chain”, “resilience”, and “model” or “design”, following the established protocol by Tranfield, Denyer and Smart (2003) and Kitchenham (2007). Inclusion criteria were applied by limiting to English-language journal publications from the recent five-year period. After the screening of relevance and quality, the literature corpus resulted in 87 relevant articles, forming the literature base for the analysis. The relevant articles were then processed through the triangulated review method. Bibliometric maps informed the thematic cluster based on their emergence in the breadth of the SCRES literature. SLR was carried out to envelop the pattern of conceptualization regarding SCRES literature. Informed by the results of these two synthesis methods, integrative analysis was conducted by expanding the understanding through a deep review of the literature on resilience thinking, complex system concept, and adaptive pathways. These comprehensive syntheses result in the proposal of a conceptual framework titled Supply Chain Resilience – Adaptive System-Level (SCRES-ASL). This triangulation review method ensures both breadth and depth analysis of existing literature in the field of SCRES. Figure 1 summarizes the research design comprising methodological activities, their analytical purposes, and the nature of the outcome at each stage, while Figure 2 shows data collection following the PRISMA protocol.

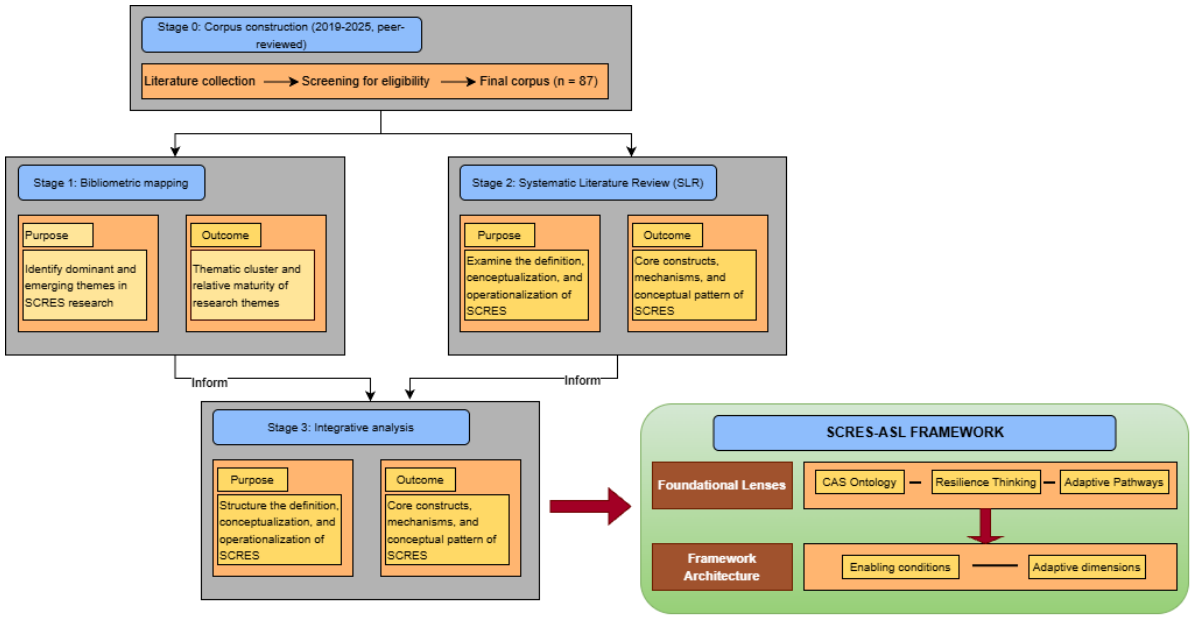

Figure 1: Research design

Source: Author

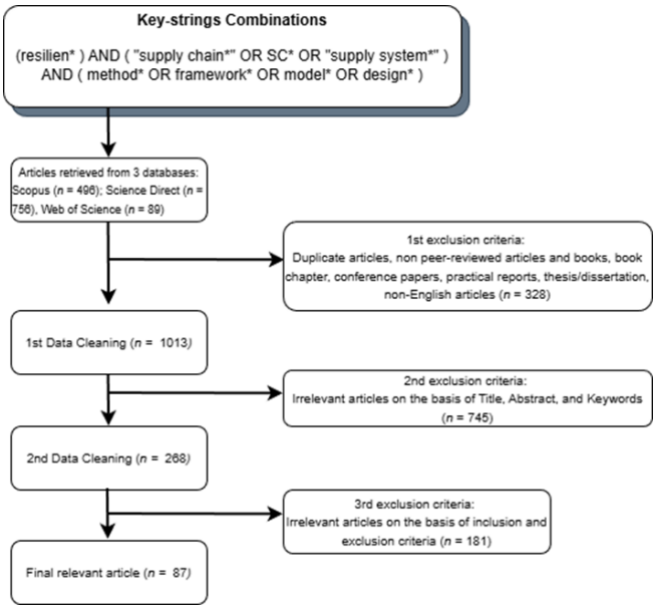

Figure 2: Systematic search and articles selection strategy on the Supply Chain Resilience (SCRES) model and design

Source: Author

2.1 Bibliometric mappings

Bibliometrics serves as a means to map the published articles and gather knowledge regarding the evolution of the themes and interconnectedness between different themes in the SCRES research domain (Amlan et al., 2023; Candeias Fernandes & Franco, 2022). As a methodology, bibliometrics focuses on quantitative analytics of academic outputs through network analysis and trend mapping on the author, content, and institutions. In this study, bibliometric analysis was conducted to obtain a macro-level overview of SCRES literature. The identification of dominant themes, conceptual clusters, and topic evolution patterns was executed to enable a structural visualization of the field's conceptual landscape and to show the organization of the topic. Conducting this analysis allows researchers to gain a macro-level view of the specified research topic.

2.2 Systematic Literature Review (SLR)

SLR is useful in synthesizing broad research in a particular research area (Snyder, 2019). Complementing the thematic analysis, a systematic literature review (SLR) was conducted to examine how SCRES has been conceptually defined, operationalized, and theoretically grounded across studies in recent years (2019 – 2025). SLR provides a structured approach, utilized to examine the definition, conceptualizations, and operationalization of SCRES across peer-reviewed publications. SLR was conducted in three stages: planning, implementation, and reporting, following Kitchenham's SLR protocol (Kitchenham et al., 2009). The review protocol is using PICOC (Population, Intervention, Comparison, Result, Context). The collected literature was screened for relevance and quality check, resulting in the identification of established assumptions, resilience mechanisms, and analytical point of view. Following this protocol, the population consists of peer-reviewed literature on supply chain resilience, strategies, mechanisms, and conceptual approaches revolving around SCRES perspectives. This process contributes to the in-depth analysis of literature in SCRES. This process aims to identify conceptual limitations and fragmentations across the research corpus, reflecting the state-of-the-art of SCRES research.

2.3 Integrative Synthesis

The integrative analysis developed by combining insights gathered from the bibliometric mapping and SLR, complemented with deep narrative review on foundational theory related to resilience, ranging from complexity theory, resilience thinking, and adaptive pathways. This review on foundational works such as CAS by Holland,

adaptive cycle by Holling, and resilience thinking by Folke allows the grounded conceptual understanding needed to develop a coherent system-level framework. This approach follows established practices in theory development, where insights generated from literature review analysis are interpreted and synthesized through broader cross-disciplinary fundamentals to reconcile fragmented constructs to develop an integrated conceptual architecture, as seen in Holling & Gunderson (2002a), Tranfield et al. (2003), and Massari & Giannoccaro (2023). Fundamental works in CAS concept and resilience thinking provide ontological and strategic scaffolding needed to consolidate contemporary SCRES phenomena into a coherent system-level framework, in which the adaptive pathway concept complements these concepts with operationalization tools. Through this comprehensive synthesis, dispersed insights were reorganized into a hierarchical conceptual structure that informed the development of the SCRES-ASL (Supply Chain Resilience – Adaptive System-Level) framework, which integrates the enabling conditions and adaptive dimensions of adaptive supply chain resilience. These integrated analytical layers inform the development of a hierarchical architecture that distinguishes (i) the enabling condition required for adaptive functioning and (ii) the core adaptive dimensions of SCRES.

3. Results

The outputs of the synthesis are presented in this section, beginning with the thematic map visualization and proceeding to the development of a consolidated, foundational architecture for the resilience framework.

3.1 Insights from Literature Synthesis

The literature synthesis offers complementary insights that informed the proposed framework. The bibliometric maps in Figure 3 show topic clustering within the SCRES corpus, with the motor theme cluster dominated by Supply Chain Resilience, indicating its central position in the corpus and its integrative function. More operational themes such as risk management, disruption¸ digitalization, and collaboration exhibit high centrality but lower internal density, indicating their widespread use in literature. Conceptual themes such as supply chain visibility, viability, and systematic review appear in the niche theme quadrant, suggesting the fragmentation of discussion in this topic in the SCRES discourse. The domain-specific and methodological themes, such as food supply chain and fuzzy modelling, fell into the emerging/declining quadrant, indicating their context-bound applications that need further reinforcement.

Figure 3 also shows visible patterns of connection between different themes that represent keyword co-occurrence relationships. These connections reveal the different themes that are frequently discussed together in SCRES research. Themes such as visibility, viability, and systematic review are connected to the SCRES theme through supply chain management, and risk management, indicating the connection between those themes as a unified discussion, not isolated streams.

Overall, the thematic maps show the central role of Supply Chain Resilience, which also serves as the most developed focus. SCRES are developed around operational enablers and conceptual developments. Importantly, the co-occurrence connections between topics show the topics that are frequently discussed together, indicating intellectual linkages between those topics. However, these connections do not show a structure that explains the relation of these topics in the system level. Therefore, highlighting the need for an integrative analysis that provides organization and structure for these dispersed yet related themes.

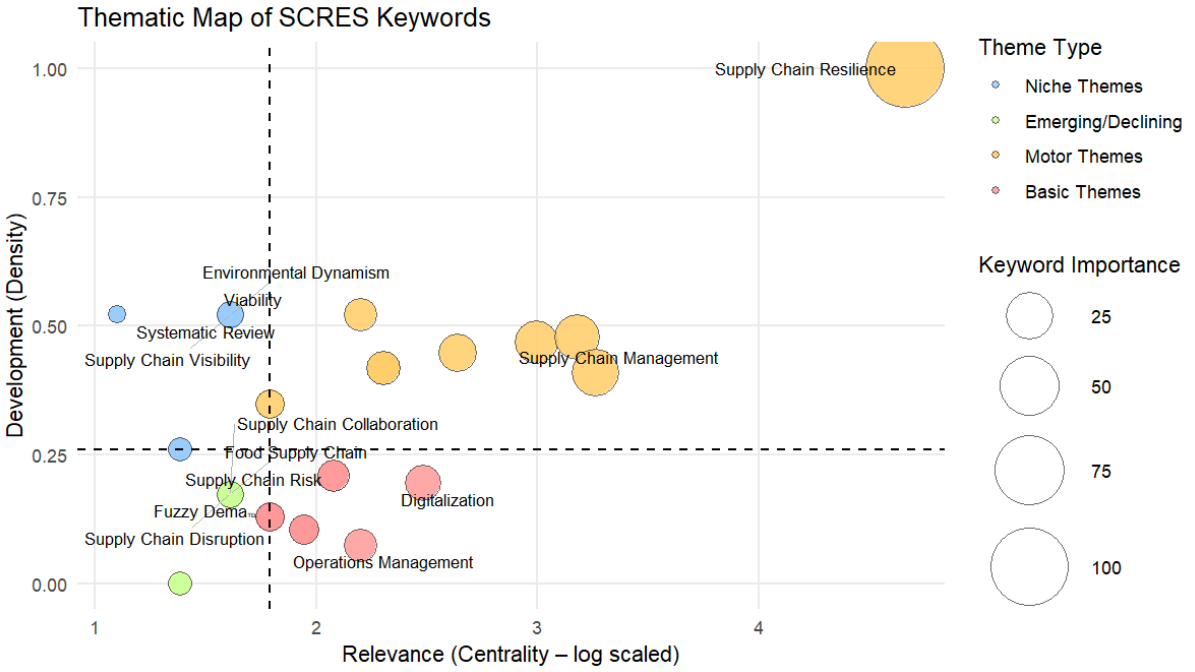

Figure 3: Thematic maps of academic works in supply chain resilience (SCRES)

Source: Author

3.2. Insights from SLR

The SLR process resulted in the dominant perspectives revolving around SCRES conceptual approaches, showing the state-of-the-art research in SCRES. Four key insights were derived from this process. First, the SLR shows dominance of capability-based resilience, where SCRES conceptualizes operational capabilities such as redundancy, flexibility, buffering, and contingency planning. This perspective resulted in a particular framing that see resilience as a set of predefined capabilities, rather than an evolving system property. The second stream of literature focuses on the technology-oriented resilience, in particular related to digital technologies and Industry 4.0 technology that improve SC visibility, coordination and analytical efficiency. Technology, however, only seen as a tool rather than a part of a system-level adaptive mechanism that influences emergence behavior. Another major body of work focuses on SCRES as part of risk management frameworks that emphasize risk identification, mitigation strategies, and preparedness-response-recovery cycles. These streams see resilience as the embodiment of risk mitigation and disruption management. The details of the literature explaining these key takeaways is described in Table 1.

Table 1: Key takeaways of state-of-the-art research in SCRES

Literature streams	Detail	Author
Capability – based resilience conceptualization	Redundancy, flexibility, buffering, adaptive routing, adaptive capability development	(Alikhani et al., 2023; Bag, Sabbir, et al., 2023; Y. Bai et al., 2025; Bowen & Siegler, 2024; Centobelli et al., 2023; Dura et al., 2025a; Furstenau et al., 2022a; Gavalas, 2025; Gruchmann et al., 2024; Ivanov, 2025; Khalilpoor et al., 2025; Liu et al., 2023; Machfudiyanto et al., 2025; Mahmud et al., 2023; Manafi & Sayan, 2025; Modgil et al., 2022; Olfati & Paydar, 2023; Oliveira Silva et al., 2024; Pang et al., 2025; Pu et al., 2025; Rajesh, 2020a; Riccardo et al., 2021; Sawik, 2022; Song et al., 2022; F. R. Taghikhah et al., 2025; Tiwari et al., 2024; Wube et al., 2025;

		Ye et al., 2025; Zheng et al., 2025)
Technology-oriented resilience	Digital supply chain, Industry 4.0, data visibility, sensing and monitoring, SC data analytics, digital platforms, digitalization	(Aslam et al., 2025; Bag, Dhamija, Singh, et al., 2023; X. Bai et al., 2025; Boone et al., 2025; Bowen & Siegler, 2024; Centobelli et al., 2023; Dong et al., 2025; Dura et al., 2025b; Furstenau et al., 2022b; Ivanov, 2025; Jafarian et al., 2025; Lv, 2025; Modgil et al., 2022; Peron et al., 2025; D. Singh et al., 2025; G. Singh et al., 2023; F. R. Taghikhah et al., 2025; Wang et al., 2025; Zhao et al., 2025)
Risk management and disruption mitigation perspective	Risk identification, mitigation strategies, preparedness-response-recovery cycles	(Bag, Dhamija, Luthra, et al., 2023; X. Bai et al., 2025; Bowen & Siegler, 2024; Broekaert et al., 2025; Centobelli et al., 2023; Chen et al., 2025b; Dura et al., 2025b; Furstenau et al., 2022b; Gruchmann et al., 2024; Ivanov, 2025; Jain et al., 2024; Khalilpoor et al., 2025; C. R. Lin et al., 2025; López et al., 2025; Lv, 2025; Mahmud et al., 2023; Modgil et al., 2022; Ozdemir et al., 2022; Pan et al., 2025; G. Singh et al., 2024; S. Singh et al., 2025; F. Taghikhah et al., 2021; Tiwari et al., 2024; Wang et al., 2025; Zhao et al., 2025)

Source: Author

Literature streams mostly focused on firm-level capabilities and strategies, without further explanation on how resilience emerged in system-level across multi-tier supply networks. Consequently, the conceptualization of SCRES remains fragmented and lack of understanding regarding persistent and cascading disruptions in complex supply networks. This limitation, therefore, highlights the need for an alternative that frames SCRES from system-level conceptualization that able to explain adaptive process within complex supply networks.

3.3. Insights from Integrative Analysis: Categories and factors of SCRES-ASL

The systematic literature review (SLR) that was complemented and refined through integrative analysis conducted in this study resulted in the formulation of the SCRES-ASL architecture, which consists of two conceptual clusters. The first cluster contains enabling conditions that need to be in place to realize adaptive behavior. If these enabling conditions are met, then the supply chain system can go through an adaptive process, which is the second cluster. The enabling conditions comprise governance, visibility, collaboration, learning system, and digitalization, while the adaptive process is characterized by decentralized responses, network reconfiguration, feedback-driven learning, and scenario branching. These constructions are then organized into a two-level categorization and labelled as follows:

1. Label A1-A5 are the Enabling Conditions; and
2. Label B1-B4 are the Adaptive Dimensions

These categories provide a coherent hierarchical structure that comprises the prerequisite conditions followed by adaptive processes.

Table 2: Enabling conditions for SCRES-ASL

Enabling Condition	Definition	Author
A1. Governance & Decision Rights	Establishes clear cross-tier responsibilities, flexible escalation paths, and adaptive decision mandates. Enables network-level governance to empower adaptive decision-making under uncertainties.	(J. Lin & Fan, 2024; Tsolakis et al., 2023; Wu et al., 2023)

A2. Data & Visibility Infrastructure	Provides interoperable data systems, shared indicators, and early warning tools to enhance transparency and timeliness. Strengthening sensing capabilities is vital for rapid detection and informed response.	(Bag, Dhamija, Singh, et al., 2023; Bowen & Siegler, 2023; Chen et al., 2025a; Tiwari et al., 2024)
A3. Collaboration & Incentive Alignment	Enhance cross-firm action by developing relational mechanisms, trust, and coordinated routines, while ensuring aligned incentives through benefit and risk sharing, and risk mitigation arrangements.	(Mwesiumo et al., 2021; Orji & U-Dominic, 2024; Peron et al., 2025; Ul Akram et al., 2024)
A4. Learning & Knowledge Systems	Creates routines for post-event learning, capturing feedback, and reflecting on performance. Enables the learning loop across tiers while retaining organizational knowledge	(Gao et al., 2021; Herold et al., 2021; Schoenherr et al., 2023; Zighan et al., 2024)
A5. Digital Enablement	Enhances the sensing, coordination, and scenario evaluation through the integration of AI, data analytics, digital twins, and simulation tools, supporting faster and better adaptive response	(Iftikhar et al., 2025; Ivanov & Gusikhin, 2026; Jafarian et al., 2025; Modgil et al., 2022)

Source: Author

Table 3: Core Adaptive Dimensions of SCRES-ASL

Adaptive Dimension	Operational Factors	Author
B1. Decentralized Adaptation (Agents & Interactions)	• Define agent-level response options, reflecting heterogeneity and bounded rationality. • Establish coordination pivots that align distributed decisions as disruptions evolve.	(Adobor, 2020; Wieland & Durach, 2021; Yaroson et al., 2021)
B2. Network Reconfiguration (Connectivity & Architecture)	• Implement modular, flexible network structures that allows re-routing and multi-sourcing. • Maintain redundancy and alternate pathways while preventing structural lock-in. • Flexibility on coupling/decoupling to manage propagation risks.	(Alikhani et al., 2023; Hart Nibbrig et al., 2025; Rajesh, 2020a; Sawik, 2022)
B3. System Dynamics & Learning Loops	• Define monitoring indicators responding to feedback loops and system delays. • Identify adaptation tipping points (ATPs) that trigger transitions across adaptive phases. • Revision of pathways based on learning and evolving system states	(Carpenter et al., 2001; Holling & Gunderson, 2002a; Ivanov, 2024; Massari & Giannoccaro, 2023)

B4. Scenario Branching & System Renewal (Emergent Properties)	• Create alternative pathways for diverging future conditions. • Identify convergence points stabilizing trajectories. • Design transformational options in case of unreliable prior configurations.	(Kivimaa et al., 2021; Öberg, 2023; Sparkes et al., 2023)

Source: Author

The two sets of categories above operate as interdependent elements, in which resilience emerges as a system-level process. The enabling conditions act as structural foundations covering institutional, informational, relational, learning-related, and technological aspects as enablers of adaptive behavior in practice. Governance and decision rights (A1) define the authority and coordination mechanisms needed for distributed responses. Data and visibility infrastructures (A2) strengthen sensing and early warning across tiers, allowing early recognition of propagation risks. Collaboration and incentive alignment (A3) supports coordination and burden sharing when adaptation requires cross-firm trade-offs. Learning and knowledge systems (A4) allow feedback and revision of routines, while digital enablement (A5) provides analytics and simulation needed for sensing, coordination, and scenario evaluation. Together, these enabling conditions provide the structural basis to inform the development and refinement of adaptive dimensions as conditions evolve.

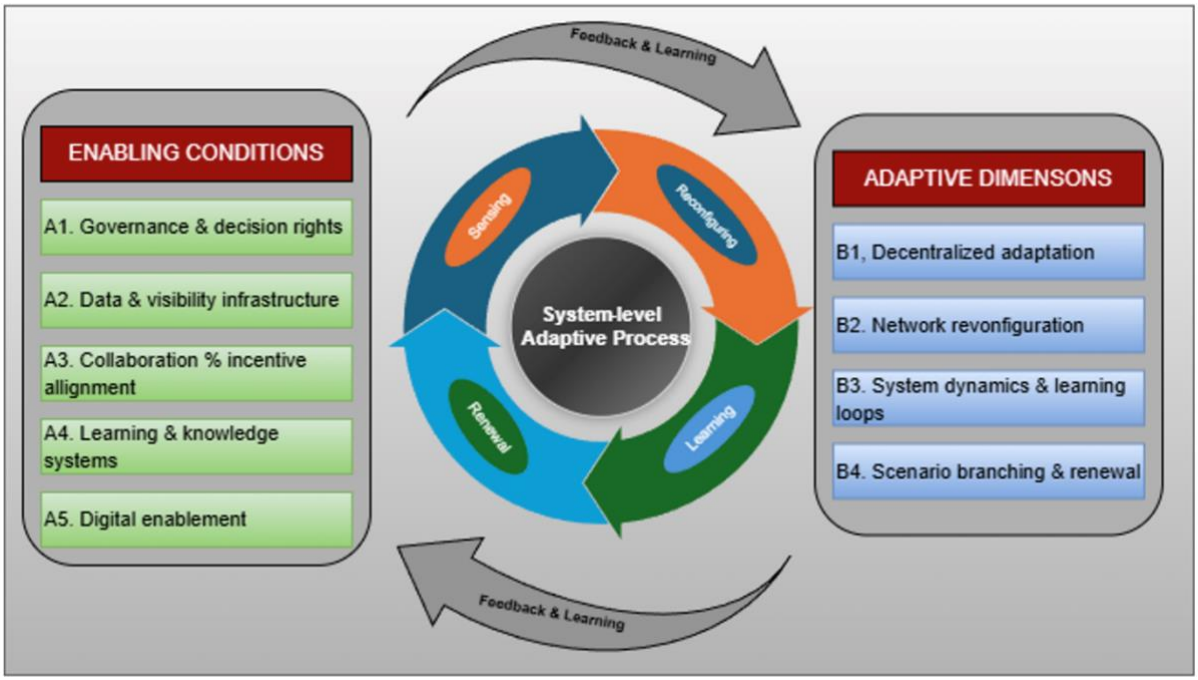

Figure 4: SCRES – ASL Integrated Conceptual Framework

Source: Author

The SCRES-ASL architecture framework, as depicted in Figure 4, has a two-level hierarchical structure that describes how the supply chain resilience should unfold in a continuously turbulent situation through a system-level adaptation. The enabling conditions labelled A1-A5 act as prerequisite conditions needed to sense changes, coordinate decisions, and mobilize responses across tiers. These conditions are the baseline of the adaptive dimension labelled as B1-B4. This dimension explains how resilience in the supply chain should be regarded as an ongoing process of continuous adjustment, instead of a one-time recovery attempt. The adaptation process goes iteratively between Enabling Conditions and Adaptive Dimensions, emphasizing the co-evolution situation, where the adaptive actions reshape the governance arrangements, the information structure needed, the collaboration routines, the learning process, and the technology adaptation, which in turn becomes the

foundation of the next adaptation cycle. This process goes iteratively, thus showing the feedback loops situation that connects the enabling situations and adaptive mechanisms to ensure the evolution process.

SCRES-ASL contributes to practical domain by informing supply chain managers a diagnostic design through the following sequence: (1) assess gaps in current situation across supply chain tiers; (2) identify the adaptive dimensions that are currently lacking in the gaps; (3) prioritize the enabling conditions that allows adaptive movements; and (4) revisit the assessment following the evolution of disruptions. For example, when a disturbance emerges that limits visibility, sensing lags and early signals of propagation are missed, thus hindering the network reconfiguration process, because rerouting and multisource decisions are late. This situation hampers feedback-driven learning because indicators are incomplete or delayed. In this case, data and visibility infrastructure need to be strengthened to support the decentralized response, followed by reconfiguration that reduces the escalation of the disturbance and lock-in effects.

4. Discussion

This study proposed a reconceptualization of SCRES through a triangulated methodology involving bibliometrics analysis, SLR, and integrative analysis. Bibliometrics and SLR show several persistent limitations in the existing SCRES literature. A capability-centric perspective dominated the literature, framing SCRES primarily as the development of discrete operational capabilities such as redundancy, flexibility, and buffering. Further, these studies emphasized recovery from a single disruptive event, rather than continuous adaptation in a prolonged disruption, a situation that is more relevant in today's world. The elaboration of resilience is fragmented across different bodies of literature regarding structural conditions and organizational-level resilience strategies. Thus, offering limited guidance for a system-level perspective on how resilience evolves through nonlinear interactions among supply-chain actors. These limitations highlight the need for a coherent perspective that bridges structural enabling conditions with adaptive operational processes across the supply chain system.

SCRES-ASL framework proposed in this study enriches the current understanding of supply chain resilience by offering a system-level view that integrates enabling conditions with the adaptive process needed to unfold resilience over time. The existing SCRES literature is dominated by the perspective that sees SCRES as a situation achieved through predefined, recovery-oriented capabilities such as redundancy, buffering, and risk-based optimization. This dominant perspective frames resilience as capabilities that need to be developed to achieve a predefined outcome, thereby neglecting the dynamic adjustments within the system. Through the SCRES-ASL framework, the perspective was shifted by reconceptualizing supply chain resilience as a continuous system-level process that emerges through cycles of sensing, reconfiguration, learning, and renewal. From this perspective, SCRES is conceptualized as a learning and evolutionary process. The proposed SCRES-ASL framework aligns with current empirical observations that underscore the importance of dynamic adjustment and feedback-driven coordination in mitigating prolonged disruptions. Therefore, this perspective points out the key role of interaction within supply chain tiers in supporting the evolving nature of resilience, rather than by defining engineered attributes.

Furthermore, by integrating structural elements with adaptive mechanisms, SCRES-ASL provides an evolutionary process driven through continuous sensing, decentralized coordination, reconfiguration, and system renewal. Hence, this framework complements the dynamic capability perspective by extending the analytical lens from firm-level adjustment to network-level co-adaptation. The system-level integration allows SCRES-ASL framework to capture the evolving nature of resilience development that frames SCRES as an emergent, continuous adaptive process, shaped by the structural and relational foundations of the supply chain system. This conceptualization thus goes beyond the static engineering conceptual approach.

SCRES-ASL framework provides valuable insights for managers and policymakers by providing practical direction for resilience design under contemporary continuous disruptions. The Enabling Conditions can be used to measure structural or relational problems, such as a low level of visibility, unclear decision mandates, a weak learning process, and more problems that potentially hinder the adaptation process. The Adaptive Dimensions further provide process-oriented guidance that manages the sequence of actions. These dimensions provide

understanding of the conditions when decentralized adjustments are appropriate, when the network reconfiguration needs to take place, when the existing feedback loops require realignment, and when there is a need to reform the emerging trajectories. Further, to fully realize the resilience of the supply chain, this framework helps policymakers to strengthen the institutional arrangements and data infrastructure required in enabling coordination and cross-organizational adaptation. Overall, by treating supply chain as an adaptive economic system, SCRES-ASL provides the structure of system-level architecture that synthesizes dispersed perspectives in the SCRES literature and provides practical pathways to navigate the supply chain system under persistent disruptions.

5. Conclusion

This study proposes a framework titled as SCRES – Adaptive System-Level (SCRES-ASL) that advances the conceptualization of supply chain resilience (SCRES) through the integrated synthesis of bibliometric mapping, systematic literature review, and theory-informed deep synthesis. This study achieved three key objectives. It identified structural patterns and major limitations in the contemporary literature corpus comprising SCRES conceptualization. This study also synthesized insights from CAS, and *resilience thinking* as theoretical grounding, and *adaptive pathways* as operational approach to construct SCRES-ASL frameworks. This study further provide theoretical guidance for SCRES under continuous disruptions by articulated enabling conditions and adaptive dimensions. Through the establishment of Enabling Conditions and Adaptive Dimensions the framework moves beyond the static resilience thinking emphasizing recovery-centric approaches toward a dynamic understanding of resilience development process through continuous sensing, reconfiguration, learning, and renewal. In this hierarchical architecture, the framework provides clarity on how the foundational structures comprise governance, visibility, collaboration, learning systems, and digitalization operationalizes through adaptive mechanisms at multiple system levels, offering managers and policymakers an actionable guidance for designing and evaluating SCRES under continuous and cascading disruptions.

As a conceptual proposition, the proposed SCRES-ASL framework calls for further empirical examination to operationalize and realize the adaptive factors through structural assessment, applying simulation or a system-dynamic modelling to explore the various pathways under different disruption contexts. Longitudinal case studies are also valuable in tracing adaptive processes and interacting across supply-chain tiers. The exploration on how digital technologies, data-sharing policies, and institutional arrangements should be developed under the framework on diverse industries also needed. Such investigations not only deepen the understanding of resilience under this framework but also provide more practical and empirical evidence across different contexts.

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