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Exploring the nexus of real options and ESG : A bibliometric analysis of Asian research

Vivien Csapi *
Alexandra Posza †
Department of Finance and Accounting
Faculty of Business and Economics
University of Pécs
Pécs 7622
Hungary

Abstract

Integrating Environmental, Social, and Governance (ESG) factors into investment decisions is receiving increasing attention amid global sustainability challenges. Real options theory provides a framework for incorporating ESG into corporate finance under uncertainty. This study conducts a bibliometric analysis of 50 peer-reviewed Scopus articles from the past decade, focusing on ESG and real options in Asia. Using keyword mapping, we identify key research clusters and themes. Findings show a growing but nascent field, highlighting corporate sustainability strategies, ESG metrics in valuation, and regulatory impacts. Insights benefit academics, policymakers, and practitioners navigating ESG uncertainties in Asian markets.

Subject Classification: *91G50.*

Keywords: *Real options theory, ESG integration, Investment decision-making, Bibliometric analysis, Sustainability-oriented investments.*

1. Introduction

The integration of ESG considerations into corporate and investment decisions has accelerated significantly worldwide in recent years. Economic growth converges with mounting sustainability challenges,

* *ORCID-ID:* 0000-0003-1996-091X
† *ORCID-ID:* 0009-0000-9609-9866

* *E-mail:* csapiv@ktk.pte.hu (Corresponding Author)
† *E-mail:* poszaa@ktk.pte.hu

compelling firms, regulators, and investors to consider ESG indicators as a core element of their strategic and financial assessments [1]. Asia seems to be as one of the most dynamic regions within this landscape, given its rapid economic development and diverse regulatory and cultural contexts [2].

Simultaneously, real options theory has emerged as an efficient tool for evaluating corporate investments under uncertainty [3, 4]. Unlike traditional approaches such as Net Present Value (NPV), real options models explicitly incorporate managerial flexibility to adapt, expand, defer, or abandon projects in response to volatile market or regulatory conditions [5]. The potential synergy between real options and ESG considerations is recognized: more attention to environmental and social parameters introduces new sources of uncertainty and potential value, especially in emerging markets where policy direction and stakeholder expectations can shift rapidly [6].

However, research on the intersection of real options and ESG in Asia is still in its early stages. The region encompasses both highly developed economies with well-established sustainability reporting standards (e.g., Japan, Singapore) and emerging markets with evolving regulatory structures (e.g., China, India, Southeast Asian nations) [7]. There is a notable scarcity of studies examining how firms employ real options logic to navigate ESG-related risks and opportunities. This gap is salient given the broad scope of ESG factors - from carbon emissions and community relations to corporate governance - each potentially affecting a firm’s financial performance and strategic flexibility [8].

In response to this gap, the present study conducts a bibliometric analysis of recent peer-reviewed articles linking real options theory with ESG topics in Asia. Bibliometric techniques (e.g. citation analysis, co-authorship, and keyword network mapping can reveal thematic clusters, influential authors, and research trends. By scrutinizing 50 Scopus-indexed publications, our objective is to understand how researchers conceptualize the strategic incorporation of ESG into corporate financial decision-making through a real options lens, and to identify emergent themes, methodological approaches, and regional nuances in this domain.

Several key research questions guide this effort:

- How has the volume and scope of publications evolved over the last decade regarding real options and ESG in Asia?

- Which areas of ESG receive the most attention in the context of real options applications, and which industry sectors predominate these studies?
- How do regional variations in regulatory environments, cultural norms, and stakeholder expectations shape the use of real options as a strategic tool for ESG-related decisions?
- What are the predominant methodological approaches for integrating ESG metrics within real options models, and what empirical gaps remain?

By exploring these dimensions, our analysis offers an integrative perspective on the state of the field and highlights underexplored areas—particularly regarding the operationalization of ESG variables within real options frameworks. As Asia continues to drive economic expansion and ESG-driven regulatory innovation, exploring the role of real options in sustainable investment strategies could provide valuable insights to scholars, practitioners, and policymakers.

2. Literature review

The real option theory provides a dynamic approach to investment under uncertainty by valuing managerial flexibility. This framework recognizes the option-like value of deferring or adjusting investment decisions in response to unfolding events, challenging traditional static valuation models. By allowing managers to adapt or abandon projects as new information arises, real options theory acknowledges that uncertainty can add value to investment opportunities [9]. This perspective is particularly relevant in industries characterized by high volatility and irreversible investments, such as technology or energy, where flexibility is crucial.

ESG considerations have evolved from niche concerns to central pillars of corporate strategy and reporting [10]. Environmental factors (e.g., carbon emissions, water usage, and waste management) have gained particular attention as climate change shapes public policy and market dynamics [6]. Firms that proactively manage their environmental impact can gain competitive advantages, but face uncertainties from shifting regulations and technological change [11]. Social factors, including labor practices and community engagement, can bolster a firm's reputation and stakeholder trust, though their financial benefits are often diffuse and complex to quantify [12]. Governance factors, such as board structure and transparency, help mitigate risks and align management with long-term goals. In many Asian markets, common ownership structures (family-controlled conglomerates and state involvement) introduce unique governance challenges [13] that influence how companies balance profitability with ESG commitments.

Few studies have explicitly integrated ESG factors into a real options framework, making this an emergent area of inquiry. Some research treats sustainability initiatives as real options themselves. For instance, investments in renewable energy projects can be evaluated as real options, acknowledging uncertainties in future carbon pricing or technology costs. Corporate social responsibility projects may be viewed as growth options that a firm can expand if initial outcomes are positive or abandon if stakeholder sentiment shifts [11]. Strong corporate governance can enhance the value of these options by enabling timely and strategic decision-making. Real options thus serve as a tool for navigating the uncertainties inherent in ESG-related investments, from regulatory changes to shifting consumer preferences. At the same time, inconsistent ESG data and disclosure quality across countries make cross-comparison difficult, underscoring the challenges of integrating ESG metrics into financial models.

Prior studies at the ESG-real options nexus have employed various methods, often borrowing from corporate finance and strategic management. Quantitative approaches are common – for example, adapting valuation models (binomial lattices, Monte Carlo simulations) to incorporate carbon taxes or other ESG-related scenario variables. Some studies combine real options analysis with resource-based and stakeholder theories, assessing how intangible assets like brand reputation or stakeholder goodwill contribute to option value [8]. Evidence shows that markets reward sustainability initiatives, implying an option-like value to such strategic moves. However, research bridging real options and ESG remains fragmented and limited in scope. This highlights an opportunity to consolidate existing knowledge and identify gaps. A systematic bibliometric analysis can map the intellectual structure of this nascent field and guide future investigations. The present study addresses this need by quantitatively analyzing the relevant literature, as described next.

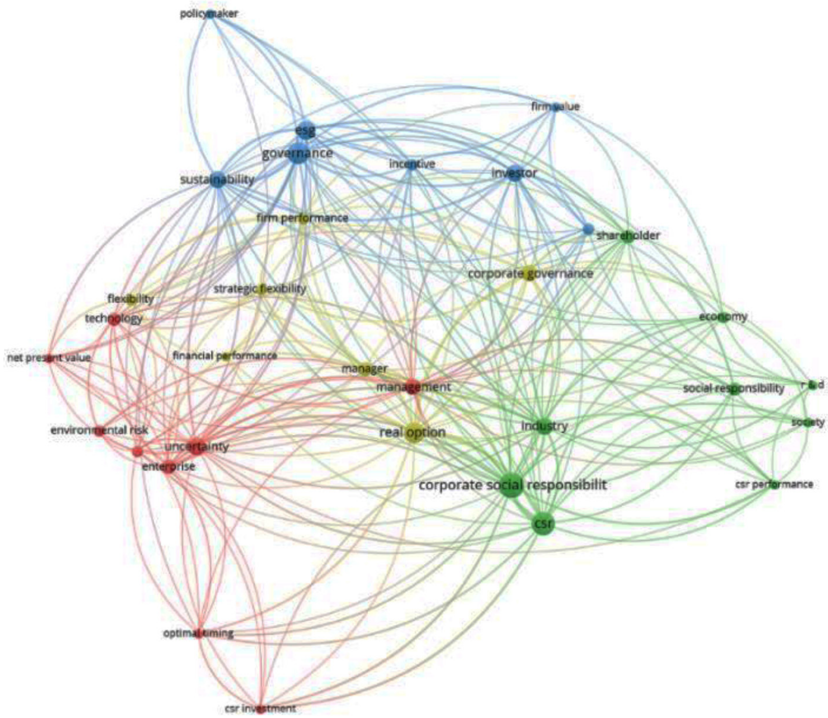
3. Methodology

We employed a bibliometric analysis to systematically review the literature at the intersection of real options and ESG in Asia. Following the PRISMA guidelines for transparent literature reviews, we constructed a comprehensive search query and screening process. The Scopus database was searched using keywords related to real options ("real option*" OR "managerial flexibilit*" OR "strategic flexibilit*" OR "strategic investment*" OR "irreversible investment*" OR "investment under uncertainty") combined with ESG terms ("ESG" OR " environ*social*govern* " OR "ESG criteria" OR "ESG factors" OR "corporate governance" OR "social responsibilit*" OR "environmental risk") and restricting results to Asian countries. Only peer-reviewed journal articles written in English and published in the last ten years were considered. We further filtered results by region, including only studies with empirical focus or data from Asian countries. This procedure yielded an initial set of 145 records. Non-English publications, and non-journal sources (conference papers, books), and excluding studies lacking a specific focus on Asia, a total of 50 journal articles were retained for the final analysis. Using bibliometric tools (e.g. VOSviewer for network visualization), we analyzed this dataset's publication trends, citation patterns, and keyword co-occurrences. Key information extracted from each article included publication year, journal, country focus, methodological approach, and thematic keywords. We mapped co-authorship networks to identify collaborations and used citation analysis to pinpoint influential studies in the field. The results of these analyses are presented in the next section.

4. Results

Our bibliometric analysis confirms that academic research linking real options and ESG in Asia is nascent but growing rapidly. The publication trend shows a marked increase in interest since 2018, then peaking in 2024 with 16 articles, reflecting the rising scholarly attention to sustainable investment strategies in the region. The 50 studies are spread across 41 different journals, with a few key outlets – such as Strategic Management Journal, Sustainability (Switzerland), and Business Strategy and the Environment – featuring multiple relevant publications. Citation analysis shows that the most-cited paper in the sample has over 200 citations, and several others exceed 100 citations, underscoring that these studies are building on and contributing to a solid scholarly base in strategic finance and sustainability.

Keyword co-occurrence mapping (via VOSviewer) identified keywords with a minimum frequency of three, and revealed four distinct research clusters in the literature (Figure 1):



Source: Authors' own construction with VOSviewer

Figure 1

Bibliometric map of Real option and ESG in Asian research

Cluster 1: Investment Decisions and Management Dimensions

The first cluster includes key concepts such as management (8), enterprise (6), technology (5), investment decision (4), and uncertainty (10). The high frequency of uncertainty (10) and environmental risk (4) suggests that these concepts are closely related to corporate investment risk factors, as well as the timing (optimal timing, 3) and valuation (net present value, 3) of investments. The presence of optimal timing (3) and real options indicates the practical relevance of flexible investment scheduling, as highlighted by [9], who argue that investment flexibility helps mitigate risks arising from uncertainty.

Cluster 2: Corporate Social Responsibility (CSR) and Socio-Economic Contexts

This cluster is centered on corporate social responsibility, as shown by the high occurrences of corporate social responsibility (19), CSR (16), and social responsibility (5) and the presence of industry (9), shareholder (5), and economy (4) suggests that CSR is not studied in isolation but rather in relation to industry characteristics, economic conditions, and shareholder perspectives. The mention of CSR performance (3) indicates a focus on measuring CSR effectiveness and its economic and social impact [10].

Cluster 3: ESG and Sustainability

The third cluster highlights ESG (11), governance (14), and sustainability (9), indicating a strong focus on environmental, social, and governance aspects of corporate operations. Additionally, firm value (3), incentive (4), and investor (9) suggests a connection between investor behavior, incentive structures, and sustainable corporate governance. The mention of policymaker (3) underscores the importance of regulatory and policy interventions in the sustainability transition.

Cluster 4: Corporate Governance and Strategic Flexibility

This cluster focuses on corporate governance (8) and manager (6), indicating that corporate governance and leadership decision-making play a central role. The firm performance (4) and financial performance (3) highlights the importance of financial success and operational efficiency. Furthermore, the high frequency of real option (13) and strategic flexibility (4) suggests a strong emphasis on strategic decision-making under uncertainty, particularly in real options thinking and flexibility in market adaptation.

The keyword frequencies indicate a strong connection between sustainability and corporate responsibility (CSR, ESG), investment decision uncertainty, corporate governance, and strategic flexibility. These concepts are not examined in isolation but rather within economic, regulatory, and societal contexts.

5. Discussion

The evidence from this study suggests that the intersection of real options theory and ESG in Asia, while still emerging, is gaining momentum. The post-2018 surge in publications and citations reflects a growing recognition that sustainability considerations have become critical strategic factors in investment decision-making. Our analysis shows that this field is inherently multidisciplinary, bridging finance, strategic management, and sustainability science. The identified keyword clusters illustrate how uncertainty, flexibility, and stakeholder value permeate the discourse, demonstrating the intuitive alignment between real options thinking and ESG challenges in dynamic, regulation-sensitive environments.

Some Asian governments periodically implement abrupt policy changes—such as modifying renewable energy subsidy schemes or tightening ESG reporting requirements overnight—which significantly affect the timing and scope of ESG-related investments [6, 11].

At the same time, the uneven geographic distribution of research points to significant regional differences in how ESG is institutionalized. In markets with established ESG frameworks and stronger regulatory mandates, companies (and scholars) are more actively exploring sophisticated tools like real options to manage sustainability investments. In countries where ESG standards are nascent or voluntary, the academic focus appears to be on identifying basic relationships and making the case for more structured approaches. These regions present fertile ground for further empirical work – for example, investigating how small and medium-sized enterprises (SMEs) in emerging Asian economies can leverage strategic flexibility to cope with ESG-related risks and opportunities.

SMEs have fewer resources to meet ESG requirements but tend to be more agile and adaptive; therefore, applying real options approaches can be especially valuable for them [21, 22].

From methodological perspective, a clear gap emerges in fully integrating ESG factors into financial models. Many studies simplify environmental and social variables or treat them in isolation. Environmental metrics (such as carbon emissions) are more frequently quantified in real option models, whereas social and governance dimensions are often addressed qualitatively or left out. This underscores the need for hybrid models combining rigorous financial valuation with stakeholder theory and institutional analysis insights. Developing such models could improve how uncertainty in ESG outcomes is measured and managed, offering a more holistic valuation of sustainability-oriented projects.

Our bibliometric review suggests that while progress has been made in linking real options with ESG imperatives, there is significant scope for deepening and broadening this line of inquiry. Future research could focus on underexplored themes such as the role of real options in corporate climate adaptation strategies, the impact of ESG-driven regulatory changes on investment timing decisions, and the strategic behavior of SMEs under ESG pressures. By addressing these areas, scholars can contribute to a more robust theoretical and practical framework for sustainable financial management in Asia and beyond.

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