

**MINISTRY OF FINANCE**

**UNIVERSITY OF FINANCE – MARKETING**

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**TRAN THI LE HIEN**

**THE IMPACT OF FINANCIAL DEVELOPMENT ON SUSTAINABLE  
DEVELOPMENT IN ASIAN COUNTRIES:  
THE MODERATING ROLE OF GLOBAL INNOVATION**

Major: Finance - Banking

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## LIST OF PUBLISHED RESEARCH PAPERS

- Trần, T. L. H., & Phạm, T. T. V. (2025). The impact of financial development on sustainable development in Asian countries. *Journal of Economics and Forecasting*, 601. <https://kinhtevadubao.vn/tac-dong-cua-phat-trien-tai-chinh-den-phat-trien-ben-vung-tai-cac-quoc-gia-chau-a-31479.html>
- Trần, T. L. H., & Phạm, T. T. V. (2025). The impact of global innovation on sustainable development in Asian countries. *Asian Journal of Economics and Banking*, 231(6), 69–82. <https://doi.org/10.63065/ajeb.vn.2025.231.115682>
- Trần, T. L. H., & Phạm, T. T. V. (2025). The impact of financial development on sustainable development in Asian countries: The moderating role of global innovation. *Journal of Finance and Accounting Research*, 291(7), 21–24.

## **CHAPTER 1: INTRODUCTION**

### **1.1. Research rationale**

#### **1.1.1. Scientific significance**

In the context of the twin transitions of energy and digitalization, financial development (FD) is not limited to expanding in scale but also entails restructuring the financial system (FS) to adapt to the demands of greening and digitalizing the economy (Fan et al., 2025). FD plays a crucial role in resource allocation, reducing transaction costs, and supporting investments in clean technologies and renewable energy to promote sustainable development (SD) (Demirguc-Kunt & Levine, 2008; Li & Shao, 2023). However, the effectiveness of FD depends on the degree of global innovation (GI), public policy, and consumer behavior (Du et al., 2025; Calvino et al., 2025).

There are three principal mechanisms through which FD affects SD: supporting economic growth, enhancing social inclusion, and promoting the green economy (Levine, 2005; King & Levine, 1993; Claessens & Feijen, 2007). Nevertheless, without proper regulation, FD may lead to financial instability, environmental pollution, and increased inequality (Sakalsiz & Kiliç, 2024; Petrović & Lobanov, 2021). In addition, GII acts as an intermediary, influencing SD through financial and technological innovations such as FinTech and blockchain, thereby contributing to transparency and efficient capital allocation (Khraisha & Arthur, 2018; Leng et al., 2024). However, if poorly regulated, GII can exacerbate inequality, amplify global risks, and foster “greenwashing” practices (Zhu et al., 2020; Ibrahim & Vo, 2021).

#### **1.1.2. Practical significance**

From a practical perspective, climate change, geopolitical instability, and economic and social crises have underscored the pivotal role of sustainable finance in addressing systemic vulnerabilities and advancing the SDGs (Sachs et al., 2024; ADB, 2023). Financial barriers and inequality remain major challenges in Asia, where more than 1.2 billion people live on less than USD 3.2 per day and nearly 1.7 billion are unbanked (ADB, 2023). The development of green technologies and sustainable finance is therefore an urgent necessity, requiring institutional reforms, enhanced transparency, and stronger risk governance (Patel & Mehta, 2023).

This dissertation seeks to analyze the relationship between FD, GI, and SD across 44 Asian countries during the period 2007–2023, thereby providing empirical evidence to inform policymaking and promote inclusive and SDG.

## **1.2. Research objectives and questions**

### **1.2.1. Research objectives**

The overarching objective of this dissertation is to examine the impact of FD on SD in Asian countries and to test the moderating role of GII in this relationship during 2007–2023. From this, the dissertation aims to synthesize and propose key policy implications for strengthening SD on the foundation of FD and GII in Asia. To achieve this overall objective, the dissertation addresses three specific objectives:

First, to analyze and assess the impact of FD on SD in Asian countries.

Second, to analyze and assess the impact of GII on SD in Asian countries.

Third, to analyze and assess the moderating role of GII in the relationship between FD and SD.

Finally, the dissertation synthesizes and formulates policy implications regarding FD and the moderating role of GII to foster SD in Asian countries.

### **1.2.2. Research questions**

Based on the research objectives, the dissertation proposes four research questions:

How does FD affect SD in Asian countries?

How does GII affect SD in Asian countries?

How does GII moderate the relationship between FD and SD?

What policy recommendations regarding FD and GII can be drawn to promote SD in Asian countries?

### **1.3. Research subjects and scope**

#### **1.3.1. Research subjects**

The dissertation focuses on two main subjects: (i) evaluating the overall impact of FD on SD in the Asian context; and (ii) analyzing the moderating role of GII in the relationship between FD and SD in order to better understand the interaction mechanisms among these three factors.

#### **1.3.2. Research scope**

Timeframe: 2007–2023.

Geographical scope: Data from 44 Asian countries (see Appendix 3).

Content scope: The study focuses on examining the impact of FD on SD in 44 Asian countries, employing composite indices to measure FD, GI, and SD. It tests the effect of GII on SD to determine the extent of innovation's influence. It further examines the moderating role of GII in the FD and SD relationship, clarifying whether GII amplifies or diminishes the impact of FD on SD.

### **1.4. Research methodology and data**

#### **1.4.1. Research methodology**

This dissertation adopts a mixed-methods approach, combining both quantitative and qualitative analyses to ensure a comprehensive examination of the relationship between FD, SDG, and the moderating effect of GII.

For the quantitative analysis, the study employs the system generalized method of moments (GMM) regression model to address issues of endogeneity, autocorrelation, and heteroskedasticity, following the methodologies of Barro

(1996), Arellano & Bond (1991), Arellano & Bover (1995), and Blundell & Bond (1998). Diagnostic tests such as Sargan/Hansen, Hausman, Breusch-Pagan, Wooldridge, and CIPS are conducted to validate model robustness. Stability is further tested through alternative variables such as CO<sub>2</sub> emissions, biosphere conservation, private sector credit, and technological indices using principal component analysis.

#### **1.4.2. Research data**

The dataset covers 44 Asian countries during 2007–2023, comprising 748 observations. The dependent variable is the SD index from Sachs et al. (2024). The main independent variable is the composite FD index by the IMF (Svirydzenka, 2016). The moderating variable is the GII index developed by WIPO (Dutta et al., 2023). Control variables include trade openness, FDI, urbanization, and inflation from the World Bank. In addition, alternative variables such as CO<sub>2</sub>, EPIG, DCP, and ICT1 are incorporated to test the robustness of results.

### **1.5. Novelty and contributions of the dissertation**

#### **1.5.1. Novelty of the dissertation**

The dissertation presents five key novelties.

First, it is the first comprehensive study to analyze the impact of FD on SD with the moderating role of GII across 44 Asian countries, while prior works such as Ziolo et al. (2023), Petrović & Lobanov (2021), Ganda (2019), and Li et al. (2024) focused on other regions or had narrower scopes.

Second, the research is situated in the specific context of Asia, a region heavily affected by climate change and characterized by significant disparities in financial capacity and innovation (IPCC, 2021; Blunden & Boyer, 2021; Roy et al., 2024).

Third, the dissertation delves into the moderating role of GII in the FD - SD nexus, a gap largely overlooked by prior studies (Khraisha & Arthur, 2018; Demirgüç-Kunt & Levine, 2009; Frigerio, 2024).

Fourth, it applies the system GMM model with multiple robustness checks, incorporating alternative indicators such as CO<sub>2</sub>, and EPIG for SD; DCP for FD; ICT1 and the centralized interaction term FD\_CGII an approach not found in previous works (Petrović & Lobanov, 2021; Khan & Ozturk, 2021; Yu et al., 2022; Zhu et al., 2020).

Finally, the findings reveal that GII exerts a negative moderating effect, indicating that uncontrolled innovation may weaken the positive influence of FD on SD by fostering financial speculation and misallocating capital flows (Krozer, 2015; Nakitende, 2024). Thus, while innovation is vital for growth and green transition, proper governance mechanisms are required to prevent instability in FD and potential obstacles to SD.

## **1.5.2. Contributions of the dissertation**

### **1.5.2.1. Theoretical contributions**

The dissertation constructs an extended theoretical framework by integrating three domains: FD (grounded in financial market theory, financial intermediation, and financial inclusion), GII (financial, ecological, and technological innovation), and SD (endogenous growth theory, the three-pillar model of sustainability, and capital access). Financial intermediation theory emphasizes risk regulation and efficient capital allocation (Leland & Pyle, 1977; Levine, 1999). Financial market theory highlights transparency and competition (King & Levine, 1993). Financial inclusion theory expands access to capital for disadvantaged groups through digital tools and FinTech (Demirguc-Kunt et al., 2017). This integrated framework helps explain the interaction mechanisms

between FD, SD, and the moderating role of GII in promoting green, equitable, and resilient development.

The dissertation does not only analyze isolated impacts but also empirically tests the moderating role of GII in the FD - SD nexus using three established indices: FD (Svirydzenka, 2016), GII (Dutta et al., 2023), and SD (Sachs et al., 2024). It further incorporates macroeconomic variables such as trade openness, urbanization, FDI, and inflation to enhance analytical precision. These contributions provide an important theoretical foundation for designing sustainable financial policies adjusted by innovation.

#### **1.5.2.2. Practical contributions**

The dissertation provides empirical evidence from 44 Asian countries, demonstrating that both FD and GII have positive effects on SDG when considered independently. However, the moderating role of GII may weaken the impact of FD on SD. This finding offers important insights for reshaping financial policies to enhance long-term effectiveness.

Furthermore, the dissertation highlights the pivotal role of GII in supporting the green transition through digital technologies, blockchain, and FinTech. Nonetheless, this requires appropriate risk-control policies to ensure that innovation genuinely contributes to SD.

The study also proposes a flexible policy approach that balances FD and GI, rather than adopting a rigid framework. The development of instruments such as green bonds, microfinance, and green credit should be accompanied by effective monitoring mechanisms to mitigate financial risks and avoid “greenwashing” Finally, the results offer valuable references for policymakers, financial institutions, and enterprises in formulating strategies that integrate finance and innovation with sustainability. These findings help shape effective investment policies that balance growth with environmental protection..

## **CHAPTER 2: LITERATURE REVIEW ON FINANCIAL DEVELOPMENT, GLOBAL INNOVATION, AND SUSTAINABLE DEVELOPMENT**

### **2.1. Theoretical background**

#### **2.1.1. Overview of financial development**

##### **❖ Definition of financial development**

According to Adnan (2011), FD refers to the set of policies and institutions that strengthen financial intermediation, diversify risks, allocate capital efficiently, and mobilize savings for investment. Demirguc-Kunt and Levine (2008, 2009) expand this concept by emphasizing access to financial services as well as the role of investment supervision and risk management. Svirydzienka (2016) defines FD as encompassing five core functions: mobilizing savings, allocating capital, monitoring investments, diversifying risks, and facilitating the exchange of goods and services thereby contributing to macroeconomic stability and reducing inequality. This dissertation adopts Svirydzienka's (2016) definition, as it best captures the fundamental role of the financial system (FS) in fostering growth and equity.

##### **❖ Financial intermediation theory and financial markets**

Financial intermediation theory posits that financial institutions mitigate information asymmetry and transaction costs (Akerlof, 1970; Leland & Pyle, 1977). When borrowers hold more information than lenders, risks rise and market efficiency declines. Konstantakopoulou (2023) argues that financial intermediation also helps reduce liquidity risk through portfolio diversification. High transaction costs have been recognized as another barrier to FD (Benston & Smith, 1976; Campbell & Kracaw, 1982). Fry and Goldsmith (1970) further assert that the size of the FS depends on its ability to separate savings from investment.

From the perspective of financial market theory, capital is efficiently allocated to green projects, thereby fostering SD (Demirguc-Kunt & Levine, 2001; Fu et al., 2023). Since the 1980s, with support from the IMF and World Bank, stock markets have played a significant role in mobilizing capital and promoting growth (Levine, 1999). However, the rise of FinTech, DeFi, and BigTech necessitates adaptive regulatory frameworks that both safeguard the role of financial intermediaries and encourage competition (Murinde et al., 2022). Alongside benefits such as cost reduction and financial inclusion, financial innovation raises pressing regulatory challenges such as Know Your Customer (KYC), Anti-Money Laundering (AML), and cybersecurity (Dhanya et al., 2025; Bakare et al., 2024; Ali, 2024). At the same time, financial intermediation theories are being adjusted to account for the impacts of decentralized finance and cryptocurrencies on asset valuation (Zeiß et al., 2024).

#### ❖ **Financial inclusion theory**

Financial inclusion theory (FIT), developed in the 1990s, emerged to address financial exclusion and to expand access to financial services for disadvantaged groups (Veena, 2022). FIT emphasizes the role of financial accounts, digital payments, and digital finance in promoting gender equality, improving risk management capacity, and strengthening macroeconomic stability (Demirgüç-Kunt & Levine, 2001). Theoretically, FIT reflects a form of market failure in which individuals with financial needs cannot access capital due to constraints related to assets, income, or geographic location (Kulkarni & Joshi, 2021; World Bank, 2014). FIT is regarded as a public good, integrating finance with social policy to reduce income inequality and enhance financial literacy and behavioral capacity (Huang et al., 2021; Kling et al., 2020). According to Ozili (2022), FIT influences SDG in three ways: by expanding capital access for green investment, creating uneven impacts across energy

sources, and regulating SD when integrated into existing socio-economic systems.

### ❖ **Theory of sustainable finance**

The theory of sustainable finance originates from Ferris & Rykaczewski (1986), evolving from socially responsible investment (SRI) into broader forms of finance that incorporate environmental, social, and governance (ESG) factors and corporate social responsibility (CSR). Sustainable finance directs capital flows into green sectors, strengthens the resilience of the financial system (FS), and necessitates the development of new measurement indices beyond traditional credit or FIT-based indicators (Kumar et al., 2022; Szalai & Czakó, 2023). Since the Rio Summit in 1992, the need to integrate SD principles into finance has become increasingly evident (Canlıtepe & Künç, 2024). However, the distribution of benefits along the global value chain remains inequitable (UN, 2024). Moreover, the global climate finance system remains fragmented, with more than 81 independent funds, creating significant challenges for oversight and coordination (OECD, 2024).

### ❖ **Measuring financial development**

Sahay et al. (2015) proposed a measurement framework comprising three dimensions depth, access, and efficiency yet without constructing a composite index. Svirydzenka (2016) addressed this limitation by applying principal component analysis (PCA) to develop a composite index using data from 183 countries. This index captures the structure of the financial system (FS) across three components: size (market scale and liquidity), access (services for individuals and businesses), and efficiency (costs, profitability, and capital market performance). The IMF further developed this index based on datasets from GFDD, FinStats, BIS, Dealogic, and IMF surveys. Given the large dataset (151 indicators), the IMF aggregated them into sub-indices and an overall

composite index to monitor six key characteristics of FS, thereby identifying weaknesses and exploring links between FD and macroeconomic outcomes.

According to the 2013 global financial development report, the World Bank emphasized that stability is essential for effective FD. A stable FS is defined as one capable of managing risks, allocating resources efficiently, maintaining employment near its natural rate, and mitigating asset price volatility (World Bank, 2012a). A stable FS can also self-adjust in response to shocks. However, when comparing different approaches, this dissertation adopts Svirydenka's (2016) FD index, as it emphasizes the three core aspects depth, efficiency, and access making it more suitable for the research objectives.

### **2.1.2. Overview of global innovation.**

#### **❖ Definition of global innovation**

The concept of “global innovation” is understood as the set of methods by which individuals and institutions manage common affairs (Soják, 1996). Dutta (2011) defines innovation as the introduction of new products, processes, marketing methods, or organizational practices. According to OECD and Eurostat (2018), innovation refers to the implementation of a significantly new or improved product or process. In today's context, innovation extends to social innovation, business models, and technical advancements. Global innovation (GII) refers to the development of products, processes, or services with multi-market impact, linked to the cross-border circulation of ideas and technologies (Lind & Ramondo, 2022).

This dissertation employs the GII, developed by WIPO in collaboration with Cornell University and INSEAD, which measures both inputs and outputs of innovation (Dutta, 2023).

#### **❖ Financial innovation theory**

Financial innovation encompasses derivatives, securitization, and instruments designed to manage risks and allocate capital (Luong, 2024). It represents the process of inventing and disseminating new ideas that improve market efficiency (Mention, 2012; Sekhar, 2013). FinTech through blockchain and artificial intelligence has expanded this theory by enabling more efficient financial services and start-up models (Luo, 2024; Varalakshmi, 2024). Financial innovation influences both the inputs and outputs of GI, but it also raises systemic risks (Luong, 2024). Capital is typically allocated to high-potential firms through R&D and venture capital (Scherer, 1999; Hall & Lerner, 2010; Kerr & Nanda, 2015). Yet start-ups often face financing barriers due to information asymmetry (Cirera, 2021). Venture capital is thus regarded as the “money of innovation” (World Bank, 2013). Financial innovation particularly FinTech plays a crucial role in driving economic growth and SD. FinTech expands lending, enhances financial access, and reduces inequality through tools such as e-wallets and blockchain (ADB, 2024). Moreover, green bonds and sustainable funds contribute to climate goals and clean energy development (Chala, 2024; Raman, 2025). However, overly rigid regulations can constrain innovation (Mention, 2012; Klimontowicz, 2023). If FD does not progress in tandem with technological innovation, the effectiveness of sustainability policies diminishes (Sabir, 2024).

#### ❖ **Theory of technological innovation system (TIS)**

TIS theory emphasizes technology and technological change as the starting point, distinguishing it from national or regional systems (Speirs, 2008). According to Jacobsson and Bergek (2004), TIS consists of three elements: actors, networks, and institutions. Hekkert (2007) and Bergek (2008a) identified seven core functions: entrepreneurial activities, knowledge development and diffusion, guidance of the search, market formation, resource mobilization, creation of legitimacy, and development of positive externalities. Technological

innovation contributes to emission reduction and renewable energy development (Abbass, 2025). When combined with financial systems, it supports sustainable business (Tabash, 2025). Green finance plays an intermediary role in providing capital for green technologies (Sun, 2024). However, if innovation remains weak or is adversely affected by globalization, finance may generate negative environmental consequences (Toumi, 2024).

### ❖ **Ecological innovation theory**

Emerging in the mid-1990s, ecological innovation was defined by Kemp and Foxon (2007) as the production, application, or exploitation of goods, services, processes, or organizational models designed to minimize risks and adverse environmental impacts. Andersen (2010) argued that this theory stemmed from the need to integrate environmental aspects into innovation processes. It was further developed by the OECD (2011), which highlighted the critical role of policy. Ecological innovation encompasses pollution-control technologies and environmentally friendly products, while also stressing non-technological factors such as marketing and organizational practices (Kral and Janoskova, 2021). OECD (2011) emphasized that ecological innovation enhances financial efficiency by channeling capital into green projects. Human resources play a pivotal role (Kemp and Foxon, 2007; OECD, 2011), alongside sustainable human resource management and continuous training (Fei and Wang, 2022; Ryketeng, 2023). Infrastructure such as smart grids and renewable research centers is also essential (Achmad, 2023; OECD, 2005). Ecological innovation leads to sustainable products, strengthens green marketing, boosts competitive advantage, and facilitates compliance with policy requirements (Demirel and Kesidou, 2019; Kouser, 2024).

### ❖ **Measuring global innovation**

Since 2007, WIPO, in collaboration with Cornell University and INSEAD, has developed the Global Innovation Index (GII) to help developing economies adapt to technological change (Dutta, 2023; Lundvall, 2007; Reis, 2021). Beyond measuring competitiveness, the GII serves as a predictive tool based on past, present, and future data (Wonglimpiyarat, 2010). The GII model (2011) comprises 80 indicators, including 59 quantitative measures, 15 aggregated from international organizations, and 6 derived from executive surveys (Dutta, 2023). The GII is structured into two main components: innovation inputs and innovation outputs (Dutta, 2023; Lundvall, 2007; Sohn, 2015). Inputs include five pillars: institutions, human capital and research, infrastructure, market sophistication, and business sophistication. Outputs comprise two categories: knowledge outputs (knowledge creation and impact) and creative outputs (intellectual property, creative goods, and services). The GII score is calculated as the average of these two categories on a 0–100 scale, with higher scores reflecting stronger innovation capacity.

### **2.1.3. Overview of sustainable development**

#### **❖ Definition of sustainable development**

The concept of sustainability first appeared in the 17th and 18th centuries in forestry as a response to declining forest resources (Warde, 2011). Political economists such as Smith, Mill, Ricardo, and Malthus raised questions regarding the limits of growth and social equity (Lumley and Armstrong, 2004), while the natural sciences of the 19th and 20th centuries debated conservation for human benefit versus the intrinsic value of nature (Callicott and Mumford, 1997). The Brundtland Report defined SDG as meeting present needs without compromising the ability of future generations to meet theirs (Al-Athel, 1987). Fischer (2023) identified three core pillars: economy, environment, and society. Clark and Wu (2016) emphasized the 17 global SDGs, while Sengupta (2020)

highlighted the role of sustainability education in raising youth awareness of responsibility and fostering actions for a sustainable future.

### ❖ **Endogenous growth theory**

Endogenous growth was defined by Aghion and Howitt (1998) as long-term growth driven by internal factors such as R&D, human capital, and technological innovation. Unlike the neoclassical model, it explains sustained growth through positive feedback mechanisms, spillover effects (Arrow, 1962), and the benefits of specialization (Marshall, 1949). Romer (1990) argued that technology results from economic decisions, while Lucas (1988) stressed the importance of education and workforce skills. The theory asserts that even developing countries can achieve sustainable growth through innovation and human capital (Romer, 1990), though challenges arise from policy distortions, instability, and weak institutions (Hartwick, 1981; Stiglitz, 1974). Resource dependence undermines innovation incentives, leading to environmental degradation and social conflict (Homer-Dixon, 1995). Resource-saving innovations primarily reduce pollution but pay less attention to biodiversity conservation. Mazzucato (2023) emphasized that sustainable finance requires long-term investment, fair risk-sharing, and credit conditions tied to green innovation, thereby enhancing social welfare.

### ❖ **Capital approach theory in sustainable development**

The capital approach to SDG evolved from classical economics, expanding to address the question of long-term sustainability. Hamilton and Ruta (2007) argued that sustainability requires maintaining and increasing per capita wealth rather than total wealth. Five types of capital are identified: financial, produced, natural, human, and social. Economic wealth is the aggregate of these assets, many of which are not directly observable. Hamilton and Hartwick (2005) together with the World Bank (2005) proposed the Inclusive Wealth Index (IWI) to measure national wealth. Hamilton and Ruta

(2007) stressed that maintaining total assets is only a necessary condition, while effective management and utilization are decisive for sustainability. Nonetheless, valuing social and human capital remains a challenge (Greaker, 2007). The World Bank (2005) applied this framework to more than 100 countries, while Grootaert and Bastelaer (2002) suggested using proxy indicators for social capital. Tzachor (2020) considered this a robust theoretical framework for SDG. According to OECD (2019), developing countries require trillions of USD annually, but declining FDI and ODA, along with an inequitable global financial system, pose constraints. The UN (2024) proposed policy reforms, domestic resource mobilization, and debt-swap mechanisms to finance green investment. Mazzucato (2023) further stressed the need for a resilient financial ecosystem, with development banks playing a leading role in channeling capital flows.

#### **❖ Three pillars theory**

The three-pillar theory posits that SDG encompasses three domains: economy, environment, and society (Sreenath, 2021). This framework provides the foundation for policy and governance (James and Magee, 2016). However, research shows that in practice the focus often leans toward the economic dimension, with insufficient attention to social and environmental aspects (Wojewódzka-Wiewiórska, 2019). Although the three pillars are frequently treated as separate fields, they are inherently interdependent and require integration (Hariram, 2023). Reddy and Thomson (2015) emphasized that globalization and economic growth have increased environmental pressures, necessitating a globalized relationship among the three pillars. Incorporating environmental, social, and governance (ESG) criteria into finance helps channel capital toward sustainable projects (UN, 2024).

#### **❖ Measuring of sustainable development**

The measurement of SDG has evolved through several stages, reflecting global efforts to establish tools for assessing progress and guiding policy.

Formative stage (1970s–1990s): The 1992 UNCED Conference and Agenda 21 called for the renewal of sustainability indicators (UN, 1992).

Development stage (2000s): Eurostat developed a set of indicators for the EU (2005, revised in 2007) covering 11 themes such as resources, climate, energy, sustainable production, education, health, social inclusion, and governance (Hametner, 2019). UNECE, in collaboration with the European Commission and OECD, promoted methodological harmonization, leading to the establishment of the UN’s 17 SDGs (UNECE, 2009).

Current stage (2010s–present): The 2024 Sustainable Development Report by Sachs (2024) employs 125 indicators, including 98 global and 27 specific to OECD countries. The SDG Index is measured on a 0–100 scale, reflecting the distance from the optimal benchmark. It is only calculated for countries with at least 80% data availability (Sachs, 2024).

#### **2.1.4. Theoretical foundations of the relationship between financial development, global innovation, and sustainable development**

##### **2.1.4.1. Theories on the relationship between financial development and sustainable development**

FD plays a crucial role in economic growth by improving capital allocation, supporting innovation, and fostering competition. King and Levine (1993) argued that financial systems provide enterprises with capital, thereby driving innovation and economic growth. Levine (2005) and Demircuc-Kunt and Levine (2008) further emphasized the reduction of risks and the enhancement of competitiveness.

In the context of SDG, FD contributes by financing green projects and improving access to finance for low-income groups (Claessens and Feijen,

2007; Demirguc-Kunt, 2017). Digital finance reduces costs, curbs corruption, enhances women's economic empowerment, and increases household expenditure on education and healthcare (Aker, 2016; Muralidharan, 2014; Prina, 2015). Savings through formal financial institutions enable households to expand investment and improve living standards (Brune, 2011; Dupas and Robinson, 2013). Moreover, FD helps reduce gender inequality and strengthen women's empowerment (WB, 2012b; Rose, 1999; Duflo, 2012; Jayachandran and Muney, 2009; O'Malley and Burke, 2017; Sinha and Batniji, 2010).

#### **2.1.4.2. Theories on the relationship between global innovation and sustainable development**

Innovation and technological change directly affect SDG through three mechanisms: economic growth, ecological conservation, and social improvement.

Economic dimension: Innovation enhances productivity through R&D, production processes, and financial innovations (Schumpeter, 1997; Brătășanu, 2017; Mishra, 2008). However, the adoption of sustainable practices in enterprises often requires policy intervention (Glover, 2014). Financial markets support innovation by providing capital (King and Levine, 1993; Ayyagari, 2011). FinTech and sustainable financial instruments open opportunities for clean energy but also pose risks in the absence of robust theoretical frameworks (Khraisha and Arthur, 2018).

Environmental dimension: Innovation fosters the development of green technologies, improves energy efficiency, and reduces emissions (Ippolitova, 2024; Yigit, 2021; Xiao, 2020; Santana, 2015). Yet Kemp and Foxon (2007) warned of potential inequalities when countries lack the capacity to absorb technology.

Social dimension: Technological change contributes to reducing inequality by generating employment and income (Benos and Tsiachtsiras,

2019). Banks support long-term innovative projects to enhance SDG (Frigerio, 2024), while social innovation addresses challenges in education, healthcare, and financial inclusion (Mulgan, 2006).

#### **2.1.4.3. Theories on the regulatory role of global innovation in the relationship between financial development and sustainable development**

Technological change and global innovation play a regulatory role in the relationship between FD and SDG. According to endogenous growth theory, innovation is an intrinsic driver of long-term growth, while finance supports investment in innovation (Romer, 1990). The national innovation system framework emphasizes the coordination of finance, government, and markets (Lundvall, 2007), whereas the three-pillar model of SD illustrates how global innovation mediates financial impacts toward sustainability. Green innovation, in particular, is regarded as a key intermediary enabling finance to foster SDG (Aghion, 2009).

However, the complexity of financial innovation can pose systemic risks and undermine SD if left unchecked, as short-term capital flows and speculation may overshadow long-term investments (Khraisha and Arthur, 2018; Demirgüç-Kunt and Levine, 2009). Frigerio (2024) argued that inappropriate financial policies can reduce the effectiveness of innovation. Nakitende (2024) emphasized that the diffusion of innovation depends critically on infrastructure, finance, and human capital. Krozer (2015) highlighted that while green innovation and sustainable finance create opportunities for SD, misguided or speculative orientations may exacerbate instability.

## **2.2. Review of related studies**

### **2.2.1. Studies on the impact of financial development on sustainable development**

Research demonstrates that FD exerts multidimensional effects on SD.

First perspective positive role of FD: Li (2024) found that Chinese FD positively influenced the SDGs in Belt and Road Initiative (BRI) countries. Zulfiqar (2024) showed that FD supports sustainable economic growth, although access to finance may weaken this relationship. Ziolo (2023) confirmed the positive association between FD and SD in Europe, despite regional differences. Second perspective risks of FD: Sakalsiz and Kiliç (2024) argued that FD increases energy demand and carbon emissions, while Petrović and Lobanov (2021) demonstrated that FD raises CO<sub>2</sub> emissions, thereby undermining environmental sustainability. Third perspective FD's impact on specific SD goals: Yap (2023) found that financial inclusion supports poverty alleviation, gender equality, and economic growth, though its influence on education and health is limited. Ordoñez (2012) confirmed that expanding financial services reduces poverty. Abbas (2022) reported that FD reduces inequality in middle-income countries. Sezgin (2023) and Kiliç (2018) emphasized that FD enhances human capital and social quality. Tissaoui (2024) identified a financial inclusion threshold that positively affects the HDI in middle-income economies.

### **2.2.2. Studies on the impact of global innovation on sustainable development**

GII influences SD in two directions: it can both promote and hinder sustainability.

Positive impacts: Many studies show that global innovation enhances competitiveness, alleviates poverty, protects the environment, and improves governance. Ippolitova (2024) linked innovation to SDG 9 and SDG 12, with implications for e-waste and SO<sub>2</sub> emissions. Yigit (2021) demonstrated that innovation drives both economic and social progress while reducing CO<sub>2</sub> emissions. Chaparro-Banegas (2023) classified country clusters by innovation

and SD levels, while Stawicka (2023) stressed the roles of institutions, human capital, and infrastructure in advancing SDG 9 and SDG 12.

Other works highlight the role of sub-indicators: strong institutions promote SD and SDG 2 (Galabada, 2022; Malik, 2024); human capital, healthcare, and ICT reduce poverty and strengthen SD (Olowookere, 2022; Pata, 2025); strategic infrastructure fosters sustainability (Adshead, 2019); business environment and ICT improve SD (Myrvang, 2023); and CSR alongside corporate governance positively support SD (Farda and Saraswati, 2024). Technological innovation also contributes to CO<sub>2</sub> reduction, green industry development, and the advancement of SDGs (Saqib, 2023; Li, 2019; Khan, 2025; Omri, 2020; Agan, 2024; Yu and Huarng, 2024).

Negative impacts: Conversely, some studies caution that global innovation can hinder SD. Musah (2023) argued that weak institutions undermine MDGs and SD in Africa. Nahar (2024) showed that AI innovation generates uneven effects across SD goals. Nazneen (2021) found that transport infrastructure development in BRI countries promoted tourism and poverty reduction (SDG 1) but harmed the environment (SDG 15).

### **2.2.3. Studies on the impact of financial development on sustainable development: The moderating role of global innovation**

A growing body of research confirms that global innovation moderates the relationship between FD and SDG. Innovation fosters SDG by enhancing productivity, mobilizing capital, and optimizing resource use. Van Pho et al. (2025) demonstrated that FD particularly financial market development promotes SDG, whereas financial institutions may exert negative effects. Institutional quality plays a crucial moderating role. Xu et al. (2021) emphasized that strong financial systems amplify the effectiveness of innovation. Empirical studies across Vietnam, the G7, BRICS, and Africa consistently confirm that

digital innovation, fintech, and green technologies contribute to emission reduction and resource efficiency, provided they are aligned with sustainability goals. GII is therefore regarded as a key moderating variable that adjusts the impact of FD on SDG. Ahmad et al. (2024) and Khan et al. (2024) showed that ecological innovation and green technologies mitigate environmental consequences. However, Yu et al. (2022) and Zhu et al. (2020) warned that innovation may increase emissions if FD or innovation exceeds certain thresholds. Several studies, such as Loukil (2020), Khan and Ozturk (2021), and Kihombo et al. (2021), found that the impact of FD on innovation and the environment depends on the level of economic development and the effectiveness of policy control. Ultimately, without appropriate regulatory mechanisms, global innovation can create instability and undermine the effectiveness of FD in promoting SDG.

### **2.3. Discussion of research gaps**

Existing studies have shown that FD and global innovation influence SD through multiple channels, including capital provision, promotion of green technologies, resource efficiency, and mitigation of environmental risks. Nevertheless, important research gaps remain. Many studies rely on single indicators such as CO<sub>2</sub> emissions or the HDI (Ganda, 2019; Tissaoui, 2024; Khan and Ozturk, 2021), resulting in incomplete assessments. Moreover, most research examines the separate impacts of FD and innovation without clarifying the moderating role of global innovation in this relationship (Khan and Ozturk, 2021; Habiba and Xinbang, 2023; Yu, 2022; Zhu, 2020). In Asia, diversity and climate challenges demand highly localized research (IPCC, 2021; Blunden and Boyer, 2021; Krakauer, 2023; Roy, 2024).

In addition, many studies employing the GMM method lack robustness checks and fail to fully account for critical control variables such as institutional quality or trade openness (Sheraz, 2022; Ullah, 2023; Yu, 2022). This

dissertation seeks to address these limitations by applying comprehensive index systems (Svirydzenka, 2016; Dutta, 2023; Sachs, 2024) and conducting robustness tests with alternative variables to evaluate the impact of FD on SDG and the moderating role of global innovation in Asian countries.

## CHAPTER 3: DATA AND RESEARCH METHODOLOGY

### 3.1. Research Model

This dissertation employs the SGMM using panel data from Asian countries for the period 2007–2023.

#### ❖ Objective 1: The impact of FD on SDG

$$SDGs_{i,t} = \alpha_0 + \alpha_1 \times SDGs_{i,t-1} + \alpha_2 \times FD_{i,t} + \alpha_3 \times TOP_{i,t} + \alpha_4 \times FDI_{i,t} + \alpha_5 \times UBA_{i,t} + \alpha_6 \times INF_{i,t} + \varepsilon_{i,t} \quad (1)$$

#### ❖ Objective 2: The impact of GII on SDG

$$SDG_{i,t} = \theta_0 + \theta_1 \times SDG_{i,t-1} + \theta_2 \times GII_{i,t} + \theta_3 \times TOP_{i,t} + \theta_4 \times FDI_{i,t} + \theta_5 \times UBA_{i,t} + \theta_6 \times INF_{i,t} + \varepsilon_{i,t} \quad (2)$$

#### ❖ Objective 3: The combined impact of FD and GII on SDG

$$SDG_{i,t} = \beta_0 + \beta_1 \times SDG_{i,t-1} + \beta_2 \times FD_{i,t} + \beta_3 \times GII_{i,t} + \beta_4 \times (FD_{i,t} \times GII_{i,t}) + \beta_5 \times TOP_{i,t} + \beta_6 \times FDI_{i,t} + \beta_7 \times UBA_{i,t} + \beta_8 \times INF_{i,t} + \varepsilon_{i,t} \quad (3)$$

In which:

- \_ SDG<sub>s<sub>i,t</sub></sub>: Sustainable development index of country i at time t.
- \_ FD: Financial development index.
- \_ GII: Global Innovation Index.
- \_ FD<sub>i,t</sub> × GII<sub>i,t</sub>: Interaction term capturing how the effect of FD on SD is contingent upon the level of GII in a given country.
- \_ TOP: Trade openness.
- \_ UBA: Urbanization rate.
- \_ FDI: Foreign direct investment.
- \_ INF: Inflation.
- \_ ε<sub>i,t</sub>: Random error term.
- \_ i Country, t: Time.

**CHAPTER 4: EMPIRICAL RESULTS ON THE IMPACT OF  
FINANCIAL DEVELOPMENT ON SUSTAINABLE DEVELOPMENT  
IN ASIAN COUNTRIES: THE MODERATING ROLE OF GLOBAL  
INNOVATION**

**4.1. Results of descriptive statistics**

Table 4.2 summarizes the characteristics of the research variables in the model examining the impact of FD and GII on SDG across Asian countries during 2007–2023. The dependent variable, SDG, has a mean value of 65.01 with a standard deviation of 6.782, indicating a moderate level of SDG in the region with limited dispersion. The minimum and maximum values are 36.6 and 79.869, respectively.

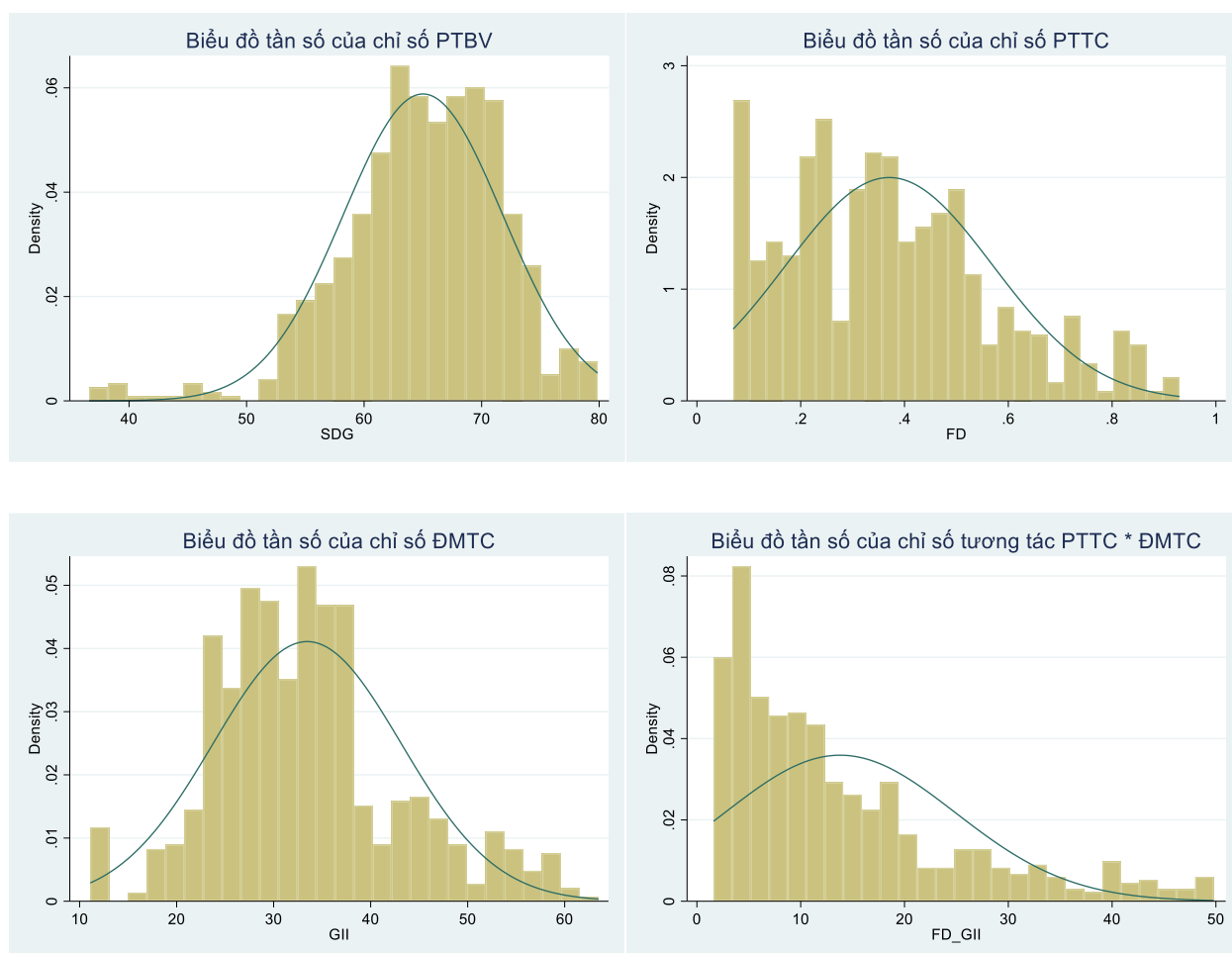
**Table 4.2: Table of descriptive statistics**

<b>Biến chính</b>	Số quan sát	Giá trị trung bình	Độ lệch chuẩn	Giá trị nhỏ nhất	Giá trị lớn nhất	Độ lệch Skew.	Độ nhọn Kurt.
SDG	748	65.01	6.782	36.6	79.869	-0.829	4.777
FD	748	0.371	0.2	0.07	0.93	0.619	2.791
GII	748	33.456	9.708	11.1	63.5	0.568	3.392
FD_GII	748	13.795	11.11	1.611	49.777	1.317	4.1
TOP	748	88.685	56.86	1.043	437.327	2.337	11.813
FDI	748	5.582	20.939	-101.833	279.361	8.718	97.645
UBA	748	59.285	24.676	15.781	100	-0.011	1.745
INF	748	7.001	13.367	-28.76	150.001	3.926	33.473
<b>Biến thay thế</b>							
CO2	748	7.487	9.254	0.078	53.598	2.234	8.927
EPIG	748	48.304	26.767	0.21	100	-0.078	1.944
DCP	748	59.657	44.724	2.448	254.668	1.507	5.641
IUI	748	47.635	31.437	0	100	0.058	1.644
Mobi	748	108.16	42.785	0.082	221.309	-0.333	2.861
FIXB	748	9.298	9.847	0	44.729	1.215	3.717
ICT1	748	0	1	-1.515	1.666	0.058	1.644
FD_CGII	748	1.398	5.296	-11.24	21.932	1.642	6.1
FD-ICT1	748	0.081	0.438	-1.288	1.305	-0.036	3.92

*Source: Author's calculation using Stata (2025)*

The financial development variable (FD) has a mean of 0.371 and a standard deviation of 0.2. Its distribution is slightly right-skewed and close to normal, reflecting moderate heterogeneity across countries. The GII has a mean of 33.456, with a mildly right-skewed and relatively even distribution. The interaction term (FD\_GII) has a mean of 13.795, a high degree of dispersion, and a clearly right-skewed distribution, indicating substantial variation in the combined effects of FD and GII on SDG.

**Figure 4.1** illustrates the frequency distribution of these indicators, showing clear disparities in the levels of FD, GII, and strategic orientations toward SDG among countries.



**Figure 4.1. Frequency distribution of financial development, global innovation, and sustainable development indices**

Source: Author's calculation using Stata (2025)

#### 4.5. Regression results: The impact of financial development on sustainable development and the moderating role of global innovation

Table 4.10 presents the system GMM regression results, indicating that the model is reliable. The Hansen J test ( $p = 0.249-0.335$ ) confirms the absence of over-identification. The AR(1) test ( $p = 0.000$ ) indicates first-order autocorrelation, while the AR(2) test ( $p = 0.207; 0.104; 0.300$ ) confirms the absence of second-order autocorrelation. The number of instruments (42–43) is smaller than the number of countries (44), suggesting that the model design is both appropriate and efficient..

**Table 4.10. Summary of the independent and interaction effects of financial development and global innovation on sustainable development**

Biến	(1) Mô hình FD	(2) Mô hình GII	(3) Mô hình FD_GII
FD	2.705*** [43.85]		9.252*** [13.43]
dGII		0.083*** [20.68]	0.024*** [4.81]
FD_GII			-0.189*** [-10.29]
dTOP	-0.007*** [-8.13]	-0.011*** [-18.51]	-0.008*** [-6.63]
FDI	0.002*** [35.99]	0.002*** [19.66]	0.003*** [17.58]
ddUBA	0.101* [1.98]	1.668*** [3.12]	0.434*** [12.87]
INF	-0.014*** [-13.69]	0.002*** [2.60]	-0.017*** [-11.39]
* $p < 0.1$ , ** $p < 0.05$ , *** $p < 0.01$ , [ ] là giá trị t			
Giá trị trung bình của biến phụ thuộc	0.440	0.440	0.440
Số quan sát	660	660	660
Số quốc gia	44	44	44
Số công cụ	42	42	43
Giá trị p (AR (1))	0.000	0.000	0.000

Giá trị p (AR (2))	0.207	0.104	0.300
Giá trị p (Hansen J)	0.249	0.338	0.335

*Source: Author's calculation using Stata (2025)*

#### **4.5.1. Impact of financial development on sustainable development in asian countries**

The regression results in Table 4.10 demonstrate that FD exerts a strong positive effect on SDG across Asian countries. In Model (1), the coefficient of FD is 2.705 ( $t = 43.85$ ;  $p = 0.000$ ), which rises to 9.252 ( $t = 13.43$ ;  $p < 0.01$ ) in Model (3) when accounting for the moderating role of global innovation. This indicates that a well-developed financial system effectively SDG. These findings are consistent with Hunjra et al. (2022), Zioło et al. (2023), Frick (2019), Kihombo et al. (2021), Tissaoui et al. (2024), and Yap et al. (2023), but contradict the evidence of Petrović and Lobanov (2021) and Sakalsiz and Kiliç (2024), which focused on weaker financial systems.

#### **4.5.2. Impact of global innovation on sustainable development in asian countries**

Regarding global innovation, Model (2) reports a coefficient of 0.083 ( $t = 20.68$ ;  $p < 0.01$ ), which remains significant in Model (3) with a coefficient of 0.024 ( $t = 4.81$ ;  $p < 0.01$ ). This confirms the positive role of innovation in fostering SDG. These results align with Ippolitova et al. (2024), Stawicka (2023), and Abbass et al. (2025), but differ from Musah (2023) and Nahar (2024), who emphasized the dependence on institutional quality.

#### **4.5.3. Moderating role of global innovation in the relationship between financial development and sustainable development in asian countries**

The interaction term FD\_GII in Model (3) has a negative coefficient of -0.189 ( $t = -10.29$ ;  $p < 0.01$ ), indicating that global innovation negatively

moderates the relationship between FD and SD. This result is consistent with Xu et al. (2021), Khan et al. (2024), and Ibrahim and Vo (2021), suggesting that without adequate financial oversight, innovation may weaken the positive effects of FD on SD.

#### 4.6. Robustness test

##### 4.6.1. Robustness check of the dependent variable: Sustainable development (SDG)

To test the robustness of the model, the study replaces the dependent variable SDG with two environmental indicators: CO<sub>2</sub> emissions and the EPIG index, in order to evaluate the impacts of FD and global innovation from an ecological perspective. CO<sub>2</sub> reflects emissions, while EPIG measures biodiversity protection commitments (Abbasi and Riaz, 2016; Petrović and Lobanov, 2021; Khan and Ozturk, 2021). The results indicate that FD reduces CO<sub>2</sub> emissions and increases EPIG, while GII positively influences SDG and EPIG and also contributes to lowering CO<sub>2</sub>. These findings confirm the roles of finance and innovation in promoting green investment and environmentally friendly technologies.

**Table 4.11. Robustness test of the dependent variable using CO<sub>2</sub> and EPIG**

Biến quan sát	(3) SDG	(4) CO2	(5) EPIG
FD	9.252*** [13.43]	-5.502*** [-14.57]	373.93*** [18.09]
dGII	0.0237*** [4.81]	-0.038*** [-7.52]	1.819*** [16.06]
FD_GII	-0.189*** [-10.29]	0.131*** [14.42]	-6.773*** [-14.50]
dTOP	-0.00753*** [-6.63]	0.002*** [3.18]	0.256*** [11.54]
FDI	0.00284*** [17.58]	-0.002*** [-9.05]	-0.016*** [-11.40]

ddUBA	0.434*** [12.87]	-4.502*** [-9.12]	31.298*** [7.42]
INF	-0.0166*** [-11.39]	0.016*** [25.69]	-0.325*** [-6.29]
* p<0.1, ** p<0.05, *** p<0.01, [ ] là giá trị t			
Số quan sát	660	660	660
Số quốc gia	44	44	44
Số công cụ	43	38	43
Giá trị p (AR (1))	0.000	0.045	0.001
Giá trị p (AR (2))	0.300	0.556	0.341
Giá trị p (Hansen J)	0.335	0.198	0.429

*Source: Author's calculation using Stata (2025)*

When the interaction term FD\_GII is introduced into the model, the results show opposite trends. The coefficient of FD\_GII is positive with respect to CO<sub>2</sub>, indicating that the combination of FD and GII increases emissions. This suggests that current innovation is not yet clearly environmentally oriented, leading to financial flows being diverted away from green activities. In contrast, for the EPIG index, the FD\_GII coefficient is negative (-6.773) and highly significant, implying that GII weakens the positive impact of FD on biosphere conservation. The reason lies in innovation being concentrated on rapidly commercialized technologies, with insufficient sustainable financing for ecological objectives. Overall, the results with CO<sub>2</sub> and EPIG confirm the stability of the model while warning that effective coordination mechanisms are required to avoid adverse effects.

#### **4.6.2. Robustness test of the independent variable: Financial development (FD)**

For robustness testing of the independent variable FD, when FD is replaced by DCP (domestic credit to the private sector as a share of GDP), the results remain consistent. DCP has a positive coefficient (0.0379), exerting a positive impact on SDG, consistent with Hunjra et al. (2022), Ganda (2019), and Abbas et al. (2022). However, the interaction between DCP and GII yields

a small but statistically significant negative coefficient, suggesting that innovation does not enhance the effectiveness of private credit for SDG unless properly directed. This result confirms the robustness and reliability of the model and underscores that credit for sustainability must be accompanied by appropriate innovation policies.

**Table 4.12. Robustness test of the independent variable using DCP**

Variable	(6) SDG
dDCP	0.0379*** [11.9]
dGII	0.0414*** [5.08]
dDCP_GII	-0.00086*** [-14.05]
dTOP	-0.00774*** [-8.5]
FDI	0.00204*** [17.78]
ddUBA	0.1450*** [4.63]
INF	-0.01123*** [-10.67]
* p<0.1, ** p<0.05, *** p<0.01, [ ] indicates t-values	
Number of observations	660
Number of countries	44
Number of instruments	43
p-value (AR (1))	0.000
p-value (AR (2))	0.383
p-value (Hansen J)	0.193

*Source: Author's calculation using Stata (2025)*

#### **4.6.3. Robustness test of the moderating variable: Global innovation (GII)**

To test the robustness of the moderating variable GII, two alternative approaches are applied: (1) Mean-centering GII to create FD\_CGII in order to reduce endogeneity bias, following Aiken et al. (1991), Cohen et al. (2003), and Hayes (2013); (2) Replacing GII with ICT1, an index representing information

technology development, constructed from PCA of three variables (IUI, Mobi, and FIXB), following the approaches of Sezgin et al. (2023), Anwar et al. (2022), Lv et al. (2024), and Myrvang et al. (2023).

The results show that in both models, FD continues to have a positive and highly significant effect on SDG (coefficients of 1.114 and 2.144;  $p < 0.01$ ), confirming the beneficial role of FD. The innovation variable, whether measured by CGII or ICT1, also remains positive and significant (0.116 and 1.872;  $p < 0.01$ ), reinforcing the hypothesis that innovation positively contributes to SDG. However, the interaction coefficients between FD and GII in both models are negative, indicating that the current interaction does not generate synergistic effects but instead creates conflicting outcomes for sustainability goals when technological innovation is not explicitly directed toward sustainable sectors.

**Table 4.13. Robustness test of the moderating variable: Global innovation, replacing with FD\_CGII and FD\_ICT1**

Variable	(7) SDG	Variable	(8) SDG
FD	1.114*** [9.53]	FD	2.144*** [19.46]
dGII	0.116*** [22.98]	dICT1	1.872*** [14.42]
dFD-CGII	-0.288*** [-22.43]	dFD-ICT1	-5.171*** [-13.99]
dTOP	-0.00817*** [-10.21]	dTOP	-0.00681*** [-8.10]
FDI	0.00225*** [17.72]	FDI	0.00219*** [20.42]
ddUBA	1.199*** [3.74]	ddUBA	0.286*** [3.98]
INF	-0.00526*** [-3.87]	INF	-0.0102*** [-11.36]
* $p < 0.1$ , ** $p < 0.05$ , *** $p < 0.01$ , [ ] indicates t-values			
Number of observations	660		660
Number of countries	44		44
Number of instruments	43		43

p-value (AR (1))	0.000	0.000
p-value (AR (2))	0.451	0.238
p-value (Hansen J)	0.498	0.228

*Source: Author's calculation using Stata (2025)*

## **4.7. Discussion of research findings**

### **4.7.1. Discussion of the impact of financial development on sustainable development**

The results confirm that FD has a positive effect on SDG in Asian countries, thereby addressing the first research objective. FD contributes to improved capital mobilization, reduced transaction costs, and support for long-term investments in key sectors such as infrastructure, education, and clean energy (Levine, 2005; Ganda, 2019). The transmission mechanisms operate through financial inclusion and sustainable financial instruments such as green credit and microinsurance (Khan & Ozturk, 2021; Petrović & Lobanov, 2021). However, the effectiveness of FD depends on institutional quality and the capacity for market supervision; in the absence of proper regulation, capital flows may be misdirected, leading to speculation and undermining sustainability (Harrison et al., 2022; Krychevska, 2023; Patel & Mehta, 2023).

### **4.7.2. Discussion of the impact of global innovation on sustainable development**

Regarding the second research objective, the findings indicate that GII also exerts a positive influence on SD. Technological, financial, and ecological innovations enhance efficiency, facilitate the diffusion of clean technologies, and promote sustainable production and consumption models (Coccia, 2017; Hayes, 2013; Ganda, 2019). Nonetheless, GII does not automatically translate into positive outcomes without clear policy guidance. In such cases, innovation tends to lean toward rapid commercialization, which may exacerbate digital

inequality and neglect essential areas such as education and sustainable agriculture (Hayes, 2013; Omar & Inaba, 2020; Bongomin et al., 2021).

#### **4.7.3. Discussion of the moderating role of global innovation in the FD–SD relationship**

As for the third research objective, the results reveal that the interaction term between FD and GII is statistically significant with a negative sign, suggesting that GII negatively moderates the relationship between FD and SD. Without appropriate policy alignment, FD may encourage unsustainable credit expansion, while GII may be skewed toward short-term sectors, thereby weakening sustainable outcomes (Aghion et al., 2009; Omar & Inaba, 2020). Although GII is expected to enhance financial efficiency (Hayes, 2013; Coccia, 2017), such benefits are realized only when policy linkages are established between the financial system and the innovation ecosystem (Bongomin et al., 2021; Lv et al., 2024; Ganda, 2019). To avoid this “misalignment effect,” it is essential to establish cross-sectoral coordination mechanisms, particularly in transitional economies that face simultaneous pressures from digital transformation and the pursuit of green growth.

## CHAPTER 5: CONCLUSION AND POLICY IMPLICATIONS

### 5.1. Research conclusion

This dissertation was conducted to evaluate the impact of FD on SDG and the moderating role of GII, using data from 44 Asian countries over the period 2007–2023. The analysis employed the system GMM method along with robustness checks. The main findings are as follows:

First, FD has a positive and significant impact on SD, reinforcing the role of the financial system in efficient capital allocation and supporting long-term sustainable growth (Levine, 2005; Ganda, 2019).

Second, GII comprising three key components also positively influences SDG by improving resource efficiency, enabling the diffusion of clean technologies, and enhancing social service delivery (Lv et al., 2024; Coccia, 2017).

Third, when considering its moderating role, FI can weaken the positive effect of FD on SD if it lacks proper orientation and regulation. In such cases, financial flows may be diverted away from sustainable goals echoing concerns raised by Patel and Mehta (2023) and Bongomin et al. (2021).

In addition, control variables such as trade openness (TOP), foreign direct investment (FDI), urbanization (UBA), and inflation (INF) also significantly affect SD. While trade openness and FDI can support SD when coupled with effective oversight, unregulated urbanization and high inflation exert negative pressures on the environment and sustainable investment. The study shows that SD is a multifactorial outcome, requiring tight coordination among finance, innovation, and broader socio-economic policies.

## **5.2. Policy implications for asian countries**

Based on the research findings, several policy implications are proposed to promote FD aligned with SD and to leverage FI effectively across Asian countries:

First, to ensure FD contributes effectively to SD, countries should develop ESG-oriented financial systems, with modern and transparent legal frameworks and robust risk oversight mechanisms. It is essential to promote green banking, concessional green loans, and financial guarantees for green projects; expand financial inclusion via fintech, e-wallets, and digital banking (Demirguc-Kunt et al., 2017; OECD, 2019). At the same time, building sustainable capital markets with instruments like green bonds, ESG equities, and green taxonomies is necessary to channel long-term capital into low-emission sectors. Financial education and inclusive finance should also be integrated into national financial strategies to enhance sustainable investment decision-making and reduce financial inequality (Sachs et al., 2024).

Second, regarding FI, a comprehensive innovation ecosystem must be developed encompassing financial, technological, and ecological innovation. Policies should provide long-term funding for R&D, support the development of fintech and blockchain, and offer incentives for green-focused innovation. Tools such as green investment funds, innovation credit guarantees, mandatory ESG standards, and green taxonomies can help steer capital toward sustainable outcomes (UNCTAD, 2023; Sachs et al., 2024). Technological innovation should focus on green AI, next-generation renewable energy, and ecosystem linkages among businesses, research institutes, and communities (Li & Ding, 2024). For ecological innovation, policies should promote circular economy models, eco-labeling, and green skills to prevent innovation from drifting into mere commercialization.

Third, it is crucial to integrate the moderating role of FI into the design of FD policies. This includes developing “sustainable innovation-oriented finance” with capital allocation criteria based on long-term environmental and social performance. Public-private coordination platforms should be established to monitor innovation-related capital flows and mitigate risks such as greenwashing (Demir et al., 2020; ADB, 2023). ESG screening must be strengthened, financial risk alert systems (e.g., climate-related financial risks TCX) should be implemented, and integrated financial instruments like ESG funds and environmental innovation insurance should be developed. Promoting both deep and broad innovation will amplify the impact of FD across vulnerable groups and regions (Sachs et al., 2024).

Fourth, financial policy must be aligned with other variables such as FDI, trade, urbanization, and inflation. For FDI, a sustainability assessment framework and mechanisms to monitor capital flows according to ecological standards are needed (Khan & Ozturk, 2021). In trade, countries should take advantage of agreements with environmental provisions and prevent the importation of outdated technologies. Urbanization should be linked with local green finance tools such as urban green bonds and green infrastructure funds (Ahmad et al., 2024). Lastly, monetary and fiscal policies should include countercyclical green credit windows and integrate financial stability with interest rate management to safeguard the financial system against macroeconomic risks (ADB, 2023).

In summary, a well-coordinated strategy combining ESG-oriented financial systems, an effective innovation ecosystem, and sound governance of economic and social variables will help Asian countries build inclusive, balanced, and SDG models in the long term.

### **5.3 Research limitations and suggestions for future research**

While this dissertation provides important theoretical and empirical contributions, several limitations should be acknowledged.

First, the study focuses solely on Asia and uses data from 2007 to 2023, which may not fully capture recent economic disruptions such as supply chain crises or geopolitical conflicts. Future research should broaden the geographical scope and update datasets to assess the generalizability of the model across different regions and more current contexts.

Second, the study has not thoroughly examined the impact of financial shocks and macroeconomic volatility on the relationship between FD, GII, and SDG. Future research could develop dynamic models to test the resilience of financial systems and the effects of crisis-time policies, such as carbon taxes or green subsidies (Beck et al., 2016; Khan & Ozturk, 2021).

Third, the role of green finance instruments such as green bonds or sustainable investment funds has not been deeply explored. Future studies could analyze the effectiveness of green finance mechanisms, develop a comprehensive green finance index, and compare the performance of bank-based and market-based financial systems in funding green projects.

Fourth, the study does not utilize micro-level data. The impacts of FD and FI may vary significantly at the firm or household level. Future research should use microdata to evaluate the role of financial inclusion, green consumer behavior, and innovation among tech enterprises.

Fifth, institutional factors and financial governance have not been fully examined. Future studies should assess the regulatory influence of institutions, compare the effectiveness of sustainable financial policies across different levels of institutional development, and investigate the impact of regulations such as Basel III or mandatory ESG disclosures on the effectiveness of FD in promoting SD.

In summary, expanding geographic coverage, updating data, incorporating green finance mechanisms, using micro-level data, and deepening institutional analysis are critical directions for enhancing both the scientific value and practical relevance of future research.

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