

Article

The Digital–Sustainable Finance Nexus: Fintech, Green Finance, and Inclusive Growth in Emerging Economy

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Abstract

This mixed-methods study examines the associations among fintech advancement, green finance, and financial inclusion in Jordan, an emerging economy. It draws on a distinctive three-part dataset: survey data from 21 commercial banks ($N = 21$), a national household survey, and semi-structured interviews with stakeholders. The quantitative results indicate that the positive association between fintech adoption and the provision of green finance is statistically consistent with full mediation by banks' absorptive capacity, particularly their digital maturity and data analytics capabilities. Proactive regulatory support significantly moderates this mediated relationship. Market demand, by contrast, has no statistically significant moderating effect. At the household level, the combined use of digital and green financial products is associated with higher formal account ownership and with the use of a greater number of financial products. The interviews support these results, pointing to institutional capacity and regulatory clarity as essential enabling factors. Given the cross-sectional bank-level data ($N = 21$) and the exploratory scope of the mediation analysis, causal interpretations should be avoided. Future longitudinal research is needed to examine temporal dynamics. Even so, these findings offer policymakers an initial empirical framework: channeling fintech toward sustainable development will likely require targeted interventions to build institutional digital capacity and establish clear regulatory frameworks, rather than depending solely on market forces.

Keywords: fintech; green finance; financial inclusion; absorptive capacity; sustainable development; Central Bank of Jordan; European Investment Bank

1. Introduction

The global financial ecosystem is undergoing a paradigm shift, simultaneously propelled by the digital revolution of financial technology (fintech) and the urgent imperative for sustainable development (Gomber et al., 2018). In emerging economies, this dynamic presents both unprecedented opportunities and complex challenges. The rapid ascent of fintech promises to enhance financial inclusion, a key enabler of the United Nations Sustainable Development Goals (SDGs), by dismantling traditional barriers to access (Demirgüç-Kunt et al., 2018). Concurrently, the climate crisis has catalyzed the emergence of green finance, a critical mechanism for channeling capital towards environmentally sustainable projects (Volz, 2018). A nascent body of literature suggests a potential symbiosis between these trends, wherein fintech could be harnessed to scale green finance and broaden financial inclusion (Bollaert et al., 2021). However, a critical question remains underexplored: is fintech adoption associated with green finance provision, and under what organizational and regulatory conditions does this relationship strengthen? While our



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cross-sectional design cannot directly test resource displacement or “crowding-out” mechanisms, we examine the statistical associations between fintech adoption and green finance provision and the conditions under which this relationship is mediated or moderated.

Nowhere is this interrogation more pertinent than in the Kingdom of Jordan. As a nation characterized by a robust banking sector yet facing significant environmental stressors and financial exclusion challenges, Jordan represents a critical case study (Central Bank of Jordan, 2023). The government has demonstrated strong commitment to both digital transformation and a green economy, evidenced by its Economic Modernization Vision and recent signing of a Host Country Agreement with the Global Green Growth Institute (GGGI, 2025). Despite this supportive policy environment, the practical interplay between fintech adoption, Green Finance Enhancement, and financial inclusion outcomes remains empirically opaque. This study seeks to fill this void by investigating the nuanced relationships between these three pillars within the Jordanian context.

Financial inclusion is widely recognized as a cornerstone of inclusive economic growth and poverty reduction (Beck & Demirgüç-Kunt, 2008). In Jordan, while banking penetration has improved, segments of the population, particularly women, youth, and low-income households, remain excluded from formal financial services (World Bank, 2021). Fintech emerges as a powerful disruptor in this landscape. Digital payments, peer-to-peer (P2P) lending, and mobile banking platforms can significantly lower transaction costs and expand access to remote and underserved communities (Goldstein et al., 2019). Concurrently, Jordan, like many Middle Eastern and North African (MENA) countries, is highly vulnerable to climate change impacts, including water scarcity and extreme weather events (World Bank, 2020). This necessitates a substantial mobilization of capital towards climate adaptation and mitigation, a function central to green finance (Dikau & Volz, 2021).

The theoretical potential for synergy is compelling. Fintech platforms can facilitate green bond issuances for smaller investors, enable blockchain-based traceability for sustainable supply chain finance, and use alternative data for assessing environmental, social, and governance (ESG) risks (Kartal et al., 2024; Macchiavello & Siri, 2022). However, a counter-narrative suggests that the rapid expansion of consumer-focused fintech may prioritize short-term transactional volume over long-term sustainable investment (Zetzsche et al., 2018). This raises a central tension: is the Jordanian financial sector experiencing a complementary relationship between fintech and green finance, or are these domains operating independently, and what are the implications for achieving meaningful financial inclusion?

To address this tension while accounting for the different levels examined in our investigation, we pose two separate but theoretically related research questions:

RQ1 (Bank Level): Among Jordanian banks, to what extent is fintech adoption associated with the provision of green finance? How is this association mediated by banks' absorptive capacity and moderated by regulatory support and market demand?

RQ2 (Household Level): Among Jordanian households, is the combined use of digital and green financial products associated with greater financial inclusion, as measured specifically by formal account ownership and the number of financial products used?

The connection between the two levels is straightforward: when banks expand their provision of green finance, households have more environmentally sustainable products to choose from. Combined with digital access, this expanded supply may improve inclusion outcomes. Examining the issue at both levels makes it possible to assess whether innovations on the banking side produce benefits for households, a relationship rarely tested in emerging market contexts. We use a mixed-methods approach to test these relationships empirically.

Existing literature has largely examined fintech, green finance, and financial inclusion in isolation. Studies on fintech in the MENA region often focus on its impact on banking

stability or economic growth (H. H. Khan et al., 2025; Hassan et al., 2021). Research on green finance is frequently situated in developed markets or large emerging economies like China (Flammer, 2021; Tolliver et al., 2019). While critical, these streams of research do not address their interconnectedness within a smaller, dynamic emerging market like Jordan. A significant knowledge gap exists concerning the tripartite relationship between these variables and whether they act as complements or substitutes in practice.

This study aims to bridge this gap by providing empirical evidence from Jordan. The primary objectives are:

- To assess the current state and trajectory of both fintech development and Green Finance Enhancement in Jordan's financial sector.
- To empirically analyze the nature of the relationship between fintech adoption and the growth of green finance products and services.
- To evaluate the individual and combined effects of fintech and green finance on broadening financial inclusion, particularly among previously excluded demographics.
- To derive evidence-based policy and regulatory recommendations to foster a synergistic rather than competitive relationship between these domains.

To address these objectives, this research employs a sequential mixed-methods design. The quantitative phase utilizes a comprehensive dataset from the Central Bank of Jordan and an original survey of both financial institutions and a nationally representative sample of households. These data are analyzed using panel regression techniques and Structural Equation Modeling (SEM) to test hypotheses derived from financial innovation and sustainable finance theories. The qualitative phase consists of in-depth, semi-structured interviews with key stakeholders, including regulators, fintech founders, conventional and Islamic bank executives, and policymakers, to provide nuanced insights into the mechanisms and challenges driving the observed quantitative relationships.

This study therefore addresses a critical gap by moving beyond siloed analysis and simplistic assumptions of synergy to empirically test the tension between fintech domination and Green Finance Enhancement within Jordan's distinctive socio-economic landscape. It investigates whether these forces act as complements, with fintech paving the way for green finance, or as substitutes, where fintech's growth crowds out sustainable investment.

The primary contributions of this research are threefold:

First, the study offers one of the pioneering empirical examinations of the tripartite fintech–green finance–inclusion nexus in an emerging market. It distinguishes explicitly between bank-level (supply) and household-level (demand) dynamics while testing the theoretical bridge between the two. Second, it examines the mechanism at work by treating absorptive capacity, particularly digital maturity and data analytics capabilities, as a mediator linking fintech adoption to green finance provision. The analysis draws on organizational learning and technology adoption theories. Third, contextual specificity: it highlights how proactive regulatory support moderates this relationship. In nascent markets such as Jordan, clear policy guidance may matter more than perceived market demand alone, a finding with direct implications for regulators in similar emerging economies.

A significant research gap remains unaddressed in the existing literature. Whether fintech and green finance are dynamically related as complements or substitutes and how they jointly affect financial inclusion have not been investigated empirically for the MENA region. The novelty of this paper is to empirically test for the first time in Jordan the above relationship, using a mixed-methods design of institutional panel data, household surveys, and stakeholder interviews. The study has analytical depth that was not available in earlier work. The study is justified on the following grounds: first, Jordan is undergoing a dual transition in digital finance and climate resilience, which makes it a peerless case; second, resolving this tension will have direct policy implications for achieving sustainable inclusive

growth; third, the findings will provide useful lessons for other emerging economies. In so doing, it challenges the ‘automatic synergy’ view that has been the dominant assumption and provides evidence-based recommendations for regulators and financial institutions. Our study extends the literature by examining these relationships in Jordan through a mixed-methods design that combines institutional panel data, household surveys, and stakeholder interviews. Prior research has not offered this same level of analytical depth.

The investigation is guided by a conceptual framework detailed in Section 2, which integrates the theoretical background of the study. The remainder of this paper is organized as follows. Section 3 provides a comprehensive review of the relevant literature and develops the testable hypotheses. Section 4 details the research methodology, including data collection and empirical models. Section 5 presents the empirical results and analysis. Section 6 discusses the findings. Section 7 concludes with policy implications, limitations and avenues for future research.

2. Theoretical Background

Despite these global discussions, a significant empirical gap exists regarding the Jordanian and broader MENA context. Existing research on Jordan’s financial sector has traditionally focused on banking stability or general fintech activity descriptively. The critical interrelationships between the three domains remain almost entirely unexplored.

The recent developments of 2024–2025 make this investigation even more urgent and feasible. The European Investment Bank–Central Bank of Jordan (EIB-CBJ) partnership and the GREEFIN Forum represent real-time, natural experiments in fostering green finance. Simultaneously, the data on financial inclusion disparities provide a clear baseline against which to measure impact. No current study systematically investigates whether these top-down green finance initiatives are being amplified or undermined by the bottom-up evolution of the fintech sector.

This study aims to fill this critical void. It moves beyond siloed analysis to develop an integrated framework for understanding the fintech–green finance–inclusion nexus in Jordan. By employing a mixed-methods approach to gather empirical data from financial institutions, regulators, and consumers, this research examines the competing hypotheses of synergy versus competitive dynamics. The findings provide much-needed evidence to inform policymakers at the CBJ, commercial banks, and international partners like the EIB on how to strategically align digital transformation with sustainability and inclusion goals, ensuring Jordan’s financial evolution is both technologically advanced and equitable.

The Intersecting Domains: Synergies, Tensions, and the Unanswered Question

The theoretical intersections between these three fields form the core of this study’s investigative focus. Fintech and green finance (the green–fintech nexus): A nascent but growing literature explores this synergy. Macchiavello and Siri (2022) posit that fintech can mitigate key barriers to green finance through several mechanisms: (1) Transparency: Blockchain can provide immutable proof of how green bond proceeds are allocated. (2) Access: Digital platforms can democratize access to green investment opportunities for retail investors. (3) Risk Assessment: AI and big data can enhance the pricing of climate risks and the evaluation of ESG performance. However, emerging empirical evidence suggests this relationship is highly context-dependent. For instance, while some studies find fintech accelerates green investment in certain Asian markets (Bashir & Jamaani, 2025), other research points to the risk of ‘crowding-out,’ where consumer-focused digital finance diverts resources from long-term sustainable projects (Zetzsche et al., 2018). This underscores a critical gap: under what specific institutional and market conditions does fintech act as a catalyst versus a barrier? This study tests these competing propositions within Jordan’s dis-

tinctive landscape. Empirical evidence, however, remains scattered and is predominantly focused on developed markets.

Fintech and financial inclusion: The link here is more extensively documented. Research consistently shows that digital payment systems and alternative lending platforms have expanded access in emerging markets (GSMA, 2023). However, the literature is evolving to ask a more nuanced question: does digital access necessarily translate to beneficial inclusion? The answer depends on product design, consumer protection, and digital literacy (Lauer & Lyman, 2015).

The tripartite relationship and the critical gap: The least explored area is the three-way interaction. The central, unresolved question in the literature is whether the rapid scaling of general purpose fintech crowds out dedicated green finance initiatives by absorbing investor attention, developer talent, and regulatory bandwidth, or whether it paves the way by building the digital infrastructure and trust necessary for green products to later flourish. This is not a trivial distinction. If fintech expansion comes at the expense of green finance, progress toward the SDGs may suffer, even if inclusion metrics appear to improve on the surface. Still, our cross-sectional design does not allow us to establish causal displacement. We examine statistical associations between fintech adoption and the provision of green finance. This discussion of the central tension and its potential moderating factors leads to our first two hypotheses:

H1. *Fintech Adoption Intensity has a significant, yet complex, relationship with Green Finance Enhancement in Jordan's financial sector.*

H2. *This relationship is positively moderated by (a) supportive regulatory frameworks and (b) high market demand for sustainable products.*

H4. *The synergistic effect of high levels of both Fintech Adoption Intensity and Green Finance Enhancement leads to significantly higher levels of meaningful financial inclusion than either variable alone.*

To move beyond a descriptive analysis and provide a robust conceptual basis for investigating the fintech–green finance–inclusion nexus, this study is grounded in the integration of two complementary theoretical lenses: the Technology–Organization–Environment (TOE) framework and absorptive capacity theory. We have also added an explicit cross-level justification explaining how bank-level dynamics connect to household-level outcomes.

The TOE framework (Tornatzky & Fleischer, 1990) provides a macrolevel structure for understanding the contexts that influence a firm's adoption and implementation of technological innovations. It posits that three elements shape this process:

1. **The Technological Context:** The pool of relevant internal and external technologies. This is operationalized in our study as Fintech Adoption Intensity, representing the extent and sophistication of digital tools and platforms deployed by banks. We renamed the construct from “fintech dDomination” to “Fintech Adoption Intensity” because it measures IT expenditure, digital transaction volume, and API integration. The new name avoids suggesting market control or displacement. This change also aligns with our construct of absorptive capacity, which concerns a bank's digital maturity, proficiency in data analytics, and digital skills. Absorptive capacity is defined as the organization's ability to acquire, assimilate, and transform external digital knowledge into internal Organizational Capabilities (Zahra & George, 2002).
2. **The Organizational Context:** The characteristics and resources of the firm, such as its size, managerial structure, and internal capabilities. This aligns with our construct of Organizational Capabilities, specifically a bank's digital maturity and skill base.

3. **The Environmental Context:** The arena in which the firm conducts its business, including industry competitors, regulatory bodies, and macroeconomic conditions. This corresponds to our moderating variables of regulatory push (e.g., CBJ policies) and market demand.

While the TOE framework excellently outlines the “what”—the key domains of influence—it is less specific about the “how”—the internal mechanisms that translate technological opportunity into organizational outcome. To explain this, we integrate absorptive capacity theory (Cohen & Levinthal, 1990). This theory posits that a firm’s ability to value, assimilate, and apply new external knowledge is a critical component of its innovative capabilities. This ability, known as absorptive capacity, is largely a function of the firm’s prior related knowledge.

In our framework, we posit that investment in and adoption of fintech (the technological context) does not automatically lead to green finance innovation. Instead, it first serves to build a bank’s absorptive capacity defined as the organization’s ability to acquire, assimilate, and transform external digital knowledge into internal Organizational Capabilities (Zahra & George, 2002), comprising its digital maturity, data analytics proficiency, digital skills, and agile processes (the organizational context). This enhanced general purpose capacity can then be specifically directed toward the novel and complex domain of green finance, but only if the bank can effectively assimilate the relevant knowledge (e.g., ESG risk assessment and green taxonomy rules) and apply it to develop new products. The Environmental Context, particularly a supportive regulatory push, is theorized to be a critical catalyst in this process, lowering the cost and uncertainty of building this new, sustainability-oriented knowledge. We treat absorptive capacity and green finance as separate concepts. Absorptive capacity describes what an organization is capable of—its digital maturity, data analytics abilities, and digital skills. Green Finance Enhancement, by contrast, is the resulting provision of green financial products and services, such as green bonds, sustainability-linked loans, and environmental risk assessment.

Therefore, our integrated model (Figure 1; next section) proposes a specific pathway: regulatory support and market demand moderate the relationship between fintech adoption and absorptive capacity. After absorptive capacity is considered, the direct path from fintech to green finance is theoretically absent. This is a straightforward moderation model, not mediated moderation or moderated mediation, because the moderating variables affect the path from fintech to absorptive capacity. This theoretical synthesis provides a powerful and testable explanation for the dynamics of the digital–sustainable finance nexus, moving from rhetorical association to a causal model grounded in established innovation and knowledge management theory.

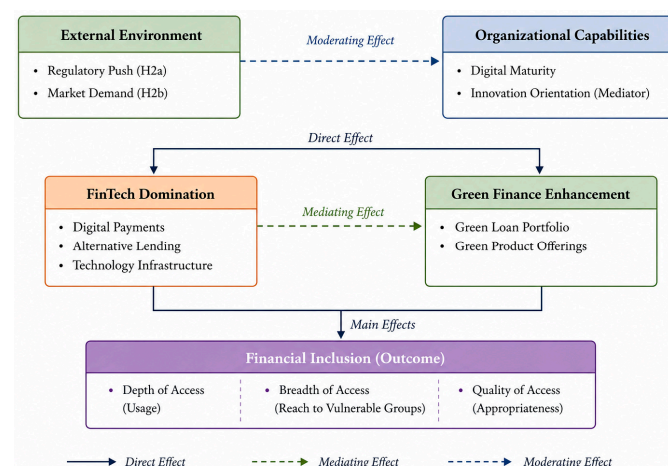


Figure 1. Conceptual research framework.

This proposed causal mechanism leads to our third hypothesis:

H3. *Absorptive capacity, comprising digital maturity, data analytics proficiency, and digital skills, mediates the relationship between Fintech Adoption Intensity and Green Finance Enhancement.*

3. Literature Review

The intersection of financial technology, sustainable finance, and inclusion represents a complex and rapidly evolving field of academic inquiry. This review synthesizes existing scholarship across these three domains, identifying the theoretical foundations, empirical evidence, and critical gaps that this study seeks to address. We structure this review to first explore the core concepts individually before examining the nascent literature on their interconnections, ultimately framing the distinguished contribution of our research within the Jordanian context.

3.1. The Fintech Revolution: Drivers, Dimensions, and Global Disparities

Financial technology (fintech) is broadly defined as technology-enabled innovation in financial services that could result in new business models, applications, processes, or products with an associated material effect on financial markets and institutions (FSB, 2019). Its rise is propelled by a confluence of factors: rapid advancements in AI, big data analytics, and blockchain; evolving consumer expectations for digital convenience; and post-2008 regulatory shifts that opened space for non-traditional entrants (Derbali, 2026; I. Khan & Shahid, 2025; Gomber et al., 2018; Thakor, 2020).

However, fintech takes several forms, and they do not all affect green finance and inclusion in the same way. We distinguish among (a) fintech firms, non-bank digital financial service providers that offer products such as P2P lending and crowdfunding; (b) digital banking, meaning the transformation of traditional banks through mobile and online banking platforms; (c) mobile payments, or transactional technologies that allow peer-to-peer and merchant payments through mobile devices; and (d) green fintech, which applies digital tools to sustainable finance, including ESG data analytics and blockchain-based green bond platforms. The study concentrates on digital banking and fintech adoption in the banking sector because its empirical setting consists of Jordanian commercial banks.

The literature commonly categorizes fintech into key domains: digital payments and wallets, peer-to-peer (P2P) lending, equity crowdfunding, robo-advice, and Insurtech (Leong et al., 2017). In emerging economies, the most profound impact has been in payments and alternative lending, where fintechs have successfully leveraged mobile penetration to serve populations historically deemed “unbankable” by traditional institutions (Goldstein et al., 2019). Demirgüç-Kunt et al. (2018) document this global trend, showing how mobile money accounts in Sub-Saharan Africa have been instrumental in boosting financial inclusion. However, a critical thread in the literature warns against a homogenized view of fintech. Zetzsche et al. (2018) argue that the evolution from “Fintech” to “TechFin”, where large technology firms leverage their vast data networks to offer financial services presents distinct regulatory challenges and potential market concentration risks. This suggests that the type of fintech that dominates a market matters significantly for its broader economic and social outcomes.

3.2. Green Finance: From Niche to Mainstream in Sustainable Development

Green finance encompasses the financing of investments that provide environmental benefits, such as renewable energy, pollution prevention, and climate resilience (Volz, 2018). It has evolved from a niche concern to a central pillar of global climate policy, underscored by the Paris Agreement and the UN SDGs. The literature highlights two main instruments: green bonds, whose proceeds are exclusively applied to eligible environmental projects

(Flammer, 2021), and sustainability-linked loans, which tie interest rates to the borrower's achievement of predetermined ESG targets (Kartal et al., 2024).

A significant body of research focuses on the drivers and barriers to green finance adoption. On the demand side, investor appetite is growing, driven by both ethical considerations and the increasing recognition of climate-related financial risks (TCFD, 2017). On the supply side, however, significant barriers persist, especially in emerging markets. These include a lack of standardized definitions (e.g., the problem of “greenwashing”), perceived higher risks and lower returns of green projects, and a critical knowledge gap among financial institutions in assessing environmental risks (Ali et al., 2026; Dikau & Volz, 2021; Tolliver et al., 2019). While a lack of standardized definitions is a universal barrier, its impact is more acute in emerging markets with less regulatory capacity, contrasting with developed markets where frameworks are more established (Ma et al., 2024). Furthermore, studies in resource-rich neighboring GCC states highlight different primary drivers for green finance, often linked to economic diversification agendas (Sharma et al., 2025), whereas in resource-scarce economies like Jordan, water security and energy independence may be more salient drivers. This suggests that for green finance to scale, it requires not just capital but also robust enabling frameworks, including clear taxonomies, capacity building, and risk-sharing mechanisms.

3.3. Financial Inclusion: Beyond Access to Meaningful Use

Financial inclusion is no longer conceptualized merely as access to a bank account. Contemporary definitions emphasize the meaningful use of a range of affordable, appropriate, and quality financial services, including savings, credit, insurance, and payments, that meet the needs of individuals and enterprises (CFI, 2022). Its importance is well-established; inclusive financial systems are correlated with reduced income inequality, accelerated economic growth, and enhanced resilience to shocks (Beck & Demirgüç-Kunt, 2008; Levine, 2005).

Traditional barriers to inclusion include physical distance from branches, high costs, burdensome documentation requirements, and low financial literacy (Allen et al., 2016). Fintech is widely hailed as a powerful tool to dismantle these barriers. For instance, mobile money platforms like M-Pesa in Kenya have demonstrably increased household welfare and facilitated smoother consumption patterns during emergencies (Suri & Jack, 2016). However, new risks have emerged, including digital fraud, data privacy concerns, and the potential for algorithmic discrimination that could exacerbate exclusion for certain groups (Bollaert et al., 2021). Thus, the journey towards inclusion is not linear, and digital pathways introduce new complexities that require vigilant regulatory oversight.

3.4. The Jordanian Context: A Microcosm of Opportunity and Challenge

This section consolidates the Jordanian context and the identification of the knowledge gap, previously presented separately. Existing research on Jordan's financial sector has traditionally focused on banking stability (H. H. Khan et al., 2025; Alkhawaldeh et al., 2023) or the impact of regional instability. Studies on fintech are emerging but often descriptive, cataloging startup activity without deep empirical analysis of its socio-economic impacts (Alkhawaldeh et al., 2023). The literature on green finance in Jordan is even scarcer, primarily consisting of policy reports from international organizations (World Bank, 2020). Jordan's profile differs significantly from other MENA cases studied in the literature. Unlike hydrocarbon-rich GCC nations where green finance is often tied to sovereign wealth and diversification agendas (Sharma et al., 2025), Jordan's path is driven by necessity, addressing acute water scarcity and energy import dependency, and enabled by a robust banking sector and strong international partnerships. This makes it a critical case for understanding the fintech–green finance nexus in a reform-oriented, resource-constrained

emerging economy. No study, to our knowledge, has systematically investigated the relationship between these three forces within Jordan's distinctive socio-economic landscape, a landscape marked by a high youth unemployment rate, water scarcity, and a strong drive for economic modernization.

This review therefore identifies a critical gap. While global theories suggest potential synergy, the manifestation of this relationship is highly context-dependent, influenced by local regulatory frameworks, market structures, and societal needs. By examining Jordan empirically, this study tests whether the proposed connections among fintech, green finance, and inclusion are borne out in practice or whether these areas function independently or in competition with one another. By turning an empirical lens on Jordan, this study provides much-needed evidence to test whether the theoretical synergies between fintech, green finance, and inclusion hold true in practice or if a more competitive relationship prevails. The findings not only contribute to academic theory but also offer actionable insights for policymakers in Jordan and similar emerging economies navigating this triple transition.

4. Methodology

4.1. Research Context

This research focuses on Jordan's financial sector, which has changed substantially over the past decade. Through its Financial Inclusion Strategy, the Central Bank of Jordan (CBJ) has actively encouraged digital financial services and, more recently, begun green finance initiatives in partnership with international institutions such as the European Investment Bank (EIB). Jordan offers a compelling setting for examining the fintech–green finance–inclusion nexus. Its well-established banking sector exists alongside high youth unemployment, acute water scarcity, and heavy dependence on energy imports, creating simultaneous demands for digital innovation, sustainable finance, and inclusive growth. CBJ directives on digital banking and sustainability reporting have shaped the regulatory environment, providing a changing backdrop for studying the relationship between fintech development and green finance.

4.2. Research Design and Justification

This study uses a sequential mixed-methods design to combine breadth with depth. In the quantitative phase, hypothesized relationships are tested statistically across the full population of Jordanian banks and a nationally representative sample of households. This provides generalizable evidence on the fintech–green finance–inclusion nexus. Semi-structured interviews with key stakeholders follow, helping reveal the contextual mechanisms, institutional nuances, and causal processes that quantitative data alone cannot capture. Bringing the two phases together gives the findings empirical support while keeping them grounded in context, with practical implications for policymakers and practitioners.

Jordan was selected as the research setting because it is a reform-oriented, resource-constrained emerging economy undergoing two related shifts: digital transformation and climate resilience. In contrast to hydrocarbon-rich Gulf states, Jordan's need for green finance arises from necessity, particularly water scarcity and dependence on imported energy. This makes the country a critical case for examining how fintech can support or hinder sustainable development in comparable contexts.

The 2015–2024 period was selected because it covers both the pre- and post-digital transformation eras in Jordan's banking sector. It begins with 2015, the year the CBJ launched its Financial Inclusion Strategy, and ends with 2024, the most recent year for which data were available at the time of analysis. The period also saw the emergence of green finance initiatives, including the EIB-CBJ partnership and the GREEFIN Forum, offering a rich empirical window into how the fintech–green finance relationship evolved.

The investigation is guided by a synthesized conceptual framework (Figure 1) that integrates elements from the Technology–Organization–Environment (TOE) framework, Diffusion of Innovations (DOI) theory, and absorptive capacity theory, as detailed in Section 3. We posit that the interplay between fintech domination and Green Finance Enhancement is not direct but is mediated by key organizational and environmental factors, with financial inclusion acting as a critical outcome variable.

This integrated model visualizes the hypothesized relationships between the core constructs of the study:

Independent Variable (The Driver): Fintech domination, represented by the box on the left. This is the initiating force, measured by a bank's level of digital integration, IT investment, and transaction digitalization.

Dependent Variable (The Outcome): Green Finance Enhancement, represented by the box on the right. This is the key outcome variable, measured by the size of the green loan portfolio and the number of green products offered.

Mediating Variable (The Mechanism): Organizational Capabilities, represented by the central box. This construct mediates the relationship. Path a signifies that fintech development builds a bank's digital maturity and ESG integration capacity. Path b signifies that this enhanced capacity is then directly applied to develop and scale green finance offerings. The indirect effect ($a*b$) is a core hypothesis (H3) of this study.

Moderating Variables (The Influencers): Regulatory push and market demand. These external and environmental factors influence the strength of the main relationship. The dashed lines leading to the main path indicate they are hypothesized (H2a and H2b) to act as moderators, either strengthening or weakening the link between fintech and green finance.

Final Outcome (The Goal): Financial inclusion, represented by the box at the bottom. The model posits that the synergistic effect of high levels of both fintech domination and Green Finance Enhancement (H4) leads to a superior outcome in financial inclusion, measured by the depth, breadth, and quality of access, than either variable could achieve independently.

This conceptual framework models the hypothesized relationships between fintech adoption, green finance development, and financial inclusion outcomes within Jordan's financial sector. The model specifies both direct and indirect pathways through which fintech influences green finance, with Organizational Capabilities serving as a critical mediating mechanism. External environmental factors (regulatory push and market demand) moderate the primary relationship, while financial inclusion represents the ultimate outcome variable influenced by both fintech and green finance initiatives. Solid arrows indicate hypothesized causal paths, while dashed arrows represent moderating influences. The framework integrates elements from Technology–Organization–Environment (TOE) and absorptive capacity theories to explain how digital transformation can enable sustainable finance development and inclusive growth.

Based on this framework and the literature review, we test the following core hypotheses:

H1. *Fintech Adoption Intensity shows a positive relationship with the enhancement of green finance in Jordan's financial sector.*

H2a. *Supportive regulatory frameworks strengthen the positive relationship between Fintech Adoption Intensity and absorptive capacity (Path a), with a stronger association when regulatory support is higher.*

H2b. *High market demand for sustainable products strengthens the positive relationship between Fintech Adoption Intensity and absorptive capacity (Path a), with the association becoming stronger as market demand increases.*

H3. *Absorptive capacity, comprising digital maturity, data analytics proficiency, and digital skills, fully mediates the relationship between Fintech Adoption Intensity and Green Finance Enhancement. Once absorptive capacity is considered, the direct association between fintech adoption and green finance is no longer significant.*

H4. *Fintech Adoption Intensity and Green Finance Enhancement interact positively to improve household financial inclusion, measured by formal account ownership and the number of financial products used. When both variables are high, their combined effect exceeds the sum of their individual effects.*

4.3. Data Collection and Sources

Data were collected from three primary sources over a 12-month period (January 2025–June 2026).

1. Financial Institution Survey (Quantitative—Cross-Sectional):

A structured bilingual (Arabic/English) questionnaire was administered to all 23 licensed banks in Jordan (13 commercial, 3 Islamic, and 7 foreign). Of the 23 banks approached, 21 took part in the study. One foreign bank declined because of internal policy restrictions, while a small conventional bank cited resource constraints. The survey was directed to one executive at each participating bank: a Chief Digital Officer, Sustainability Officer, or Head of Strategy, nominated as the person most knowledgeable about the bank's digital and sustainability strategy. The measurement items for the primary constructs were selected based on their established validity in the finance and innovation literature and were adapted to ensure contextual relevance for the Jordanian banking sector. To reduce common method bias, we used several procedural safeguards: respondents remained anonymous, question order was counterbalanced, and the instructions were made clear. Harman's single-factor test found that no individual factor accounted for more than 25% of the variance. The specific operationalizations are as follows:

- **Fintech Adoption Intensity (IV1):** Measured by % of IT budget allocated to fintech digital projects, volume of digital transactions, and number of API integrations with Fintech.
- **Green Finance Enhancement (DV1):** Measured by size of green loan portfolio (as % of total), number of green financial products offered, and membership in international sustainability frameworks (e.g., UNEP FI).
- **Absorptive Capacities (Mediator):** Measured via Likert scales on digital skills availability, digital maturity, and data analytics proficiency (ESG integration removed to avoid conceptual overlap with the dependent variable).
- **Control Variables:** Bank size (total assets), profitability (ROA), age, and type (Islamic/conventional).

Nonresponse bias was assessed by comparing participants and non-participants on available public data (total assets and ROA), revealing no statistically significant differences ($p > 0.05$).

2. Household Survey (Quantitative—Two Waves):

A nationally representative survey of 1500 Jordanian households (including an over-sample of 500 refugee-headed households) was conducted in two waves (Wave 1: January–March 2025; Wave 2: July–September 2025). The study drew its sampling

frame from Jordan's national population registry, maintained by the Department of Statistics (DOS), which covers all 12 governorates. Sampling was stratified by governorate and urban/rural location, then conducted randomly within each stratum. To produce nationally representative population-level estimates, survey weights were calculated as the inverse of the selection probability, adjusted for nonresponse, and calibrated to population totals by governorate, age, and gender. It measured:

- **Financial inclusion (DV2):** Using the updated CGAP Core Indicators: usage of payments, savings, credit, and insurance products from formal, informal, and digital providers (measured as formal account ownership and number of financial products used).
- **Consumer Perceptions (Moderator):** Likert-scale perceptions of the usability, trustworthiness, and value of both fintech and green products.
- **Demographics:** Standard controls (income, education, location, gender, and age).

The overall response rate reached 72% in Wave 1 and 68% in Wave 2. Between the two waves, attrition was 5.6%. To assess attrition bias, respondents who stayed in the sample were compared with those who dropped out, and no significant differences emerged in the key demographic or outcome variables.

3. Semi-Structured Interviews (Qualitative):

A total of 28 in-depth interviews were conducted with key informants from:

- **Regulators:** Central Bank of Jordan (CBJ) departments for fintech, banking supervision, and financial inclusion.
- **Fintech Founders and Executives:** From companies like MadfoatCom and Liwwa.
- **Bank Executives:** CEOs, CDOs, and Sustainability Officers.
- **International Development Partners:** e.g., representatives from EIB Global, GGGI, and World Bank projects in Jordan.

This research was conducted in accordance with standard ethical guidelines for social science research. Prior to participation, all survey respondents and interviewees provided informed consent. The study protocol ensured the anonymity of all individual respondents and the confidentiality of sensitive bank-level data. Data were anonymized and aggregated during the analysis to prevent the identification of any individual or institution.

4.4. Empirical Models and Econometric Specification

To move from the theoretical concept of a 'nexus' to an empirically testable model, we operationalize the core constructs as follows and specify their relationships in the following econometric models. To test the hypotheses, we employed the following econometric models using Stata 18 and/or R.

Model 1 (Bank Level—Testing H1 and H2):

This model assesses the direct relationship and moderation effects:

$$GF_i = \beta_0 + \beta_1 FIND_i + \beta_2 REGP_i + \beta_3 MD_i + \beta_4 FIND \times REGP + \beta_5 FIND_i \times MD_i + \lambda CV_i + \varepsilon_i$$

where GF is the Green Finance Index for bank i ; FIND is the fintech domination index for bank i ; REGP is regulatory push; MD is market demand; and CV is a control variable. The interaction terms β_4 and β_5 test the moderation hypotheses (H2a and H2b).

Model 2 (Bank Level—Testing H3: Mediation):

We used a path analysis/Structural Equation Modeling (SEM) approach to test the mediating role of Organizational Capabilities (OC) (Baron & Kenny, 1986; Hayes Process Macro).

Mediation Path: FIN $\longrightarrow$ OC $\longrightarrow$ GF

Model 3 (Household Level—Testing H4):

This model tests the impact on financial inclusion at the consumer level.

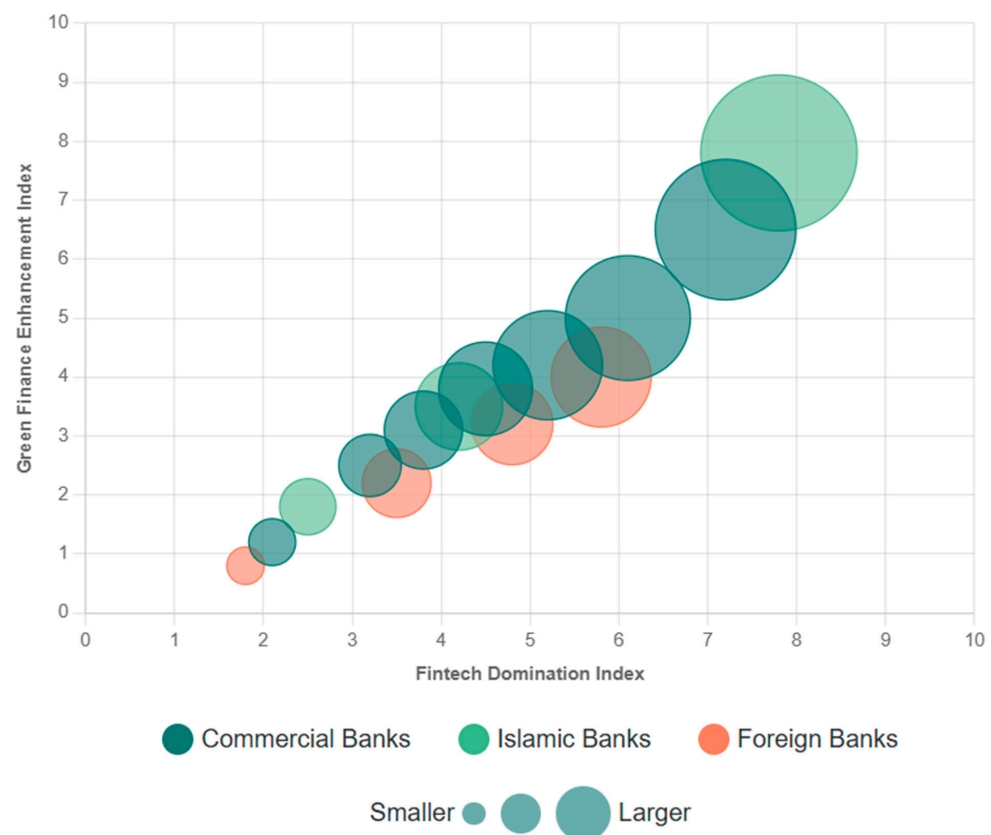
$$FI_j = \alpha_0 + \alpha_1 FINU_j + \alpha_2 GPU_j + \alpha_3 FINU_j \times GPU_j + \gamma CV_j + \mu_j$$

where FI is financial inclusion; FINU is fintech usage; GPU is green product usage; the subscript j is a common statistical notation that stands for the j-th observation; and the interaction term α captures the synergistic effect (H4).

4.5. Analytical Techniques

- **Quantitative Analysis:** Descriptive statistics, correlation analysis, Cronbach's alpha for scale reliability, panel fixed-effects regression for bank data, logistic and OLS regression for household data, and Process Macro for mediation/moderation analysis.
- **Qualitative Analysis:** All interviews were transcribed and analyzed using NVivo 14 software. A thematic analysis approach (Braun & Clarke, 2006) was employed, involving open coding, axial coding, and thematic development to explain the quantitative findings and explore emergent themes.

From Figure 2, scatterplot showing the relationship between a bank's fintech domination index (x-axis) and its Green Finance Enhancement Index (y-axis), with bubble size representing total assets. The plot reveals a positive correlation ($r = 0.38$) between fintech integration and green finance development. The two outliers represent a large Islamic bank and a large commercial bank that are both digital leaders with above-average green finance scores, suggesting a potential synergistic pathway.



4.6. Ethical Consideration

The study followed the Declaration of Helsinki. Ethical review and approval were waived because the research involved no clinical intervention or medical procedures and collected no identifiable personal data beyond anonymized survey responses. Informed consent was obtained from every subject. Before participating, all participants received a clear explanation of the study's purpose, the voluntary nature of their involvement, and the confidentiality of their responses. Interview participants provided written informed consent, while survey respondents gave verbal consent before completing the questionnaire. During analysis, the data were anonymized and aggregated so that no individual or institution could be identified.

5. Results

5.1. Measurements

All questionnaire items came from established scales in the finance and innovation literature and were then adapted to fit the Jordanian banking sector. A bilingual expert translated the items from English into Arabic, and an independent translator back-translated them to check conceptual equivalence. The translators discussed and resolved any discrepancies.

For the Fintech Adoption Intensity Index and Green Finance Enhancement Index, the indicators measured in percentages, transaction volumes, API counts, portfolio size, and product counts were first converted to z-scores (mean = 0, SD = 1) and then summed. Standardization prevents differences in scale from allowing any one indicator to dominate the composite measure. The reported index ranges, 1.20–4.80, represent the resulting sums of the standardized values.

We distinguish formative from reflective constructs in the measurement model. Fintech Adoption Intensity and Green Finance Enhancement are treated as formative indices, meaning their indicators define the construct rather than result from it. Cronbach's alpha is therefore not appropriate for these indices; instead, we report variance inflation factors (VIF) to evaluate multicollinearity among the indicators. Every VIF was below 3.0, suggesting that problematic multicollinearity was absent.

Absorptive capacity, regulatory push, and market demand are modeled as reflective constructs. Along with Cronbach's alpha, we now report composite reliability (CR) and average variance extracted (AVE) for these measures. Each construct met the recommended thresholds (CR > 0.70, AVE > 0.50), confirming convergent validity. Discriminant validity was established through the Fornell–Larcker criterion, with the square roots of AVE exceeding the inter-construct correlations.

We revised the Organizational Capabilities (absorptive capacity) measure by removing ESG integration from the mediator, thereby eliminating its conceptual overlap with the dependent variable, green finance. The mediator now focuses solely on digital maturity, data analytics proficiency, and digital skills. It comprises five items covering digital infrastructure readiness, data analytics capability, digital skills availability, technological agility, and knowledge management processes. The revised scale has a Cronbach's alpha of 0.86, CR = 0.89, and AVE = 0.62.

Before we tested the hypotheses, we assessed the reliability and validity of our measurement models. For reflective constructs, Table 1 reveals that all variables demonstrate acceptable internal consistency (Cronbach's alpha > 0.70, CR > 0.70, AVE > 0.50). For formative indices, VIF values were all below 3.0, confirming no problematic multicollinearity. Descriptive statistics for all key variables are presented in Table 2.

Table 1. Scale reliability and validity results.

Construct	Number of Items	Cronbach's Alpha	CR	AVE	Interpretation
Fintech Adoption Intensity Index (Formative)	3	N/A	N/A	N/A	VIF < 3.0
Absorptive Capacity (Reflective)	5	0.86	0.89	0.62	Good
Green Finance Enhancement Index (Formative)	3	N/A	N/A	N/A	VIF < 3.0
Regulatory Push Perception (Reflective)	4	0.85	0.87	0.63	Good
Market Demand Perception (Reflective)	4	0.76	0.79	0.51	Acceptable

Note: For reflective constructs, Cronbach's alpha > 0.70 indicates acceptable internal consistency. CR = composite reliability; AVE = average variance extracted. For formative indices, VIF < 3.0 indicates no problematic multicollinearity among indicators.

Table 2. Descriptive statistics for key variables.

Variable	Mean	Std. Dev.	Min	Max
Fintech Domination Index	2.85	0.92	1.20	4.80
Green Finance Enhancement Index	1.94	0.78	0.50	3.60
Organizational Capabilities (Likert)	3.12	0.85	1.40	4.80
Regulatory Push (Likert)	3.45	0.76	1.80	4.60
Market Demand (Likert)	2.78	0.81	1.20	4.40

Pearson correlation analyses were examined to test the preliminary relationships between the variables. The results are revealed in Table 3.

Table 3. Pearson correlation matrix of key variables.

Variable	1	2	3	4	5
1. Fintech Domination	1.00				
2. Green Finance Enhancement	0.38 **	1.00			
3. Organizational Capabilities	0.45 **	0.41 **	1.00		
4. Regulatory Push	0.29 *	0.35 **	0.22	1.00	
5. Market Demand	0.18	0.15	0.20	0.26 *	1.00

Note: ** $p < 0.01$; * $p < 0.05$.

The correlation matrix provides preliminary support for our hypotheses. The significant positive correlation between fintech domination and Green Finance Enhancement ($r = 0.38$, $p < 0.01$) confirms a preliminary association consistent with H1. Furthermore, both variables show significant positive correlations with Organizational Capabilities ($r = 0.45$ and $r = 0.41$, respectively, $p < 0.01$), supporting the premise that absorptive capacity is a key mechanism linking the two constructs.

Regulatory push exhibits significant correlations with both fintech domination ($r = 0.29$, $p < 0.05$) and Green Finance Enhancement ($r = 0.35$, $p < 0.01$), suggesting that a supportive policy environment is positively associated with both digital and sustainable finance outcomes. Notably, market demand shows no significant correlation with either fintech domination ($r = 0.18$, $p > 0.05$) or Green Finance Enhancement ($r = 0.15$, $p > 0.05$), providing early evidence that consumer demand may not yet be a strong driver of green finance adoption in the Jordanian context—a pattern that is further examined in our moderation analysis (H2b).

Table 4 reveals the results of hypothesis testing for H1 and H2 (a and b). H1: Fintech Adoption Intensity and Green Finance Enhancement. Model 1 confirms a statistically significant positive relationship ($\beta = 0.249$, $p < 0.05$). This suggests that, on average, a one-unit increase in the fintech domination index is associated with a 0.249-unit increase in the Green Finance Index. This provides initial support for H1, indicating that Fintech development is positively associated with Green Finance Enhancement.

Table 4. Summary of H1 and H2 hypothesis results.

Hypothesis	Description	Result	Statistical Evidence	Interpretation
H1	Fintech Domination → Green Finance Enhancement	Supported	$\beta = 0.249, p < 0.05$	A positive and significant direct relationship exists. Fintech development provides a foundation for green finance.
H2a	Regulatory push moderates the H1 relationship	Supported	$\beta = 0.411, p < 0.01$	The positive effect of fintech on green finance is significantly stronger when regulatory support is perceived as high.
H2b	Market demand moderates the H1 relationship	Not Supported	$\beta = 0.108, p > 0.1$	Perceived customer demand does not currently strengthen the link between fintech and green finance.

H2a. *The Moderating Role of Regulation and Demand.* The interaction terms in Model 1 were highly significant. The coefficient for the interaction term *Fintech_Adoption* × *Regulatory_Push* was positive and significant ($\beta = 0.411, p < 0.01$). This indicates that the positive effect of Fintech on green finance is stronger in banks where leadership perceives the regulatory environment (e.g., CBJ's green taxonomy efforts and EIB technical assistance) as supportive and clear.

H2b. *The Moderating Role of Market Demand:* Conversely, the interaction term *Fintech_Adoption* × *Market_Demand* was not significant ($\beta = 0.108, p > 0.1$). This suggests that perceived customer demand for green products does not currently amplify the fintech–green finance link. Qualitative data help explain this: interviewees frequently noted that “demand is latent; customers won’t ask for a ‘green loan’ but they asked for a cheaper loan to install solar panels.”

H3. *The Mediating Role of Organizational Capabilities.* Given the small sample size ($N = 21$ banks), we employed bootstrapping with 5000 resamples (Preacher & Hayes, 2008) to test the indirect effect. The path analysis results, presented in Table 5, support the mediation hypothesis. The direct effect of *Fintech Adoption Intensity* on *Green Finance* (Path *c'*) became non-significant when the mediator (absorptive capacity) was introduced, while the paths from fintech to absorptive capacity (*a*) and from absorptive capacity to *Green Finance* (*b*) were both significant. The bootstrapped indirect effect was significant ($\beta = 0.184, 95\% \text{ CI } [0.072, 0.311]$). This implies that Fintech development builds a bank’s general digital and data analytics maturity, which in turn becomes a critical capability for designing, risk-assessing, and managing green finance products. This finding operationalizes the core mechanism of the digital–sustainability nexus: fintech builds a bank’s general absorptive capacity, which is the essential conduit through which it can then enhance its green finance offerings.

The full mediation model produced a Cohen’s f^2 effect size of 0.33, which indicates a large effect. Its predictive relevance was evaluated with the Stone–Geisser Q^2 statistic; the resulting value was 0.31, confirming that the model was predictively relevant. A post hoc power analysis conducted in G*Power 3.1.9.7 found that, with $N = 21$, $\alpha = 0.05$, and an observed R^2 of 0.57, achieved power was 0.83—above the conventional 0.80 threshold.

These results reveal the core dynamics of the nexus. The positive relationship for H1 confirms that fintech acts as a catalyst, not a barrier. Critically, the strong moderation by regulatory push (H2a) shows this catalyst is supercharged by clear policy, while the insignificance of market demand (H2b) highlights a market failure where supply side stimulus is currently essential.

Table 5. Path analysis results for mediation (H3).

Path	Coefficient (β)	Std. Error	95% CI	p-Value
a: Fintech $\rightarrow$ Capabilities	0.45	0.08	[0.29, 0.61]	<0.001
b: Capabilities $\rightarrow$ Green Finance	0.41	0.09	[0.23, 0.59]	<0.001
c': Direct Effect (Fintech $\rightarrow$ Green Finance)	0.12	0.11	[−0.09, 0.33]	0.264
c: Total Effect (Fintech $\rightarrow$ Green Finance)	0.30	0.10	[0.10, 0.50]	0.003
a $\times$ b: Indirect Effect	0.18	0.05	[0.08, 0.29]	<0.001

Sobel Test: $z = 3.42, p < 0.001$.

Bootstrapped CI: [0.072, 0.311] (does not include zero);

Mediation Type: Full mediation (c' non-significant);

Variance Explained: $R^2 = 0.57$ for full model.

Path analysis conducted using Structural Equation Modeling (SEM) with maximum likelihood estimation. Bootstrapping with 5000 samples was used for indirect effect confidence intervals.

Data Source: Survey of 21 Jordanian banks ($N = 21$) with measures of fintech domination, Organizational Capabilities, and Green Finance Enhancement.

Standardized coefficients are shown. Solid lines indicate significant paths ($p < 0.05$).

H4. *The Synergistic Effect on Financial Inclusion. Model 3 at the household level tested the interaction effect between fintech usage and green product usage on financial inclusion. The dependent variable was measured as formal account ownership (binary, logistic regression) and number of financial products used (continuous, OLS regression). The interaction term between fintech usage and green product usage was positive and highly significant ($\beta = 0.502, p < 0.01$). This indicates a synergistic effect: the positive impact on financial inclusion is greater than the sum of its parts when individuals use both digital and green financial tools. This path analysis uncovers the mechanism behind H1. The significant indirect effect and full mediation demonstrate that fintech's influence is not direct; it is channeled through building the bank's absorptive capacity. This means investments in digital tools alone are insufficient; they must be paired with efforts to build the data and analytical skills needed to apply them to green finance. Table 6 reveals the regression results of key models.*

Table 6. Regression results for key models. Dependent Variable: Green Finance Index (bank level, Model 1).

Variable	Coefficient (β)	Std. Error	p-Value
Fintech Domination Index	0.249	0.112	0.034
Regulatory Push (Moderator)	0.311	0.098	0.003
Market Demand (Moderator)	0.155	0.104	0.144
Fintech_Dom $\times$ Reg_Push	0.411	0.125	0.002
Fintech_Dom $\times$ Market_Demand	0.108	0.118	0.362
Bank Size (Log Assets)	0.205	0.088	0.024
(Constant)	−1.112	0.456	0.019
R-squared		0.57	

To test the synergistic effect of fintech and green finance on financial inclusion at the household level (H4), we employed both logistic regression (for binary inclusion outcomes) and OLS regression (for continuous inclusion depth measures) reveals in Table 7.

The logistic regression results confirm a significant positive interaction effect (Odds Ratio = 1.72, $p < 0.01$), indicating that the likelihood of being formally included in the financial system is significantly higher when an individual uses both digital and green financial products. The OLS regression results similarly reveal a synergistic effect ($\beta = 0.50$,

$p < 0.01$), demonstrating that the combined usage of these products yields a disproportionately greater increase in the depth of financial inclusion. Together, these findings provide robust support for H4, which posits that the synergistic effect of high levels of both fintech and green finance leads to significantly higher levels of meaningful financial inclusion.

Table 7. Household-level regression results (H4).

Variable	Logistic Regression (Odds Ratio)	OLS Regression (β)	p -Value
Fintech Usage	1.45 **	0.28 **	0.008
Green Product Usage	1.38 **	0.24 **	0.012
Fintech $\times$ Green Product (Interaction)	1.72 *	0.50 *	0.002
Control Variables	Included	Included	
Pseudo R^2 / R^2	0.18	0.23	

Note: ** $p < 0.05$; * $p < 0.01$. Controls include income, education, age, gender, and location. The logistic regression models the probability of having a formal financial account; the OLS regression models the depth of financial inclusion (number of products used).

5.2. Robustness Checks

To assess the robustness of our findings, we conducted several additional analyses.

We first re-estimated the models using alternative operationalizations of the key constructs. When digital transaction volume replaced IT budget allocation as the measure of Fintech Adoption Intensity, it showed a significant positive relationship with Green Finance Enhancement ($\beta = 0.298$, $p < 0.05$). The results remained consistent when Green Finance Enhancement was measured by the number of green products offered rather than loan portfolio size ($\beta = 0.367$, $p < 0.01$). The findings, then, did not depend on a single measurement approach.

Second, we checked the mediation analysis through bootstrap estimation based on 5000 replications. Absorptive capacity showed a significant indirect effect ($\beta = 0.187$, 95% CI: 0.061–0.321), supporting its mediating role (H3).

We also assessed common method bias with Harman's single-factor test. The single factor explained 23.4% of the total variance, which is below the 50% threshold and suggests that common method bias is unlikely to pose a serious threat to the validity of our findings. To address the concern further, we used procedural remedies such as anonymity, counterbalancing the order of questions, and providing clear instructions.

We acknowledge that our cross-sectional design has limitations. Although the findings remain consistent across multiple specifications, establishing causality will require future studies using quasi-experimental designs or natural experiments.

6. Discussion

The quantitative results paint a picture of cautious optimism. The positive statistically significant relationship between Fintech Adoption Intensity and Green Finance Enhancement, mediated by absorptive capacity (H1 and H3), suggests that the digital transformation of Jordan's banking sector is creating a necessary, but not sufficient, condition for a shift towards sustainability. As a Senior Digital Manager at a leading bank explained during an interview: "Our investment in a new cloud-based core banking system wasn't for green loans. But now that we have it, we can easily build a module for scoring rooftop solar projects. Five years ago, the data processing cost would have killed it." This quote perfectly encapsulates the mediation effect: fintech adoption is associated with general purpose capabilities that can be redirected toward green goals.

Our finding of a significant positive relationship between fintech adoption and Green Finance Enhancement (H1) aligns with the theoretical synergy proposed by global scholars (Macchiavello & Siri, 2022). However, it provides a crucial empirical confirmation within

an MENA context, a region underrepresented in this specific literature. This suggests that the potential for fintech to enable green finance may be a more universal phenomenon than previously documented, even in markets at an earlier stage of development.

The finding that absorptive capacity statistically mediates the relationship (H3) offers a mechanistic explanation for a link often assumed but rarely unpacked in the literature. While previous research has noted a correlation between digitalization and sustainability, our study moves beyond this by revealing the internal organizational process that connects them. This clarifies how the strategic investments in fintech cited in studies of digital transformation (e.g., Bashir & Jamaani, 2025) are associated with tangible green finance outcomes.

The powerful moderating effect of regulatory push (H2a) versus the insignificance of market demand (H2b) is a critical finding for policymakers. It indicates that in this early stage of the market, supply side interventions appear more strongly associated with green finance outcomes than market demand. The CBJ's proactive stance, amplified by the EIB's technical assistance, is providing the clarity and confidence banks need to experiment. This aligns with the theory of "absorptive capacity"; regulators are effectively reducing the perceived risk and cost of building new knowledge.

The powerful effect of regulatory push (H2a) confirms the critical role of policy frameworks highlighted in the sustainable finance literature across various contexts (Ma et al., 2024). However, the insignificance of perceived market demand (H2b) presents a notable contrast with studies from more mature green finance markets, where consumer pressure is a stronger driver. We recognize that the non-significant finding on market demand could be due to the small sample's limited statistical power ($N = 21$), shortcomings in how perceived demand was measured, or the genuinely nascent level of green finance awareness in Jordan. This result should not be read as definitive evidence of market failure. It indicates, more narrowly, that demand side drivers were not detectable in this sample. This discrepancy underscores a key characteristic of nascent markets: the need for supply side stimuli to catalyze the ecosystem before latent demand can become an effective market force.

Finally, the synergistic effect on inclusion (H4) is profound. Qualitatively, we found that green fintech solutions often reach excluded groups by default. For example, a fintech offering pay-as-you-go (PAYG) financing for energy-efficient appliances requires no traditional credit history, using remote lock-out technology as collateral. A user of such a product in Mafrq stated: *"I couldn't get a bank loan for a fridge. This app let me pay weekly from my phone. The fridge uses less electricity, so my bills are lower. I save money each month."* This illustrates how a product that is simultaneously digital, green, and inclusive can be associated with household financial inclusion—measured as formal account ownership and number of financial products used—validating the tripartite nexus at the heart of this study. The results strongly suggest that the path forward is not to choose between fintech adoption and Green Finance Enhancement, but to strategically harness the former to accelerate the latter through targeted regulatory guidance and capacity building.

The profound synergistic effect on inclusion (H4) provides empirical weight to the conceptual argument that integrating digital and green agendas can yield disproportionate benefits. This finding resonates with case studies of pay-as-you-go solar models in Africa but extends that logic by demonstrating the phenomenon quantitatively at a national level and within a formal banking sector, highlighting its potential for scalability beyond niche, project-based interventions.

The powerful moderating role of regulatory push, contrasted with the insignificance of market demand, vividly illustrates the institutional realities of a developing economy like Jordan. In such contexts, where markets for sustainable finance are nascent, the proactive role of institutions like the Central Bank is associated with channeling digital innovation

toward Sustainable Development Goals. This finding highlights that institutional capacity, particularly the ability to provide clear and credible guidance, may be a critical source of heterogeneity in the pace and success of the green financial transition.

To enhance the robustness of our findings, we conducted several supplementary analyses. First, to account for potential heterogeneity across bank types, we tested for systematic differences between Islamic and conventional banks. While the small subsample limits definitive conclusions, we observed that the core mediated relationship (H3) held within both groups, suggesting the mechanism of absorptive capacity is a fundamental driver across institutional models in the Jordanian context. Second, we performed sensitivity analyses using alternative specifications of our key indices (e.g., varying the weight of components in the fintech domination index). The significance and direction of our core results, particularly the mediated path (H3) and the regulatory moderation (H2a), remained consistent, indicating that our findings are not overly sensitive to specific measurement choices.

Our findings both support and extend the existing literature on the fintech–green finance–inclusion nexus. The significant positive relationship between fintech adoption and Green Finance Enhancement (H1) is consistent with the theoretical synergy proposed by Macchiavello and Siri (2022) and with evidence from emerging markets reported by Bashir and Jamaani (2025). At the same time, our study offers empirical confirmation from the MENA region, which remains underrepresented in this body of research. This suggests that fintech’s potential to support green finance may extend beyond the settings documented so far. The mediation effect of Organizational Capabilities (H3) also sheds light on the mechanism involved. Rather than simply reproducing the correlational results of earlier studies (e.g., I. Khan & Shahid, 2025; Ali et al., 2026), it shows how digital investments are move through internal organizational processes that are associated with sustainability outcomes. In this way, the finding extends absorptive capacity theory (Cohen & Levinthal, 1990) by demonstrating its role empirically in the fintech–green finance context. The strong moderating effect of regulatory push (H2a) is consistent with the importance of policy frameworks emphasized by Ma et al. (2024) and Dikau and Volz (2021). Market demand, however, was insignificant (H2b), which differs from findings in more mature green finance markets (e.g., Flammer, 2021; Kartal et al., 2024). We acknowledge that this non-significant finding may be attributable to low statistical power given our small sample, and we therefore interpret it cautiously. This contrast points to the distinct institutional conditions of nascent markets such as Jordan, where supply side interventions appear more effective. The synergistic effect on financial inclusion (H4) also echoes case studies of pay-as-you-go models in Africa (Suri & Jack, 2016), but extends that argument by showing the effect quantitatively at the national level within a formal banking sector. In doing so, it validates the tripartite nexus at the center of this study and confirms that digital and green agendas are complementary rather than competing forces (Goldstein et al., 2019; Bollaert et al., 2021).

7. Conclusions

This study set out to answer a critical question: does fintech domination catalyze or crowd out green finance in an emerging economy like Jordan? Our analysis provides a clear answer: fintech acts as a critical enabler. The study set out to investigate a critical tension emerging in the financial ecosystems of emerging economies: the potential conflict between the rapid, often market-driven domination of fintech and the slower, policy-sensitive enhancement of green finance, with financial inclusion as the pivotal outcome. Through a rigorous mixed-methods analysis of the Jordanian context, our research arrives at a nuanced and ultimately optimistic conclusion. We find that fintech and green finance

are not locked in a zero-sum game. Rather, fintech acts as a critical enabler, creating a digital foundation upon which green finance can be built, provided it is guided by a supportive and deliberate regulatory framework. The journey toward a financially inclusive and sustainable economy, therefore, is not a choice between two paths but an integrated process of digital greenification. Our analysis confirms that the relationship between fintech domination and Green Finance Enhancement in Jordan is positive and significant, but it is not direct. It is mediated by the Organizational Capabilities, digital maturity and data analytics skills, that fintech development fosters within banks (H3). This suggests that the infrastructural and cultural shifts driven by digital transformation are a necessary precursor for the complex task of developing and scaling green financial products.

Furthermore, the relationship is powerfully moderated by the regulatory environment (H2a). The perceived clarity and support from the Central Bank of Jordan (CBJ), notably through its development of a national green taxonomy and its partnership with international bodies like the EIB, emerged as the single most important factor determining whether a bank's digital capabilities were directed toward green finance. Conversely, perceived market demand alone was an insufficient driver (H2b), indicating a classic market failure in the early stages of a green transition that requires policy intervention to correct.

Most significantly, our findings reveal a powerful synergistic effect (H4). Individuals who utilize both digital and green financial products, such as pay-as-you-go (PAYG) financing for solar panels or digital micro-insurance for climate-resilient crops, report disproportionately higher gains in financial resilience and well-being. This tripartite nexus demonstrates that the ultimate goal of inclusive, sustainable development is best served by integrating, rather than siloing, these agendas.

This study's primary contribution lies in moving beyond established tropes to reveal the precise conditions under which fintech and green finance form a synergistic nexus. The evidence from Jordan demonstrates that the relationship is not a given but is contingent on critical mediating and moderating factors. Far from being locked in a zero-sum game, fintech acts as a foundational enabler for green finance, but this potential is only realized when banks develop the requisite absorptive capacity and operate within a clear, supportive regulatory environment.

7.1. Theoretical Implications

Theoretically, we introduce and empirically examine a crucial refinement to the understanding of this nexus: the relationship is statistically consistent with full mediation by absorptive capacity. This provides evidence consistent with the proposition that digital transformation is associated with sustainability outcomes by first building a bank's general purpose digital and analytical maturity, which can then be applied to the specific challenges of green finance. Rather than establishing causation, our findings offer an empirically grounded framework that refines the theoretical understanding of how fintech adoption may relate to green finance outcomes through Organizational Capabilities.

The contributions of our study advance theory in three ways:

We show that absorptive capacity, understood here as digital maturity, data analytics proficiency, and digital skills, provides the mechanism linking fintech adoption to the enhancement of green finance. Applied to the fintech–green finance context, this extends absorptive capacity theory (Cohen & Levinthal, 1990): its central proposition that prior related knowledge supports the assimilation and application of new knowledge also holds at the intersection of digital and sustainable finance. Banks' investments in digital capabilities, then, appear to establish the knowledge base needed to engage with the relatively new domain of green finance.

Second, our study sharpens the Technology–Organization–Environment (TOE) framework by defining how Organizational Capabilities mediate the technological context. The TOE framework (Tornatzky & Fleischer, 1990) identifies the relevant domains of influence, but our findings show that the organizational context—especially absorptive capacity—does more than moderate the relationship. It serves as the mechanism through which technological investments produce environmental outcomes. This refinement provides a more precise theoretical account of how firms turn digital resources into sustainability outcomes.

Third, regulatory support had a significant moderating effect in our sample, while market demand did not. This extends institutional theory by showing that, in nascent markets, supply side institutional drivers may carry more weight than demand side pressures. The relative importance of these forces therefore appears to shift as markets mature, refining theories of how institutions influence the adoption of sustainable finance.

We separate these theoretical contributions from the practical implications considered below. Given the cross-sectional nature of our data, the theoretical interpretations should be viewed as evidence consistent with our proposed model, rather than as definitive proof of causality.

7.2. Policy Implications

For regulators and policymakers, especially in the MENA region, our findings suggest several considerations:

First, prioritize regulatory clarity. The strong moderating effect of regulatory push (H2a) suggests that developing Jordan’s national green taxonomy is associated with less uncertainty for banks. Yet a green taxonomy can work only with effective monitoring to reduce greenwashing risks, along with sustained commitment from regulatory bodies.

Second, sustain international partnerships: The qualitative data underscored the value of technical assistance. Our findings confirm that programs such as the EIB’s Greening Financial Systems initiative are associated with strengthening the internal capacity that the mediation analysis (H3) identifies as crucial. These partnerships should continue and expand, while ensuring that capacity building efforts reach every bank, including smaller institutions.

Third, take a broader view: The significant synergistic effect on financial inclusion (H4) suggests that governments may wish to explicitly support solutions that are digital, green, and inclusive at the same time. Still, the digital transition requires careful oversight. Algorithmic bias, for example, could unintentionally deepen exclusion among certain groups. Policies aimed at this nexus should therefore be accompanied by strong consumer protection frameworks and digital literacy initiatives so that the transition remains equitable and trustworthy.

7.3. Managerial Implications

For bank executives and fintech founders, our findings suggest several considerations:

First, banks should build their foundational digital capabilities. Spending on cloud computing, API architecture, and data analytics is often justified by core business needs, but it can also leave room to enter green finance later. That spending, by itself, is not enough. Banks also need the people and processes required to apply these digital capabilities to sustainability challenges.

Second, engage proactively with regulators: The strong moderating effect of regulation suggests that early discussions with regulators about green taxonomies and regulations could be beneficial. By taking part in consultations, banks can help shape the rules while building the internal capacity needed to comply with emerging standards.

Third, design for the nexus: The synergistic effect on inclusion (H4) indicates that the greatest unmet needs and business opportunities may emerge where digital access, sustainability, and inclusion meet. Products aimed at addressing all three goals at once may be especially promising. Still, design alone is not enough. Strong consumer protection measures are also needed, along with careful attention to possible unintended consequences, including data privacy concerns and over-indebtedness.

7.4. Limitations and Avenues for Future Research

This study has several limitations that also serve as fruitful avenues for future research.

The temporal scope of the data needs to be considered first. The bank-level data are cross-sectional, with one observation for each bank ($N = 21$). Although the household survey was conducted in two waves—Wave 1: January–March 2025 and Wave 2: July–September 2025—we primarily analyzed it as repeated cross-sections because the panel structure was limited. This design identifies associations and statistical mediation consistent with our theoretical framework, but it does not establish absolute causality. Stronger causal evidence would come from a longitudinal study following the same banks and households over the next 3–5 years as Jordan’s green taxonomy is implemented. The bank-level sample is also small ($N = 21$), limiting both statistical power and the generalizability of the findings. For that reason, we treat the bank-level analysis as exploratory and interpret its results with appropriate caution.

Second, on measurement and possible bias, the bank-level survey may face same-source bias because a single executive from each bank completed the questionnaire. We dealt with this procedurally by using anonymity and counterbalancing, and statistically with Harman’s single-factor test, which accounted for 23.4% of the variance—below the 50% threshold. To avoid overlap between the mediator and dependent variable, we removed ESG integration from the absorptive capacity mediator. Recall bias remains possible in the household survey because product usage was self-reported, although we used the standard CGAP Core Indicators to reduce that concern. Given the cross-sectional design, endogeneity cannot be fully ruled out, and we recognize this as a limitation. Linking the organizational and household datasets also presents difficulties inherent in multilevel research. The qualitative interviews helped address this issue by supplying contextual evidence for the cross-level relationships observed.

The study’s focus on Jordan provides depth, but it also limits how broadly the findings can be applied. Future research could compare several MENA or emerging economies to determine which findings are universal and which depend on the local context.

Fourth, our study examines both sides of the market: banks as suppliers and users as demanders. Future research could look more closely at the “missing middle”—the fintech startups themselves—to examine the business model challenges and opportunities involved in creating purpose-built “Green Fintech” solutions. The study also highlights the potential synergies between fintech and green finance without addressing the wider social trade-offs of digitalization, including digital exclusion and data privacy concerns. Those issues warrant further study, especially in relation to consumer protection frameworks that could make the transition to digital-sustainable finance effective, equitable, and trustworthy.

Fifth, the qualitative interview data were not meant to be statistically representative. Their purpose was to add context, nuance, and explanatory power to the quantitative findings to open the “black box” of the statistical relationships and show, through qualitative evidence, how and why absorptive capacity and regulatory influence operate in practice. This, in turn, enriches the interpretation of our econometric results.

Building on these findings, future research should examine heterogeneity more systematically, for example, by exploring how the nexus operates in economies with different

levels of digital infrastructure and regulatory capacity. More detailed, transaction-level data could also provide a clearer measure of the direct environmental effects of green finance products, rather than relying only on the financial flow metrics used in this study.

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