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A Measurement Model of Green Constiruction Finance Adoption in Kenya

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ABSTRACT: This study investigates the determinants of Green Construction Finance (GCF) adoption within Kenya's construction sector, addressing the significant implementation gap between sustainable policy and actual practice. Utilizing a survey design, data were collected from 55 registered property developers and analyzed through Confirmatory Factor Analysis (CFA) and Partial Least Squares Structural Equation Modelling (PLS-SEM). The results reveal an infant GCF ecosystem, with actual adoption at a mere 1.03% despite high conceptual willingness (98%) among developers. The measurement model evaluates eight key determinants: Awareness, accessibility, institutional, financial, environmental, technical, risk, and socio-cultural factors. Critically, the analysis identifies a lack of discriminant validity among these constructs, suggesting they function as an interconnected "barrier bundle" rather than independent drivers. The low explanatory power of the model ($R^2 = 0.06$) indicates that adoption is currently constrained by systemic market failures or factors beyond traditional linear determinants. The study concludes that piecemeal policy interventions are insufficient; instead, a holistic strategy is required to address the monolithic obstacles formed by regulatory, financial, and risk-related hurdles. Methodologically, it recommends that future research adopt higher-order constructs to better capture the complex reality of sustainable finance in emerging economies.

KEYWORDS: confirmatory factor analysis, determinants, green construction finance, Kenya

Introduction

The global construction and built environment sectors are at a critical juncture in the pursuit of the United Nations' 2030 Agenda for Sustainable Development. As of 2024, the building sector remains a primary driver of the climate crisis, accounting for approximately 32% of global energy consumption and contributing to 34% of global CO_2 emissions [62]. Despite a record-high $8.2 trillion in global sustainable finance in 2024, a 17% increase from the previous year, a stark geographical imbalance persists; over 90% of clean energy investment since 2021 has occurred in advanced economies, while Africa continues to capture only 3% of sustainable investment flows [61].

In Kenya, the transition toward a green economy is supported by a robust legal framework, including the Green Building Code (2022) and the Climate Change Green and Resilient Buildings Regulations 2023, which aim to establish a specialized unit to oversee green building certification and rating systems[14] Furthermore, the Finance Act 2023 has introduced incentives such as zero-rated import duty and the removal of VAT on renewable energy components to de-risk green adoption for developers [47].

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However, a significant "implementation gap" exists. Recent empirical evidence [42] indicates that GCF uptake in Kenya is extremely low, averaging only 1.06% of projects among architects and developers. Based on that study, while 98% of developers express a willingness to recommend GCF, the actual adoption is stifled by high investment costs and a lack of domestic capital. This study seeks to bridge this gap by establishing a measurement model that evaluates the determinants of GCF adoption and addresses the systemic "barrier bundles" that characterize the Kenyan construction landscape.

1 Literature review

1.1 Concept of green finance

The discourse on green financing is presently vigorous. 'Financing green' and 'greening finance' are two more terminology now employed to describe this concept. The former pertains to the funding of initiatives that either contribute to or aim to enhance the conservation, restoration, and sustainable utilization of biodiversity and its services for humanity [57]. Simultaneously, 'greening finance' aims to redirect financial resources from projects detrimental to biodiversity and ecosystems into initiatives that either reduce adverse effects or achieve positive environmental outcomes as an ancillary benefit. These principles are interrelated and facilitate a response to the climate challenge by offering a chance for enhanced coherence and depth in endeavors to restore ecosystems [15].

A precise and universally accepted definition of green finance does not exist. Most papers on the issue either fail to provide a definition or present significantly divergent definitions [38], Hohn et al. (2022) [22] define green finance as a comprehensive phrase encompassing financial investments aimed at sustainable development initiatives, projects, goods, and policies. Zadek and Flynn (2014) [77] contended that green finance and green investment are interchangeable terms, albeit the former encompasses a broader range, including operating expenses related to green investments. In the banking sector, green finance refers to financial products and services that incorporate environmental considerations in lending decisions, post-implementation monitoring, and risk management, aimed at promoting environmentally responsible investments and supporting low-carbon technologies, industries, projects, and enterprises [59]. Green finance refers to financial activities that foster improved environmental and sustainable results through the utilization of diverse financial instruments, including loans, debt structures, and varied investments [37]. Green financing refers to an investment or loan that supports environmentally beneficial activities, like the acquisition of sustainable products and services or the development of green infrastructure [33, 66].

Green finance can be delineated into three components: (i) the funding of private and public green investments, (ii) the financing of public policies that promote the execution of environmentally sustainable projects and initiatives, and (iii) elements of the financial system that specifically address green investments, encompassing their distinct legal, economic, and institutional frameworks.

1.2 Green construction project financing

Notwithstanding the favorable reports on green buildings, the construction research community has yet to comprehensively design, examine, and advocate for optimal financing methods that correspond with this revolutionary building paradigm [5]. The authors contend that green construction continues to rely on conventional project financing models, which are misaligned with the fundamental principles of green building, alongside various legislative and practical constraints [4]. Moreover, the green building model is still in its developmental stages in vast parts globally, and research on it remains limited, including the suitable financing models such as green finance tailored for green buildings [75].

1.2.1 Global perspective

Persefoni (2024) [49] reports that from 2012 to 2021, worldwide green financing increased over 100 times, rising from $ 5.4 billion to $ 540 billion. This expansion is somewhat ascribed to the increasing acknowledgment of several environmental concerns, particularly the climate catastrophe. Both foreign and domestic private capital is progressively being directed towards green development worldwide. Between 2017 and 2021, green loan finance experienced a twentyfold increase, rising from approximately $ 10 billion to a peak of $ 230 billion [70]. Green bonds constituted approximately 70 percent of that financing; Yet, certain developing debt instruments, like green sustainability bonds and loans, have been witnessing more rapid growth [27].

Equity instruments are rarely utilized, while Real Estate Investment Trusts (REITs) provide the capacity to enhance the financing of sustainable construction and operations [23]. Innovative green finance instruments, such carbon retirement portfolios and transition bonds, are almost absent in developing nations [69]. These countries are mostly excluded from the increasing influx of private green finance for sustainable construction initiatives. Since 2017, they have accounted for merely 10 percent of the overall global green debt finance [74]. Nonetheless, optimism persists. As per IFC (2022), private green financial financing for sustainable building is expanding rapidly in Sub-Saharan Africa, albeit remaining significantly low [26].

In 2021, over 90 percent of global green construction financing was allocated to green buildings, rather than to "hard-to-abate" construction materials like cement and steel, which contribute roughly 19 percent of world carbon emissions [73]. The World Economic Forum (2022a) reports that 54 percent of the total private green debt financing for green buildings in poor nations was allocated to the Caribbean and Latin America, followed by the Pacific and East Asia at 19 percent, and Central Asia and Europe at 12 percent. The Middle East, South Asia, North Africa, and Sub-Saharan Africa collectively accounted for merely 15 percent [28]. In Sub-Saharan Africa, South Africa constitutes around 75 percent of this funding [72].

In 2021, investment for green construction projects reached a record $27 billion worldwide, with 70 percent allocated to the decarbonization of construction materials. Steel and cement each accounted for around 50 percent of the total green finance allocated for construction materials, with the proportion of steel increasing more swiftly since 2019 [72] Green loans are the predominant vehicles for funding the decarbonization of construction materials, accounting for around 86 percent of overall financing; yet, green bond issuance surged seven-fold from 2019 to 2021. 208 [73].

1.2.2 Kenyan perspective

The development of Kenya's green construction market has advanced consistently. In 2020, the certified green building sector constituted 3 percent of new constructions [25]). Most of these certified buildings were offices and high-income housing. As of 2020, there were several Real Estate Investment Trusts (REITs), but the market did not record any green building construction loans or mortgage products. Though the government has a green economy strategy, the implementation and impact of these green building targets on market development are yet to be seen [25].

In Kenya, sources of green funding predominantly consist of external grants and loans from international public organizations; yet, the national government allocates billions of shillings from its revenue to climate and green-related initiatives [65]. Analysis of national budget data indicates that for the fiscal years 2017-2018 and 2019-2020, the government allocated KShs 414.23 billion and KShs 427.24 billion, respectively, to climate change sectors. On average, 40% of these funds were sourced domestically, while 60% originated from outside sources. Of these monies, the actual investment in green initiatives amounted to KShs 103 billion in 2017-2018 and KShs 120 billion in 2018-2019. The magnitude of private sector contributions to green finance remains uncertain; it is tentatively expected to average KShs 100 billion per year. Of this investment, it is projected that KShs 30 billion is derived from domestic sources and KShs 70 billion from international organizations.

Acorn Holding Limited was the inaugural private entity to capitalize on the green bond issuance in 2019, successfully raising KShs. 4.3 billion ($ 40.5 million) to establish affordable, eco-friendly student accommodations [45]. The Qwetu Hostels are constructed with climate-resilient designs, are environmentally sustainable and resource-efficient, and comply with EDGE standards.

The IFC, in partnership with International Housing Solutions (IHS), created the IHS Green Housing Fund to offer financial assistance to investors in green affordable housing [45]. The residences must comply with the IFC's EDGE requirements, which promote the efficient utilization of energy, water, and building materials. The fund aims to invest in 5,000 freshly constructed, eco-friendly, affordable dwellings, first concentrating on Nairobi County and other designated counties in Kenya.

1.2.3 Challenges facing GCF

The insufficient amounts of international and domestic private capital for green construction in developing nations may be partially attributed to market failures within the green finance and construction value chains [70]. These problems are frequently more pronounced and pervasive in low-income nations. The fragmented nature of the construction industry, informational disparities between industry segments and policymakers, highly localized regulations, and the dominance of small and medium-sized construction firms impede financing for green construction[69]. Financial decisions predominantly entail various stakeholders, including developers, owners, investors, construction specialists, and materials producers, each having divergent interests. Moreover, without green laws, regulations, and standards, investors encounter challenges in recognizing investment prospects in green construction [68]. Small and medium-sized developers, especially in economies marked by significant informality, encounter financial limitations for sustainable development. The deficiency of proficient labor in green construction methodologies further limits investment opportunities in this sector [72].

Green construction alternatives may seem disproportionately costly since existing market prices do not account for the social costs associated with emissions from traditional construction processes and materials, consequently diminishing anticipated profits for green construction projects [71]. Consumers and investors may be reluctant or unable to pay an initial extra cost of 1 to 5 percent for green buildings compared to traditional ones, especially in affordable housing intended for lower income households. This is even more challenging in low-income countries that have a few commercially viable green construction investments [74].

The absence of extensive data regarding default rates and the financial advantages of green construction investment portfolios contributes to diminished investment in green construction [68]. Financial markets frequently undervalue climate risk, encompassing economic losses attributable to climate disasters [63]. Residential property valuations often neglect the dangers associated with extreme climatic events, even when such information is publicly available[67]. This elevates the capital expenditures for green buildings compared to conventional options. This issue may be exacerbated in developing nations that are geographically vulnerable to recurrent catastrophic events and lack robust financial and insurance markets [72].

Private investors may face substantial expenses related to assessing and tracking environmental performance in green construction initiatives, particularly for "hard-to-abate" materials like cement and steel [27]. In underdeveloped nations, these costs are typically elevated due to diminished transparency, insufficient governance and disclosure standards, lax regulations, and inadequate technical capabilities for the issuance and regulation of green financial instruments [24]. Developing nations may encounter limitations in supplies. In these areas, the availability of feasible green construction projects for financing is frequently restricted [29]. This may be due to a deficiency in innovation, insufficient economies of scale, restricted green technical capabilities for execution, and limited availability of concessional financial resources [30]. Regulatory, currency, macroeconomic, and political risks, together with volatility, can elevate costs, hence diminishing the profitability of green construction investments [60].

1.3 Determinants of green construction project finance adoption

The adoption of Green Construction Finance (GCF) is influenced by a multi-dimensional array of factors that range from individual stakeholder awareness to systemic institutional frameworks. Based on the literature review, these determinants are categorized into eight key domains:

Extent of Awareness, awareness serves as a critical cognitive driver for adoption [11]. While general awareness of green building exists, many developers and construction firms—particularly smaller players—lack a detailed understanding of available green finance products, eligibility criteria, and specialized application processes [55].

Availability and accessibility, even when green finance products exist, their practical uptake is often hindered by accessibility barriers. These include complex application processes, high transaction costs, and strict eligibility requirements that may exclude smaller developers [18]. Furthermore, the limited geographical reach of green finance providers remains a significant constraint [16].

Institutional and regulatory factors, the regulatory environment provides the structural foundation for GCF. Supportive policies such as green building codes, tax incentives, and green procurement regulations are essential to encourage adoption [1]. However, gaps in institutional capacity and poor coordination among government agencies, such as the Central Bank and Ministries of Environment and Housing, can impede the effective implementation of these policies [39].

Financial and cost-related factors, high initial capital costs remain a primary barrier, as green construction typically requires a larger upfront investment compared to traditional methods [19]. This is often exacerbated by "split incentives," where the developer bears the high initial cost while the long-term benefits (e.g., lower utility bills) accrue to the tenant, creating a financial disincentive for the project owner [16].

Environmental factors, environmental concerns and sustainability awareness act as motivating drivers. Key indicators include a project's commitment to pollution prevention, resource efficiency (energy and water), material reuse, and safe waste disposal methods [12]. These factors are often driven by global climate change urgency and national environmental regulations [35].

Technological and technical factors, the availability of technological innovations, such as on-site renewable energy and digital tools (e.g., BIM), improves project feasibility and reduces implementation risks [58]. However, the lack of a standardized knowledge database and a shortage of skilled human resources can weaken the positive impact of technical readiness [63].

Risk-related factors, perceptions of risk—including financial, operational, and regulatory uncertainties—permeate all decision-making processes [12]. Developers often cite economic variability, potential technology failures, and supply chain vulnerabilities as major deterrents. Risk mitigation instruments, such as loan guarantees, are critical to bolstering financier and developer confidence[32].

Social and cultural factors, adoption is also influenced by market demand, social legitimacy, and peer influence within the industry [52]. Building trust and demonstrating the broader social benefits of green buildings (e.g., occupant well-being) are essential for fostering a cultural shift toward sustainable construction practices [53].

2 Methodology

2.1 Research design

This study employed a survey research design. This involves the gathering of quantitative data from multiple cases at a particular time point, concerning two or more variables, which are subsequently analyzed to identify patterns of association and other relationships[9]. Upon identifying the target demographic, a suitable sample was selected for data collection. After determining the level of GCF adoption and its drivers from the sample, a generalization was drawn for the overall population.

2.2 Target population and sampling procedures

The study targeted registered property developers in Kenya, who constituted the unit of analysis. Developers were selected because they serve as primary decision-makers and implementers of construction projects, positioning them as key demand-side actors in GCF. According to the Kenya Property Developers Association (KPDA) (2025) [36] online register, 69 developers were registered as of 12 March 2025 [36]. Given this relatively small population, the study adopted a census approach, distributing questionnaires to all 69 firms. A total of 55 responses were received, yielding a response rate of 79.7%, which was considered adequate for analysis. Although some missing values in responses were observed, their impact was minimal. Of the 68 questions, 62 had complete responses ($n=55$), three had one missing value ($n=54$), and another three had two missing values ($n=53$). Consequently, no imputation or corrective measures were undertaken.

2.3 Data collection

Data was collected using questionnaires administered to registered property developers in June 2025. The questionnaire was divided into two parts. The first part requested demographic data regarding the years of existence and the total number of projects undertaken by participating firms. The second part measured the following determinants of green construction uptake: Extent of awareness, availability and accessibility, institutional and regulatory related factors, financial and cost-related factors, environmental-related factors, technological and technical-related factors, risk-related factors, as well as social and cultural-related factors. A total of 68 indicators were used to measure the eight determinants based on the following 7-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Somewhat Disagree, 4= Neutral, 5= Somewhat Agree, 6= Agree, and 7 = Strongly Agree. Based on the provided scale, the developers were requested to indicate their level of agreement with a series of statements.

2.4 Data analysis

The Partial Least Squares Structural Equation Modelling (PLS-SEM) method was selected as the analytical tool for the inferential statistics. This choice was well-justified given the nature of the research, which aims to investigate a complex model with multiple constructs and indicator variables. PLS-SEM is a component-based approach that is particularly suitable for exploratory research where the theoretical framework is still developing or is based on an underdeveloped theory[17]. Unlikecovariance-based SEM (CB-SEM), PLS-SEM is a predictive causal approach that prioritizes prediction over model fit[13]. The adoption of PLS-SEM was adopted because the issue of green construction finance is relatively new, and not much has been written about its determinants and interrelationships. A key advantage of PLS-SEM is its robustness to data that does not conform to normal distribution assumptions and its ability to provide reliable results even with small sample sizes [6]. The study adopted ADANCO software, which uses a consistent PLS-SEM algorithm according to-Henseler (2016). The algorithm computes measurement and structural relationships separately and iteratively, a process that is well-suited for the complexity of the research model under consideration [41].

2.5 Ethical considerations

First, a letter of introduction was obtained from the Jomo Kenyatta University of Agriculture and Technology (JKUAT). The researcher then obtained a research permit from the National Commission for Science, Technology & Innovation (NACOSTI). These two documents were used by the researcher and research assistants for identification purposes. The study participants were informed that their participation in the study was voluntary, anonymous, and confidential, and that non-participation would not affect them in any way. Furthermore, they were informed that even when they consented to participate, they were free to withdraw their participation at any time during the study without any consequences. All aspects of the research were explained to the participants. Further, the information obtained during this research was treated with confidentiality. To help achieve anonymity of the data gathered during the survey, personal data such as names was omitted from the data collection instruments.

3 Findings and discussion

3.1 Developers' profile

3.1.1 Professional Experience

To evaluate the duration of developer firms in Kenya's construction sector, respondents were requested to provide the operational period of their firms. Figure 1 displays the results. Significantly, the sample had no enterprises with fewer than 11 years of operational experience. This is due to the absence of recorded replies in both the 1-5 years and 6-10 years groups. As a result, all participating firms possessed more than ten years of expertise in the Kenyan construction sector. The experience profile of the sample is predominantly biased towards long-established development organizations. Sixty-seven point three percent of the enterprises have been in operation for over 15 years, while thirty-two point seven percent have exceeded 25 years in the industry. This distribution signifies a seasoned respondent demographic with considerable experience in market cycles, regulatory environments, and established business practices.

Older firms are more inclined to possess substantial institutional knowledge, strong financial resources, and the ability to assimilate new innovations, including the adoption of GCF[76,78] Their comments are anticipated to demonstrate substantial operational and sectoral understanding. Although stability can promote investment in green initiatives, established firms may adhere to conventional financing and construction methods, potentially demonstrating reluctance to adopt innovative mechanisms unless motivated or coerced by market or regulatory changes[31,48].

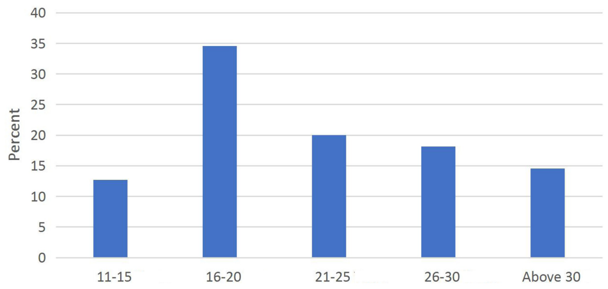

Figure 1 Developer firms' professional experience

The lack of organizations founded in the past decade indicates that the dataset fails to encompass the viewpoints or obstacles specific to newer, potentially more agile or creative enterprises.Zuo et al. (2012) [7] propose that such enterprises may exhibit enhanced flexibility and a propensity to experiment with novel financial instruments, and their removal could restrict the generalizability of findings across the whole industry. Since established firms frequently serve as industry leaders and trendsetters, their endorsement is essential for the widespread adoption of green finance techniques. Nonetheless, strategies designed to promote GCF adoption must also account for the requirements and possible contributions of new enterprises, which are absent from this sample.

Prior studies highlight the benefits and obstacles related to organizational maturity in the implementation of novel industry practices.Osei-Kyei et al. (2018) discovered that established enterprises typically possess superior resource capacity and are more adept at executing sustainable innovations. Yin et al. (2018) indicated that larger and older enterprises exhibit more receptivity to green finance; yet, inertia within established practices may hinder swift transformation. Zuo et al. (2012) noted that nascent and younger enterprises disproportionately drive innovation adoption and industry transformation owing to their receptiveness to novel concepts.

3.1.2 Number of green financed construction projects

A significant majority of developers have not utilized green finance instruments for any of their projects. Figure 2 indicates that 83.6% (n= 46) of developers had not engaged in any green-financed initiatives, while 10.9% (n= 6) had finished one project and 3.6% (n= 2) had completed two projects. Merely 1.8% (n= 1) had engaged in three green-financed projects throughout that period. Consequently, the respondents completed 13 green-financed building projects over the past five years. Figure 3 illustrates that the proportion of green-financed buildings among the total projects executed by developers (n= 1,265) is 1.03%.

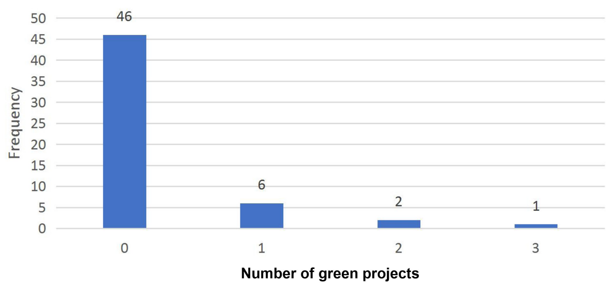

Figure 2 Total Number of green-financed projects undertaken by developers

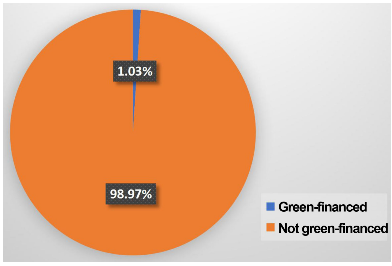

Figure 3 Proportion of green financed building projects undertaken by developers

The GCF adoption rate of 1.03% signifies that the utilization of green financial instruments in construction projects in Kenya is exceedingly restricted, with the overwhelming majority of developers and architects lacking direct expertise. This discovery aligns with overarching patterns in Kenya and several emerging nations, where the green financing ecosystem, particularly within the real estate sector, is nascent and underdeveloped. The findings indicate a nascent green finance ecosystem inside Kenya's building sector. As per Afriwise (2025) [3] Kenya is in the nascent phase of green finance implementation in construction, with pilot bonds and specialized banking products having only recently emerged in the market. Prior research [45] indicates that, despite heightened policy focus and the development of instruments like green bonds and green mortgages, actual market penetration remains constrained. Numerous studies have revealed significant obstacles to this restricted adoption. Initially, there exists a paucity of awareness and knowledge. Darko et al. (2017) assert that developers in the majority of African and developing market environments possess inadequate understanding regarding the availability, prerequisites, and advantages of green financial products. Secondly, there exists perceived complexity alongside uncertain returns. [7] assert that green finance alternatives are often regarded as intricate, with ambiguous short-term financial advantages, resulting in risk aversion among developers. The third obstacle is an inadequately developed product market. Until recently, Kenya had a limited number of green bonds issued and few prominent financial institutions actively advocating for green loans aimed at property development. Ngare (2025) [43] asserts that the challenge of securing substantial access to green financing arises from various obstacles, including intricate legal frameworks, restricted availability of different financial instruments, and insufficient capacity to create viable investment projects.

Though the early adopters of GCF are rare, they're significant, and their experiences may help drive broader market acceptance. The presence of even a few green-financed projects indicates that market structures, however limited, do exist and can be leveraged with further support. Early adopters can showcase feasibility and help reduce perceived risk among peer firms, supporting the "demonstration effect" described in adoption literature. To enhance uptake, concerted efforts are needed to address informational, financial, and regulatory barriers.

3.1.3 Likelihood of recommending adoption of GCF to other developers

Developers were requested to evaluate the likelihood of recommending green finance solutions to peers in the construction sector using a 7-point Likert scale ranging from "extremely unlikely" to "extremely likely." Contrary to the findings regarding GCF uptake, the replies indicated a predominantly favorable attitude towards endorsing green financing. Only one respondent (1.8%) indicated neutrality, while the remaining respondents (98.2%) selected options ranging from likely to extremely likely, as illustrated in Figure 4.

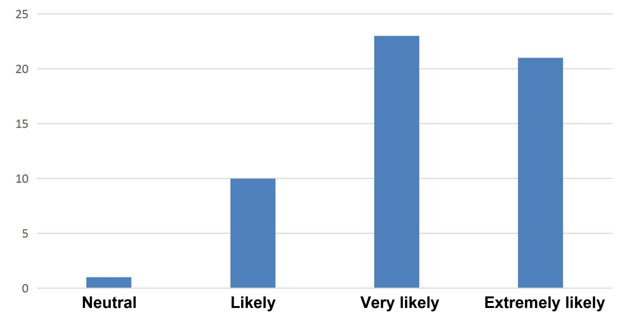

Figure 4 Likelihood of recommending adoption of GCF

Approximately 98% of developers expressed a favorable disposition ("likely," "very likely," or "extremely likely") toward endorsing green financing options, indicating robust confidence and contentment among participants in green finance initiatives. This enthusiasm indicates a responsive and optimistic stakeholder base that may be utilized to expedite the implementation of green finance solutions in Kenya's building sector. The propensity to recommend is essential for fostering peer influence and the broader dissemination of innovative financial solutions [51]. Developers who advocate for green financing can enhance demand among industry participants, financial institutions, and investors, thereby broadening the green finance ecosystem. This corresponds with findings from emerging market research, which emphasize the significance of word-of-mouth and peer recommendations in surmounting initial market inertia in green building finance [10].

The positive developer attitude corresponds with Kenya's growing institutional support for green finance. Initiatives such as the IFC's Green Housing Fund, Kenya's Green Bond programme, and the Guarantee Facility under the Environment Facility (EEF) provide critical technical assistance, credit enhancement, and risk mitigation that increase developer confidence [34,46]. Although the actual uptake remains very low, as demonstrated in this study, the strong positive recommendation sentiment signals that where green finance is experienced, it is valued, making education, capacity building, and risk-sharing mechanisms crucial to broaden access.

3.2 Confirmatory factor analysis results

Since research on Green Construction Finance (GCF) is relatively new, the current study aimed to investigate potential relationships among all the variables. This was achieved through a measurement model (Figure 5) executed via the Confirmatory Factor Analysis (CFA) function in ADANCO software. The measurement model comprises nine latent constructs, all interacting with each other as dependent (endogenous) and independent (exogenous) variables. The operationalization of these constructs and their associated indicators is detailed in Table 1.

Table 1 Construct operationalization

Code	Construct	Indicators	Indicators (Measured attributes)
EA	Extent of Awareness of GCF	7	EA1, EA2, EA3, EA4, EA5, EA6, EA7
AA	Availability and Accessibility of GCF	6	AA1, AA2, AA3, AA4, AA5, AA6
IRF	Institutional and Regulatory Factors	9	IRF1, IRF2, IRF3, IRF4, IRF5, IRF6, IRF7, IRF8, IRF9
FCF	Financial and cost-related Factors	7	FCF1, FCF2, FCF3, FCF4, FCF5, FCF6, FCF7
EF	Environmental Factors	9	EF1, EF2, EF3, EF4, EF5, EF6, EF7, EF8, EF9
TTF	Technological and Technical Factors	10	TTF1, TTF2, TTF3, TTF4, TTF5, TTF6, TTF7, TTF8, TTF9, TTF10
RF	Risk Factors	11	RF1, RF2, RF3, RF4, RF5, RF6, RF7, RF8, RF9, RF10, RF11
SCF	Social and Cultural Factors	9	SCF1, SCF2, SCF3, SCF4, SCF5, SCF6, SCF7, SCF8, SCF9
GCF	Adoption of GCF	1	GCF

3.2.1 Goodness of model fit

The ADANCO output provides the Standardized Root Mean Square Residual (SRMR) as the key indicator of model fit. The SRMR measures the average discrepancy between the observed and the model-implied correlation matrices, whereby a lower value indicates a better fit [8] The measurement model achieved an SRMR (Standardized Root Mean Squared Residual) of 0.0867 (Table 2), which is below the specified threshold of 0.1 [6,13,21], indicating an acceptable model fit, suggesting the model adequately reproduces the observed data relationships. The second SRMR value was for the modified measurement model after the three problematic indicators (those with low factor loadings) were removed.

Table 2 Goodness of model fit (saturated model)

Index	Initial model	Modified model	Threshold
SRMR	0.0867	0.0850	⩽0.1

Since the SRMR value falls within the acceptable range, it provides initial evidence that the model adequately represents the empirical data. This suggests that the measurement model is a valid representation of the relationships among the constructs and their indicators.

3.2.2 Construct reliability and internal consistency

Construct reliability evaluates the internal consistency of the indicators measuring each latent variable. Three metrics were used to measure the construct reliability. These are: Dijkstra-Henselers rho, Joreskog's rho (also known as composite reliability), and Cronbach's alpha. While a general threshold of > 0.70 is recommended for all three, values between 0.60 and 0.70 are considered acceptable in exploratory research, and those exceeding 0.95 suggest multicollinearity or indicator redundancy [13,17]. As seen on Table 3, all the values were within the acceptable limits, indicating very good internal consistency. The only exception was for the GCF adoption variable, which had a value of 1.0 because it was only measured using a single indicator.

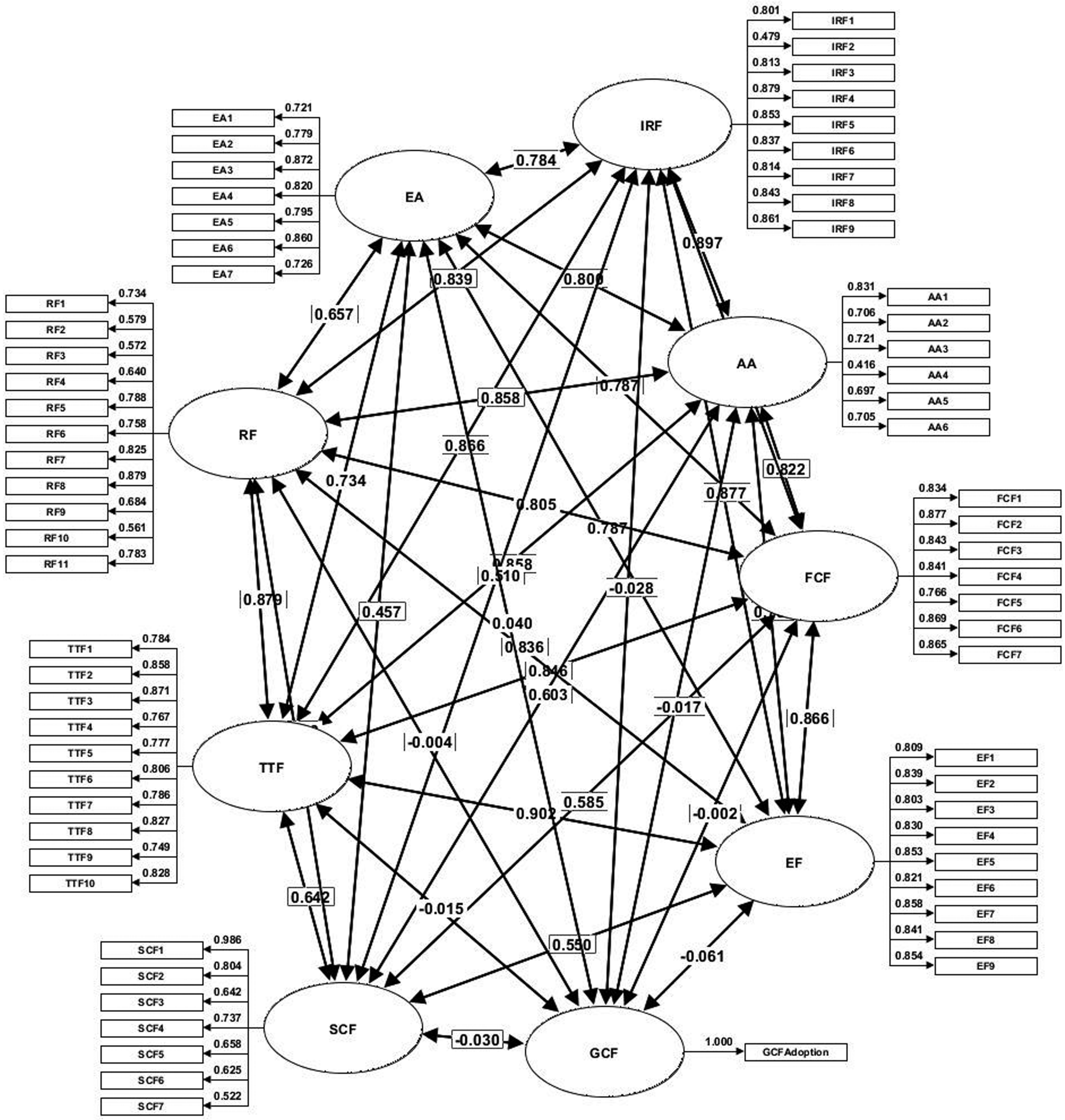

Figure 5 Graphical representation of the modified measurement model (CFA output)

Table 3 Construct reliability

Construct	Dijkstra-Henseler's rho (ρ_A)	Jöreskog's rho (ρ_c)	Cronbach's alpha(α)
Extent of awareness of GCF	0.9270	0.9243	0.9251
Availability and accessibility of GCF	0.8582	0.8414	0.8439
Institutional and regulatory factors	0.9490	0.9424	0.9393
Financial and cost-related factors	0.9457	0.9449	0.9451
Environmental factors	0.9540	0.9538	0.9538
Technological and technical factors	0.9497	0.9488	0.9486
Risk factors	0.9273	0.9194	0.9203
Social and cultural factors	0.8975	0.8414	0.8453
Adoption of GCF	1.0000	1.0000	—

3.2.3 Indicator reliability and factor loadings

Indicator reliability assesses the extent to which a construct explains the variance of its individual indicators. This is determined by the outer loadings, with a preferred threshold of > 0.70 [54]. Loadings between 0.40 and 0.70 may be acceptable in some cases, provided their removal does not negatively impact other validity metrics [20,50]. Indicators with loadings below 0.40 should be removed (Hair et al., 2022). The results of the factor loadings (Appendix Ⅰ) revealed significant issues with several constructs. In availability and accessibility (AA), indicator AA4 has a loading of 0.4159, falling below the ideal 0.70 threshold. Among the institutional and regulatory factors (IRF), indicator IRF2 has a low loading of 0.4807. Among the risk factors (RF), indicators RF2 (0.5812), RF3 (0.5741), RF4 (0.6376), and RF10 (0.5638) all fail to meet the 0.70 threshold. Lastly, it is important to point out that social and cultural factors (SCF) were the most problematic, with a majority of the indicators failing to meet the threshold. SCF3 (0.6334), SCF5 (0.6487), SCF6 (0.6174), SCF7 (0.5160), SCF8 (0.3133), and SCF9 (0.0918) all have inadequate loadings, with the last two being extremely poor and falling well below the 0.40 threshold for removal. The two indicators were removed from the model accordingly. Figure 5 thus presents the modified measurement model, while the initial model is presented in Appendix Ⅱ. The factor loadings for the modified measurement model are presented in Appendix Ⅳ.

3.2.4 Convergent validity

Convergent validity ensures that a construct is effectively capturing the variance of its indicators [21]. This was assessed using the Average Variance Extracted (AVE), with a recommended threshold of>0.50 [41,44] An AVE value above this threshold signifies that the construct explains more than 50% of the variance of its indicators [17]. As shown in Table 4, all the AVE values were> 0.5, except for availability and accessibility (AA= 0.4777) and social and cultural factors (SCF= 0.4088), indicating acceptable convergent validity with some weaknesses. These findings are a direct consequence of the low indicator loadings identified in the previous section. The poor performance of the individual indicators for AA and SCF collectively pulls down the AVE for their respective constructs. Once the two problematic indicators were deleted, all the AVE values were more than 0.5, as shown in the added column in Table 4, indicating that convergent validity had been achieved.

Table 4 Convergent validity

Code	Construct	AVE (Initial model)	AVE (Modified model)
EA	Extent of awareness of GCF	0.6368	0.6369
AA	Availability and accessibility of GCF	0.4777	0.5142
IRF	Institutional and regulatory factors	0.6498	0.6499
FCF	Financial and cost-related factors	0.7104	0.7104
EF	Environmental factors	0.6963	0.6963
TTF	Technological and technical factors	0.6498	0.6498
RF	Risk factors	0.5143	0.5139
SCF	Social and cultural factors	0.4088	0.5240
GCF	Adoption of GCF	1.0000	1.0000

3.2.5 Discriminant validity

Discriminant validity ensures that a construct is conceptually distinct from other constructs in the model [20]. This was evaluated using two key criteria: The Heterotrait-Monotrait Ratio (HTMT) and the Fornell-Larcker criterion. Based on the HTMT criterion, the HTMT values should be below the conservative threshold of 0.85, or below 0.90 for conceptually similar constructs[21]. As seen in Table 5, the HTMT correlation values between IRF and FCF (0.9092), EF and TTF (0.9013), IRF and TTF (0.8698), and AA and IRF (0.8902) exceeded the recommended thresholds, indicating a lack of discriminant validity between these pairs of constructs.

Table 5 Discriminant validity: Heterotrait-monotrait ratio of correlations (HTMT)

Construct	EA	AA	IRF	FCF	EF	TTF	RF	SCF	GCF
EA	—	—	—	—	—	—	—	—	—
AA	0.7718	—	—	—	—	—	—	—	—
IRF	0.7821	0.8902	—	—	—	—	—	—	—
FCF	0.7831	0.8038	0.9092	—	—	—	—	—	—
EF	0.7855	0.7788	0.8787	0.8654	—	—	—	—	—
TTF	0.7281	0.8527	0.8698	0.8446	0.9013	—	—	—	—
RF	0.6431	0.8460	0.8363	0.7966	0.8269	0.8717	—	—	—
SCF	0.4108	0.6256	0.4807	0.5413	0.5430	0.6173	0.7223	—	—
GCF	0.0433	0.0255	0.0313	0.0000	0.0617	0.0156	0.0062	0.0747	—

According to the Fornell-Larcker criterion, the square root of a construct's AVE (its diagonal value in the table) must be greater than its correlation with all other constructs in the row and column[41]. As presented in Table 6, the AVE for AA (0.4777) is lower than its correlations with IRF (0.8044), FCF (0.6764), EF (0.6208), TTF (0.7359), and RF (0.7365). Also, the AVE for IRF (0.6498) is lower than its correlation with FCF (0.8327). Lastly, the AVE for FCF (0.7104) is lower than its correlation with IRF (0.8327).

Table 6 Discriminant validity: Fornell-larcker criterion

Construct	EA	AA	IRF	FCF	EF	TTF	RF	SCF	GCF
EA	0.6368	—	—	—	—	—	—	—	—
AA	0.6402	0.4777	—	—	—	—	—	—	—
IRF	0.6140	0.8044	0.6498	—	—	—	—	—	—
FCF	0.6188	0.6764	0.8327	0.7104	—	—	—	—	—
EF	0.6194	0.6208	0.7686	0.7504	0.6963	—	—	—	—
TTF	0.5390	0.7359	0.7504	0.7150	0.8141	0.6498	—	—	—
RF	0.4308	0.7365	0.7033	0.6484	0.6987	0.7717	0.5143	—	—
SCF	0.2082	0.3848	0.2625	0.3407	0.3141	0.4186	0.5193	0.4088	—
GCF	0.0016	0.0003	0.0008	0.0000	0.0037	0.0002	0.0000	0.0021	1.0000

The failure of both discriminant validity tests suggests a fundamental conceptual problem. The respondents likely do not perceive these factors (institutional/regulatory, financial, environmental, and risk) as distinct concepts. This is not just a statistical issue; it reflects the real-world complexity of a nascent market. In such an environment, an underdeveloped institutional framework (IRF) directly translates into higher financial costs (FCF) and increased risk perceptions (RF) for potential investors. The lack of conceptual distinction is a reflection of this interconnected reality, where a "barrier bundle" [56] of intertwined challenges exist rather than a set of isolated determinants.

3.2.6 Indicator multicollinearity

Multicollinearity is a statistical phenomenon where two or more predictor variables in a multiple regression model are highly correlated [17]. In reflective measurement models like the one in this study, it is assessed using Variance Inflation Factors (VIFs), with a VIF> 5 being a common threshold for concern, and a VIF> 10 indicating a serious problem [54]. The results presented in Appendix Ⅲ reveal the presence of multicollinearity at the indicator level. Indicators IRF4 (8.8924), IRF5 (6.4703), EF2 (7.5346), EF8 (6.2283), TTF2 (9.0448), TTF3 (10.8928), RF5 (6.1900), and SCF4 (6.2259) were all above 5, though only one indicator had severe multicollinearity exceeding 10. These high VIFs are a direct consequence of the lack of discriminant validity. When constructs are not distinct, their underlying indicators will be highly correlated, leading to inflated VIFs. This compromises the stability and reliability of the regression coefficients in the structural model, making their interpretation unreliable [50]. The collinearity indicates that the model is statistically fragile and that the conceptualization of the determinants as separate variables is problematic in this context.

These multicollinearity findings align with the strong determinants' interrelationships findings from the bivariate correlation analysis and the lack of discriminant validity and multicollinearity among the constructs. This means that respondents do not conceptually differentiate between these factors. The data does not support the idea that these are distinct drivers of GCF adoption. This empirical finding aligns with a significant body of literature on green finance barriers in developing countries. Research has repeatedly identified that obstacles like financial constraints, weak policy structures, and high-risk perceptions do not exist in isolation [2]. Instead, they are part of a larger, interconnected "barrier bundle" that must be addressed systemically [40]. An insufficient institutional framework, for example, makes it challenging to provide clear financial incentives and leads to a higher perception of risk, as earlier shown by the strong correlation between IRF, FCF, and RF in this study's data.

4 Conclusions and recommendations

4.1 Conclusions

The most profound conclusion from the CFA is the complete failure of discriminant validity across both the Fornell-Larcker and Heterotrait-Monotrait (HTMT) criteria. The extremely high correlations (often exceeding 0.90) between constructs such as institutional and regulatory factors (IRF), financial and cost-related factors (FCF), and risk-related factors (RF) indicate that Kenyan developers do not perceive these as distinct, independent drivers of adoption. Instead, they function as a single, interconnected "barrier bundle" where a deficiency in one area (e.g., poor regulation) is indistinguishable from its impact on another (e.g., increased financial risk).

The presence of significant multicollinearity at the indicator level, evidenced by Variance Inflation Factors (VIF) exceeding 5.0 and 10.0 for several items, suggests that the measurement model is statistically fragile. This implies that the current first-order conceptualization of these eight determinants as independent variables is problematic and leads to unreliable path coefficients in the structural model.

The CFA results culminate in an exceptionally low R-squared value for GCF adoption (0.0595), meaning that the eight theorized determinants collectively explain only 6% of the variance in actual uptake. This leads to the conclusion that adoption is currently driven by factors outside the traditional theoretical domains or that the current first-order model is too simplistic to capture the complex, non-linear reality of the Kenyan construction market.

4.2 Recommendations

The study offers the following recommendations for future research and practice.

4.2.1 Recommendations for policy and market strategy

Adoption of a systemic intervention approach, because the CFA proves that determinants are part of an inseparable "barrier bundle," piecemeal policy interventions (e.g., focusing only on awareness or only on tax incentives) are unlikely to succeed, policymakers and financial institutions must adopt a holistic strategy that simultaneously addresses the regulatory, financial, and risk-related components of the bundle to achieve a meaningful shift in adoption.

De-risking through institutional reform, since the model shows that institutional frameworks (IRF) and risk perceptions (RF) are statistically intertwined, strengthening the regulatory environment is identified as the primary lever for lowering perceived financial risk. Streamlining project approval timelines and clarifying green codes should be prioritized as direct "risk-reduction" mechanisms to unlock private capital.

4.2.2 Methodological recommendations for future research

Transition to higher-order constructs, given the lack of discriminant validity, future studies should abandon first-order models that treat determinants as independent.

Instead, researchers should employ second-order (or higher-order) latent constructs that consolidate these overlapping factors into broader, systemic dimensions such as "integrated market barriers" or "systemic institutional drivers".

Development of context-ppecific measurement scales, the CFA indicates that existing indicators (often adapted from developed-market literature) are not effectively distinguishing between constructs in the Kenyan context. There is an urgent need to develop and validate new, context-aware measurement instruments that better reflect the unique sociocultural and economic nuances of the African construction industry.

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

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Appendices

Appendix Ⅰ: Factor loadings (Initial measurement model)

Indicator	EA	AA	IRF	FCF	EF	TTF	RF	SCF	GCF
GCFAdoption	—	—	—	—	—	—	—	—	1.0000
EA1	0.7207	—	—	—	—	—	—	—	—
EA2	0.7786	—	—	—	—	—	—	—	—
EA3	0.8728	—	—	—	—	—	—	—	—
EA4	0.8195	—	—	—	—	—	—	—	—
EA5	0.7951	—	—	—	—	—	—	—	—
EA6	0.8595	—	—	—	—	—	—	—	—
EA7	0.7262	—	—	—	—	—	—	—	—
AA1	—	0.8292	—	—	—	—	—	—	—
AA2	—	0.7062	—	—	—	—	—	—	—
AA3	—	0.7216	—	—	—	—	—	—	—
AA4	—	0.4159	—	—	—	—	—	—	—
AA5	—	0.6976	—	—	—	—	—	—	—
AA6	—	0.7067	—	—	—	—	—	—	—
IRF1	—	—	0.8028	—	—	—	—	—	—
IRF2	—	—	0.4807	—	—	—	—	—	—
IRF3	—	—	0.8121	—	—	—	—	—	—
IRF4	—	—	0.8788	—	—	—	—	—	—
IRF5	—	—	0.8521	—	—	—	—	—	—
IRF6	—	—	0.8374	—	—	—	—	—	—
IRF7	—	—	0.8136	—	—	—	—	—	—
IRF8	—	—	0.8423	—	—	—	—	—	—
IRF9	—	—	0.8613	—	—	—	—	—	—
FCF1	—	—	—	0.8331	—	—	—	—	—

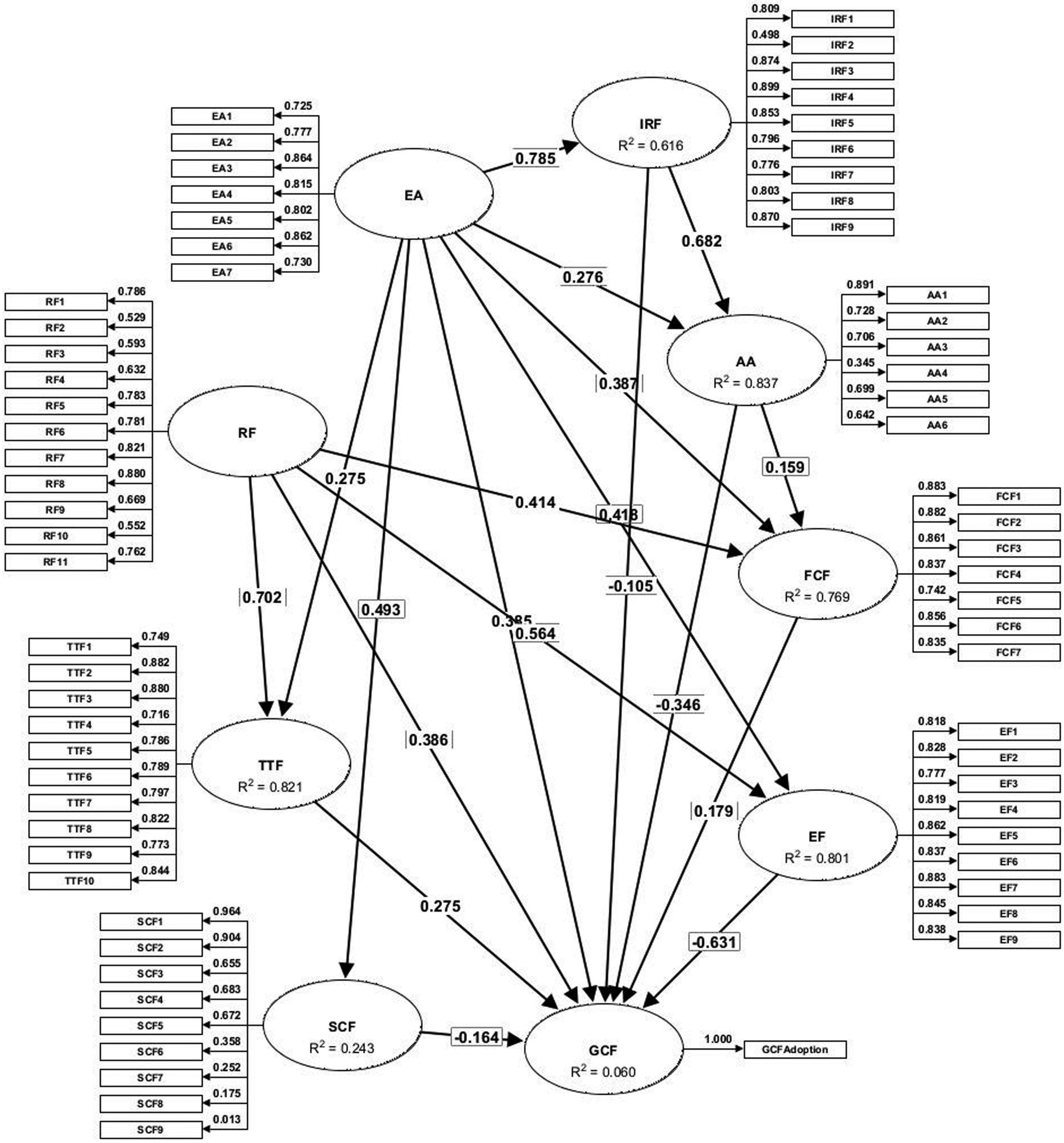
(Continued)

Indicator	EA	AA	IRF	FCF	EF	TTF	RF	SCF	GCF
FCF2	—	—	—	0.8754	—	—	—	—	—
FCF3	—	—	—	0.8447	—	—	—	—	—
FCF4	—	—	—	0.8401	—	—	—	—	—
FCF5	—	—	—	0.7671	—	—	—	—	—
FCF6	—	—	—	0.8690	—	—	—	—	—
FCF7	—	—	—	0.8656	—	—	—	—	—
EF1	—	—	—	—	0.8084	—	—	—	—
EF2	—	—	—	—	0.8378	—	—	—	—
EF3	—	—	—	—	0.8020	—	—	—	—
EF4	—	—	—	—	0.8311	—	—	—	—
EF5	—	—	—	—	0.8535	—	—	—	—
EF6	—	—	—	—	0.8211	—	—	—	—
EF7	—	—	—	—	0.8585	—	—	—	—
EF8	—	—	—	—	0.8419	—	—	—	—
EF9	—	—	—	—	0.8539	—	—	—	—
TTF1	—	—	—	—	—	0.7829	—	—	—
TTF2	—	—	—	—	—	0.8576	—	—	—
TTF3	—	—	—	—	—	0.8712	—	—	—
TTF4	—	—	—	—	—	0.7678	—	—	—
TTF5	—	—	—	—	—	0.7759	—	—	—
TTF6	—	—	—	—	—	0.8054	—	—	—
TTF7	—	—	—	—	—	0.7856	—	—	—
TTF8	—	—	—	—	—	0.8276	—	—	—
TTF9	—	—	—	—	—	0.7494	—	—	—
TTF10	—	—	—	—	—	0.8288	—	—	—
RF1	—	—	—	—	—	—	0.7340	—	—
RF2	—	—	—	—	—	—	0.5812	—	—
RF3	—	—	—	—	—	—	0.5741	—	—
RF4	—	—	—	—	—	—	0.6376	—	—
RF5	—	—	—	—	—	—	0.7844	—	—
RF6	—	—	—	—	—	—	0.7598	—	—
RF7	—	—	—	—	—	—	0.8262	—	—
RF8	—	—	—	—	—	—	0.8792	—	—
RF9	—	—	—	—	—	—	0.6840	—	—
RF10	—	—	—	—	—	—	0.5638	—	—
RF11	—	—	—	—	—	—	0.7817	—	—
SCF1	—	—	—	—	—	—	—	0.9723	—
SCF2	—	—	—	—	—	—	—	0.7930	—
SCF3	—	—	—	—	—	—	—	0.6334	—
SCF4	—	—	—	—	—	—	—	0.7272	—

(Continued)

Indicator	EA	AA	IRF	FCF	EF	TTF	RF	SCF	GCF
SCF5	—	—	—	—	—	—	—	0.6487	—
SCF6	—	—	—	—	—	—	—	0.6174	—
SCF7	—	—	—	—	—	—	—	0.5160	—
SCF8	—	—	—	—	—	—	—	0.3133	—
SCF9	—	—	—	—	—	—	—	0.0918	—

Appendix Ⅱ: Initial structural model



Appendix Ⅲ: Indicator multicollinearity/variance inflation factors (VIF)

Indicator	EA	AA	IRF	FCF	EF	TTF	RF	SCF	GCF
GCFAdoption	—	—	—	—	—	—	—	—	1.0000
EA1	4.6279	—	—	—	—	—	—	—	—
EA2	5.6821	—	—	—	—	—	—	—	—
EA3	3.7815	—	—	—	—	—	—	—	—
EA4	2.4533	—	—	—	—	—	—	—	—
EA5	6.6726	—	—	—	—	—	—	—	—
EA6	7.0089	—	—	—	—	—	—	—	—
EA7	3.7237	—	—	—	—	—	—	—	—
AA1	—	2.5032	—	—	—	—	—	—	—
AA2	—	2.0729	—	—	—	—	—	—	—
AA3	—	2.4302	—	—	—	—	—	—	—
AA4	—	1.6321	—	—	—	—	—	—	—
AA5	—	1.6057	—	—	—	—	—	—	—
AA6	—	2.2245	—	—	—	—	—	—	—
IRF1	—	—	2.8479	—	—	—	—	—	—
IRF2	—	—	1.7054	—	—	—	—	—	—
IRF3	—	—	3.2812	—	—	—	—	—	—
IRF4	—	—	8.8924	—	—	—	—	—	—
IRF5	—	—	6.4703	—	—	—	—	—	—
IRF6	—	—	4.2381	—	—	—	—	—	—
IRF7	—	—	3.7953	—	—	—	—	—	—
IRF8	—	—	4.4108	—	—	—	—	—	—
IRF9	—	—	5.0756	—	—	—	—	—	—
FCF1	—	—	—	4.0866	—	—	—	—	—
FCF2	—	—	—	5.1558	—	—	—	—	—
FCF3	—	—	—	3.2911	—	—	—	—	—
FCF4	—	—	—	5.9357	—	—	—	—	—
FCF5	—	—	—	4.2771	—	—	—	—	—
FCF6	—	—	—	4.6377	—	—	—	—	—
FCF7	—	—	—	1.9738	—	—	—	—	—
EF1	—	—	—	—	4.9952	—	—	—	—
EF2	—	—	—	—	7.5346	—	—	—	—
EF3	—	—	—	—	4.3284	—	—	—	—
EF4	—	—	—	—	3.5527	—	—	—	—
EF5	—	—	—	—	4.9538	—	—	—	—
EF6	—	—	—	—	4.5951	—	—	—	—

(Continued)

Indicator	EA	AA	IRF	FCF	EF	TTF	RF	SCF	GCF
EF7	—	—	—	—	5.3242	—	—	—	—
EF8	—	—	—	—	6.2283	—	—	—	—
EF9	—	—	—	—	5.4041	—	—	—	—
TTF1	—	—	—	—	—	4.8776	—	—	—
TTF2	—	—	—	—	—	9.0448	—	—	—
TTF3	—	—	—	—	—	10.8928	—	—	—
TTF4	—	—	—	—	—	3.5201	—	—	—
TTF5	—	—	—	—	—	5.4301	—	—	—
TTF6	—	—	—	—	—	5.3569	—	—	—
TTF7	—	—	—	—	—	2.4162	—	—	—
TTF8	—	—	—	—	—	4.3221	—	—	—
TTF9	—	—	—	—	—	3.2532	—	—	—
TTF10	—	—	—	—	—	5.3660	—	—	—
RF1	—	—	—	—	—	—	5.1631	—	—
RF2	—	—	—	—	—	—	2.3645	—	—
RF3	—	—	—	—	—	—	3.2422	—	—
RF4	—	—	—	—	—	—	5.3807	—	—
RF5	—	—	—	—	—	—	6.1900	—	—
RF6	—	—	—	—	—	—	6.2314	—	—
RF7	—	—	—	—	—	—	4.2042	—	—
RF8	—	—	—	—	—	—	3.6682	—	—
RF9	—	—	—	—	—	—	2.2365	—	—
RF10	—	—	—	—	—	—	3.0604	—	—
RF11	—	—	—	—	—	—	2.3639	—	—
SCF1	—	—	—	—	—	—	—	1.5408	—
SCF2	—	—	—	—	—	—	—	1.6283	—
SCF3	—	—	—	—	—	—	—	3.9536	—
SCF4	—	—	—	—	—	—	—	6.2259	—
SCF5	—	—	—	—	—	—	—	4.9269	—
SCF6	—	—	—	—	—	—	—	4.3680	—
SCF7	—	—	—	—	—	—	—	4.8926	—
SCF8	—	—	—	—	—	—	—	2.5354	—
SCF9	—	—	—	—	—	—	—	2.1943	—

Appendix Ⅳ: Factor loadings (Modified measurement model)

Indicator	EA	AA	IRF	FCF	EF	TTF	RF	SCF	GCF
GCFAdoption	—	—	—	—	—	—	—	—	1.0000
EA1	0.7213	—	—	—	—	—	—	—	—
EA2	0.7787	—	—	—	—	—	—	—	—
EA3	0.8720	—	—	—	—	—	—	—	—
EA4	0.8196	—	—	—	—	—	—	—	—
EA5	0.7953	—	—	—	—	—	—	—	—
EA6	0.8596	—	—	—	—	—	—	—	—
EA7	0.7260	—	—	—	—	—	—	—	—
AA1	—	0.8309	—	—	—	—	—	—	—
AA2	—	0.7064	—	—	—	—	—	—	—
AA3	—	0.7211	—	—	—	—	—	—	—
AA4	—	0.4157	—	—	—	—	—	—	—
AA5	—	0.6971	—	—	—	—	—	—	—
AA6	—	0.7054	—	—	—	—	—	—	—
IRF1	—	—	0.8015	—	—	—	—	—	—
IRF2	—	—	0.4794	—	—	—	—	—	—
IRF3	—	—	0.8134	—	—	—	—	—	—
IRF4	—	—	0.8787	—	—	—	—	—	—
IRF5	—	—	0.8526	—	—	—	—	—	—
IRF6	—	—	0.8373	—	—	—	—	—	—
IRF7	—	—	0.8136	—	—	—	—	—	—
IRF8	—	—	0.8432	—	—	—	—	—	—
IRF9	—	—	0.8610	—	—	—	—	—	—
FCF1	—	—	—	0.8337	—	—	—	—	—
FCF2	—	—	—	0.8765	—	—	—	—	—
FCF3	—	—	—	0.8432	—	—	—	—	—
FCF4	—	—	—	0.8410	—	—	—	—	—
FCF5	—	—	—	0.7662	—	—	—	—	—
FCF6	—	—	—	0.8693	—	—	—	—	—
FCF7	—	—	—	0.8653	—	—	—	—	—
EF1	—	—	—	—	0.8095	—	—	—	—
EF2	—	—	—	—	0.8391	—	—	—	—
EF3	—	—	—	—	0.8027	—	—	—	—
EF4	—	—	—	—	0.8296	—	—	—	—
EF5	—	—	—	—	0.8533	—	—	—	—
EF6	—	—	—	—	0.8213	—	—	—	—

(Continued)

Indicator	EA	AA	IRF	FCF	EF	TTF	RF	SCF	GCF
EF7	—	—	—	—	0.8576	—	—	—	—
EF8	—	—	—	—	0.8415	—	—	—	—
EF9	—	—	—	—	0.8538	—	—	—	—
TTF1	—	—	—	—	—	0.7840	—	—	—
TTF2	—	—	—	—	—	0.8583	—	—	—
TTF3	—	—	—	—	—	0.8712	—	—	—
TTF4	—	—	—	—	—	0.7669	—	—	—
TTF5	—	—	—	—	—	0.7768	—	—	—
TTF6	—	—	—	—	—	0.8056	—	—	—
TTF7	—	—	—	—	—	0.7856	—	—	—
TTF8	—	—	—	—	—	0.8270	—	—	—
TTF9	—	—	—	—	—	0.7486	—	—	—
TTF10	—	—	—	—	—	0.8284	—	—	—
RF1	—	—	—	—	—	—	0.7336	—	—
RF2	—	—	—	—	—	—	0.5795	—	—
RF3	—	—	—	—	—	—	0.5716	—	—
RF4	—	—	—	—	—	—	0.6399	—	—
RF5	—	—	—	—	—	—	0.7876	—	—
RF6	—	—	—	—	—	—	0.7578	—	—
RF7	—	—	—	—	—	—	0.8254	—	—
RF8	—	—	—	—	—	—	0.8786	—	—
RF9	—	—	—	—	—	—	0.6844	—	—
RF10	—	—	—	—	—	—	0.5606	—	—
RF11	—	—	—	—	—	—	0.7834	—	—
SCF1	—	—	—	—	—	—	—	0.9860	—
SCF2	—	—	—	—	—	—	—	0.8044	—
SCF3	—	—	—	—	—	—	—	0.6415	—
SCF4	—	—	—	—	—	—	—	0.7372	—
SCF5	—	—	—	—	—	—	—	0.6583	—
SCF6	—	—	—	—	—	—	—	0.6247	—
SCF7	—	—	—	—	—	—	—	0.5219	—