Unveiling How Digital Finance Enhances Sustainability-Oriented Organizational Performance: Insight into Mediating Role of Heterogeneous Technological Progress and Green Innovation

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ABSTRACT

This research sets its sight to conceptualize and verify a model that emphasizes relationship between digital finance (DF) and Sustainability-Oriented Organizational Performance (SOP). Outstandingly, it makes many attempts to deepen insight into the mediation mechanisms of Heterogeneous Technological progress (HTP) and Green innovation (GI) in proposed model's postulated constructs. Statistical database was compiled from a paper and pencil survey distributed to a sample of respondents through convenient and snowballing approach. Two-step methodology with SEM was utilized to weigh the measurement and structural models. Results substantiated the markedly positive interconnection between DF and SOP. Its findings and insights learnt from this study would be useful to practitioners looking for sustainable solutions on the route to become innovative businesses. On the other hand, the observations would provide fresh insights to practitioners and policymakers to develop focused strategies in terms of HTP and GI and enact laws and regulations in terms of DF.

1. INTRODUCTION

Due to the increasingly unstable global environment, businesses are being pushed to change their current practices in order to meet sustainability targets. All countries in the global world are placing more emphasis on how well businesses perform in the areas of governance, social responsibility, and the environment. Enterprises must adopt green practices as the guiding principles, technology as the enabler, and innovation as the engine to further the green innovation (GI) driven strategy and advance the greening of traditional industries. Vietnam, a nation in the Asia-Pacific area that is transitioning from a developing to an industrialized nation, must deal with a wide range of environmental challenges and consumption difficulties as a result of its accelerating economic expansion. Given that Vietnam's manufacturing sector has consistently acted as a major engine for the country's highly industrialized economy, it is urgent to keep an eye on how these operations are affecting these companies' overall performance, particularly their environmental performance. Organizations implement a variety of strategies at once to support their main processes with supporting sub-strategies in order to reach their sustainable goals [1]. In order to eliminate this pollution, it is vital to put into effect GI strategies and practices. Innovation is crucial right now since stakeholders and customers are constantly concerned about environmental protection. As a result, established business models must alter, and this

includes a move toward GI in businesses [2].

Small and medium-sized businesses (SMEs) have not been given as much attention in recent studies on organizational sustainability and sustainable resource use [3]. SMEs are interdependent groups operating in a worldwide systemic environment that promotes the use of sustainable development resources, including social, natural, and financial ones. These groups also provide a sizable portion of the environmental effects. Still, businesses, especially those small ones, may find it difficult to implement them. This is a result of small businesses' inability to comprehend green initiatives and their lack of financial resources. However, small businesses must implement GI because they produce around 70% of the industrial pollutants and have little concern for the environment. Additionally, there has been ongoing push from various parties, including the government and industry, to integrate GI practices and principles into corporate operations and create cutting-edge goods and technologies.

Corporate growth is significantly influenced by technological progress [4]. Innovation activities, which are the fundamental driver of technological progress, are more vulnerable to financial constraints than physical capital investments. SMEs in particular are more likely than large businesses to experience financial constraints. Since many SMEs that engage in high-risk innovative initiatives are not compelled to disclose their financial reports, it is more expensive for financial institutions to evaluate their creditworthiness, making information asymmetry a bigger

problem for SMEs. The results of these projects are typically intangible and cannot be utilized as collateral, which is another drawback.

Several research have indicated a positive correlation between improved digital finance (DF) and increased levels of GI [5]. Nevertheless, upon reviewing the available literature, it is evident that there has been a scarcity of research that directly examines the influence of DF on GI [6]. While Jiang et al. [5, 7] conducted empirical studies on the influence of the DF on GI at a micro level, they failed to consider the potential mechanisms and heterogeneity involved.

Moreover, the investigation of the prospective influence of DF on the sustainability centers on the correlation between DF and sectoral performance as well as DF and firm performance. On the facet of sectoral performance enhancement, Ma et al. [8] explored the advancement of China's manufacturing sector and the coordinated development of DF as a facet of sectoral performance enhancement, utilizing a coupling coordination approach. The impact of DF on agricultural green total factor productivity in China was investigated by Shen et al. [9]. Based on the paper's findings, it was evident that DF had a substantial positive influence by alleviating credit constraints. The relationship between energy efficiency and DF was investigated by Wu et al. [10]. It has been observed that areas with higher levels of DF development tend to experience energy efficiency gains. Regarding firm performance, Hossain et al. [11] investigated SME financing models designed to alleviate borrowing constraints. Through the implementation of a data-driven credit risk score methodology, they discovered that DF facilitates sustainable finance by decreasing transaction costs and default risks. Shinozaki [12] evaluated the function of DF within the framework of the Russia-Ukraine conflict on enterprises in Central and West Asia, as a mechanism for shock resilience and sustainability.

While numerous scholarly articles have emphasized the critical role of DF in sustainability, less attention has been paid to the intricacies of how DF can improve and enhance all facets of sustainability-oriented organizational performance (SOP), including environmental, financial, governance, and human performance.

This research aims at establishing a theoretical framework that is comprehensive enough to provide a holistic picture of on the role of DF in supporting SMEs which plan to become innovative businesses to be able to get the high success in their future routes. To do so, this manuscript sets its sight at constructing a theoretical framework to analyze the specific influence of DF on heterogeneous technological progress (HTP) and GI which ultimately enhance SOP. Also, this theoretical gap inspired the intriguing research questions as follows.

RQ1. *How far does DF impact SOP?*

RQ2. *Does HTP act as a mediator in the interlink between DF and SOP?*

RQ3. *Does GI act as a mediator in the interlink between DF and SOP?*

By examining the purpose of the research, which has never been done previously, the study makes a theoretical contribution. In Vietnam, research into the implementation of DF by SME's is still in its infancy. This research endeavor represents a groundbreaking attempt to assess the implementation of DF within SMEs and to pinpoint areas that require further investigation by scholars and practitioners. The prior study found that the extent to which DF contributes to sustainable development in SMEs that aims to establish

innovative firms in developing countries is poorly understood. By utilizing an understudied research approach, this article contributes to a comprehensive comprehension of the way in which DF can be utilized to improve SOP. Additionally, it introduces a novel concept to the field by proposing four dimensions of SOP that assist managers in conducting a more practical analysis of SOP.

This research investigates the mediating role of GI in the connection between SOP and DF. Hu et al. [13] argued that empirical research on the adoption of GIs in developing environments was scarce, despite the fact that numerous studies have found that the expansion of DF fosters corporate innovation. Remarkably, this study builds upon previous research that has focused solely on the adoption of GI practices, neglecting to examine the broader impact of such adoption. Besides, this could be the initial investigation into the manner in which HTP mediates the relationship between SOP and DF. This research elucidated the critical significance of GI and HTP in accelerating the advancement of SOP. Such are the distinctive qualities of this conceptual paradigm for research.

The study's practical contribution is to furnish the government with a reference framework that facilitates the implementation of enterprise digital transformation decisions and the formulation of differentiated policies for the development of DF. Additionally, the research provides practitioners with insights into the operational and organizational tasks that are entailed in the management and planning of GI processes and technological progress.

To achieve the above-mentioned study objectives, The next sections of the current manuscript are planned as follows. In Section 2, the conceptual underpinnings are briefly discussed, and in Section 3, the study's hypotheses are developed. Section 4 explains the study technique and materials in light of these perspectives. The research findings are then elaborated and interpreted in Part 5. The discussion and implications are illuminated in Section 6 while the conclusion and future research directions are discussed in Part 7 to wrap up the manuscript.

2. LITERATURE REVIEW

Agency theory. Agency theory, which serves as the fundamental framework for business practice, originated from economic theory and was initially expounded upon by Ross [14] and subsequently expanded upon by Jensen and Meckling [15]. GI plays a pivotal role in shaping the long-term development of contemporary enterprises and serves as their primary source of competitive advantage; consequently, critical details regarding it are rarely divulged or made public [16]. DF, which is predicated on digital technology, has the capacity to incorporate user information with greater ease than conventional finance. As a result, the information asymmetry between credit parties is diminished [17]. DF facilitates enhanced enterprise transparency, mitigates the information asymmetry between the internal and external environments, and empowers stakeholders to leverage digital benefits for information screening [18]. According to literature [16], stakeholders are more capable of identifying instances of "greenwashing" or environmentally detrimental practices when they have access to exhaustive information concerning the behavior of an enterprise.

Contingency theory. Contingency theory was a set up theory in organizational studies in light of the fact that the theory was deep-rooted in numerous definitions of organizational literature. Under the theorical point of view, it was broadly approved that optimal structure of an entity was contingent upon various determinants namely the features of organizational works, organizational technologies as well as market conditions. The progressing switch of economies, given the mounting embeddedness of digital technologies generally, could be categorized as just such a shift pertaining to technological and markets driven force that impacted on the organizational performance [19]. More concretely, it has resulted in significant alternation on the way of which organizations have procured and generated value, communicated and interplayed with its stakeholders, and simultaneously, shifting procedures and internal constitutions whilst unleashing advanced functionalities, both internal and external organizational borders [20].

Stakeholder theory. Stakeholders are now taken into account in all facets of decision-making, and many strategies have been created and put into practice to engage with them successfully [21]. Stakeholder theory was primarily centered on managerial issues but has since expanded to cover business ethics, strategic management, finance, accounting, marketing, and administration. Secondary stakeholders are becoming more and more empowered in the digital age to openly challenge corporations and politicians to adopt, for example, more sustainable attitudes [22]. A key element of organizational decision-making in areas like corporate strategy, corporate governance, and social and environmental management is the development of trust-based collaboration across a wide range of stakeholders.

Digital finance. According to literature [23], "digital finance" is the practice of Internet companies and financial institutions using digital technology to offer financial services. These platforms include capital financing, payments, and information intermediation. This practice has established an emerging technological model that goes beyond conventional financial operations.

Heterogeneous Technological progress. By enabling more specialized production methods, technological progress encourages the growth of new industries, which improves the social division of labor and raises the added value of products [24]. Building on the viewpoint of [25], neutral technology progress can raise labor and capital efficiency at the same time, spur economic growth, increase overall output, and increase demand for goods and services related to energy. Additionally, labor-saving technological progress boost the share of capital income, direct the transfer of production factors to capital-intensive industries, and aid in the development of those industries, the proportion of capital-intensive industries rises and the proportion of labor-intensive industries declines. In the meanwhile, progress in capital-saving technologies, which favors using less capital, boosts the usage of labor, raises the share of revenue from labor, encourages the growth of labor-intensive industries, and decreases the proportion of capital-intensive ones. The fourth component is energy-saving technological progress. On the one hand, energy-saving technological advancement can increase energy efficiency, which is the ability of technological advancement to produce more output with the same or less energy input. This is known as the "energy-saving effect" and assumes that there is a reliable energy market mechanism. On the other side, a rise in energy efficiency causes a drop in the relative cost of energy consumption and an increase in the relative income of energy goods and services.

Green innovation. According to literature [26], GI is a modern and honorable way for creating new services, procedures, tools, techniques, practices, and systems that add value for organizations and clients while also taking the environment into account. It is a type of innovation that emphasizes long-term environmental sustainability and is essential to accomplishing it [27].

Sustainability-Oriented Organizational Performance. The concept of SOP in this study can be understood as the organizational capacities of using the resources available in an efficient and effective manner to understand the interconnectedness of ecological, social, and economic dimensions of organizational sustainability [28]. This will allow the organization to successfully address ecological, social, and economic issues of an organization across political, temporal, and spatial dimensions, which cannot be handled in isolation [29].

3. HYPOTHESIS DEVELOPMENT

Organizations engaged in sustainable development may find DF beneficial in mitigating financing and investment risks. DF enhances the accessibility of external resources for businesses, thereby facilitating improved financial management, competitive advantage, and the promotion of sustainable development objectives [13]. DF may contribute to a greater reduction in environmental inequality in areas where businesses relocate due to their increased demands for industrial transformation and financing [30]. DF can aid organizations in surmounting these financial constraints through the provision of liquidity assistance, facilitation of efficient, accurate, and customized customer service, and improvement of credit allocation efficiency. It is expected that DF will expedite the lending process through the accurate and timely processing of loan and mortgage applications. This could potentially support organizations in their efforts to adopt environmentally friendly and sustainable business practices. By leveraging information and data sources obtained from third-party assessments, DF is capable of significantly reducing agency issues and information asymmetry in comparison to conventional finance [31]. Therefore, the first hypothesis addressed in this study is as follows.

Hypothesis 1 (H1). *DF results in a substantial and positive effect on SOP.*

According to literature [32], the implementation of DF has not only resulted in the creation of enough business space and the exploration of opportunities for corporate technology innovation, but it has also led to a substantial reduction in the expenses related to search and risk detection. The advantages of digital banking, such as low cost, quick speed, and extensive coverage, contribute to the achievement of low entry barriers for financial services. The implementation of DF has the potential to enhance a company's preparedness in initiating innovative technological initiatives. The advancement of DF has a significant influence on the technological innovation of enterprises [33]. The worldwide nature of this promotion effect is particularly significant in its influence on the technical innovation of enterprises operating in countries characterized by limited traditional financial development. DF has the potential to foster industry expansion, alleviate financial

limitations, and expedite technical advancement. Therefore, the second hypothesis addressed in this study is as follows.

Hypothesis 2 (H2). *DF results in a substantial and positive effect on HTP.*

Expanding upon the viewpoints expressed by García-Quevedo et al. [34], it will be illustrated that financial constraints have an effect on the choices that organizations make regarding innovation as well as the results that ensue from those choices. As a consequence, the capacity of an organization to innovate in the green sector could be adversely affected by financial constraints. Fortunately, the ascent of DF has the potential to effectively mitigate the credit risk faced by banks and aid businesses in addressing this matter. Chen and Yoon [35] posit that financial technology has the potential to alleviate financial burdens and reduce costs associated with debt financing. DF revolutionized credit pricing models through the transparency of credit and information [32]. Green growth will benefit from DF's potential to reduce credit approval requirements and provide businesses with an efficient financing alternative; this will accelerate industrial upgrading and foster a more sustainable environment for the development of green projects. In addition, DF enhances the efficacy of risk management and resource allocation capabilities, thereby mitigating mismatch concerns and reducing financial constraints [35]. By potentially increasing its investments in research and development, DF may be able to influence GI. Previous research has suggested that GI could be stimulated by financial support for environmental innovation research and development. Therefore, the third hypothesis addressed in this study is as follows.

Hypothesis 3 (H3). *DF results in a substantial and positive effect on GI.*

In light of the perpetual evolution of technology, technological components are indispensable for the adoption of GIs. Technological progress has facilitated waste reduction and the adoption of environmentally wise practices. The advancements in the processes of product and service creation, manufacturing, and distribution have caused significant and far-reaching disruptions in every aspect of human existence [36]. Recent advancements in the production and delivery processes have introduced fresh opportunities for innovation through the integration of state-of-the-art digital manufacturing technology and precise equipment [37]. It is well-established, according to Fang et al. [38], that the Internet promotes technological innovation among SMEs through the reduction of information asymmetry, the optimization of resource allocation, and the expansion of innovative openness. Furthermore, the acquisition and implementation of external knowledge are essential components of enterprise innovation, alongside the requisite financial backing. The utilization of big data technology can facilitate the acquisition of vast quantities of detailed information from numerous sources. These emerging technologies have not only enhanced quality and accelerated time-to-market, but have also contributed to more environmentally sustainable production processes [39]. Therefore, the fourth hypothesis addressed in this study is as follows.

Hypothesis 4 (H4). *HTP results in a substantial and positive effect on GI.*

SMEs have the imperative to embrace novel technology and enhance their operations in order to operate in a sustainable manner. Previous scholarly literature has indicated that advancements in technology have played a significant role in

mitigating carbon emissions [40]. Drawing upon the viewpoints put forth by Zhao et al. [41], the concept of technical progress can be defined as the proficient application of energy resources in order to mitigate carbon emissions. Technological progress is considered the primary catalyst for increasing total factor production while adhering to carbon intensity limits. To achieve the goal of reducing carbon emissions, it is feasible to enhance the technological capabilities of industrial firms, thereby increasing their rate of resource utilization and decreasing their unit energy consumption. Furthermore, it has been shown that allocating resources towards research and development endeavors, specifically targeting energy conservation and emission reduction objectives, can effectively enhance environmental conditions and mitigate haze pollution. Hence, it can be argued that over time, advancements in technology have the potential to significantly improve energy efficiency and contribute to the mitigation of haze pollution. Therefore, the fifth hypothesis addressed in this study is as follows.

Hypothesis 5 (H5). *HTP results in a substantial and positive effect on SOP.*

As both an exogenous and endogenous force, GI has the capacity to foster sustained economic growth [42]. It is imperative for businesses to give precedence to GI due to its capacity to enhance customer satisfaction and mitigate environmental damage. GI is expected to increase output while decreasing resource consumption. Zhao et al. [43] conclude, based on their research into the effectiveness of GI in China, that GI is a crucial element in enhancing resource efficiency. GI is crucial for the development of a decarbonized economy and the sustainability of the industrial sector. It has the potential to transform the structure of the industrial sector from one dependent on fossil fuels to one that fosters sustainable economic expansion. Consequently, enterprises bolster their competitiveness and sustain their advantage through brand enhancement, market expansion, and adherence to environmental protection regulations. Environmental protection can be supported by businesses through the production of superior goods and services, as well as the implementation of innovative procedures designed to boost productivity and efficiency. In other words, GI is essential for businesses to increase their future competitiveness and maintain legitimacy. Therefore, the sixth hypothesis addressed in this study is as follows (Figure 1).

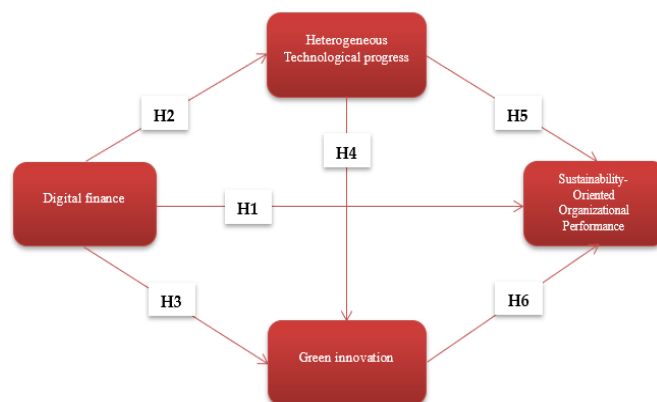**Hypothesis 6 (H6)**. *GI results in a substantial and positive effect on SOP.*

Figure 1. Hypothesized model

4. MATERIALS AND METHOD

4.1 Scale item generation and construct domain determination

To accomplish the goal of the study, a research design based on a hypothetico-deductive technique is adopted. Reading the necessary literature, formulating hypotheses, creating a theoretical model, and deriving logical inferences from the study's findings are all components of this approach. The measuring criteria for each concept in the current study were chosen after a thorough literature assessment. The initial version of the questionnaire was written in English, and it was then painstakingly translated into Vietnamese using a back-translation technique that is typically laborious in order to ensure that the source and target texts are equivalent. An initial assessment of the measuring scales was made using a small-scale pilot test before a larger survey was conducted. A pool of respondents in SMEs that was readily chosen from the target demographic was used for the small-scale pilot survey, which involved 30 participants. Cronbach's alpha score was used to assess the degree of internal consistency of each construct of the pilot questionnaire and was required to be equal to or higher than 0.7 to create the proper reliability coefficient. The small-scale pilot test's Cronbach's alpha score was reported to be higher than 0.7, indicating that the questionnaire was regularly answered with reliable and cogent responses.

Digital finance. The second-order constructs comprising of digital financial access, digital financial usage, and digital financial quality shaped the first-order concept of DF. More instrumentally, the criteria employed to measure digital financial access, digital financial usage, and digital financial quality were sprung from the contributions of previous study [44].

Heterogeneous Technological progress. The second-order constructs comprising of neutral technological progress, labor-saving technological progress, capital-saving technological progress, and energy-saving technological progress shaped the first-order concept of HTP. More instrumentally, the criteria employed to measure neutral technological progress, labor-saving technological progress, capital-saving technological progress, and energy-saving technological progress were sprung from the contributions of previous study [25].

Green innovation. The second-order constructs comprising of green innovation product innovation, green innovation process innovation, green innovation managerial innovation, and green innovation marketing innovation shaped the first-order concept of GI. More instrumentally, the criteria employed to measure green innovation product innovation, green innovation process innovation, green innovation managerial innovation, and green innovation marketing innovation were sprung from the contributions of previous study [45].

Sustainability-Oriented Organizational Performance. Four criteria—financial performance, environmental performance, human performance, and governance performance—were used to assess the SOOP. As a result, the items used in this study to evaluate financial performance were inspired by the findings of previous study [46]. Items from the contribution of previous study [47] were used to create the items used to assess environmental performance. The accomplishments of previous study [47] served as the foundation for the measurement scales of human performance. The gathered observations of previous study [48] guided the measurement items of governance performance.

A five-point Likert scale (1 = "staunchly disagree," 5 = "staunchly agree") was used for all measurements to gauge the respondents' degrees of agreement with the claims.

4.2 Target population and survey administration

To represent the research population and gather the essential primary data, the production enterprise was chosen as the target. In the meanwhile, the participants were accountants in this type of company. The circumstance related to the development of SMEs in Vietnam resulted in the selection of this country as the geographic location for data collection. Indeed, the majority of SMEs in Vietnam have begun to take GI practices and digital technologies adoption into account, and the researcher took use of this development to create a research report. Besides, given the pivotal role that accountants would assume in attaining a positive result due to the pervasive integration of digital technologies, the individuals who partake in this research were accountants employed by diverse SMEs. The researchers requested permission from the senior management of those organizations to gather the contact information of employees before inviting them to take part in the study. After acquiring their informed consent from participants, the questionnaires were distributed in person to participants by the researchers. In doing so, researchers would have the chance to inform participants about the proper way to complete questionnaires, decrease the common method variance, and inform them about the anonymity and confidentiality of the study's findings. Participants were promised secrecy and anonymity and they can withdraw freely from the investigation at any time and for any reason. In addition, in order to ascertain that respondents had adequate understanding to complete the survey, they were expected to respond to inquiries concerning their familiarity with DF, technological progress, GI, organizational performance, and sustainable development within a digitalized business environment. This procedure guarantees the exclusion of any participants from the dataset who were not cognizant of these concerns. The sample for this study was formulated via convenience and snowball sampling due to time and budget restrictions on the investigation. One kind of nonprobability sampling is convenience sampling, which involves selecting members of the target population based on whether or not they are easily accessible and available. At the same time, snowball sampling is a well-known and practical method for finding study participants who are either hard to reach or already known to the researchers. The sample size is thought to be 10 times the number of structural paths to the dependent variables and increasing the sample size is crucial for enhancing the model's dependability [49]. The first week of November 2022 marked the beginning of data collection, which continued through the third week of July 2023. The researcher goes above and above to safeguard the data. A total of 683 valid surveys were gathered with an 80.38 percent response rate.

Due to the utilization of a singular questionnaire approach for data collection, it is possible for common technique variance to arise, contingent of the specific context and attributes of the research endeavor. A systematic error is defined as the variance that occurs in the common method. Harman's single-factor test could be employed to identify common technique variance in this context. The statistical analysis using exploratory factor analysis indicated that the most significant factor accounted for 23.128% of the variation.

This suggested that the presence of common method bias was not a concern within the scope of this study. The sample size is adequate for constructing SEM because the study's valid sample size of 683 exceeds the number recommended by Hair et al. [49]. Numerous studies in the field of management, particularly those examining information technology systems and technology management, have employed structural equation models [50, 51]. The decision to utilize Partial least square structural equation modeling (PLS-SEM) was based on its capacity to analyze intricate models and its resilience to deviations from the norm [52]. PLS-SEM offered a greater degree of adaptability in terms of investigating and testing a multitude of configurations [53]. The PLS-SEM with SmartPLS 4.0.9.2 was employed to conduct the data analysis.

According to the sociodemographic characteristics of the sample, women made up 72.04 percent of the participants, while men made up 27.96 percent. In terms of respondents' ages, the group "35-45" made up 68.52 percent of the sample as a whole, followed by the group "45-55," which made up roughly 26.21 percent. The group "over 55" occupied the bottom spot among the listed groups with a meager 5.27 percent representation. In terms of academic ability, practically all of the participants held a graduate degree or higher. These survey participants have had more than ten years of accounting experience.

5. STATISTICAL INFERENCE

5.1 Assessment on measurement model

Content validity. Cross-loading, used to assess content validity, showed that questionnaire item meanings matched [54] ideas. This required a construct's value to be higher than the others in the same rows and columns [55]. The evaluation scale used in this study had perfect content validity, as shown in Table 1 for all assessed constructs.

Table 1. Results summary for the content validity

	CTP	DFA	DFQ	DFU	EP	ETP	FP	GMNI	GMRI	GP	GPEI	GPI	HP	LTP	NTP
CTP1	0.875	0.158	0.052	0.072	0.123	0.047	0.153	0.079	0.076	0.066	0.095	0.111	0.117	0.098	0.103
CTP2	0.871	0.178	0.052	0.048	0.110	0.088	0.118	0.080	0.055	0.061	0.084	0.066	0.101	0.068	0.128
CTP3	0.860	0.160	0.060	0.080	0.146	0.091	0.115	0.127	0.097	0.080	0.083	0.118	0.128	0.101	0.088
DFA1	0.093	0.670	0.154	0.181	0.113	0.070	0.146	0.045	0.125	0.045	0.127	0.108	0.137	0.049	0.089
DFA2	0.128	0.690	0.165	0.167	0.086	0.066	0.140	0.056	0.119	0.068	0.109	0.124	0.110	0.051	0.103
DFA3	0.103	0.678	0.122	0.163	0.124	0.081	0.149	0.054	0.101	0.065	0.113	0.080	0.100	0.019	0.112
DFA4	0.179	0.646	0.166	0.195	0.110	0.092	0.190	0.090	0.200	0.079	0.104	0.159	0.165	0.059	0.107
DFA5	0.134	0.640	0.130	0.191	0.108	0.083	0.171	0.053	0.169	0.096	0.049	0.165	0.147	0.055	0.075
DFA6	0.113	0.633	0.107	0.177	0.134	0.097	0.171	0.068	0.185	0.117	0.108	0.136	0.114	0.077	0.083
DFQ1	0.045	0.168	0.766	0.132	0.047	0.035	0.049	0.095	0.164	0.056	0.071	0.114	0.051	0.045	0.011
DFQ2	0.077	0.155	0.751	0.133	0.065	0.035	0.066	0.085	0.150	0.066	0.077	0.097	0.036	0.032	0.021
DFQ3	0.079	0.188	0.775	0.185	0.049	0.036	0.083	0.065	0.205	0.050	0.099	0.115	0.044	0.047	0.025
DFQ4	0.019	0.141	0.681	0.102	0.020	-0.014	0.031	0.043	0.089	0.032	0.090	0.054	0.051	-0.006	0.011
DFQ5	0.001	0.106	0.653	0.059	0.030	-0.015	-0.002	0.015	0.064	0.041	0.090	0.012	0.026	0.001	0.020
DFQ6	0.034	0.155	0.677	0.083	0.033	0.006	0.033	0.079	0.102	0.038	0.071	0.077	0.053	-0.005	0.069
DFU1	0.071	0.260	0.132	0.738	0.069	0.013	0.064	0.084	0.153	0.062	0.122	0.110	0.053	0.051	0.052
DFU2	0.036	0.208	0.096	0.740	0.026	0.037	0.065	0.083	0.165	0.045	0.145	0.120	0.063	0.024	0.061
DFU3	0.005	0.202	0.124	0.717	0.022	0.011	0.069	0.080	0.146	0.037	0.091	0.091	0.042	0.033	0.013
DFU4	0.091	0.191	0.147	0.673	0.047	0.037	0.080	0.090	0.128	0.052	0.107	0.094	0.052	0.047	0.047
DFU5	0.056	0.156	0.133	0.680	0.065	0.003	0.067	0.085	0.143	0.017	0.041	0.135	0.067	0.003	0.008
DFU6	0.066	0.094	0.056	0.645	0.030	0.025	0.020	0.078	0.059	-0.007	0.007	0.071	0.008	0.008	-0.006
EP1	0.143	0.144	0.053	0.041	0.890	0.052	0.079	0.081	0.044	0.156	0.026	0.074	0.242	0.085	0.087
EP2	0.120	0.177	0.049	0.058	0.890	0.037	0.092	0.065	0.074	0.153	0.058	0.090	0.210	0.080	0.070
EP3	0.125	0.132	0.053	0.068	0.888	0.064	0.078	0.078	0.038	0.203	0.039	0.072	0.226	0.099	0.066
ETP1	0.105	0.099	0.026	0.009	0.054	0.861	0.041	0.100	0.033	0.046	0.015	0.125	0.083	0.079	0.001
ETP2	0.060	0.121	0.002	0.034	0.051	0.851	0.080	0.108	0.047	0.016	0.062	0.113	0.065	0.128	0.000
ETP3	0.058	0.097	0.030	0.033	0.043	0.866	0.044	0.100	0.066	0.034	0.034	0.091	0.056	0.093	0.016
FP1	0.140	0.194	0.067	0.058	0.080	0.074	0.879	0.131	0.118	0.112	0.100	0.135	0.130	0.088	0.148
FP2	0.124	0.230	0.071	0.112	0.100	0.059	0.895	0.132	0.140	0.114	0.128	0.133	0.170	0.105	0.142
FP3	0.125	0.216	0.028	0.059	0.062	0.034	0.851	0.106	0.106	0.089	0.125	0.139	0.127	0.112	0.152
GMNI1	0.092	0.087	0.083	0.080	0.066	0.091	0.133	0.847	0.077	0.082	0.163	0.191	0.132	0.088	0.092
GMNI2	0.088	0.050	0.054	0.104	0.080	0.106	0.088	0.829	0.079	0.091	0.124	0.168	0.107	0.064	0.089
GMNI3	0.098	0.095	0.090	0.117	0.069	0.104	0.133	0.854	0.126	0.081	0.180	0.215	0.118	0.065	0.085
GMRI1	0.092	0.194	0.178	0.178	0.071	0.040	0.122	0.103	0.903	0.112	0.217	0.190	0.089	0.075	0.076
GMRI2	0.065	0.215	0.158	0.170	0.033	0.062	0.129	0.099	0.900	0.102	0.201	0.195	0.105	0.047	0.060
GP1	0.070	0.110	0.051	0.024	0.163	0.033	0.111	0.095	0.106	0.861	0.133	0.106	0.208	0.111	0.070
GP2	0.058	0.102	0.067	0.072	0.154	0.034	0.103	0.091	0.102	0.862	0.124	0.129	0.171	0.133	0.070
GP3	0.077	0.096	0.056	0.042	0.184	0.030	0.101	0.076	0.102	0.885	0.109	0.135	0.253	0.095	0.065
GPEI1	0.073	0.132	0.087	0.101	0.041	0.036	0.124	0.158	0.168	0.134	0.846	0.068	0.080	0.097	0.075
GPEI2	0.102	0.118	0.079	0.096	0.046	0.031	0.097	0.144	0.220	0.101	0.837	0.068	0.087	0.100	0.069
GPEI3	0.078	0.138	0.122	0.124	0.029	0.041	0.118	0.167	0.195	0.117	0.836	0.114	0.110	0.053	0.088
GPI1	0.086	0.147	0.061	0.127	0.078	0.123	0.127	0.181	0.162	0.139	0.064	0.854	0.166	0.110	0.089
GPI2	0.127	0.199	0.109	0.129	0.072	0.128	0.125	0.210	0.219	0.123	0.109	0.868	0.194	0.096	0.096
GPI3	0.074	0.151	0.120	0.125	0.078	0.074	0.145	0.191	0.164	0.102	0.080	0.841	0.176	0.125	0.129
HP1	0.098	0.177	0.061	0.066	0.193	0.050	0.142	0.131	0.102	0.192	0.101	0.189	0.873	0.108	0.062
HP2	0.130	0.158	0.042	0.038	0.224	0.086	0.157	0.115	0.072	0.228	0.107	0.170	0.881	0.113	0.128
HP3	0.122	0.182	0.058	0.081	0.251	0.073	0.133	0.128	0.110	0.222	0.084	0.194	0.885	0.132	0.107
LTP1	0.084	0.067	0.047	0.024	0.083	0.103	0.091	0.050	0.039	0.101	0.083	0.107	0.103	0.853	0.066
LTP2	0.105	0.057	0.015	0.045	0.112	0.083	0.103	0.102	0.067	0.122	0.071	0.130	0.121	0.838	0.083
LTP3	0.069	0.074	0.012	0.035	0.054	0.109	0.098	0.063	0.065	0.103	0.095	0.086	0.113	0.829	0.059
NTP1	0.106	0.108	0.020	0.019	0.080	0.005	0.131	0.092	0.049	0.055	0.088	0.076	0.092	0.088	0.875
NTP2	0.124	0.161	0.040	0.078	0.109	-0.004	0.150	0.092	0.077	0.103	0.080	0.142	0.129	0.062	0.884
NTP3	0.094	0.110	0.035	0.019	0.030	0.016	0.162	0.093	0.072	0.050	0.076	0.103	0.079	0.069	0.882

Convergent validity. Initially, the factor loading values need to be determined. According to Hair et al. [49], every factor in this study had a loading value greater than 0.70. Building on the perspectives of previous study [56], the value of outer loading between 0.4 and 0.7 can be retained when it is possible to enhance the AVE value.

In the second phase, the internal consistency reliability calculation is completed. The two most used methods in this regard are composite reliability (CR) and Cronbach's alpha. Exploratory research is to be carried out between 0.70 and 0.95 on the significant credibility scale, according to Hair et al. [49]. In this investigation, Cronbach's alpha (α) values fluctuate from 0.740 to 0.868, which is an appropriate range for reliability [49]. Alternatively, all CRs fluctuate from 0.822 to 0.919 are higher than 0.70, in appropriate with the suggestions of previous study [49]. Similarly, the rho_A (ρA) values are gauged, the obtained values of the hypothesized constructs fluctuate between 0.741 and 0.868, which is considerably above the cutoff point of 0.70 [57]. The following phase is to compute the AVE values. Accordingly, AVE values for the constructs in this investigation fluctuate from 0.436 to 0.813.

Although AVE is less than 0.5, but CR is higher than 0.6, convergent validity of the construct is acceptable. Taken together, the statistical output demonstrated in Table 2 provides proof that the constructs used in this research are distinct in their composition.

Discriminant validity. In this research, the Fornell and Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT) are used to examine the discriminant validity. Regarding this, it's important to note that the Fornell and Larcker criterion refers to how much variance a construct collects from its indicators, which must be more than the variance the construct shares with the rest [58]. Table 3 displays the formation of a diagonal with the highest values found in the data set.

The Heterotrait-Monotrait Ratio (HTMT) is the second measurement tool utilized to evaluate the discriminant variance. On each sample, all Heterotrait-Monotrait (HTMT) ratios were less than a more stringent threshold of 0.85 [59], indicating that discriminant validity was met. Accordingly, Table 4 demonstrates that all values are suitable and acceptable because they are less than 0.85.

Table 2. Results summary for convergent validity

Constructs and Operationalization	Items (Abbreviation)	Convergent Validity		Construct Reliability		
		Factor Loadings	AVE	Cronbach's Alpha	Composite Reliability	PA
Digital finance	**DF**					
Digital Financial Access	DFA	0.633 - 0.690	0.436	0.740	0.822	0.741
Digital Financial Usage	DFU	0.645 - 0.740	0.490	0.792	0.852	0.796
Digital Financial Quality	DFQ	0.653 - 0.775	0.516	0.813	0.864	0.820
Heterogeneous technological progress	**HTP**					
Neutral technological progress	NTP	0.875 - 0.884	0.775	0.855	0.912	0.855
Labor-saving technological progress	LTP	0.829 - 0.853	0.706	0.792	0.878	0.792
Capital-saving technological progress	CTP	0.860 - 0.875	0.754	0.837	0.902	0.837
Energy-saving technological progress	ETP	0.851 - 0.866	0.739	0.823	0.895	0.823
Green innovation	**GI**					
Green innovation Product innovation	GPI	0.841 - 0.868	0.730	0.815	0.890	0.818
Green innovation Process innovation	GPEI	0.836 - 0.846	0.705	0.791	0.878	0.791
Green innovation Managerial innovation	GMNI	0.829 - 0.854	0.712	0.798	0.881	0.801
Green innovation Marketing innovation	GMRI	0.900 - 0.903	0.813	0.770	0.897	0.770
Sustainability-Oriented Organizational Performance	**SOP**					
Environmental performance	EP	0.888 - 0.890	0.791	0.868	0.919	0.868
Financial performance	FP	0.851 - 0.895	0.766	0.847	0.907	0.852
Governance performance	GP	0.861 - 0.885	0.755	0.838	0.903	0.841
Human performance	HP	0.873 - 0.885	0.774	0.854	0.911	0.855

Table 3. Results summary for discriminant validity on Fornell-Larker criterion

	CTP	DFA	DFQ	DFU	EP	ETP	FP	GMNI	GMRI	GP	GPEI	GPI	HP	LTP	NTP
CTP	0.868														
DFA	0.190	0.660													
DFQ	0.063	0.215	0.719												
DFU	0.077	0.271	0.167	0.700											
EP	0.146	0.170	0.058	0.063	0.890										
ETP	0.087	0.123	0.023	0.030	0.057	0.860									
FP	0.148	0.244	0.064	0.089	0.093	0.064	0.875								
GMNI	0.110	0.093	0.091	0.119	0.084	0.119	0.141	0.844							
GMRI	0.087	0.227	0.187	0.193	0.058	0.057	0.140	0.112	0.901						
GP	0.079	0.118	0.066	0.052	0.192	0.037	0.121	0.100	0.119	0.869					
GPEI	0.101	0.154	0.115	0.128	0.046	0.043	0.134	0.186	0.232	0.140	0.840				
GPI	0.113	0.195	0.114	0.149	0.088	0.128	0.155	0.228	0.214	0.142	0.100	0.854			
HP	0.133	0.196	0.061	0.070	0.254	0.079	0.164	0.142	0.107	0.244	0.110	0.210	0.880		
LTP	0.103	0.078	0.030	0.041	0.099	0.117	0.116	0.086	0.068	0.129	0.098	0.129	0.134	0.840	
NTP	0.123	0.144	0.036	0.044	0.083	0.006	0.167	0.105	0.075	0.079	0.092	0.122	0.114	0.083	0.880

Table 4. Results summary for discriminant validity on Heterotrait-Monotrait ratio

	CTP	DFA	DFQ	DFU	EP	ETP	FP	GMNI	GMRI	GP	GPEI	GPI	HP	LTP	NTP
CTP															
DFA	0.241														
DFQ	0.075	0.272													
DFU	0.097	0.345	0.197												
EP	0.171	0.213	0.067	0.075											
ETP	0.104	0.158	0.046	0.040	0.068										
FP	0.176	0.308	0.076	0.106	0.108	0.076									
GMNI	0.134	0.119	0.111	0.150	0.102	0.147	0.170								
GMRI	0.109	0.301	0.227	0.242	0.071	0.071	0.172	0.142							
GP	0.094	0.151	0.080	0.068	0.224	0.045	0.143	0.123	0.148						
GPEI	0.124	0.201	0.143	0.156	0.056	0.054	0.164	0.232	0.297	0.172					
GPI	0.136	0.250	0.136	0.184	0.105	0.155	0.187	0.280	0.268	0.171	0.122				

5.2 Assessment on structural model

Based on the statistical results illustrated in Table 5 and Figure 2, all inner variance inflation factor (VIF) values are considerably below the critical threshold value of 3, indicating no serious collinearity problems [49]. The SRMR, also known as the standardized root mean square residual, quantifies the quality of model fit. According to literature [60], a satisfactory fit is characterized by a value below 0.08. The fit of the structural model for theory testing was found to be satisfactory, as evidenced by the SRMR value of 0.072, which falls below the established threshold of 0.08. Building on the bootstrap outcomes (percentile bootstrapping, two-tailed test, 0.05 significance level, with 10,000 resamples), DF substantially and positively affects SOP ($\beta = 0.127$; t-value = 4.926; p-value = 0.000); HTP ($\beta = 0.195$; t-value = 7.198; p-value = 0.000); GI ($\beta = 0.291$; t-value = 11.784; p-value = 0.000). In the same vein, HTP substantially and positively affects SOP ($\beta = 0.218$; t-value = 8.365; p-value = 0.000) and GI ($\beta = 0.224$; t-value = 8.700; p-value = 0.000). As anticipated by H3, the results reveal that GI demonstrates a direct positive impact on SOP ($\beta = 0.207$; t-value = 8.118; p-value = 0.000) In light of this, H1-H6 are supported. Alternatively, the mediating impact of HTP was evaluated. First, the significance of DF's indirect impact on SOP through HTP was evaluated. Given that the direct effects of DF on HTP are also supported and that the indirect effects are significant (t-value = 5.360; p-value = 0.000), it was determined that HTP partially mediates the association between DF and SOP [49]. Likewise, the indirect effect of DF on SOP through GI is significant (t-value = 6.506; p-value = 0.000), it is determined that GI partially mediates the association between DF and SOP [49]. As a result, the findings indicate partial mediation.

The R^2 was 0.160 for GI and for SOP while R^2 for HTP is 0.038. The f^2 effect size [49] was also employed to evaluate the strength of the structural model relationships. The analysis reveals that DF had a small effect size on HTP, SOP and GI (0.039, 0.017 and 0.097, respectively). In the same vein, HTP had a small effect size on GI and SOP (0.058 and 0.051, respectively). Additionally, GI had a small effect size on SOP (0.043).

When compared to a linear benchmark model, the model does not demonstrate good out-of-sample prediction ability for all construct indicators. The PLS$_{predict}$ [61] results in Table 6 show that the RMSE obtained by the linear model (LM) is smaller than the RMSE obtained by PLS-SEM for almost all items (i.e., this results in favor of the LM prediction benchmark; the same finding holds for the mean average error). Furthermore, when employing the cross-validated predictive ability test (CVPAT) [62], the result analysis reveals that the LM has a reduced average loss than the PLS-SEM. On the other hand, PLS-SEM can outperform the naive indicator average (IA) prediction benchmark for both PLS$_{predict}$ (as evidenced by the positive $Q^2_{predict}$ values) and CVPAT (as evidenced by the significantly negative average loss difference). As a result, the model obtains some predictive capability that permits it to pass the IA test but not the more conservative LM benchmark.

Table 5. Results of hypotheses testing

| Relevant Path	Path Coefficient	SE	95% Confidence Interval	t-value	p-value	Result
Direct effect						
DF ➔ SOP	0.127	0.026	[0.076 - 0.177]	4.926	0.000	Buttressed
DF ➔ HTP	0.195	0.027	[0.142 - 0.248]	7.198	0.000	Buttressed
DF ➔ GI	0.291	0.025	[0.241 - 0.339]	11.784	0.000	Buttressed
HTP ➔ GI	0.224	0.026	[0.173 - 0.274]	8.700	0.000	Buttressed
HTP ➔ SOP	0.218	0.026	[0.165 - 0.269]	8.365	0.000	Buttressed
GI ➔ SOP	0.207	0.025	[0.157 - 0.256]	8.118	0.000	Buttressed
Indirect effect						
DF ➔ HTP ➔ SOP	0.042	0.008	[0.028 - 0.059]	5.360	0.000	Buttressed
DF ➔ GI ➔ SOP	0.060	0.009	[0.043 - 0.079]	6.506	0.000	Buttressed
R^2	$R^2_{GI} = 0.160$; $R^2_{SOP} = 0.160$; $R^2_{HTP} = 0.038$
f^2	$f^2_{DF \Rightarrow HTP} = 0.039$; $f^2_{DF \Rightarrow SOP} = 0.017$; $f^2_{DF \Rightarrow GI} = 0.097$; $f^2_{HTP \Rightarrow GI} = 0.058$; $f^2_{HTP \Rightarrow SOP} = 0.051$; $f^2_{GI \Rightarrow SOP} = 0.043$
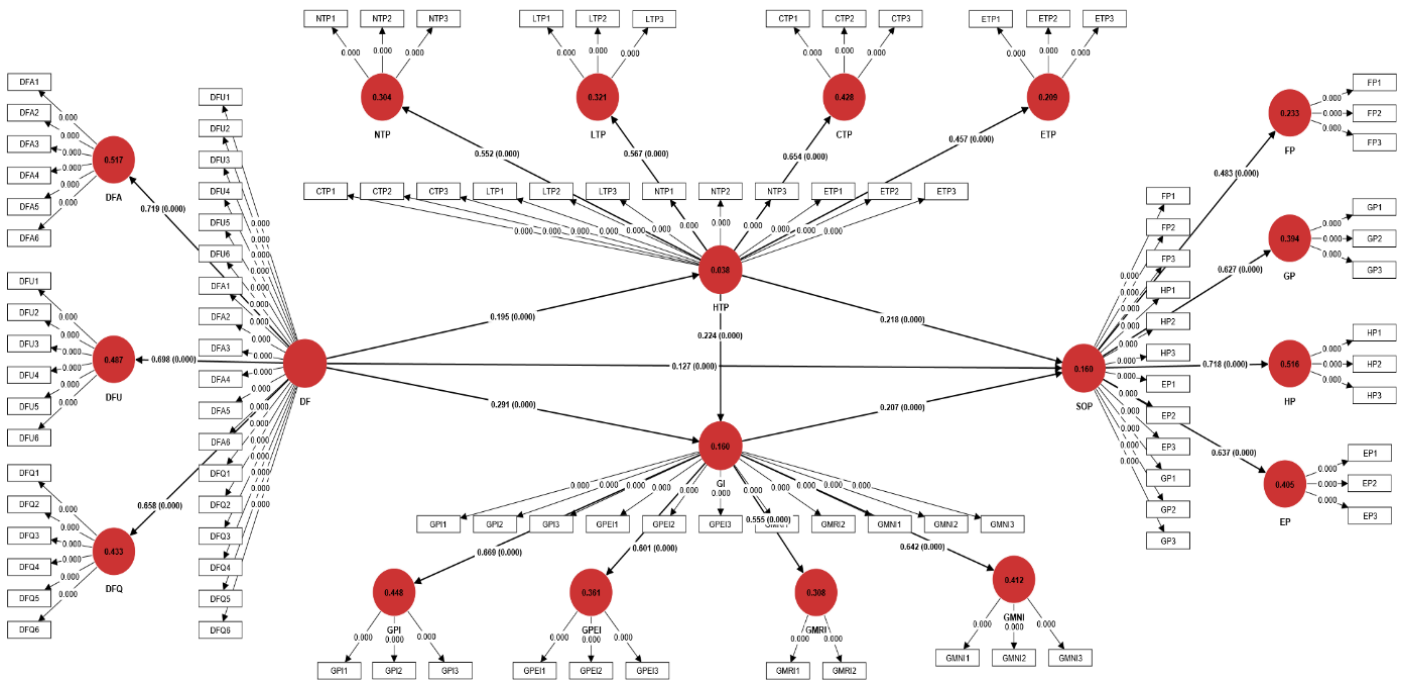
Figure 2. Structural model

Table 6. Predictive model assessment

Construct	Item	$Q^2_{predict}$	PLS$_{predict}$ RMSE PLS-SEM	LM RMSE	CVPAT IA average loss difference (p value)	LM average loss difference (p value)
NTP	NTP1		1.410	1.415		
	NTP2	0.011	1.357	1.358	-0.016 (0.058)	-0.009 (0.463)
	NTP3		1.365	1.368		
LTP	LTP1		1.396	1.404		
	LTP2	0.003	1.272	1.283	-0.004 (0.583)	-0.027 (0.002)
	LTP3		1.349	1.359		
CTP	CTP1		1.486	1.479		
	CTP2	0.024	1.476	1.474	-0.038 (0.000)	0.003 (0.830)
	CTP3		1.366	1.371		
ETP	ETP1		1.350	1.359		
	ETP2	0.007	1.348	1.355	-0.009 (0.164)	-0.021 (0.024)
	ETP3		1.341	1.350		
FP	FP1		1.421	1.421		
	FP2	0.030	1.327	1.321	-0.043 (0.000)	0.011 (0.495)
	FP3		1.305	1.299		
GP	GP1		1.302	1.309		
	GP2	0.011	1.385	1.397	-0.016 (0.152)	-0.028 (0.003)
	GP3		1.437	1.448		
HP	HP1		1.159	1.158		
	HP2	0.024	1.218	1.218	-0.025 (0.008)	0.000 (0.967)
	HP3		1.100	1.102		
EP	EP1		1.376	1.381		
	EP2	0.019	1.323	1.326	-0.028 (0.018)	-0.017 (0.142)
	EP3		1.412	1.423		
GPI	GPI1		1.361	1.367		
	GPI2	0.048	1.298	1.302	-0.064 (0.000)	-0.013 (0.211)
	GPI3		1.329	1.333		
GPEI	GPEI1		1.366	1.370		
	GPEI2	0.036	1.315	1.319	-0.046 (0.001)	-0.010 (0.381)
	GPEI3		1.323	1.327		
GMRI	GMRI1	0.074	1.385	1.383	-0.124 (0.000)	0.014 (0.386)
	GMRI2		1.400	1.392		
GMNI	GMNI1		1.364	1.377		
	GMNI2	0.016	1.418	1.423	-0.020 (0.194)	-0.019 (0.045)
	GMNI3		1.316	1.320		
Overall					-0.120 (0.000)	0.307 (0.000)

6. DISCUSSION AND IMPLICATION

6.1 Theoretical implication

By expanding upon the convergence of stakeholder theory, agency theory, and contingency theory, the present study establishes and verifies novel associations among DF, GI, HTP, and SOP. Furthermore, by incorporating these theories into a single model to analyze the investigated phenomenon, the predictive and explanatory capabilities of the hypothesized model in this research is enhanced, and results are produced that hold significance for both professionals and scholars. Based on the author's understanding, this is one of the first studies to investigate the potential impact of DF on SOP of SMEs in Vietnam, an emerging country. Furthermore, this research builds upon previous investigations that have examined the critical roles of DF [11, 12]. This obtained finding aligns with the findings [11, 12], who similarly observed that DF has a beneficial effect on the performance of organizations. The study provides significant contributions that are particular to Vietnam and may have broader implications for other areas of the Asia-Pacific region. Moreover, it underscores the pivotal significance of DF in propelling GI, hence elaborating on the viewpoints presented by Liu and Chen [63]. Recent studies have indicated that DF can effectively mitigate the financial constraints of SMEs by playing a substantial role in advancing financial inclusion [64]. Also, this research enhances the existing body of knowledge regarding the impact of DF on HTP.

By extending and reaffirming prior research on the mediating function of GI, this study establishes its indispensable status in developing nations. Previous research has extensively supported this discovery by establishing that GI plays a pivotal role in the relationship between environmental regulation and the sustainability performance of corporations [65]; green human resource management and environmental performance [66]; green transformational leadership, green entrepreneurial orientation, and the performance of SMEs [67].

This study elucidates the involvement of HTP as a partial mediator in the association between DF and SOP. The analysis demonstrates a notable interaction effect, wherein DF has a major impact on the success of SOP. This study expands upon the research conducted by Liu et al. [68], offering empirical support for the notion that technological advancements play a crucial role in optimizing the efficacy of accountability audits pertaining to natural resources policy in relation to provincial agricultural carbon intensity.

This work contributes to the existing body of knowledge by elucidating a favorable association between HTP and GI, thereby enhancing our comprehension of their relationship. To the best of researchers' knowledge, this scholarly endeavor may be the first endeavor to offer novel and substantial insights into the notable impact of HTP on GI. The transformation of the resource curse into a resource blessing is facilitated by technological progress, as it alters the trajectory of economic development [69]. According to Sadik-Zada [70], certain researchers have identified that advancements in technological progress have the potential to promote the utilization of natural resources, hence influencing the industrial structure. This, in turn, can contribute to the promotion of GI, ultimately leading to the attainment of sustainable development goals.

6.2 Practical implication

By highlighting a number of enlightening conclusions derived from theoretical analysis and empirical testing, this research article facilitates the practical application of its findings and hypotheses. SMEs can utilize the findings of this research to better administer and regulate their GI. Accordingly, SMEs should eliminate obsolete concepts and proactively increase their levels of innovation in order to generate the endogenous force of GI. In order to implement strategies that support GI regulations and standards, SMEs must coordinate and collaborate with innovation consultants and advisers from corporations, universities, and organizations to organize training courses on GI and share knowledge as well as green solutions. Additionally, public policies and promotion programs that provide financial resources and training to SMEs seeking to implement green solutions can foster GI. Moreover, the public's and the government's subsidies are indispensable for the sustainable development of SMEs and the creation of green communities.

The current research also aids corporate leaders in comprehending the prerequisites and advantages of HTP. Companies are now required to incorporate technological advancements into their operational, financial, sales, and marketing strategies in order to maintain a competitive edge. Thus, SME managers and executives should concentrate on how digital transformation can effectively integrate all of these contemporary technologies in order to improve the SME's SOP. The results in this study might inspire business leaders to make investments in digital technology.

Nonetheless, the obtained findings in this study revealed that GI and HTP achievements would be maximized through the support of DF. To accomplish sustainable development, SMEs should increase their modern financial awareness, seize the opportunity presented by the development of DF, and implement DF policy in an efficient manner. SMEs ought to proactively engage with national policies and fulfill development obligations by leveraging digital financial services to support the GI and HTP of enterprises. Alternatively, SMEs ought to have expedited their digital transformation, thereby ensuring the precise alignment of digital financial services. In light of this, the government should support the digital transformation of the financial system, expedite the development of DF infrastructure, and enable the precise achievement of SME business development objectives. One potential course of action is for the government to augment its financial and policy backing for SMEs, provide them with guidance throughout their digital transformation, and enhance the technological sophistication of DF. Furthermore, it is imperative that banks and other financial institutions take proactive measures to address the government's DF policy by devising suitable financial support strategies to ensure the continued existence and progress of SMEs.

7. CONCLUSIONS

As a consequence of the progressively volatile global landscape, SMEs are compelled to modify their existing methodologies in order to align with sustainability objectives. The implementation of a DF strategy for SMEs has been a longstanding goal of governments, especially in developing nations. This study aims to develop and validate a model that

highlights the connection between DF and SOP. Significantly, the suggested model takes numerous efforts to enhance understanding of the mediation pathways between HTP and GI within its assumed structures. The analysis of the acquired outcomes highlights significant and positive relationships between the proffered constructs related to significance and effect size. Concretely, the outcome confirmed the significantly favorable correlation between DF and SOP. This association was partially mediated by both HTP and GI concurrently. The study's findings and insights would be valuable to practitioners seeking sustainable strategies to foster innovation in their enterprises. Conversely, the aforementioned observations would offer novel perspectives to professionals and policymakers, enabling them to formulate targeted approaches pertaining to HTP and GI, as well as establish legislative measures and regulatory frameworks for DF.

It is paramount to be aware of the limits because they will serve as the foundation for upcoming academic work. Utilizing cross-sectional data constitutes the principal obstacle that impedes the ability to draw definitive conclusions when analyzing results. Conversely, one could argue that conclusions regarding the research can only be drawn from the interrelationships between the variables under consideration since the study offers no definitive perspectives on compatibility. Therefore, it is advisable that forthcoming investigation integrate robust longitudinal analysis, secondary data sources, and modern statistical methodologies. Second, caution should be taken when generalizing because the particulars of the study environment may limit the conclusions drawn from the observations. The fact that all of the samples were sourced from Vietnam makes it necessary for more cross-regional research to confirm the findings before they can be generalized. Further analysis could be conducted by gathering additional data from developed and emerging markets so as to obtain more insightful information. It was also suggested that researchers conduct comparative analyses of developed and emergent nations in order to obtain more useful results. Third, the statistical information used in this study mainly relies on a self-report design. As a result, each SME receives the survey forms from just one person. Because individuals who have more favorable opinions of DF, HTP, and GI might be more inclined to fill out and submit their survey forms, the responses from single participants may be skewed. Therefore, future studies might also think about gathering the opinions of other pertinent stakeholders in this context. The convenience and snowball sampling procedures represent the fourth bottleneck and may have an impact on the study's generalizability. To ensure that the results are both representative and scientific, it is advised that future studies use the quota sampling method to collect sample data. This study's relatively small sample size is its fifth limitation, which calls for additional research. It would therefore be beneficial to have a wider geographic scope. Additionally, it is advised that more components be added to the model in upcoming research to produce a more accurate depiction of the problem.

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