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Impact of Dynamic Capabilities and Digital Innovation on Competitiveness mediated by Responsible Innovation

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PRESENTADA POR

Alicia Alexandra, de la Torre Rojas

Cédula de identidad: 1716130842 – ECUADOR

ASESOR

Dr. Iván Manuel, De la Vega

Carné de Extranjería: 001524411

ORCID https://orcid.org/0000-0002-8554-0510

JURADO

Iván Manuel, de la Vega Hernández

María José, Ibáñez Caamaño

Giulio Franz, Marchena Sekli

May Iliana, Portuguez Castro

Surco, Mayo 2025

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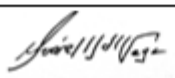
CE: 001524411	Firma 
ORCID: 0000-0002-8554-0510	

Dedication

To God who accompanies and blesses me every day.

To my beloved mother, brothers, sisters-in-law, nephew, and my aunt Chely, without whose support I would not have achieved this goal.

To my father who accompanied me on this journey from heaven.

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Abstract

In a dynamic global context towards digitalization, and with increasing social demands, companies face the challenge of staying competitive. This study empirically validates the relationship between dynamic capabilities (digital orientation, digital capability, and willingness to change), digital innovation, responsible innovation, and competitiveness by integrating them into a competitive and sustainable digital innovation model. This model allows companies to identify innovation strategies for sustainability that are aligned with the concept of innovability. Considering the theory of dynamic capabilities to achieve sustainable competitive advantage, a structural equation model was applied with data from 216 private Ecuadorian technology companies, which validated responsible innovation as a mediator of digital innovation, competitiveness, and dynamic capabilities as facilitators of digital innovation, responsible innovation, and its impact on competitiveness. This research contributes to business practice on the need for companies to redefine their digital innovation management strategies, incorporating dynamic capabilities for the rapid reconfiguration of resources in a changing environment and responsible innovation for sustainable competitiveness aligned with compliance with the SDGs. For future research, this model can be considered a starting point, since the mediating or moderating variables can be replicated and extended to other sectors or countries, and can be complemented with qualitative research.

Keywords: Dynamic capabilities, Digital innovation, Responsible Innovation, Competitiveness.

Resumen Ejecutivo

En un contexto global dinámico hacia la digitalización y con crecientes demandas sociales, las empresas se enfrentan al reto de mantenerse competitivas. Este estudio valida empíricamente la relación entre las capacidades dinámicas (orientación digital, capacidad digital y disposición al cambio), la innovación digital, la innovación responsable y la competitividad, integrándolas en un modelo de innovación digital competitivo y sostenible. Este modelo permite a las empresas identificar estrategias de innovación para la sostenibilidad alineadas con el concepto de innovabilidad. Considerando la teoría de las capacidades dinámicas para lograr una ventaja competitiva sostenible, se aplicó un modelo de ecuaciones estructurales con datos de 216 empresas tecnológicas privadas ecuatorianas, que validó la innovación responsable como mediadora de la innovación digital y la competitividad, y las capacidades dinámicas como facilitadoras de la innovación digital, la innovación responsable y su impacto en la competitividad. Esta investigación contribuye a la práctica empresarial en cuanto a la necesidad de que las empresas redefinan sus estrategias de gestión de la innovación digital, incorporando capacidades dinámicas para la rápida reconfiguración de recursos en un entorno cambiante e innovación responsable para una competitividad sostenible, alineada con el cumplimiento de los ODS. Para futuras investigaciones, este modelo puede considerarse un punto de partida, ya que las variables mediadoras o moderadoras pueden replicarse y ampliarse a otros sectores o países, y puede complementarse con investigación cualitativa.

Keywords: Capacidades dinámicas, Innovación digital, Innovación responsable, Competitividad.

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Introduction

This thesis is structured in two Chapters. The first Chapter presents the research paper accepted for publication, which is required to complete the degree of Doctor en Administración Estratégica de Empresas granted by the Pontificia Universidad Católica del Perú through its graduate school in business management, CENTRUM PUCP. The second Chapter includes the main conclusions and recommendations of the thesis. Therefore, Chapter 1 of this thesis includes the research paper entitled "Dynamic Capabilities and Digital Innovation: pathways to Competitive Advantage through Responsible Innovation", which was accepted for publication by Journal of Responsible Innovation on April 4, 2025 (see Appendix A, message accepting the paper). This journal is part of the Scopus and Web of Science, in quartile Q1.

Considering a global context of high digitalization and the growing demand for sustainable businesses (Rîndașu et al., 2023; D'Ippolito et al., 2019), this paper explored the relationship between dynamic capabilities (digital orientation, digital capability, and willingness to change), digital innovation, and responsible innovation and competitiveness, integrating them into a model of competitive and sustainable digital innovation. This model challenges companies to identify key variables to determine new business management approaches in a changing environment.

The sustainable and competitive digital innovation approach implies that companies' strategies should not only be aimed at obtaining economic benefits but also at generating a positive impact on society and the environment in the long term. This is associated with the concept of the triple bottom line (Chen et al., 2022), the generation of shared value (Porter & Kramer, 2006), and the concept of innovability (De la Vega & Barcellos de Paula, 2020). This process also strengthens organizational legitimacy and reputation, generating a competitive advantage (Carroll & Shabana, 2010; Porter & Kramer, 2006).

In recent years, digital innovations have transformed different sectors, generating economic benefits (Khin & Ho, 2018) and alternatives to address social and environmental issues (Srisathan & Naruetharadhol, 2022), which contributes to the achievement of the Sustainable Development Goals (Rîndaşu et al., 2023). However, there are also risks and impacts associated with digital innovations that require the integration of ethical principles and social interests (van den Hoven, 2022). It is in this context that the responsible innovation approach applied in the digital field (Stilgoe et al., 2013) becomes relevant.

To achieve a sustainable competitive advantage considering the implementation of digital innovations, companies need to identify the enabling and mediating variables in this relationship to develop specific strategies in practice (El-Haddadeh, 2019; Hadj et al., 2020), to which this research contributes. From the literature review, it was identified that dynamic capabilities, such as digital capability (DIGC), digital orientation (DIGO), and willingness to change (WC), (Khin & Ho, 2018; Teece, 2018; Kreiterling, 2023; Yaqub &Alsabban, 2023; Xiao et al., 2023), and responsible innovation (RI) play a relevant role (Hadj et al., 2020; Li et al., 2023; Lehoux et al., 2023, Cheng et al., 2024). Requiring more quantitative research that links and tests the relationships of these variables with competitiveness (Zacca & Dayan, 2018; Hadj, 2020; Hadj et al., 2020).

It was also identified as a research gap that the study of the relationship between these variables has been carried out in regions such as Asia, Africa, and the Middle East. This highlights the need for studies in other regions such as Latin America (Chen et al., 2022; Zhang et al., 2022). In the case of Ecuador, the development of competitive and sustainable technology companies represents both an opportunity and an urgency for its dollarized economy, which is highly dependent on natural resources. Considering the identified gaps, the research question was posed, How do dynamic capabilities and responsible innovation influence the relationship between digital innovation and business competitiveness?

Theoretical Framework. Considering the need for companies to achieve greater business agility to respond to the environment through innovation, this research considers the dynamic capability theory, which is based on Barney's (1991) resource and capabilities theory (RBV). In Teece (2007), the dynamic capabilities theory seeks to explain an organization's strategic decisions by considering the changing environment with the reconfiguration of resources and capabilities. Dynamic capabilities, built from these strategic resources, will translate into competitive strength and the construction of a sustainable competitive advantage. These dynamic capabilities and strategies combine to create or adjust a business model that guides organizational transformation and generates an adequate level of profit (Syahrawi et al., 2024). In this sense, competitive advantage originates in the firm's distinctive capabilities, which include the ability to detect, capture, and transform capabilities, moving from first-order capabilities to second-order capabilities (Teece, 2018). Thus, in environments of rapid technological change, wealth generation depends largely on the improvement of the company's internal technological, organizational and management processes (Teece et al., 1997).

Methodology. To examine the relationships between the variables proposed in the model, a structural equation model was applied to data from 216 private information technology (IT) companies in Ecuador, nationwide, across three regions (Coast, Highlands, and Amazon). To collect data, a survey was conducted among those responsible for digital projects (See Appendix B). This selection was based on previous studies that considered these profiles (Cao et al., 2020a; Cao et al., 2020b).

Considering the studies by Khin and Ho (2018) and Zhang et al. (2022), in the empirical context of our study, we focused on the IT sector in an upper-middle-income economy. This sector was selected because IT companies innovate rapidly and benefit from emerging

technologies (Cao et al., 2020a). This framework was established considering that it opens an interesting context for testing the empirical model.

Results. The sample characteristics did not differ from the sampling framework. Most companies were located in the Highlands region (63%). Regarding technology, cloud computing was the most widely used technology for product and service development (82%) of the surveyed companies, followed by big data (44%). Finally, 71% indicated that their digital innovation processes were linked to compliance with the SDGs, indicating a high level of awareness of these global commitments within companies.

All the constructs included in this research (digital innovation, digital capability, digital orientation, willingness to change, and competitiveness) demonstrated respective validity and reliability in previous studies and this study, thus obtaining average variance extracted (AVE) measures above 0.5, composite reliability above 0.7, and Cronbach's alpha above 0.7.

To test the proposed hypotheses, the structural model and the relationships between variables were evaluated. Among the findings, a direct relationship between digital orientation and digital capability on digital innovation was tested. The direct effect of change readiness on digital innovation was not verified. Regarding the effect of dynamic capabilities (DIGO, DIGC, and WC) on competitiveness mediated by digital innovation, DIGO and DIGC were significant and positive, while WC was not. Regarding the direct link between digital innovation and competitiveness, a direct effect was verified. A direct relationship between digital innovation and responsible innovation was also verified. Furthermore, the direct effect of DIGC on competitiveness was significant and positive, while DIGO and WC were not significant.

The structural model includes the construct of responsible innovation, whose direct effect on competitiveness is validated. Furthermore, responsible innovation is accepted as mediating the relationship between digital innovation and competitiveness. Likewise, the orientation

toward SDG compliance, included in the structural model as a control variable, significantly affected the relationship with the competitiveness SDGs. A relevant finding is the direct and significant effects of WC and DIGC on responsible innovation. Finally, it was shown that responsible innovation mediates the relationship between competitiveness and WC and DIGC.

The findings contribute to the identified research gaps, particularly to the study of the relationships of the proposed variables in the context of a Latin American country. The application of the theory of dynamic capabilities in a digital context, intersecting with the variable of responsible innovation, is relevant. For business practice, the new business challenges of developing sustainable digital innovation models are presented. The results broaden the understanding of the topic, identifying key variables for determining specific strategies that impact business competitiveness in a context of constant change.

Chapter I: The Research Article

Disclaimer. Centrum PUCP Business School and the Pontificia Universidad Católica del Perú are not responsible for any potential methodological, conceptual and statistical weaknesses in this article, weaknesses that were not detected by the journal editor or by the reviewers in the double-blind review process, to whom the journal editor sent the article for review. Also, these weaknesses are not the responsibility of those who reviewed the quality of the thesis at Centrum PUCP, who actually detected them, in view that the article is presented here exactly as it was published by the journal.

The research paper. The research paper "Dynamic Capabilities and Digital Innovation: pathways to Competitive Advantage through Responsible Innovation" was accepted for publication by Journal of Responsible Innovation on April 4, 2025 (see Appendix A, message accepting the paper). This journal is indexed on Scopus and Web of Science (WoS), in quartile Q1. Journal of Responsible Innovation, ISSN: 23299037, 23299460.

Dynamic Capabilities and Digital Innovation: pathways to Competitive Advantage through Responsible Innovation

Abstract:

In a dynamic global context towards digitalization, and with increasing social demands, companies face the challenge of remaining competitive. This study empirically validates the relationship between dynamic capabilities (digital orientation, digital capability, and willingness to change), responsible innovation, and competitiveness by integrating them into a competitive and sustainable model. This model allows companies to identify innovation strategies for sustainability that are aligned with the concept of innovability. Guided by the dynamic capabilities theory for achieving a sustainable competitive advantage, this study applies a structural equation model using data from 216 private Ecuadorian technology companies. The results validate responsible innovation as a mediator between digital innovation and competitiveness and confirms dynamic capabilities as key facilitators of both digital and responsible innovation and their joint impact on competitiveness. This research contributes to business practice by highlighting the need for

companies to redefine their digital innovation management strategies. It emphasizes incorporating dynamic capabilities to rapidly reconfigure resources in a changing environment, and responsible innovation to achieve sustainable competitiveness aligned with the Sustainable Development Goals (SDGs).

Keywords: Dynamic capabilities, Digital innovation, Responsible Innovation, Competitiveness

1. Introduction

In recent years, technological maturity, access to new technologies, digital literacy in society (Buck et al. 2022; Soto-Acosta 2022), and the acceleration of digitalization as a result of the COVID-19 pandemic, caused by SARS-CoV-2, have enabled a significant evolution of digital innovations that are transforming the business models of different economic sectors (Pradhan et al. 2021; Yaqub and Alsabban 2023). These factors have also generated social concerns regarding the security, ethical use, and privacy of user data that must be managed by companies (Vilken et al. 2019; Budd et al. 2020; Zhang et al. 2022; Gegenhuber et al. 2023; Neethirajan 2023). In parallel with the evolution of digital innovations, there is a high demand for sustainable businesses that generate social value as a response to global problems such as climate change, poverty, inequality, water scarcity, and others (D'Ippolito, Messeni, and Panniello 2019; Rîndaşu et al. 2023).

In this global context of digitalization and new social demands, characterized by a competitive and highly agile environment, companies require new approaches or business management models that integrate digital innovation with sustainability in the search for competitiveness. A new approach to sustainability implies that companies' strategies should not only be aimed at adjusting their business models to obtain economic benefits but also at generating and mitigating impacts on society and the environment in the long term, which is associated with the concept of the triple button line (Trupp and Dolezal 2020; Chen, Li, and Zhang 2022), the generation of shared value (Porter and Kamer 2006) and the concept of innovability (De la Vega and Barcellos de Paula 2020).

Digital innovations, conceptualized as solutions that integrate emerging digital technologies to create or improve products, services, processes or business models, have made it possible to meet new demands (Chen and Roldan 2021), generate shared value for customers and other stakeholders (Dreyer et al. 2017; Ureña-Espaillat, Briones-Peñalver, and Bernal-Conesa 2022), and provide alternatives to social and environmental issues (Srisathan and Naruetharadhol 2022), thereby contributing to the fulfillment of the Sustainable Development Goals (Rîndaşu et al. 2023). As previously noted, the process of digital business innovation can generate value with benefits not only for customers, but also for shareholders, suppliers, and the society in which it operates (Porter and Kramer 2006; Dreyer et al. 2017; Ureña-Espaillat, Briones-Peñalver, and Bernal-Conesa 2022; Abdurrahman, Gustomo, and Prasetio 2024). This process also strengthens organizational legitimacy and reputation, generating competitive advantage (Carroll and Shabana 2010; Porter and Kramer 2006).

The successful implementation of digital innovations that impact sustainable competitiveness (El-Haddadeh 2019; Hadj, Omri, and Al-Tit 2020) extends beyond technological considerations and often requires organizational changes and process adaptations (Messina 2018). Therefore, companies must identify and generate strategies related to mediating and facilitating variables such as dynamic capabilities (Chen, Wang, and Huang 2020; Kreiterling 2023; Xiao et al. 2023; Yaqub and Alsabban 2023; Abdurrahman, Gustomo, and Prasetio 2024), responsible innovation (Li et al. 2023; Lehoux et al. 2023; Cheng et al. 2024), and flexible organizational culture, among others (Müller et al. 2019; Maritz, Pretorius, and Plant 2011).

Dynamic capabilities or higher-order capabilities refer to adaptation skills as well as the rapid reconfiguration of resources, capabilities, and routines (Schick, Hobson, and Ibisch 2017; Teece 2018; Sultana, Akter, and Kyriazis 2022; Priyono and Hidayat 2024). They are

built from strategic resources and have a differentiating effect compared with competition (Teece, 2007). Considering the concept of dynamic capabilities, various authors identify specific dynamic capabilities and test their direct or indirect relationship with digital innovation, competitiveness, and responsible innovation.

Regarding the relationship between dynamic capabilities, digital innovation, and competitiveness, Khin and Ho (2018) found that in Malaysian technology companies, dynamic capabilities, digital orientation, and digital capacity directly affect digital innovation and indirectly affect financial and non-financial organizational performance. Zacca and Dayan (2018) validate the relationship of United Arab Emirates companies between entrepreneurial orientation, managerial competence, and willingness to change with the organization's performance. The authors recommend further research to test and apply the models in other regions and sectors and expand the analysis of the relationship with other variables.

The relationship between dynamic capabilities and responsible innovation remains underexplored in the literature, limiting companies' ability to fully understand how to implement responsible innovation effectively. Some studies focus their attention on aspects related to relationships with stakeholders or environmental management. For instance, Tian and Tian (2021) state that stakeholder pressure positively impacts corporate sustainability performance in Chinese companies, and responsible innovation partially mediates this relationship. Similarly, Zhang et al. (2022) explore the direct relationship between strategic orientations and responsible innovation in Chinese SMEs. Moreover, Adomako and Tran (2022) test the relationship between environmental collaboration, stakeholder pressure, responsible innovation, and competitiveness in Ghanaian companies. Thus, for future research, it is proposed to delve deeper into other enablers of responsible innovation, its direct and indirect relationships with competitiveness, and how to apply these relationships in

other geographical and cultural contexts. The literature review did not identify the application of an integrated model of dynamic capabilities, digital innovation, responsible innovation, and competitiveness.

The successful implementation of digital innovations requires integrating ethical and sustainability principles (van den Hoven 2022) to prevent and mitigate environmental or social risks or impacts (Budd et al. 2020; Pan et al. 2022). This need arises as a consequence of a new business vision of business to meet social demands (Hadj, Omri, and Al-Tit 2020). Therefore, responsible innovation becomes relevant in digital business innovation models (Stilgoe, Owen, and Macnaghten 2013). This approach recognizes and integrates the operational practice of corporate social responsibility (CSR) to generate shared value, which has implications for competitive advantage (Bachnik and Nowacki 2018; Chou 2018; Hadj, Omri, and Al-Tit 2020).

Although there are significant theoretical developments and qualitative studies in the literature on responsible innovation, Li et al. (2023) highlight the need to develop empirical studies in specific scenarios and environments, integrating responsible innovation and technology. Studies by Adomako and Tran (2022) in Ghana, Tian and Tian (2021) in China, Hadj, Omri, and Al-Tit (2020) in Saudi Arabia, and Hadj (2020) in North Africa have shown a positive relationship between responsible innovation and sustainable competitiveness. The authors propose that the management of responsible innovation, based on its components of inclusion, anticipation, responsiveness, and reflexivity, which consider the participation of stakeholders, contributes to the improvement of competitiveness and sustainability (Stilgoe, Owen, and Macnaghten, 2013; Jirotka et al. 2017; Cao, Lv, and Xing, 2020; Hadj 2020; Li et al. 2023).

In response to the identified research gaps and answer the research question, How do dynamic capabilities and responsible innovation influence the relationship between digital

innovation and business competitiveness?, this study presents an empirical model focused on Ecuador, a developing Latin American country classified as an upper-middle income economy. Despite the significant growth of digital innovations in sectors such as finance, telecommunications, and technology services in Latin America and Ecuador, no empirical studies have examined the integration of dynamic capabilities, digital innovation, and responsible innovation. The relationships proposed in the model pose important practical challenges for the business sector and constitute a starting point for future research that could integrate new variables to deepen the discussion of new digital business models using a sustainable approach.

The model proposes that dynamic capabilities should be combined with responsible innovation to adjust a digital business model that positively impacts the competitiveness and sustainability of an organization (Abdurrahman, Gustomo, and Prasetio 2024). Therefore, a part of business strategies for digitalization is to identify and develop dynamic capabilities for sustainability that include capabilities to create and co-create digital innovation and promote greater participation of multiple stakeholders (Iakovleva, Oftedal, and Bessant 2021). Greater participation impacts competitiveness, as it allows solving problems and gaining legitimacy and reputation (Porter and Kramer 2006; Carroll and Shabana 2010; Ortiz-Avram, Ovcharova, and Engelmann 2023). Additionally, new strategies must consider that companies are moving towards more open and collaborative structures to generate value (Adomako and Tran 2022; Li et al. 2024), requiring new governance schemes (Randles, Loconto, and Steen 2024).

This article's structure begins with a proposal of hypotheses based on a review of articles and theories and continues with a description of the methods used in the research. Finally, the results, conclusions, limitations, and suggestions for future research are presented.

2. Conceptual framework and hypotheses

2.1. Dynamic capabilities and their link to digital innovation and competitiveness

The new context of digitalization poses a challenge for companies to execute strategies to quickly adapt their resources and capabilities and remain in the market, which has been studied using the theory of dynamic capabilities (Teece, 2007). The theory of dynamic capabilities aims to explain an organization's strategic decisions, considering the changing environment and its capabilities to integrate, build, and reconfigure internal competencies and routines (Teece 2007). These capabilities enable effective organizational transformation, leading to adequate profits (Abdurrahman, Gustomo, and Prasetio 2024).

The theory of dynamic capabilities is recognized as an extension of Barney's (1991) resource- and capability-based theory, also known as the Resource-Based View (RBV). According to this perspective, dynamic capabilities are developed from VRIN resources, which are defined as valuable, rare, inimitable, and non-substitutable (Sultana, Akter, and Kyriazis 2022; Abdurrahman, Gustomo, and Prasetio 2024). These VRIN resources enhance adaptability and support the development of sustainable business models that can maintain a long-term competitive advantage (Teece 2018).

From the dynamic capability perspective, innovation management is viewed as a form of organizational capacity (Teece 2018). Therefore, to manage innovations in technology companies, it is essential to identify higher-order capabilities that enhance digital innovation processes. As a starting point, it is considered that the adoption of digital technologies becomes possible when digital preparation includes the organization's capacity, orientation, and willingness to create opportunities enabled by technologies and, overall, a favorable ecosystem and conditions (Yaqub and Alsabban 2023). Although the relationship between dynamic capabilities and digital innovation has been addressed in the literature, it remains scarce, particularly in quantitative studies (Zacca and Dayan 2018; Yousaf et al. 2021).

A fundamental factor in digital innovation is digital orientation, which is defined as a company's commitment to applying new technologies to generate new products, services, or solutions and the ability to respond to technological changes (Khin and Ho 2018). Companies with a higher technological orientation achieve a higher level of innovation because they have a greater vision and commitment to using new technologies to develop innovative products (Sultana, Akter, and Kyriazis 2022).

In addition, it should be considered that organizations seeking to adopt digital technologies to develop new products, processes, and services that offer superior performance must invest in and promote digital capability (Sultana, Akter, and Kyriazis 2022). Digital capability refers not only to IT resources, such as infrastructure, which are key in IT-enabled business models (El-Haddadeh 2019), but is more broadly defined as a company's ability, talent, and experience in managing digital technologies to develop new products and services (Khin and Ho 2018). Digital skills or capabilities must go beyond pure technology to include specific technologies and analytical skills to generate value, such as big data (Zhao 2024; Khin and Ho 2018).

The adoption of efficient digital innovations also depends on organizational culture, openness to change, and flexibility (Müller et al. 2019). A fundamental component of change management is the willingness to change, especially by leaders or managers, to reconfigure resources, capabilities, and routines (Teece 2018). The willingness to change implies the position of managers to take on new challenges and innovate or try new things (Zacca and Dayan 2018), which is essential to undertake changes in the business model based on digital innovations. The improvement of business practices in knowledge management, collaborative networks, and instances of participatory governance is associated with a company's willingness to change.

Although digital innovation depends on multiple factors, this study draws on the theory of dynamic capabilities and the work of Khin and Ho (2018), who identify digital orientation and digital capability as dynamic capabilities. It also incorporates the concept of willingness to change, as proposed by Zacca and Dayan (2018). Based on these foundations, the following hypotheses are proposed:

H1a Digital orientation has a positive direct effect on digital innovation

H1b Digital capability has a positive direct effect on digital innovation

H1c Willingness to change has a positive direct effect on digital innovation

Competitive advantage originates from a company's distinctive resources and competencies, including detecting, capturing, and transforming competencies, moving from first-order to second-order or dynamic capabilities (Teece 2018). Thus, in environments with rapid technological changes, wealth generation depends largely on the improvement of internal technological, organizational, and management processes within the company, or on the creation of resource configurations that are necessary in the face of changing markets (Teece, Pisano, and Shuen 1997). Therefore, learning and knowledge management, whether technological or organizational, are fundamental bases for the development of dynamic capabilities in organizations (Priyono and Hidayat 2024).

In this sense, dynamic capabilities, in addition to affecting digital innovation, can also directly impact competitiveness by influencing a company's organizational capacity, business model, or ongoing innovation (Abdurrahman, Gustomo, and Prasetio 2024). Chen, Wang, and Huang (2020) tested the direct relationship between firm performance and learning capabilities from external sources, research and development, resource allocation, and strategic planning by enabling adjustments in organizational processes. Accordingly, we propose the following hypotheses:

H1d Digital orientation has a positive direct effect on competitiveness

H1e Digital capability has a positive direct effect on competitiveness

H1f Willingness to change has a direct positive effect on competitiveness

Dynamic capabilities are relevant as enablers of digital innovation that impact competitiveness (Abdurrahman, Gustomo, and Prasetio 2024). Furthermore, strong dynamic capabilities will play a key role in achieving sustainability, which will mean strength in relation to competition (Gruchmann and Seuring 2018). When combined with digital strategy, dynamic capabilities redefine the business model that guides organizational transformation, permanent adjustments, and higher profits and competitiveness (Teece 2018). The exact manner in which an organization can benefit from a digitally oriented strategy remains scarce in the existing literature (Yousaf et al. 2021). Therefore, studying dynamic capabilities in digital environments and their effects on competitiveness is relevant (Abdurrahman, Gustomo, and Prasetio 2024).

Studies have confirmed that the relationship between dynamic capabilities and competitiveness is mediated by digital innovation. According to Abdurrahman, Gustomo, and Prasetio (2024), technological, organizational, strategic, and ecosystemic capabilities enable innovation and drive digital transformation in the banking sector. For example, data-driven capabilities, defined as a series of innovation processes that utilize big data analysis and technologies like machine learning, deep learning, and artificial intelligence (AI), allow organizations to extract significant value from data and efficiently generate innovative outcomes. These capabilities contribute to improved strategic performance (Sultana, Akter, and Kyriazis 2022). Khin and Ho (2018) presented the effect of digital capability and digital orientation on organizational performance mediated by digital innovation, a proposal applied in this research. Other capabilities from the organizational field are explored in this study, such as Zacca and Dayan (2018), who determined the positive relationship between willingness to change and business performance.

In practice, technology companies, for example, are developing dynamic capabilities such as big data analytics capabilities to explore business needs and opportunities to develop new digital products or services (Zhao 2024). Or are more actively integrating their stakeholders into open innovation schemes that promote co-creation and greater value generation for customers and the environment (De la Vega and Barcellos de Paula 2019; Lee, Moon, and Yin 2020; Barcellos-Paula, De la Vega, and Gil-Lafuente 2021).

Considering the digital orientation and digital capability linked to the digital environment and the willingness to change aligned with organizational and leadership capabilities, the following hypotheses are proposed:

H2a The positive impact of digital orientation on competitiveness is mediated by digital innovation

H2b The positive impact of digital capability on competitiveness is mediated by digital innovation

H2c The positive impact of willingness to change on competitiveness is mediated by digital innovation

2.2. Digital innovation and its link to competitiveness and responsible innovation

From an economic perspective, innovation is associated with competitiveness, not as an end in itself, but as a means of increasing a company's productivity and competitiveness by reducing production costs and participating in new markets (Khalil, Khawaja, and Sarfraz 2022; Cao et al. 2020). Specifically, technological innovations have been decisive in building competitive advantages (Kreiterling 2023; Yaqub and Alsabban 2023; Bodrožić and Adler 2017; Linden, Schmidt, and Rosenkranz 2017), by promoting operational efficiency, including automation, business process improvement, and cost savings (Vial 2019), and improving the relationship with customers and their stakeholders, generating greater shared value (D'Ippolito, Messeni, and Panniello 2019; El-Haddadeh 2019).

Digital innovations can bring value to a company and society by generating new products that meet new demands, redefining productivity in the value chain, and creating support groups for the company (Jirotka et al. 2017; Porter and Kramer 2006). Digital innovations have triggered revolutions influencing almost all aspects of the economy, including productive links and consumers (Soto-Acosta 2022), and changed economic and social structures and management models worldwide (Vial 2019).

Digital innovations are characterized by using computers and telecommunications supported by a digital network infrastructure (Bodrožić and Adler 2017). The presence of the Internet has brought about significant changes in the development of artificial intelligence, the Internet of Things (IoT), blockchains, cloud storage, data generation, and ecosystems (D'Ippolito, Messeni, and Panniello 2019; El-Haddadeh 2019). Digital innovation has multiple effects, such as improving customer experience, generating value, and increasing operational efficiency. In addition, they allow the use of dynamic capabilities, such as data analysis, to optimize processes that allow cost reduction and compliance with the changing regulations that govern the organization (Abdurrahman, Gustomo, and Prasetio 2024).

Beyond its impact on performance, digital innovation also drives greater articulation among stakeholders. It makes it easier to anticipate and respond to the effects of the environment, which aligns with the dimensions of responsible innovation (Stilgoe, Owen, and Macnaghten 2013; Cheng et al. 2024). In addition, advances in digital innovations have created new innovation schemes, such as open innovation, promoting the idea of collaboration with third parties, and breaking confidentiality schemes (De la Vega and Barcellos de Paula 2019; Elfaki and Ahmed 2024). Co-innovation in digital ecosystems enables the interconnection and interdependencies of economic actors who collectively share a common goal and destiny (Lee, Moon, and Yin 2020).

Digital innovation enables changes in business models, including disruptive changes in the film and entertainment industry, where Over-the-top (OTT) technology platforms such as Netflix enable new products and generate new global demand (Lee, Moon, and Yin 2020). Similarly, in the financial sector, financial technology in an open innovative ecosystem continues to evolve with important implications for stability and financial inclusion, posing significant challenges (Goo and Heo 2020; Fisher 2017). In the health and education sectors, digital innovations have enabled the large-scale transformation of care services on a large scale (Bodrožić and Adler 2017; Robbins et al. 2020; Yaqub and Alsabban 2023). Developing autonomous vehicles and IoT applications in the automotive sector highlights potential changes in the industry and everyday life (Bodrožić and Adler 2017). Likewise, digital innovations in the value chain have facilitated environmental management, time optimization, and community relationships (Fritz and Silva 2018). Consequently, we propose the following hypotheses:

H3a Digital innovation has a direct positive effect on competitiveness

H3b Digital innovation has a direct positive effect on responsible innovation

2.3. Responsible innovation, its mediating role and link with dynamic capabilities, digital innovation, and competitiveness

Responsible Research and Innovation (RRI) approaches emerged decades ago in response to the need for innovation and scientific research that integrates social and ethical considerations and fosters greater citizen engagement for enhanced social benefits and the creation of new governance frameworks (von Schomberg 2011; Guston 2014; Gayathri and Jananai 2019; Jakobsen, Fløysand, and Overton 2019). The European Union has integrated RRI principles into its innovation programs, recognizing that these programs must be technically sound, socially acceptable, and sustainable. In the "Horizon 2020" program, RRI is defined as an approach that allows the anticipation and evaluation of the potential impact and social

expectations associated with scientific research and innovations to facilitate the development of inclusive and sustainable research (Owen, von Schomberg, and Macnaghten 2021; Cao et al. 2020).

A key aspect of this approach is the need to promote greater communication among the actors involved, who become mutually responsible for the ethical acceptability, sustainability, and social convergence of innovation (Sánchez-Hernández. and Castilla-Polo 2024; Hadj, Omri, and Al-Tit 2020; Thapa, Iakovleva, and Foss 2019; Stilgoe, Owen, and Macnaghten 2013). Consequently, innovation processes must address both organizational interests and what is socially desirable, incorporating fundamental principles, such as ethical values and sustainable vision (von Schomberg 2011). These principles and values should be considered throughout the innovation development cycle to prevent stakeholder conflicts (Li et al. 2023).

The responsible innovation approach has also been linked to CSR and the triple bottom line principle, which includes the economy, environment, and society (Zhang et al. 2022). It can also be associated with the innovability approach integrated into the analysis of the model, which refers to "the convergence of innovation and sustainability in strategies to develop a product, process, service, organizational change, marketing strategy, or business model (or a combination of two) that seek greater competitiveness through sustainable practices" (De la Vega and Barcellos de Paula 2020, Section 3, paragraph 21).

Although efforts to integrate the responsible innovation approach are gaining strength at the business level, they remain relatively limited and represent a new paradigm for promoting risk management and sustainable development (Zhang et al. 2022). Cao, Lv, and Xing (2020) define responsible innovation as the initial stage of innovation, where companies include stakeholders who participate in decision-making and predict the impact of innovation on society and where employees are the central axis of the interested parties (Ureña-Espaillat et al. 2022). Stilgoe, Owen, and Macnaghten (2013) state that "responsible innovation means

taking care of the future through collective stewardship of science and innovation in the present" (1570). The concept of responsible innovation is dynamic and operates at multiple levels, with proposals demanding new governance of science (Zhang et al. 2022).

Considering the responsible innovation approach and its relationship with digital innovations, global initiatives have emerged that address the positive relationship between business and social well-being (Hadj 2020). However, several authors highlight gaps in analyzing the relationship between technology and society, noting that business actions involving technological components, particularly digital ones, can foster social value while still maintaining a competitive development orientation (Jirotka et al. 2017; Vial 2019; Ahuja, Chan, and Krishnamurthy 2022) and contribute to achieving the Sustainable Development Goals (Rîndaşu et al. 2023). These aspects require deeper analysis, aligning with Hadj, Omri, and Al-Tit (2020) observations on the need to explore the relationship between CSR, competitiveness, innovation, and responsible innovation, which is still in its developmental stage (Chou 2018).

Studies on responsible innovation can address this theoretical gap concerning its positive and negative impacts, providing a deeper understanding of innovation management (Pan et al. 2022), considering responsible innovation as a new norm of innovating or a new paradigm, which allows finding a balance between innovation and ethical risks and imposing ethical restrictions on emerging technologies (Cao, Lv, and Xing 2020; Cao et al. 2020; Chou 2018). Furthermore, from a stakeholder perspective, responsible innovation can enhance financial performance and promote sustainability (Pan et al. 2022).

Considering that digital innovations may raise societal concerns related to security, ethical information management, and other social and environmental impacts, these challenges can be addressed through responsible innovation strategies (Cao, Lv, and Xing 2020) and their core components: inclusion, anticipation, responsiveness, and reflexivity (Hadj 2020).

Accordingly, Stilgoe, Owen, and Macnaghten (2013) define these components as follows: inclusion involves engaging relevant stakeholders in the innovation process; anticipation refers to the analysis of present dynamics to shape desirable future outcomes; responsiveness is the ability to identify and mitigate risks; and reflexivity entails incorporating societal values and beliefs into innovation and research practices.

Therefore, companies must create, redesign, adapt, and disseminate technologies that address the relationship between business and social well-being, considering potential impacts and societal expectations (Hadj 2020; Ahuja, Chan, and Krishnamurthy 2022). Digital technologies positively impact the competitiveness of companies and society and create new opportunities. For instance, integrating big data and artificial intelligence can enhance companies' capabilities for a circular economy and sustainability in society, aligning with the SDGs' fulfillment (Yaqub and Alsabban 2023). Additionally, the Internet of Things, artificial intelligence, and sensor technology in agriculture and export industries enable greater traceability for sustainability (Neethirajan 2023).

Based on the above, the following hypotheses are proposed:

H4a Responsible innovation has a positive direct effect on competitiveness

H4b The positive impact of digital innovation on competitiveness is mediated by responsible innovation

H4c The positive impact of digital innovation on competitiveness is mediated by responsible innovation according to the orientation towards compliance with the SDGs.

Finally, this model proposes a relationship between willingness to change, digital capability, and responsible innovation. Given the need for responsible leadership and human and technical capabilities aligned with digital strategy, the following hypotheses are proposed:

H5a Willingness to change has a positive direct effect on responsible innovation

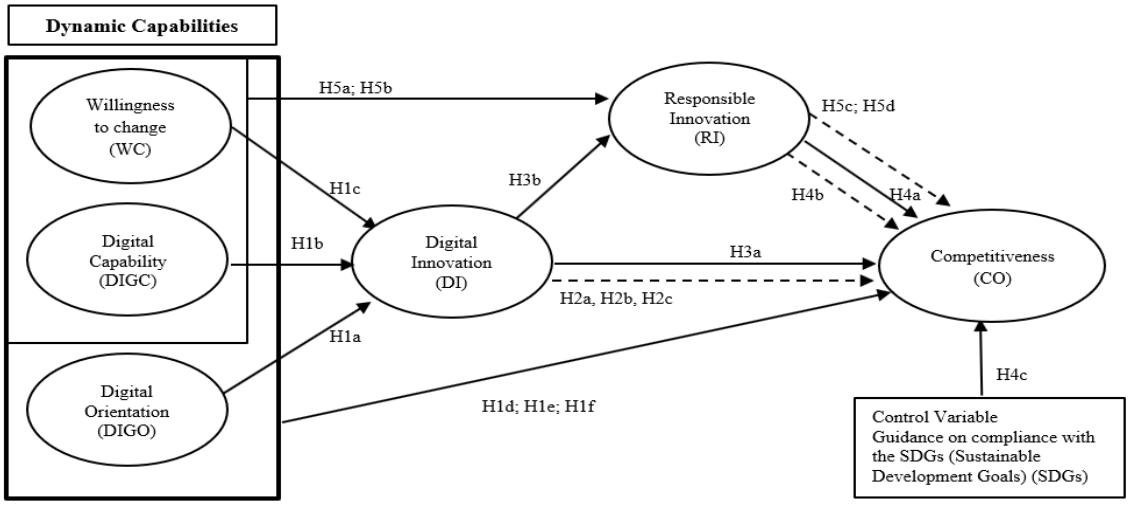
H5b Digital capability has a positive direct effect on responsible innovation

H5c The positive impact of willingness to change on competitiveness is mediated by responsible innovation.

H5d The positive impact of digital capability on competitiveness is mediated by responsible innovation.

In summary, this study considers innovation, specifically digital innovation, as the basis for achieving competitive advantage (Schumpeter 1934; Porter 1982; Bodrožić and Adler 2017). For the sustainable implementation of digital innovations, both dynamic capabilities and responsible innovation serve as differentiating factors in business models that demand agility (Elfaki and Ahmed 2024; Sultana, Akter, and Kyriazis 2022; Rîndașu et al. 2023). Furthermore, dynamic capabilities enable responsible innovation, which impacts the interrelationship between sustainable competitiveness in the digital innovation model. The proposed model is illustrated in Figure 1.

Figure 1. *Proposed Theoretical Model*



Note: Dashed lines refer to hypotheses with mediation relationships

3. Methodology

This research was framed as a quantitative paradigm based on experimental and transversal designs. A structural equation model (SEM) was used to perform multivariate and factorial analysis of the investigated variables.

3.1. Sample and data collection

To examine the relationships among the variables proposed in the model, we conducted a questionnaire survey with those responsible for digital projects of private information and technology (IT) companies in Ecuador at the national level in three regions of the country (Coast, Highlands, and Amazon) to reduce regional risk. The selection of those responsible for digital projects as middle or senior managers was based on previous studies that considered these profiles appropriate for learning innovation processes (Cao, Lv, and Xing 2020; Cao et al. 2020).

Aligned with Khin and Ho (2018) and Zhang et al. (2022), we focused on the IT sector in an upper-middle-income economy in the empirical context of our study. This sector was chosen because IT companies innovate rapidly and are enabled by emerging technologies (Cao, Lv, and Xing 2020), thus opening an interesting context for testing our empirical model.

According to the World Bank (2024), Ecuador, a Latin American and Caribbean country, is classified as an upper-middle-income developing economy. It represents a context in which companies must engage in continuous innovation to remain competitive and respond to market demands (Fritz and Silva 2018; Chen, Li, and Zhang 2022). In addition, this environment is shaped by growing expectations around adopting responsible innovation practices (Ureña-Espaillat, Briones-Peñalver, and Bernal-Conesa 2022). Conducting research in a Latin American country is particularly significant, as no prior empirical studies have examined responsible innovation in digital environments within this regional context. It is

aligned with the identified research gaps that emphasize the importance of studying responsible innovation in diverse cultural and geographical settings. While such studies have been conducted in Asia, Africa, and the Middle East, Latin America remains underexplored (Chen, Li, and Zhang 2022; Zhang et al. 2022).

Like other countries in the Latin American region and middle-income countries worldwide, Ecuador has made progress in adopting digital technologies largely due to improvements in connectivity. According to World Bank data, Ecuador had 70% Internet coverage in homes in 2021, compared to an average of 75% in Latin America and the Caribbean, 63% globally, 91% in high-income countries, 58% in middle-income countries, 38% in lower-middle-income countries, and 25% in low-income countries. Digital payments made or received by people in Ecuador went from 25% in 2014 to 47% in 2021, compared to an average of 66% in Latin America and the Caribbean in 2021, 64% globally, 57% in middle-income countries, 38% in lower-middle-income countries, and 35% in low-income countries. Furthermore, in Ecuador, there is high access to cell phones for those over 15 years of age, which reached 89% of the population in 2021, compared to 89% in Latin America and the Caribbean and 84% in middle-income countries (Demirgüç-Kunt et al., 2022).

The development of competitive and sustainable technology companies represents an opportunity and urgency for the Ecuadorian economy, which relies heavily on extracting natural resources. Ecuador must also prioritize strengthening sectors with added value and export potential as a dollarized economy.

Improving the competitiveness and sustainability of Ecuadorian technology companies has an impact on the rest of the business environment, as these firms provide digital services to other companies seeking to adjust and adapt their traditional business models to the digital realm. Additionally, Ecuador's status as one of the most megadiverse countries in the world, due to its wide variety of species, ecosystems, and environmental services (Kleemann et al.

2022), positions it as a unique context for innovation. For instance, applying digital technologies such as blockchain and non-fungible tokens (NFTs) in forest conservation and offsetting carbon footprint (Grupo Futuro 2023) exemplifies initiatives that align with responsible innovation and the Sustainable Development Goals. Incorporating the concept of responsible innovation in the digital innovation models of Ecuadorian companies is new. It aims to highlight the importance of promoting innovations that contribute to mitigating climate change, fostering financial inclusion, supporting the conservation of fragile ecosystems, and improving the living conditions of Indigenous communities and the poor population in the country.

Implementing digital innovation in Ecuador's important economic sectors has generated value and positive social and environmental impacts (Ramírez-Orellana et al. 2021). In the financial sector, fintech companies have promoted financial inclusion. The export sector has positive impacts on resource management, such as water. Thus, the application of the Internet of Things in the floriculture sector through sensors in crops generates information that improves the decision-making process and impacts production levels (Arcos, Calvache, and Calderón 2024). The application of IoT, big data, and artificial intelligence in shrimp sector pools improves productivity by remotely monitoring water quality and use (Pontón et al. 2024).

Regarding the research questionnaire, we developed the original questionnaire in English based on existing measures and then translated it into Spanish following the back-translation approach (Brislin 1970). To ensure the content and understanding of the questionnaires, cognitive interviews were conducted with five senior and expert managers of digital projects who reviewed the questionnaire to assess the conceptual equivalence between the original and translated instruments (Chen, Li, and Zhang 2022). Based on the interviews, grammatical adjustments were made to the questionnaires, and a pilot study was conducted with 45 digital

project managers from private companies. The results showed internal reliability and validity levels according to confirmatory factor analysis.

Data collection was carried out in several stages. First, IT companies in Ecuador were identified based on the International Standard Industrial Classification (ISIC) Rev. 4.0. These companies are registered with the Superintendence of Companies, Securities, and Insurance of Ecuador and include technological manufacturers, fintech firms, implementers and technology integrators, technological infrastructure providers, technology wholesalers, satellite tracking services, computer security firms, internet service providers, cloud and data transmission services, image transmission services, and cellular and landline telecommunication providers. Hardware vendors were excluded from the analysis.

Second, a database was created by identifying individuals responsible for digital projects, including their names, positions, email addresses, and LinkedIn profiles, from a sampling frame of 2,749 companies.

Third, the questionnaire validated in the pilot study was emailed to all companies in the database. The email included a request for participation, for which the presentation was made, with an explanation of the research topic aimed at academic purposes, the time required to complete the questionnaire, and a commitment to anonymity and confidentiality. To improve the response rate to the survey, emails were spaced over time to remind participants of their participation, in addition to using other channels, such as LinkedIn. A total of 223 questionnaires were obtained, of which 216 were usable observations (six observations were dropped due to missing data), complying with the necessary sample greater than the 200 suggested, in order to apply the SEM model (Hoelter 1983; Kelloway 1998). Online channels stand out in several studies because they do not have time or space barriers (Zhang et al. 2022). In this study, data was collected over three months. The characteristics of the sample are presented in Table 1 and do not present differences with

respect to the sampling frame. Most respondents were in the highland region (63%). Regarding technology, the most used technology for developing products and services was cloud computing, with 82% of the companies surveyed, followed by big data (44%). Finally, 71% indicated that their digital innovation processes were linked to compliance with the SDGs, indicating a high level of awareness of these global commitments.

Table 1. *Sample characteristics (N=216)*

Sample characteristics	N	Percentage
Total firms = 2749		
Region		
Coast	78	36%
Highlands	136	63%
Amazon	2	1%
Number of employees		
1 - 49 employees	179	83%
50 - 249 employees	25	12%
More than 250	12	6%
Sector		
Data processing	110	51%
Accommodation and related services	29	13%
Other Information Services (including software publishers)	77	36%
Years in the market		
0 - 1 year	26	12%
2 - 5 years	50	23%
6 - 10 years	48	22%
10 - 15 years	25	12%
More than 16 years	67	31%
Digital innovation processes linked to compliance with the SDGs		
Yes	154	71%
No	62	29%
Type of digital technology used for product and service development		
Big data	94	44%
Internet of Things (IoT)	72	33%
Cloud Computing	177	82%
Augmented and virtual reality	19	9%
Artificial Intelligence (AI)	65	30%
Cyber-physical systems (CPS)	46	21%

3.2. Measures

Constructs and their measures from previous studies were used as references to contribute to the validity and reliability of the results obtained in this study (Khin and Ho 2018; Zacca and Dayan 2018; Hadj 2020). All constructs included in this research–digital innovation, digital capability, digital orientation, willingness to change, and competitiveness in previous studies–presented the respective validity and reliability, thus obtaining average variance extracted (AVE) measurements greater than 0.5, composite reliability greater than 0.7, and Cronbach's alpha greater than 0.7. These studies also reference the relationships that they present in the structural models of the studied variables. The details of the constructs, measurement items, scales, and sources are shown in Table 3, considering good scale practices (Haws, Sample, and Hulland 2023).

3.3. Nonresponse bias and common method variance

To ensure the sample was representative, a nonresponse bias test was performed. According to Armstrong and Overton (1977), late respondents are similar to those who did not respond. When comparing early and late respondents on general descriptive characteristics and research variables, we found no significant differences ($p>0.05$; Table 2), suggesting that nonresponse bias does not affect our results.

Table 2. *Test for nonresponse bias*

Variables	Sample classification (before and after)	
	t value	*P* value
Digital Innovation	1.551	0.064
Digital Orientation	0.302	0.382
Digital Capability	-0.447	0.328
Willingness to change	1.127	0.133
Responsible Innovation	-0.729	0.235
Competitiveness	1.095	0.139

Regarding the risk of common method bias, first, for the development of the research ex-ante, good practices from other studies were considered, such as including in the presentation of the questionnaire that explained the purpose of the research, commitment to

confidentiality, and anonymity of the participants to reduce social desirability bias. Furthermore, different measurement scales were maintained for the items of the dependent and independent constructs, and the constructs were randomly arranged in the questionnaire (Zhang et al. 2022). An unmeasured random marker variable was used to identify common bias method factors for the ex-post evaluation. It was confirmed that the common bias method did not affect the data because the inclusion of the unmeasured latent factor did not alter the significance of any factor loading of the model fit indices, with VIF values of less than 3 (Podsakoff et al. 2003).

4. Analysis and Results

The structural equation model (SEM) was applied for data analysis, using the partial least squares (PLS) approach to determine the relationships of the variables with multivariate regressions and factor analysis and to answer the proposed hypotheses. PLS-SEM is used for exploratory research (Hair 2017; Hair et al. 2019) and is considered a variance-based approach due to its ability to measure compounds and factors (Richter et al. 2022). The Smart PLS 4.0 equation modeling tool was used for the analysis. Firstly, the evaluation of the measurement model was carried out to establish the reliability and validity of the constructs, and secondly, the structural model that determines the significance of the relationships proposed in the hypotheses is evaluated, using bootstrap analysis with 5000 samples (Richter et al. 2022; Rîndașu et al. 2023).

4.1. Analysis of the measurement model

Confirmatory factor analysis (CFA) was used to determine the factor structure of the dataset and measurement model, allowing the validity and reliability to be estimated. All factor loadings were significant ($p < 0.001$) with an average greater than 0.7, and the average variance extracted (AVE) was higher than the threshold of 0.5 (Fornell and Larcker 1981), which supports the convergent validity of all constructs (Table 3). In this study, all constructs

were modeled as reflective; therefore, the indicators should share a high proportion of variance (Richter et al. 2022). The square root of AVE was greater than the correlations between constructs (Table 4), and the HTML values were less than 0.9, indicating discriminant validity (Fornell and Larcker 1981; Richter et al. 2022). Cronbach's alpha and composite reliability (CR) were used to evaluate reliability; all values obtained were higher than 0.7 (Khin and Ho 2018).

Table 3. *Measurement items, construct validity, and reliability*

Source	Measurement Likert scales	Questionnaire Items	Factor loadings	AVE	CR	Cronbach's α
		Digital Innovation (DI)		0.69	0.92	0.89
Khin and Ho (2018)	From 1 = Strongly disagree to 5 = Strongly agree	Considering your company, indicate the LEVEL OF AGREEMENT with the following statements:				
		(1) The quality of our digital solutions is superior to that of our competition.	0.88			
		(2) The features of our digital solutions are superior to those of our competitors.	0.85			
		(3) The applications of our digital solutions are totally different from those of our competitors.	0.83			
		(4) Our digital solutions are different from our competitors in terms of product platform.	0.81			
		(5) Some of our digital solutions are new to the market at the time of their launch.	0.78			
		Competitiveness (CO)		0.63	0.87	0.81
Hadj (2020)	From 1 = Not at all important, 2 = Not very important, 3 = Somewhat important, 4 = Quite important and 5 = Extremely important	Indicate the LEVEL OF IMPORTANCE given by your company for each of the following statements:				
		(1) Ability to attract customers with the benefits of its products by improving its brand image and its own characteristics	0.85			
		(2) Encourages consumers to buy products by offering them specific services compared to competing companies	0.80			
		(3) Competitive pressure has decreased as a result of the specificities of your product compared to the different products available on the market	0.72			
		(4) Has a good communication policy	0.80			
		Responsible Innovation (RI)		0.60	0.86	0.78
Hadj (2020)	From 1 = Not at all, 2 = Rarely, 3 = Often and 4 = Always	Indicate THE FREQUENCY with which your company applies each of the following statements:				
		(1) Involves different stakeholders in the innovation process (Inclusion)	0.76			
		(2) Takes into account the current dynamics in the innovation process for the design of the future (Anticipation)	0.77			
		(3) Ability to identify potential risks and react accordingly (Response Capacity)	0.81			
		(4) Integrates the values and beliefs of the public into its research and development activities (Reflexivity)	0.76			
		Dynamic Capabilities				

		Digital Capability (DIGC)		0.68	0.92	0.88
Khin and Ho (2018)	From 1 = Very low to 5 = Very high	Indicate the CAPACITY LEVEL of your company regarding the following actions:				
		(1) Acquisition of important digital technologies	0.78			
		(2) Identification of new digital opportunities	0.84			
		(3) Response to digital transformation	0.87			
		(4) Mastery of cutting-edge digital technologies	0.81			
		(5) Development of innovative products/services/processes using digital technology	0.84			
		Digital Orientation (DIGO)		0.72	0.91	0.87
Khin and Ho (2018).	From 1 = Strongly Disagree to 5 = Strongly Agree	Please indicate your LEVEL OF AGREEMENT of your company with the following statements				
		(1) We are committed to using digital technologies in the development of our new solutions.	0.88			
		(2) Our solutions have superior digital technology.	0.86			
		(3) New digital technology is easily accepted in our organization.	0.83			
		(4) We are always looking for opportunities to use digital technology in our innovation.	0.82			
		Willingness to change (WC)		0.78	0.91	0.86
Zacca and Dayan (2018)	From 1 = Strongly disagree to 5 = Strongly agree	Please indicate your LEVEL OF AGREEMENT of your company with the following statements				
		(1) Managers are willing to take on the new challenges that our company faces.	0.91			
		(2) Managers are usually willing to try new things for our company.	0.90			
		(3) In general, managers are fascinated by novel ideas.	0.84			

Table 4. *Correlations between constructs*

	COMP	DI	DIGC	DIGO	RI	WC
COMP	*0.79*					
DI	0.69	*0.83*				
DIGC	0.65	0.68	*0.83*			
DIGO	0.52	0.64	0.69	*0.85*		
RI	0.68	0.57	0.64	0.58	*0.78*	
WC	0.44	0.54	0.56	0.68	0.56	*0.88*

Note: The numbers in italics on the diagonal are the square roots of the AVE; off-diagonal numbers are the correlations between the constructs.

4.2. Structural model results

The structural model and relationships between variables were evaluated to test this hypothesis, as presented in Table 5 and Figure 2.

Regarding the relationship between digital orientation, digital capability, willingness to change, and digital innovation, the direct effects of digital orientation (β=0.265, $p < 0.001$) and digital capability (β=0.430, $p < 0.001$) on digital innovation are significant and positive;

thus, H1a and H1b are supported. The direct effect of willingness to change on digital innovation was not verified, and H1c was rejected. The R^2 of 0.523 for digital innovation in Figure 2 suggests that 52.3% of the variation is explained by digital orientation (f^2=0.059) and digital capability (f^2=0.199).

Regarding the effect of dynamic capabilities (DIGO, DIGC, and WC) on competitiveness mediated by digital innovation, DIGO (β=0.103, p <0.009) and DIGC (β=0.168, p <0.001) are significant and positive; thus, H2a and H2b are accepted. The WC was not significant; therefore, H2c was rejected. Regarding the direct link between digital innovation and competitiveness, the direct effect was verified (β=0.389, p <0.001), and H3a was accepted. The direct relationship between digital innovation and responsible innovation is also verified (β=0.179, p <0.023), and H3b is accepted. Furthermore, the direct effect of DIGC on competitiveness was significant and positive (β=0.172, p <0.045), and H1e was accepted. DIGO and WC were not significant, thus rejecting H1d and H1f, respectively.

The structural model includes the responsible innovation construct, whose direct effect on competitiveness is validated (β=0.375, p <0.001), and H4a is accepted. Furthermore, H4b is accepted, referring to the fact that responsible innovation mediates the relationship between digital innovation and competitiveness (β=0.067, p <0.042). Furthermore, orientation toward compliance with the SDGs included in the structural model as a control variable significantly affected the relationship with competitiveness SDGs (β=0.275, p <0.019). H4c is accepted.

A relevant finding is the direct and significant effects of WC (β=0.262, p <0.001) and DIGC (β=0.369, p <0.001) on responsible innovation. Thus, H5a and H5b were supported. The R^2 value of responsible innovation (0.484) suggests that DIGC, WC, and digital innovation can explain 48.4% of the variation in responsible innovation. Responsible innovation also mediates the relationship between competitiveness and WC (β=0.098, p <0.003) and DIGC (β=0.138, p <0.001); thus, H5c and H5d are supported.

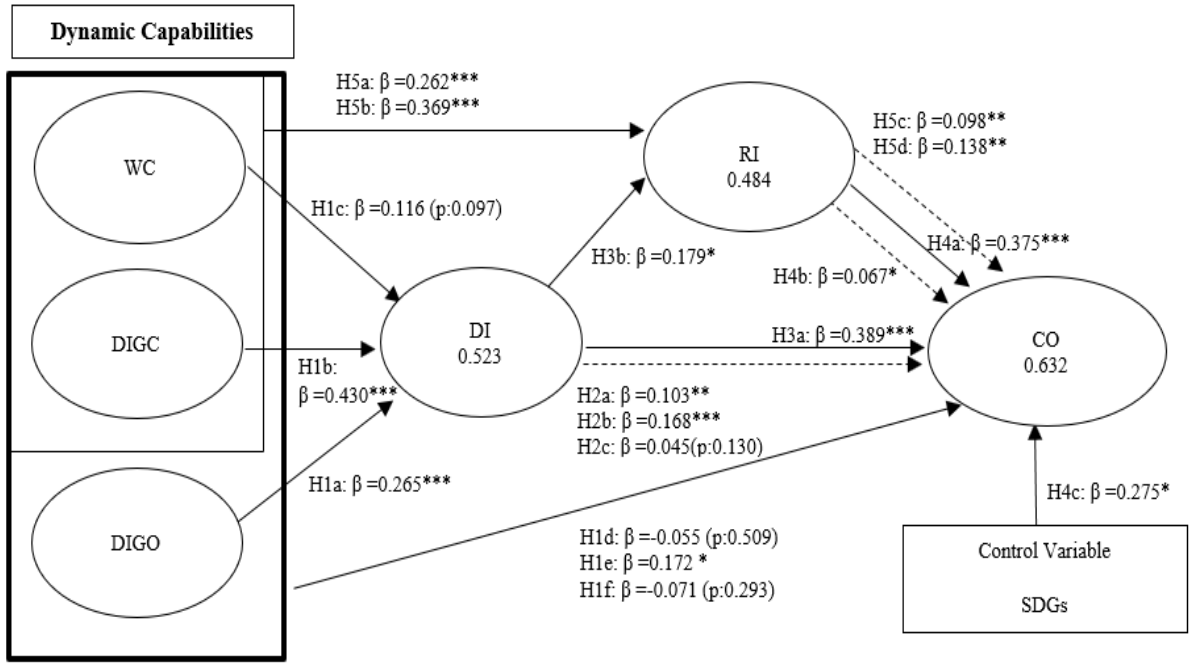
Finally, the R^2 value of 0.632 for competitiveness suggests that 63.2% of the variation is explained by the constructs digital capability (f^2=0.031), digital innovation (f^2=0.188), responsible innovation (f^2=0.192), and compliance orientation. SDGs (f^2=0.034) considering impact thresholds.

Table 5. *Hypothesis testing results*

Hypothesis – Effect			β	Av. sample	SD.	T-Value	P Values		Decision
H1a	DIGO -> DI	DIGO positively affects DI	0.265	0.270	0.08	.502	0.000	***	Accepted
H1b	DIGC -> DI	DIGC positively affects DI	0.430	0.429	0.09	.068	0.000	***	Accepted
H1c	WC -> DI	WC positively affects DI	0.116	0.115	0.07	.66	0.097		Rejected
H1d	DIGO -> COMP	DIGO positively affects COMP	-0.055	-0.052	0.08	.661	0.509		Rejected
H1e	DIGC -> COMP	DIGC positively affects COMP	0.172	0.173	0.09	.003	0.045	*	Accepted
H1f	WC -> COMP	WC positively affects COMP	-0.071	-0.072	0.07	.051	0.293		Rejected
H2a	DIGO -> DI -> COMP	DI mediates the positive effect of DIGO on COMP	0.103	0.106	0.04	.612	0.009	**	Accepted
H2b	DIGC -> DI -> COMP	DI mediates the positive effect of DIGC on COMP	0.168	0.164	0.04	.129	0.000	***	Accepted
H2c	WC -> DI -> COMP	DI mediates the positive effect of WC on COMP	0.045	0.045	0.03	.513	0.130		Rejected
H3a	DI -> COMP	DI positively affects COMP	0.389	0.389	0.08	.826	0.000	***	Accepted
H3b	DI -> RI	DI positively affects RI	0.179	0.180	0.08	.276	0.023	*	Accepted
H4a	RI -> COMP	RI positively affects COMP	0.375	0.373	0.08	.773	0.000	***	Accepted
H4b	DI -> RI -> COMP	RI mediates the positive effect of DI on COMP	0.067	0.067	0.03	.035	0.042	*	Accepted
H4c	SDGs -> COMP	SDGs positively affect COMP	0.275	0.279	0.12	.352	0.019	*	Accepted
H5a	WC -> RI	WC positively affects RI	0.262	0.262	0.07	.706	0.000	***	Accepted
H5b	DIGC -> RI	DIGC positively affects RI	0.369	0.370	0.08	.394	0.000	***	Accepted
H5c	WC -> RI -> COMP	RI mediates the positive effect of WC on COMP	0.098	0.097	0.03	.972	0.003	**	Accepted
H5d	DIGC -> RI -> COMP	RI mediates the positive effect of DIGC on COMP	0.138	0.138	0.04	.245	0.001	**	Accepted

Note: *p<0.05; **p<0.01; ***p<0.001

Figure 2. *Structural Model*



Notes: *p<0.05; **p<0.01; ***p<0.001
Dashed lines refer to hypotheses with mediation relationships

To evaluate the potential endogeneity of the model, the Gaussian copula approach of Park and Gupta (2012) was applied, following the procedure of Hult et al. (2018). First, the Kolmogorov–Smirnov test was applied with the Lilliefors correction, and it was verified that the variables (WC, DIGC, DIGO, DI, and RI), which served as independent variables of the latent variable COMP in the model, did not have a normal distribution. With this verification, the Gaussian copula approach was applied. The results showed that none of the Gaussian copulas (WC, DIGC, DIGO, DI, or RI) were significant ($p > 0.05$). Specifically, considering the five predictor constructs of COMP as potentially endogenous produced non-significant copulas: WC ($p = 0.328$), DIGC ($p = 0.295$), DIGO ($p = 0.56$), DI ($p = 0.764$), and RI ($p = 0.287$). These results support the model's robustness by not showing endogeneity (Sarstedt et al. 2020; Hult et al. 2018).

5. Discussion and implications

5.1. Main findings

This study empirically validates the relationship between dynamic capabilities (digital orientation, digital capability, and willingness to change), digital innovation, responsible innovation, and competitiveness by integrating them into a competitive and sustainable digital innovation model in Ecuadorian IT companies.

5.1.1. Dynamic capabilities and their link to digital innovation and competitiveness

Our results show that dynamic capabilities positively influence digital innovation and competitiveness, aligning with dynamic capabilities theory on firms' ability to adjust their strategic resources and processes (Teece 2007; Khin and Ho 2018; Teece 2018). Digital orientation and digital capability have been shown to have a direct relationship with digital innovation (Khin and Ho 2018; Yousaf et al. 2021; Srisathan and Naruetharadhol 2022; Sultana, Akter, and Kyriazis 2022; Rîndașu et al. 2023); and digital capability has a direct impact on competitiveness (Chen, Wang, and Huang 2020; Chen, Li, and Zhang 2022). Digitally oriented companies can quickly gain information through digital technology, which allows them to understand the market and new trends. Small companies can participate in digital ecosystems to complement their limited technological resources and to identify customer needs (Li et al. 2024; Zhang et al. 2022). Digital capabilities are relevant for companies to reconfigure their internal and external capabilities and adapt to external uncertainties to maintain competitiveness (Chen, Li, and Zhang 2022).

The willingness to change, considered in the model a second-order capacity, has no direct relationship with digital innovation or competitiveness; however, its direct and positive relationship with responsible innovation has been proven, considering that the willingness to change is essential to adapt the organizational culture and greater participation of interested parties towards organizational strategies linked to co-creation in the new digital era (Zacca

and Dayan 2018; Zhang et al. 2022). The results are associated with those proposed by Chou (2018), who shows that strategic orientation and an organization's principles and values that guide ethical conduct are positively associated with responsible innovation.

5.1.2. Digital innovation and its link to competitiveness and responsible innovation

This study, specifically conducted in Ecuadorian technology companies, corroborates other studies (Khin and Ho 2018; Khalil, Khawaja, and Sarfraz 2022; Sultana, Akter, and Kyriazis 2022; Elfaki and Ahmed 2024) that demonstrate the direct and positive relationship between digital innovation and competitiveness. This relationship enables companies to improve processes and productivity and provides more extensive and accurate information, allowing them to identify potential risks ahead of their competitors (Cao et al. 2020). Digital innovation is also a mediating variable between dynamic capabilities (digital capability and digital orientation) and competitiveness (Khin and Ho 2018; Yousaf et al. 2021; Sultana, Akter, and Kyriazis 2022), demonstrating that a true digital transformation that impacts competitiveness does not focus solely on technical aspects but on higher-order organizational capabilities (Khin and Ho 2018). It has also been shown that a high percentage of IT companies in Ecuador are oriented towards compliance with the SDGs in their relationship with digital innovation and competitiveness.

5.1.3. Responsible innovation, its mediating role and link with dynamic capabilities, digital innovation, and competitiveness

Responsible innovation has been included in the digital innovation model, considering the challenges that companies face when integrating the principles of social responsibility in promoting digital development (Yousaf et al. 2021). The direct and positive relationship of responsible innovation with competitiveness was verified in this study (Hadj 2020; Hadj, Omri, and Al-Tit 2020; Chatterjee, Chaudhuri, and Vrontis 2021; Ureña-Espaillat et al. 2022). Furthermore, responsible innovation was proven to mediate between digital innovation

and competitiveness, which aligns with the findings of Pan et al. (2022), according to which technological progress is a key factor in transforming companies' responsible innovation models.

The incorporation of responsible innovation into the digital model emphasizes a collective and democratic approach to managing the innovation process. This approach enables a wider range of interested actors to become co-creators of value, promoting inclusive participation in shaping innovation outcomes (Stilgoe, Owen, and Macnaghten 2013; Zhang et al. 2022). It aligns with the concept of participatory democracy, which establishes a new logic of governance in the digital sphere (Cao et al. 2020), and entails a new paradigm for the transformation of traditional innovation toward a competitive and sustainable digital innovation paradigm (Cao, Lv, and Xing 2020).

Stakeholder participation can help companies analyze and anticipate the impact of innovation (Zhang et al. 2022), which impacts competitiveness. Responsible innovation includes relationships with stakeholders, including employees (Tian and Tian 2021). For instance, Indian IT companies use best practices to improve their ability to share knowledge among employees and stimulate innovation (Chatterjee, Chaudhuri, and Vrontis 2021). In the context of a dynamic market, companies can adopt responsible innovation to improve performance and mitigate the damages that could occur (Stilgoe, Owen, and Macnaghten 2013), considering a collaborative approach that constitutes an effective tool for an impact on the organization and financial reward (Chatterjee, Chaudhuri, and Vrontis 2021).

Furthermore, responsible innovation mediates the relationship among the dynamic capabilities of willingness to change, digital capability, and competitiveness. These results align with those of Zhang et al. (2022), who found that companies with digital strategic orientation allow them to capture, discover, and analyze a large amount of information at high speed to respond to demands and risks with counterparties. Incorporating responsible

innovation positively impacts competitiveness, which requires a holistic approach that allows it to take advantage of competitive opportunities and simultaneously generate positive economic, social, and environmental impacts (Gurzawska 2021).

5.2. Theoretical contributions

First, this study contributes to the discussion of the relationship between dynamic capabilities theory in technological contexts (Barney 1991; Teece 2007) based on the development of an empirical model of competitive and sustainable digital innovation, which integrates dynamic capabilities (digital orientation, digital capability, and willingness to change) as enablers of digital innovation, competitiveness, and responsible innovation. Second, responsible innovation was incorporated into the empirical digital innovation and competitiveness model. This contribution is relevant because there is little literature at a global level on the application of responsible innovation in empirical models and digital contexts. This research is the first study for Ecuador and the Latin American region to integrate responsible innovation applied to technology companies. Therefore, the findings provide a reference for further theoretical research on responsible innovation (Nanath and Pillai 2017; Hadj 2020; Hadj, Omri, and Al-Tit 2020; Pan et al. 2022). Third, it expands research on dynamic capabilities and their relationship with digital and responsible innovation. The results obtained in the model clarify the strategic role of dynamic capabilities and responsible innovation in supporting successful business digital transformation processes that impact competitiveness.

5.3. Managerial implications

In the context of permanent changes, technology companies and other companies of different sectors generally face enormous challenges in achieving sustainable competitiveness, which is not limited to resources but requires adjustments in organizational capabilities. This study proposes a digital innovation model that presents key variables (dynamic capabilities and

responsible innovation) to enable companies to determine strategies or practices that lead to a sustainable competitive advantage. To implement this model in practice, companies need to self-assess as a starting point to identify their VRIN strategic resources (human, technological, and operational) and determine the key dynamic capabilities to respond to a changing environment (Teece 2018; Cheng et al. 2024).

There are several strategies and mechanisms for developing dynamic capabilities and implementing responsible innovation, highlighting the inclusion of stakeholders in the innovation process and monitoring (Cao, Lv, and Xing 2020). It is key to understand the impact of digital innovations on stakeholders to support the improvement of competitiveness (Kreiterling 2023). Participating in innovation ecosystems and integrating stakeholders supports co-innovation and co-evolution to generate new products and identify impacts (Lee, Moon, and Yin 2020). Internally, it is relevant for companies to generate second-order capabilities associated with knowledge management for digital innovation, management of organizational change towards flexible innovation schemes, agile management of projects aligned with digital strategy, and management of corporate digital infrastructure with data security criteria (Ellström et al. 2022). Digital innovations linked to dynamic capabilities and responsible innovation have significant potential for improving competitiveness, which requires clear strategy and leadership.

6. Conclusions, limitations, and future research

The results demonstrate that implementing a competitive and sustainable digital innovation model that integrates dynamic capabilities with responsible innovation enables companies to achieve higher levels of competitiveness. This approach allows for a broader discussion of the intersection of the dynamic capabilities theory to explore sustainable competitiveness in the digital age.

This study constitutes the first empirical study of responsible innovation in the digital field in Ecuador and a reference for other countries in the region to delve deeper into the subject. Furthermore, this study deepens the discussion and analysis of the business sector, academia, government, and citizens to promote the technology sector with a focus on sustainability, considering the opportunities and risks that it can generate.

Although the findings of this study are consistent with those of the theoretical proposal, there are some limitations. First, the study was quantitative, cross-sectional, and self-reported, which may have caused common method problems. Some considerations were contemplated for this, such as an anonymous questionnaire and constructs comprising several items from previous research that presented adequate psychometric measurements. Corresponding validity and reliability assessments were performed. Data collection was rigorous according to the determined profile. Second, the research results correspond to a middle-income country and a growing technology sector in Latin America; therefore, extrapolation of the results must consider these differences. Third, although it has been proven that there is no endogeneity in the model, the risk is not completely ruled out; therefore, longitudinal studies are recommended.

For future research, this model can be considered as a starting point, as the mediating or moderating variables can be replicated and expanded for other sectors or countries, and it can be complemented with qualitative research. Finally, statistics or information on technology companies at the national level are still limited, as is their impact on the economy, environment, and society, a relevant field for future research.

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Chapter II. Conclusions and Recommendations

Conclusions

The study empirically validates a model of sustainable digital innovation at the firm level in the new digital era, which includes dynamic capabilities (digital orientation, digital capability, and readiness for change), responsible innovation, and their positive link with competitiveness in technology companies in Ecuador, a developing Latin American country. The model contributes to the debate on the incorporation of responsible innovation in digital contexts and the need for a paradigm shift in the digital era regarding the factors that drive sustainable and competitive digital innovation, including greater stakeholder participation in co-innovation processes or collaborative schemes. Furthermore, the research contributes to the research gaps identified by other authors on the relationship between dynamic capabilities, digital innovation, responsible innovation, and competitiveness.

Digital innovation driven by a set of dynamic or second-order capabilities generates innovations that impact the sustainable development of companies. In this context, companies and policymakers in these countries should include strategies to strengthen people's digital skills that impact competitiveness in a digital environment. Responsible innovation mediates the relationship between digital innovation and competitiveness. This requires companies to incorporate a responsible approach to generating shared value into their strategies. This involves aligning digital innovations with societal needs, implementing ethical principles, and engaging stakeholders in their development from the outset.

The study's results demonstrate the need to develop sustainable digital innovation models as a differentiating factor for companies and a determinant of greater competitiveness in the 4.0 era. Companies' efforts to safeguard the future through responsible innovation management and dynamic capabilities can help them achieve a sustainable competitive advantage and contribute to achieving the SDGs.

Implications

This study makes several theoretical contributions. First, it proposes an empirical model for sustainable digital innovation based on dynamic capabilities as enablers of digital innovation and their relationship with competitiveness, and includes responsible innovation as a key variable in a company's digital strategy. This innovative approach presents companies with the need to strengthen their resource adjustment capabilities (organizational and strategic) aligned with elements that enable the generation of shared value.

Second, it tests the relationship of dynamic capabilities—which in this study include digital orientation, digital capability, and readiness for change—with digital innovation, responsible innovation, and competitiveness, demonstrating the need for companies to establish strengthening strategies based on these elements as the basis of a digital transformation strategy. Third, it incorporates responsible innovation as a mediating variable in a model of digital innovation and competitiveness, highlighting the need to make the impacts of innovation visible from the outset. The incorporation of responsible innovation into an empirical model for digital issues in developing countries is a significant contribution. While previous qualitative studies have been conducted in this field, the literature identifies gaps (Pan et al., 2022; Hadj et al., 2020; Hadj, 2020; Nanath & Pillai, 2017). The results obtained enrich the literature and suggest a deeper debate on dynamic capabilities and responsible innovation as essential elements in the development of sustainable digital innovation strategies.

Recommendations

The study addresses the challenge of promoting a sustainable model of digital innovation at the business level, which presents an opportunity for future research, given that these are concepts under development. While the study's findings are consistent with the theoretical proposal, it presents some limitations. First, the study is quantitative, cross-sectional, and

self-reported, which can lead to common methodological problems. Therefore, some considerations were taken into account in this research, such as the anonymous nature of the questionnaire. Furthermore, the constructs are composed of several items, which correspond to previous research that, like the present one, demonstrates adequate psychometric measurements, and the corresponding validity and reliability assessments were conducted. The data collection phase was rigorous, beginning with a review of the IT company database and identifying informants based on their specific profile. The survey was sent to the entire company base, yielding 216 valid responses, a sample that can be expanded.

Second, the research results correspond to a middle-income country and a growing technology sector in Latin America, so the extrapolation of the results must consider these differences. However, due to the structure of the model, especially its theoretical basis, other researchers can consider this research as a starting point and replicate and expand the mediating or moderating variables for other companies, sectors, and regions according to their context. For future research and to strengthen the model, it is important to incorporate enabling variables for digital innovation or responsible innovation studied in other research, such as long-term or strategic orientation, orientation toward organizational virtues, innovative resources, knowledge transfer, transformational leadership, and adaptive governance, which means that both the government and stakeholders play an important role in the policymaking process (Ureña-Espaillat et al., 2022; Cao et al., 2020a; Cao et al. 2020b; Chou, 2018).

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Appendices

Appendix A. Research proposal

https://drive.google.com/drive/folders/1sC3rfYwl8-8j9XRSvKhLonyxgq_HDTgD?usp=sharing

Appendix B. Letter of acceptance

240485635 (Journal of Responsible Innovation) Your submission has been accepted Recibidos ×

Journal of Responsible Innovation <em@editorialmanager.com> 25 abr 2025, 18:48 (hace 4 días)
para mí

Traducir al español ×

Apr 22, 2025

Ref.: Ms. No. TJRI-2024-0110R3
240485635
Dynamic Capabilities and Digital Innovation: pathways to Competitive Advantage through Responsible Innovation
Journal of Responsible Innovation

Dear Alicia de la Torre,

I am pleased to tell you that your work has now been accepted for publication in Journal of Responsible Innovation.

It was accepted on Apr 25, 2025

Comments from the Editor and Reviewers can be found below.

Thank you for submitting your work to this journal.

With kind regards

Tatiana Iakovleva
Guest Editor
Journal of Responsible Innovation

Comments from the Editors and Reviewers:

Appendix C. Research Instrument

Receive a warm greeting. My name is Alicia de la Torre, a Doctoral Candidate from CENTRUM PUCP. I am conducting the research focused on validating the impact of digital innovation, dynamic capabilities, and responsible innovation on competitiveness. The results will serve as a reference for Ecuadorian companies in defining strategies to enhance their competitiveness.

The survey, directed at those responsible for digital innovation projects in private technology companies, will take no more than 10 minutes. The information provided will be anonymous and used exclusively for this research.

I appreciate your participation and contribution to identifying key aspects that can enhance digital innovation in the business sector in Ecuador.

The information will be used solely for academic purposes and under the principle of confidentiality.

I agree to participate.
( ) Yes
( ) No

If you answer yes, continue.

Indicate the region in which your company's headquarters is located (select one option):
( ) Cost
( ) Highlands
( ) Amazon

Indicate your company's years of experience in the market (select one option):
( ) 0 - 1 year
( ) 2 - 5 years
( ) 6 - 10 years
( ) 10 - 15 years
( ) More than 16 years

Indicate the main activity of your technology and information services company (select an option from the following subsectors of the technology and information sector):
( ) Data processing (ISIC J62 Computer programming, computer consulting and related activities)
( ) Accommodation and related services (ISIC J63 Information service activities)
( ) Other Information Services (ISIC J61 Telecommunications: wired, wireless, satellite and others)
( ) Software publishers (ISIC J582 Software Publishing)

Please, indicate the number of employees in your company (select one option):
( ) Up to 9 Employees
( ) From 10 to 49 Employees
( ) From 50 to 249 Employees
( ) Over 250 Employees

Do you consider that your company's digital innovation processes are linked to compliance with the Sustainable Development Goals?
( ) Yes
( ) No

Please, indicate the Digital Technologies that your company uses for the development of its products or services (select one or more options):
( ) Big data
( ) Internet of Things (IoT)
( ) Cloud Computing
( ) Augmented and virtual reality
( ) Artificial Intelligence (AI)
( ) Cyber-physical systems (CPS)

Considering your company, indicate the LEVEL OF AGREEMENT with the following statements: **From 1 = Strongly disagree to 5 = Strongly agree** *Digital solutions = digital products or services	**1**	**2**	**3**	**4**	**5**
The quality of our digital solutions is superior to that of our competition.					
The features of our digital solutions are superior to those of our competitors.					
The applications of our digital solutions are totally different from those of our competitors.					
Our digital solutions are different from our competitors in terms of product platform.					
Some of our digital solutions are new to the market at the time of their launch.					
Our new digital solutions are minor improvements to existing products*					

Indicate the LEVEL OF IMPORTANCE given by your company for each of the following statements: **From 1 = Not at all important, 2 = Not very important, 3 = Somewhat important, Quite important and 5 = Extremely important**	**1**	**2**	**3**	**4**	**5**
Ability to attract customers with the benefits of its products by improving its brand image and its own characteristics					
Encourages consumers to buy products by offering them specific services compared to competing companies					
Competitive pressure has decreased as a result of the specificities of your product compared to the different products available on the market					
Has a good communication policy					

Indicate THE FREQUENCY with which your company applies each of the following statements: **From 1 = Not at all, 2 = Rarely, 3 = Often and 4 = Always**	**1**	**2**	**3**	**4**
Involves different stakeholders in the innovation process (Inclusion)				
Takes into account the current dynamics in the innovation process for the design of the future (Anticipation)				
Ability to identify potential risks and react accordingly (Response Capacity)				
Integrates the values and beliefs of the public into its research and development activities (Reflexivity)				

Indicate the CAPACITY LEVEL of your company regarding the following actions: **From 1 = Very low to 5 = Very high**	**1**	**2**	**3**	**4**	**5**
Acquisition of important digital technologies					
Identification of new digital opportunities					
Response to digital transformation					
Mastery of cutting-edge digital technologies					
Development of innovative products/services/processes using digital technology					

Please indicate your LEVEL OF AGREEMENT of your company with the following statements: **From 1 = Strongly Disagree to 5 = Strongly Agree**	**1**	**2**	**3**	**4**	**5**
We are committed to using digital technologies in the development of our new solutions.					
Our solutions have superior digital technology.					
New digital technology is easily accepted in our organization.					
We are always looking for opportunities to use digital technology in our innovation.					

Please indicate your LEVEL OF AGREEMENT of your company with the following statements: **From 1 = Strongly Disagree to 5 = Strongly Agree**	**1**	**2**	**3**	**4**	**5**
Managers are willing to take on the new challenges that our company faces.					
Managers are usually willing to try new things for our company.					
In general, managers are fascinated by novel ideas					
In general, managers find it difficult to change*					

*Note: items were removed from the measurement model because they did not demonstrate statistical significance