

Responsible Innovation and Responsible Digital Transformation in Emerging Economies (Vietnam): the Roles of Innovation Barriers and Ethical Pressure

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ABSTRACT: Responsible innovation and responsible digital transformation are increasingly important for firms seeking to create innovation value while responding to ethical, social, and stakeholder expectations. However, empirical evidence on how barriers to responsible innovation influence responsible innovation implementation, responsible digital transformation, and innovation performance remains limited, particularly in emerging economies. Drawing on Responsible Innovation Theory, Stakeholder Theory, and Dynamic Capabilities Theory, this study examines the relationships among barriers to responsible innovation, responsible innovation implementation, responsible digital transformation, innovation performance, and ethical pressure. Data were collected from 240 senior managers and decision-makers in medium and large enterprises in Vietnam and analyzed using Partial Least Squares Structural Equation Modeling with SmartPLS 4.

The findings show that barriers to responsible innovation significantly reduce responsible innovation implementation. In turn, responsible innovation implementation positively affects both responsible digital transformation and innovation performance. Responsible digital transformation also has a strong positive effect on innovation performance and is the most influential predictor of innovation outcomes in the model. In addition, ethical pressure positively moderates the relationship between responsible innovation implementation and responsible digital transformation, suggesting that stakeholder and regulatory expectations strengthen the translation of responsible innovation practices into responsible digital transformation. The results further indicate that responsible innovation implementation partially mediates the relationship between barriers to responsible innovation and responsible digital transformation.

This study contributes to the literature by positioning responsible innovation implementation as a dynamic organizational capability linking internal barriers, external ethical pressure, responsible digital transformation, and innovation performance. The findings offer practical implications for managers and policymakers seeking to promote ethical, transparent, and performance-enhancing digital transformation in emerging economies.

KEYWORDS: Barriers to responsible innovation; Responsible innovation implementation; Responsible digital transformation; Innovation performance; Ethical pressure; PLS SEM; Vietnam

1. INTRODUCTION

The meteoric rise of digital transformation has fundamentally changed the way organizations build technology, interact with stakeholders, and create value across various sectors. While digital innovation offers tremendous potential to improve productivity, enable new forms of value creation, and enhance competitiveness, it also raises important questions of an ethical, social, and governance nature in relation to fairness, transparency, protection of personal data, and unintended societal side-effects (Floridi, 2018; Hinings et al., 2018). The resulting problems have amplified the global debate about responsible innovation (RI) and responsible digital transformation (RDT) – two overlapping agendas that call upon firms not just to innovate but also to do so in ways that are ethical, socially inclusive, and sensitive to future effects (Owen et al., 2013; Stilgoe et al., 2013). Consequently, companies are now feeling increasing pressure from regulators, customers, and other stakeholders to embed notions of responsibility into their innovation efforts and digital strategies.

Still, even with greater awareness, responsible innovation can face numerous barriers within organizations, such as resource constraints, poor ethical capability levels, organizational inertia, and misaligned incentives (Blok & Lemmens, 2015; Khan et al., 2022). These barriers hinder the successful operationalization of RI enterprises. The influence of these barriers on downstream innovation outcomes is an under-researched subject, particularly in emerging economies where institutional infrastructures are still maturing, and digital ethics concerns are on the rise (Blok et al., 2017).

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In parallel, the adoption of RII is emerging as a dynamic company-level capability that allows organizations to preempt potential risks, engage stakeholders in dialogue, and design processes that organize technological incrementalism with ethical accountability (Pidgeon et al., 2017; Lubberink et al., 2017). However, little empirical evidence is available on how the RII programme affects responsible digital transformation and innovation performance. Current research has been mostly conceptual or limited to public sector and high-tech research settings, with scant company-level quantitative evidence, especially in emerging economies (Gonzales-Gemio et al., 2020; Martinuzzi et al., 2018).

In addition, external ethical pressure (EEP), including perceived regulatory demands, societal pressure, and stakeholder activism, has been identified as an important factor influencing firms' responsible conduct. Existing research has also found that stakeholder pressure intensifies firms' ethical commitment toward technology adoption (Pappas et al., 2023; Van de Poel, 2020). Nonetheless, very little research has been conducted on the moderating effects of ethical pressure on our understanding of the relationship between RII and responsible digital transformation (RDT), particularly in relation to private sector digital transformation projects. Moreover, as the literature increasingly makes connections between responsible innovation and higher-level sustainability constructs, there are fragmented relationships between RII and/or RDT vis-à-vis IPF. It is essential to comprehend these mechanisms, as the performance of innovations constitutes a crucial indicator of firms' competitiveness, their capacity for learning, and long-term strategic success (Garriga, 2021; Del Río et al., 2023).

In response to these lacunae, the present research presents an integrated model and investigates:

- (1) How barriers to responsible innovation (BAR) affect responsible innovation implementation (RII),
- (2) How RII influences responsible digital transformation (RDT) and innovation performance (IPF),
- (3) How RDT contributes to innovation performance (IPF), and
- (4) How ethical pressure (EP) moderates the relationship between RII and RDT.

Furthermore, the study assesses the mediating effect of RII on barriers to responsible innovation and innovation performance. Built around Responsible Innovation Theory, Stakeholder Theory, and Dynamic Capabilities Theory, this study adopts a holistic approach to how organisations can embed responsibility in their digital transformation efforts to drive more impactful innovation.

This article makes three main contributions to existing research. Firstly, it contributes to research on responsible innovation, providing an empirical yardstick based on a sample of firms operating in an emerging economy where ethical digitalization is particularly important but has received limited attention from academics. Secondly, it frames RII as a capability that facilitates responsible digital transformation and enriches our understanding of pull-based dynamic capabilities in the digital era. Third, it advances the boundary condition of ethical pressure and provides new insights into how external expectations influence organizational responses to the moral challenges of digital transformation.

In sum, this study contributes to new theoretical ground and insights for managers and policymakers in the pursuit of ethical, sustainable performance-enabling digital innovation.

2. LITERATURE REVIEW AND HYPOTHESES

2.1. Barriers to Responsible Innovation and Responsible Innovation Implementation

Responsible Innovation (RI) emphasizes anticipation, inclusion, reflexivity, balance, and responsiveness as key dimensions that shape innovation, aligning social and ethical expectations (Stilgoe et al., 2013; Owen et al., 2013). However, companies are often confronted with serious barriers to responsible innovation (BAR), including a lack of resources, insufficient ethical competencies, organizational inertia, and competing market pressures (Blok & Lemmens, 2015; Khan et al., 2022). These barriers hinder the actual implementation of RRI practices in organizations, inhibiting the ability to develop well-structured processes for ethical risk management, stakeholder engagement, and proactive reflection (Lubberink et al., 2017).

Empirical research has found that organisations face substantial organisational or technical obstacles and therefore tend to do 'less' RI activities, engage in disconnected actions for the treatment of RI, or decide not to apply the principles and strategies of the latter at all (Blok et al., 2017; Martinuzzi et al., 2018). As such, these barriers are likely to reduce responsible innovation performance by undermining managerial dedication, discouraging cross-sectional integration, and obstructing ethical reflection. Therefore, it is expected that obstacles to responsible innovation hinder the implementation of RI.

H1: Barriers to responsible innovation (BAR) have a negative effect on responsible innovation implementation (RII).

2.2. Responsible Innovation Implementation and Responsible Digital Transformation

Responsible Innovation Implementation (RII) refers to an organisation's ability to integrate RI principles into its innovation processes through structured governance, ethical impact assessment, stakeholder involvement, and transparency in decision-making (Pidgeon et al., 2017; Lubberink et al., 2017). As companies increasingly digitize their activities, RI is essential for contributing to responsible digital transformation (RDT), which aims to utilize digital technologies in a manner that respects privacy, fairness, transparency, and societal well-being (Floridi, 2018; Van de Poel, 2020).

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Recent studies suggest that organizations can refine the ethical protections embedded in AI, make algorithmic decision-making more transparent, and design digital products in accordance with normative expectations (Pappas et al., 2023; Hinings et al., 2018). These behaviors foster trust, minimize ethical harm, and enhance stakeholder buy-in, all essential elements of responsible digital transformation. As RI integration strengthens ethical reflexivity and responsibility, the capacity for digitalization within a firm increases.

Drawing on the responsible innovation approach developed by Stilgoe et al. (2013) and elaborated upon by Lubberink et al. (2017), this research defines RI implementation as a multidimensional construct comprising four principal elements: anticipation, reflexivity, inclusion, and responsiveness. Together, these dimensions depict the extent to which an organization integrates moral, social, and stakeholder concerns into its innovation processes. In this sense, RII was conceptually defined as a second-order reflective construct, and the four dimensions were defined as first-order reflective dimensions. This hierarchy of organization has been consistent with previous research, which has emphasized RII as a contented capability in many organizational processes.

H2: Responsible innovation implementation (RII) has a positive effect on responsible digital transformation (RDT).

2.3. Responsible Innovation Implementation and Innovation Performance

Innovation performance (IPF) reflects a firm's ability to develop new products, services, or processes that contribute to its competitive advantage (Del Río et al., 2023). Responsible innovation may be problematic to interpret at first sight, as it appears to be an ethical prohibition; however, the evidence suggests that RI enhances the positive outcomes of innovation, namely stakeholder engagement, reduced reputational risk, and increased user trust (Garriga, 2021; Blok et al., 2017). By embedding ethical foresight and integrating cross-industry input, RI helps companies build innovations that are more resilient, socially responsible, and sustainable, resulting in greater innovation performance.

Several empirical studies demonstrate that firms implementing RI practices achieve higher innovative quality, greater customer acceptance, and lower chances of post-launch failures (Gonzales-Gemio et al., 2020; Lubberink et al., 2017). As firms learn better and anticipate risks more effectively, it is expected to have a positive impact on innovation performance.

H3: Responsible innovation implementation has a positive effect on innovation performance.

2.4. Responsible Digital Transformation and Innovation Performance

Digital transformation enables firms to increase efficiency, responsiveness, and flexibility in the marketplace; yet, its effectiveness increasingly depends on social legitimacy and ethical norms (Hinings et al., 2018; Vial, 2019). Responsible digital transformation (RDT) is also expected to contribute significantly to innovation performance by ensuring that digital technologies are developed in a manner that is fair, transparent, and trustworthy – factors that, in turn, influence both market uptake and stakeholder support (Floridi, 2018; van de Poel, 2020).

Digitally responsible companies are also more likely to have a greater share of strong innovators. This is the case because responsible practices help to gain legitimacy, prevent ethical risks, and favour trials without threat in a clear framework (Garriga, 2021). In addition, responsible digitalization strategies, such as ethical AI governance and transparent data management, can increase customer engagement and facilitate the adoption of the product, thereby enhancing innovation performance.

H4: Responsible digital transformation (RDT) has a positive effect on innovation performance (IPF).

2.5. The Moderating Role of Ethical Pressure

The term "ethical pressure" (EP) refers to the various external pressures from regulators, customers, civil society, and industry bodies on firms to adopt more ethical and socially responsible practices (Van de Poel, 2020; Pappas et al., 2023). According to the Stakeholder Theory, firms are more willing to be accountable if external demands are strong and seeking legitimacy is essential (Freeman, 1984). If the ethical pressure is strong enough, then organizations have an intensifying pressure to align their digitalization activities with moral and societal norms.

In a higher ethical pressure context, responsible outcomes are more likely when Enacting Responsible Innovation (RI) in Firms responsible for digital transformation. This is, in part, due to societal pressure on the centrality of responsibility, increased surveillance of digital practices, and potential penalties for unethical conduct. This means that EP is expected to reinforce the association between RII and RDT.

H5: Ethical pressure (EP) positively moderates the relationship between responsible innovation implementation (RII) and responsible digital transformation (RDT).

2.6. The Mediating Role of Responsible Innovation Implementation

However, the impact of barriers to responsible innovation on firm-level outcomes will be mediated by how firms address or circumvent these barriers. Responsible innovation in practice. The Responsible Innovation approach is a key mechanism through which firms can overcome barriers to responsible innovation and operationalize the principles of responsible innovation, thereby affecting firm performance (Lubberink et al., 2017; Blok et al. From the perspective of Dynamic Capabilities Theory, capabilities

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can be considered as mediating means that translate threats and inadequacies in the environment into strategic responses and performance consequences (Teece, 2007).

When barriers reduce the effectiveness of responsible innovation implementation, and an influence on innovation performance follows this, then responsible innovation implementation mediates the indirect effects of barriers on innovation performance outcomes. This mediating effect can be either partial or complete, depending on the extent to which obstacles influence innovation performance.

H6: Responsible innovation implementation (RII) mediates the relationship between barriers to responsible innovation (BAR) and innovation performance (IPF).

2.7. Integrated Research Framework

Based on the principles of Responsible Innovation Theory (Stilgoe et al., 2013; Owen et al., 2013), Stakeholder Theory (Freeman, 1984), and Dynamic Capabilities Theory (Teece, 2007), this article develops an integrative model that explains how organizations can transform responsible innovation ideas into responsible digital transformation and improved innovation performance.

The conceptual model proposes Barriers to Responsible Innovation (BAR) as a negating antecedent that would prevent firms from incorporating responsible innovation practices efficiently. RII is conceptualized as a dynamic organizational capability that enables companies to integrate ethical and societal aspects into their innovation practices. Similarly, RII is expected to impact two important results: Responsible Digital Transformation (RDT) and Innovation Performance (IPF). RDT refers to a value-based digitalization that promotes fairness, transparency, accountability, and inclusiveness in digital technology innovation and use (Floridi, 2018; van de Poel, 2020). IPF is a measure of how effectively companies achieve innovation, i.e., improved product quality, more efficient processes, and the ability to compete at high levels of technology (Del Río et al., 2023).

The model also incorporates Ethical Pressure (EP) as a contingency of the effect of RII on responsible digital transformations. EP includes external pressure factors, such as regulatory demand and stakeholder scrutiny, in addition to societal standards and requirements that jointly influence firms' ethical responsiveness. Based on Stakeholder Theory, EP is hypothesized to strengthen the positive effect of RII on RDT.

Lastly, the model suggests that RII mediates the link between barriers to responsible innovation and innovation performance, making explicit the vehicle through which firms transform institutional hindrances into ethical-innovation-based outcomes. In this model, RI Implementation is operationalized as a second-order reflective construct consisting of four dimensions that represent the fundamental tenets of responsible innovation. This method provides a holistic description of RII as an embedded organizational routine, rather than a set of unrelated activities.

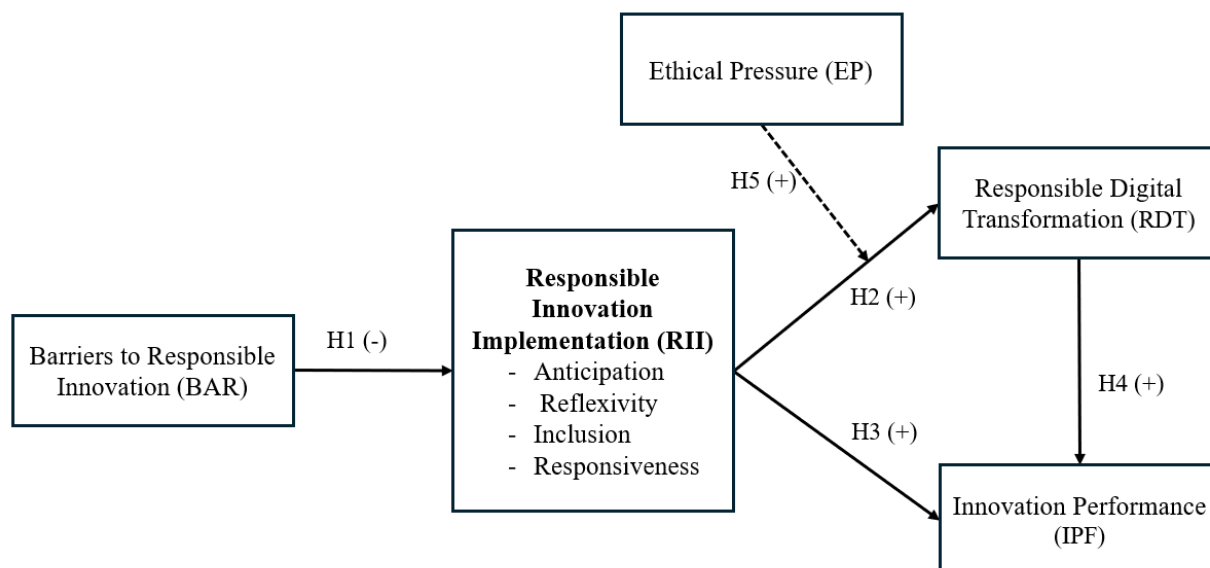


Figure 1 presents the conceptual research model and the hypothesized relationships.

3. METHODOLOGY

3.1. Research Design and Population

This study employs a quantitative method of inquiry, using a cross-sectional survey, to empirically investigate the hypothesized research model in the context of Vietnam. The recipient of this message is the executive and person in charge of digital transformation and innovation within Vietnamese enterprises. This group could include chief executive officers, chief information

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(or technology) officers, digital transformation managers, innovation managers, and senior functional managers. The sample is highly pertinent for this investigation, as it includes respondents who have experienced organizational innovation processes and have an understanding of ethical, regulatory concerns, and digital transformation activities within their organizations.

The empirical context focuses on medium and large-sized firms within Vietnam, an emerging economy that is manifesting early-stage responsible innovation and ethical digitalization insights, but which is becoming more structurally important due to changing domestic legislation and rapid technological developments. Against this background, previous work on responsible innovation has emphasized the importance of analyzing the firm level in studies of such contexts, as it increases external validity and helps situate the development of theory (Blok et al., 2017; Pappas et al., 2023). Hence, the study contributes important empirical evidence from Vietnam in relation to responsible innovation and digital transformation at the global level.

3.2. Sampling Procedure

A purposive sampling strategy was employed to identify respondents who are directly engaged in innovation, technology adoption, and digital transformation initiatives in Vietnamese firms. This approach is consistent with previous studies that examined responsible innovation and digital transformation at the organizational level (Lubberink et al., 2017; Martinuzzi et al., 2018). Potential participants were approached through professional networks, industry associations, and corporate contacts across major economic centers in Vietnam. The sample encompasses enterprises in core sectors, including manufacturing, information and communication technology, logistics, retail, financial services, and professional services, thereby ensuring sufficient heterogeneity in innovation and digitalization practices.

A total of 400 questionnaires were distributed electronically to eligible managers. After screening for incomplete responses and eliminating multivariate outliers based on Mahalanobis distance, 240 usable questionnaires were retained for analysis. This final sample size exceeds the minimum requirement suggested for PLS-SEM using the “10-times rule” (Hair et al., 2019) and provides adequate statistical power to detect medium effect sizes at the 5% significance level.

3.3. Measurement Scales

All constructs were operationalized as reflective latent variables and measured using multi-item Likert scales ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). Because there are no widely used, validated instruments that directly capture the specific combinations of barriers, responsible innovation implementation, and responsible digital transformation examined in this study, the measurement items were self-developed based on prior conceptual and empirical work and then refined through expert review and pilot testing.

Barriers to responsible innovation (BAR) were measured using five items that capture resource constraints, limited ethical and technical competencies, rigid internal procedures, short-term business pressures, and the lack of tools for assessing ethical risks. These items were developed based on conceptual discussions of organizational barriers to responsible innovation and the implementation of ethical technology, as presented in Blok and Lemmens (2015) and Khan et al. (2022).

Responsible innovation implementation (RII) was modeled as a second-order reflective construct comprising four first-order reflective dimensions: anticipation, reflexivity, inclusion, and responsiveness. Each dimension was measured by three items that represent the corresponding practices in the responsible innovation framework, such as assessing potential social and ethical impacts, reflecting on underlying values and assumptions, involving stakeholders during development, and adjusting or stopping projects in response to emerging concerns. The content of these items was derived from the four dimensions of responsible innovation proposed by Stilgoe et al. (2013) and Owen et al. (2013), and further synthesized by Lubberink et al. (2017).

Responsible digital transformation (RDT) was measured using eight items that reflect fairness and non-discrimination, inclusiveness and accessibility, transparency and explainability of digital decision making, user awareness of system operation, accountability mechanisms, ethical guidelines for data use, privacy protection, and data security. These items were conceptually grounded in discussions of digital ethics, corporate digital responsibility, and responsible digitalization, as presented in Floridi (2018), van de Poel (2020), and Pappas et al. (2023).

Innovation performance (IPF) was captured by six items that assess perceived improvements in product and service quality, the introduction of new products or processes, operational efficiency and cost reduction, competitive advantage, customer appreciation of innovative solutions, and overall innovation performance compared with competitors. These items were adapted from Del Río et al. (2023) and prior research on subjective innovation performance, including Prajogo and Sohal (2006).

Ethical pressure (EP) was measured using five items that capture perceived pressure from regulators, customers, the general public, business partners, and industry norms, aiming to align innovation and digital transformation activities with ethical and societal expectations. The items were developed drawing on work on stakeholder and regulatory pressure in the context of responsible innovation and digital transformation by Garriga (2021) and Pappas et al. (2023).

To establish content and face validity, the initial item pool was reviewed by three academic experts in innovation and digital transformation, as well as by two senior managers responsible for digital initiatives. Based on their feedback, minor wording changes

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were introduced to improve clarity, relevance, and readability. A pilot test was then conducted with 30 managers from the target population to assess item comprehension and preliminary reliability before launching the full-scale survey.

Table 1: Overview of the measurement scales (Source: Author, 2025)

Construct	Type	No. of items	Main source(s)
Barriers to Responsible Innovation (BAR)	First order reflective	5	Blok & Lemmens (2015); Khan et al. (2022)
Responsible Innovation Implementation (RII) composed of Anticipation, Reflexivity, Inclusion, Responsiveness	Second order reflective (four first order dimensions)	12	Stilgoe et al. (2013); Owen et al. (2013); Lubberink et al. (2017)
Responsible Digital Transformation (RDT)	First order reflective	8	Floridi (2018); Van de Poel (2020); Pappas et al. (2023)
Innovation Performance (IPF)	First order reflective	6	Del Río et al. (2023); Prajogo & Sohal (2006)
Ethical Pressure (EP)	First order reflective	5	Garriga (2021); Pappas et al. (2023); Van de Poel (2020)

3.4. Data analysis

Data were collected over two months. Respondents were assured confidentiality and anonymity to reduce social desirability bias. Participation was voluntary, and no incentives were provided. Before the full survey launch, a pilot test was conducted with 30 respondents to refine the clarity and reliability of the items. Minor modifications were made in response to feedback.

3.5. Data Analysis

Partial Least Squares Structural Equation Modeling (PLS-SEM) was used for data analysis, and SmartPLS 4.0 was employed as the tool for statistical analysis. The use of PLS-SEM was chosen due to its suitability for multiple criteria. The study followed the recommended two-step approach, beginning with an examination of the measurement model and then an evaluation of the structural model (Hair et al., 2017). The reflective models were assessed for internal consistency reliability using Cronbach's alpha (α) and composite reliability (CR), both of which yielded acceptable values ranging from 0.70 to 0.95. Furthermore, convergent validity was confirmed through AVE (which should be at least 0.50) and through the use of outer loadings; items with loadings below 0.70 were examined for exclusion to increase the reliability and validity of the measures. Discriminant validity was tested through the HTMT (heterotrait-monotrait ratio of correlations) with a conservative cut-off value set at 0.85 (Henseler et al., 2015). Those that did not were sequentially excluded (first items with low loadings and then those with HTMT values above the threshold), thereby maintaining content validity.

Due to its hierarchical structure, RII was treated as a reflective, second-order formative construct and tested using a two-step process. In the first step, estimates were made for the first four order dimensions (anticipation, reflexivity, inclusion, and responsiveness) as distinct reflective constructs, and their latent scores were derived. In the second step, these latent scores were used as indicators of a second-order construct, RII. The robustness of the hierarchical measurement model was tested at both the first and second levels using CR, AVE, and HTMT for reliability and convergence, in relation to a hypothetical third-order model.

Following the validation of the measurement model structure, we tested the hypotheses using cross-path coefficients, determination coefficients (R^2), effect sizes, and predictive relevance (Q^2) via bootstrapping with 5,000 resampling runs and two-tailed tests at a 5% significance level. VIFs for the predictor constructs were examined to detect multicollinearity, and all values were less than 3.3, indicating that there was no serious multicollinearity problem. This analysis is consistent with the common PLS-SEM requirement (Hair et al., 2017).

4. RESULTS

4.1. Sample Description

The demographic profile of the respondents is presented in Table 2. The respondents in the sample are 240 middle to top-level managers and decision-makers in medium- to large-sized organizations in Vietnam. A large majority of respondents are males (67%), and this ratio is representative of the gender distribution in managerial positions in Vietnamese companies. In organizational roles, a majority of participants assume functions that can be easily linked to digital transformation and innovation, such as chief information or technology officer, digital transformation manager, innovation manager, and senior functional manager. This congruence... is strong in indicating that our respondents are capable of providing informed opinions on responsible innovation practices, ethical challenges, and digital transformation policies within their organizations.

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With respect to the distribution of industries, the sample industries include six categories: manufacturing, ICT (information and communication technology), logistics, retailing, FIS (finance and insurance services), and PROS (professional services). This relatively equitable distribution across sectors suggests that the data encompasses a diverse range of innovation and digitalization types, which may contribute to the generalizability of the results within an emerging economy like Vietnam. In general, the sample appears suitable for testing how barriers to responsible innovation, the adoption of responsible innovation, and ethical pressures, as well as the aspiration for responsible digital transformation, jointly affect the performance of innovative activities.

Table 2. Sample Description (Source: Author, 2025)

Variable	Categories	Frequency	Percentage
Gender	Male	161	67%
	Female	79	33%
Position	Chief executive officers	25	10%
	Chief information or technology officers	56	23%
	Digital transformation managers	83	35%
	Innovation managers	30	13%
	Senior functional managers	46	19%
Sectors	Manufacturing	43	18%
	Information and communication technology	37	15%
	Logistics	39	16%
	Retail	41	17%
	Financial services	47	20%
	Professional services	33	14%

4.2. Evaluation of First-Order Measurement Model

4.2.1. Assessment of Reliability and Convergent Validity

To examine the reliability and convergent validity, we first analyzed four first-order dimensions of Responsible Innovation Implementation (RII) in the first step of the analysis: anticipation (RII_AN), inclusion (RII_IN), reflexivity (RII_RF), and responsiveness (RII_RS). Outer loadings of the indicators related to these dimensions are reported in Table 3 and fall between approximately 0.80 and 0.89, which is above the recommended cut-off score of 0.70. The latter finding implies substantial shared variance among the items in the respective latent constructs.

The Cronbach's alpha values of these constructs are between 0.794 and 0.865, and the composite reliability (CR) is between 0.879 and 0.917. These scores fall within the recommended range of 0.70 to 0.95, indicating adequate internal consistency reliability with no indications of redundancy. The AVE for the four factors ranges from 0.708 to 0.787, all of which exceed the recommended value of 0.50, thus confirming that they possess convergent validity. Taken together, these results support the acceptability of both reliability and convergent validity of the first-order RII dimensions, which can be used in further higher-order modeling.

Table 3. Reliability and Validity (Source: Author, 2025)

	Outer loading	Cronbach's alpha	CR	AVE
RII_AN	0.802 – 0.871	0.798	0.881	0.713
RII_IN	0.871 – 0.894	0.853	0.911	0.773
RII_RF	0.797 – 0.888	0.794	0.879	0.708
RII_RS	0.878 – 0.892	0.865	0.917	0.787

4.2.2. Assessment of Discriminant Validity

Discriminant validity among the four RII dimensions was examined using the heterotrait–monotrait ratio of correlations (HTMT). As shown in Table 4, all HTMT values fall between 0.451 and 0.599, which is well below the conservative threshold of 0.85. This indicates that the first four order constructs capture related but distinct aspects of responsible innovation implementation and are

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not empirically indistinguishable. The results, therefore, provide strong evidence of discriminant validity among anticipation, inclusion, reflexivity, and responsiveness and support the conceptualization of RII as a multidimensional construct.

Table 4. Heterotrait–Monotrait Ratio (HTMT) (Source: Author, 2025)

	RII AN	RII IN	RII RF	RII RS
RII AN				
RII IN	0.451			
RII RF	0.491	0.485		
RII RS	0.599	0.509	0.574	

4.3. Evaluation of the Higher-Order Measurement Model

4.3.1. Reliability and Validity

Table 5 reports the reliability and validity statistics for the higher order constructs and other first order constructs in the model, including barriers to responsible innovation (BAR), ethical pressure (EP), innovation performance (IPF), responsible digital transformation (RDT), and the second order RII construct. All outer loadings for the indicators of BAR, EP, IPF, and RDT are above approximately 0.82, with the exception of one RDT indicator that remains acceptable in light of the overall reliability of the scale. For the second order RII construct, which is measured by the four first order dimensions, outer loadings range from 0.705 to 0.825, indicating that each dimension contributes meaningfully to the higher order construct.

Cronbach's alpha values for BAR, EP, IPF, and RDT range from 0.909 to 0.947, while the alpha for RII is 0.752. Composite reliability values range from 0.843 (RII) to 0.956 (RDT). All reliability coefficients exceed the minimum recommended threshold of 0.70 and remain below 0.95, suggesting strong internal consistency without excessive redundancy. AVE values are 0.733 for BAR, 0.740 for EP, 0.724 for IPF, 0.730 for RDT, and 0.574 for RII, all of which are above the 0.50 cut-off and therefore provide evidence of convergent validity. Overall, the results indicate that both the first order and second order constructs satisfy the standard reliability and convergent validity criteria in PLS-SEM.

Table 5. Reliability and Validity (Source: Author, 2025)

Construct	Items	Outer Loadings	Cronbach's α	CR	AVE
BAR	5	0.841–0.862	0.909	0.932	0.733
EP	5	0.824–0.876	0.916	0.934	0.740
IPF	6	0.820–0.890	0.924	0.940	0.724
RDT	8	0.819–0.867	0.947	0.956	0.730
RII	4	0.705–0.825	0.752	0.843	0.574

4.3.2. Discriminant Validity

Discriminant validity among the higher order constructs was again assessed using the HTMT criterion. As shown in Table 6, all HTMT values between BAR, EP, IPF, RDT, and RII range from 0.039 to 0.676, which is below the conservative threshold of 0.85. This implies that the constructs capture conceptually distinct phenomena, such as structural barriers, ethical pressures, implementation capabilities, digital transformation outcomes, and innovation results. The relatively low HTMT values between BAR and EP, as well as between EP and the other constructs, suggest that ethical pressure is empirically distinct from internal barriers and capability constructs. These findings confirm that the higher order measurement model exhibits satisfactory discriminant validity and can be used to test the hypothesized structural relationships.

Table 6. Heterotrait–Monotrait Ratio (HTMT) (Source: Author, 2025)

	BAR	EP	IPF	RDT	RII
BAR					
EP	0.039				
IPF	0.332	0.084			
RDT	0.221	0.069	0.642		
RII	0.457	0.14	0.676	0.5	

4.4. Evaluation of the Higher-Order Structural Model

After establishing an adequate measurement model, the structural model was evaluated in terms of model fit, explained variance, predictive relevance, collinearity, and significance of the hypothesized paths. The standardized root mean square residual (SRMR) of 0.053 indicates a good approximation of the empirical covariance matrix and falls below the recommended threshold of 0.08, suggesting an acceptable overall model fit.

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In terms of explanatory power, the model accounts for 14.5 percent of the variance in RII ($R^2 = 0.145$), 24.0 percent of the variance in RDT ($R^2 = 0.240$), and 48.0 percent of the variance in IPF ($R^2 = 0.480$), as reported in Table 7. These values can be interpreted as small to moderate for RII and RDT and moderate to substantial for innovation performance, indicating that the proposed model explains a meaningful share of the variance in the key outcome variables. All Q^2 values obtained via blindfolding are positive and relatively high, which provides evidence of predictive relevance for RII, RDT, and IPF.

Collinearity diagnostics show that all variance inflation factor (VIF) values range from 1.000 to 1.223, which are well below the commonly accepted cut-off of 3. This indicates that multicollinearity is not a concern in the estimation of the structural paths and that the obtained parameter estimates are stable.

Regarding the hypothesized relationships, all structural paths are statistically significant at the 1 percent level. First, barriers to responsible innovation have a significant negative effect on responsible innovation implementation (H1: $\beta = -0.381$, $p < 0.001$, $f^2 = 0.170$). The effect size can be interpreted as medium, suggesting that organizational and structural barriers meaningfully reduce the extent to which firms implement responsible innovation practices.

Second, responsible innovation implementation exerts a strong positive effect on responsible digital transformation (H2: $\beta = 0.424$, $p < 0.001$, $f^2 = 0.234$), indicating that firms with stronger RI implementation capabilities are more likely to adopt digital technologies in a responsible and ethically aligned manner. Third, RII also has a significant positive effect on innovation performance (H3: $\beta = 0.378$, $p < 0.001$, $f^2 = 0.224$). This medium effect size suggests that responsible innovation practices contribute directly to superior innovation outcomes.

Fourth, responsible digital transformation further enhances innovation performance (H4: $\beta = 0.441$, $p < 0.001$, $f^2 = 0.306$). Among the predictors of IPF, RDT exhibits the largest effect size, which underlines the strategic importance of ethical and transparent digital transformation initiatives for achieving strong innovation results.

The moderating effect of ethical pressure on the relationship between RII and RDT is also significant (H5: $\beta = 0.246$, $p = 0.001$, $f^2 = 0.075$). Although the effect size is in the small to medium range, it indicates that the positive impact of responsible innovation implementation on responsible digital transformation becomes stronger under conditions of higher ethical pressure from regulators, customers, and other stakeholders.

Finally, the mediation analysis shows that responsible innovation implementation mediates the relationship between barriers to responsible innovation and responsible digital transformation (H6). The indirect effect of BAR on RDT through RII is significant and negative ($\beta = -0.162$, $p < 0.001$), and the variance accounted for (VAF) is approximately 0.50. This suggests that around half of the total effect of barriers on responsible digital transformation operates through their influence on RII, which is indicative of partial mediation. In other words, barriers undermine responsible digital transformation both directly and indirectly by weakening firms' implementation of responsible innovation practices.

Taken together, the structural model results support all hypothesized relationships and confirm the central role of responsible innovation implementation as a dynamic capability that links structural barriers, ethical pressure, responsible digital transformation, and innovation performance in Vietnamese enterprises.

Table 7. Structural Model Assessment and Hypothesis Testing Result (Source: Author, 2025)

Latent variables		R ²	Q ²					
BAR		-	0.592					
IPF		0.480	0.608					
RDT		0.240	0.649					
RII		0.145	0.296					
EP		-	0.581					
SRMR = 0.053								
Hypothesis	Path	β Coefficient	Standard deviation	p-value	Confidence intervals	VIF	f ²	VAF
H1: Yes	BAR → RII	-0.381	0.052	0.000	[-0.480; -0.280]	1.000	0.170	-
H2: Yes	RII → RDT	0.424	0.048	0.000	[0.325; 0.512]	1.010	0.234	-
H3: Yes	RII → IPF	0.378	0.046	0.000	[0.285; 0.472]	1.223	0.224	-
H4: Yes	RDT → IPF	0.441	0.046	0.000	[0.346; 0.529]	1.223	0.306	-

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H5: Yes	$EP \times (RII \rightarrow RDT)$	0.246	0.076	0.001	[0.042; 0.355]	1.010	0.075	-
H6: Yes	$BAR \rightarrow RII \rightarrow RDT$	-0.162	0.032	0.000	[-0.229; -0.104]	-	-	-0.50

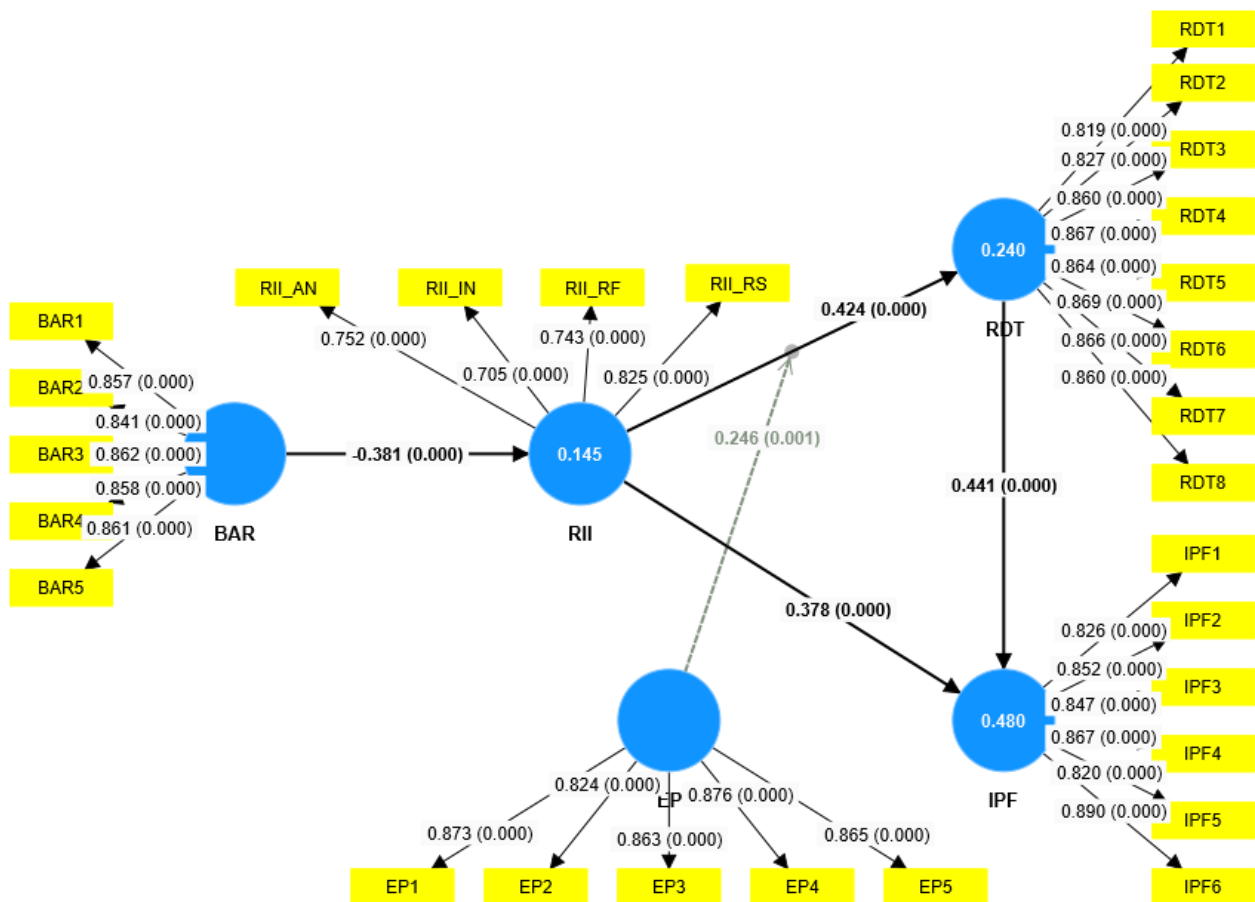


Figure 2. Final Structural Model after Bootstrapping ((Source: Author, 2025)

Note: Path coefficients (β) and explained variances (R^2) are based on SmartPLS 4 bootstrapping results.

5. DISCUSSION

This study examined how barriers to responsible innovation shape responsible innovation implementation, responsible digital transformation, and innovation performance in Vietnamese enterprises. Overall, the empirical findings provide strong support for the proposed research model. All hypothesized relationships are statistically significant, indicating that responsible innovation implementation plays a central role in explaining how firms transform ethical and organizational challenges into responsible digital and innovation outcomes.

First, the negative effect of barriers to responsible innovation on responsible innovation implementation is significant and meaningful. The result shows that barriers such as limited resources, insufficient ethical and technical competencies, rigid organizational procedures, short-term business pressures, and inadequate tools for ethical risk assessment reduce firms' ability to implement responsible innovation practices. This finding confirms that responsible innovation cannot be achieved only through normative commitment or general awareness. Instead, it requires concrete organizational conditions, including managerial support, ethical capabilities, flexible procedures, and appropriate governance mechanisms. In the context of Vietnamese enterprises, where responsible innovation and digital ethics are still emerging managerial concerns, these barriers may be particularly influential because many firms are still prioritizing short-term growth, operational efficiency, and market expansion over systematic ethical reflection.

Second, responsible innovation implementation has a strong positive effect on responsible digital transformation. This finding suggests that firms that systematically anticipate social and ethical impacts, reflect on the values embedded in innovation projects, involve stakeholders, and respond to emerging concerns are more capable of conducting digital transformation in a responsible manner. In other words, RII provides the ethical and organizational foundation through which digital transformation can move beyond technical adoption and become more transparent, inclusive, accountable, and socially acceptable. This result extends

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responsible innovation theory by demonstrating that its core principles are not limited to research and technology development contexts, but are also highly relevant to firm-level digital transformation.

Third, responsible innovation implementation also has a significant positive impact on innovation performance. This result indicates that responsible innovation is not merely a constraint or compliance-oriented activity; rather, it can become a source of better innovation outcomes. By integrating ethical foresight, stakeholder engagement, reflexive learning, and responsiveness into innovation processes, firms can improve the quality, acceptance, and sustainability of their innovations. This finding supports the view that responsible innovation helps firms reduce ethical and reputational risks while increasing stakeholder trust and market acceptance. Therefore, responsibility and performance should not be treated as competing goals. Instead, responsible innovation can strengthen firms' ability to generate valuable and legitimate innovation outcomes.

Fourth, responsible digital transformation is the strongest predictor of innovation performance in the model. The path from RDT to IPF has the largest effect size, showing that digital transformation contributes more strongly to innovation performance when it is implemented responsibly. This means that digital initiatives based on fairness, transparency, accountability, privacy protection, data security, and explainability are more likely to create innovation value. For Vietnamese enterprises, this finding is important because digital transformation is often discussed mainly in terms of technology investment, automation, and efficiency improvement. The present results suggest that ethical and responsible digital governance is also a strategic factor that improves innovation performance. Firms that build trustworthy digital systems may gain stronger customer acceptance, reduce implementation risks, and enhance their long-term competitiveness.

Fifth, ethical pressure positively moderates the relationship between responsible innovation implementation and responsible digital transformation. This finding shows that the effect of RII on RDT becomes stronger when firms face higher ethical expectations from regulators, customers, business partners, and society. From the perspective of stakeholder theory, this result confirms that external ethical pressure can encourage firms to translate internal responsible innovation practices into more concrete responsible digital transformation outcomes. Ethical pressure, therefore, should not be understood only as an external constraint. It can also function as a catalyst that pushes firms to institutionalize responsible digital practices, strengthen accountability mechanisms, and communicate more transparently with stakeholders.

Sixth, the mediation result shows that responsible innovation implementation partially mediates the relationship between barriers to responsible innovation and responsible digital transformation. The significant negative indirect effect indicates that barriers weaken responsible digital transformation partly by reducing firms' ability to implement responsible innovation. This finding provides a more nuanced explanation of how organizational barriers influence digital transformation outcomes. Barriers do not only directly restrict responsible digital transformation; they also undermine the internal capability required to transform digitalization into a responsible and ethical process. The partial mediation result further suggests that overcoming barriers requires more than removing constraints. Firms also need to actively develop responsible innovation capabilities as a mechanism for converting ethical awareness into responsible digital action.

Taken together, the findings position responsible innovation implementation as a dynamic organizational capability. RII enables firms to sense ethical and social risks, engage stakeholders, reflect on the desirability of innovation, and reconfigure innovation and digital transformation processes in response to emerging concerns. This capability is especially important in emerging economies such as Vietnam, where digital transformation is accelerating but ethical governance, regulatory frameworks, and responsible innovation practices are still developing. The study therefore contributes to the literature by showing that responsible innovation can serve as a bridge between organizational barriers, stakeholder pressure, responsible digital transformation, and innovation performance.

5.1. Theoretical Implications

This study offers several theoretical implications.

First, the study extends responsible innovation theory by empirically demonstrating the role of responsible innovation implementation at the firm level. While much prior research has discussed responsible innovation from conceptual, policy, or public research perspectives, the present findings show that RII can be operationalized and tested in enterprises. The results confirm that anticipation, reflexivity, inclusion, and responsiveness are not abstract ethical ideals, but practical organizational routines that influence digital transformation and innovation performance.

Second, the study contributes to the responsible digital transformation literature by identifying responsible innovation implementation as an important antecedent of RDT. This finding clarifies the mechanism through which firms can make digital transformation more ethical and socially aligned. Digital transformation becomes responsible not only because firms adopt advanced technologies, but because they embed ethical assessment, stakeholder dialogue, transparency, and responsiveness into the transformation process.

Third, the findings enrich dynamic capabilities theory by conceptualizing RII as a capability that helps firms respond to ethical, social, and technological complexity. The positive effects of RII on both RDT and IPF suggest that responsible innovation

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capabilities allow firms to reconfigure innovation processes in ways that improve both legitimacy and performance. This contributes to a broader understanding of dynamic capabilities in the digital era, where firms must not only adapt technologically but also respond responsibly to societal expectations.

Fourth, the study advances stakeholder theory by showing that ethical pressure strengthens the relationship between RII and RDT. This confirms that stakeholder expectations can shape how firms convert internal capabilities into responsible digital practices. The moderation result suggests that external ethical pressure plays a boundary-condition role: when such pressure is high, firms are more likely to transform responsible innovation routines into concrete digital governance practices.

Fifth, the mediation finding contributes to the literature on barriers to responsible innovation. Instead of treating barriers only as direct obstacles, this study shows that their negative impact operates partly through the weakening of responsible innovation implementation. This provides a capability-based explanation of why some firms are less able to achieve responsible digital transformation despite recognizing the importance of ethical innovation.

5.2. Managerial Implications

The findings also provide several practical implications for managers and policymakers.

First, managers should identify and reduce internal barriers that hinder responsible innovation. These barriers include lack of resources, weak ethical competence, rigid procedures, short-term pressures, and insufficient tools for ethical risk assessment. Firms need to invest in training, ethical governance systems, cross-functional coordination, and digital risk assessment mechanisms. Without addressing these barriers, responsible innovation is unlikely to become a stable organizational practice.

Second, responsible innovation should be integrated into the core innovation and digital transformation strategy. Firms should not treat responsibility as a symbolic or compliance-oriented activity. Instead, they need to formalize procedures for assessing ethical risks, consulting stakeholders, reviewing digital projects, and responding to unintended consequences. Establishing ethics committees, digital governance teams, or stakeholder advisory mechanisms can help firms strengthen transparency and accountability.

Third, firms should view ethical pressure as a strategic opportunity rather than merely an external burden. Pressure from regulators, customers, business partners, and society can motivate firms to improve their digital governance practices and build stronger legitimacy. Enterprises that respond proactively to ethical expectations may enhance stakeholder trust, reduce reputational risks, and create differentiation in increasingly digital markets.

Fourth, because responsible digital transformation has the strongest effect on innovation performance, managers should pay greater attention to ethical dimensions of digitalization. Investments in data protection, cybersecurity, algorithmic transparency, explainability, fairness, and accountability can directly support innovation outcomes. Responsible digital transformation should therefore be considered a strategic driver of innovation performance, not simply a technical or compliance requirement.

Finally, policymakers and industry associations in Vietnam should support enterprises by developing clearer guidelines on responsible innovation and ethical digital transformation. Training programs, sector-level standards, digital ethics toolkits, and incentives for responsible technology adoption can help firms overcome resource and capability constraints. Such support is particularly important in emerging economies, where many firms are still building the institutional and managerial foundations for responsible digitalization.

5.3. Limitations and Future Research

Although this study provides meaningful insights, several limitations should be acknowledged. First, the study uses cross-sectional survey data, which limits the ability to examine causal relationships over time. Future studies should use longitudinal designs to investigate how responsible innovation capabilities develop and how they influence digital transformation and innovation performance across different stages.

Second, the study relies on self-reported data from managerial respondents. Although managers are appropriate informants for firm-level innovation and digital transformation issues, future research could reduce potential common method bias by collecting data from multiple respondents within each firm or combining survey data with objective indicators such as innovation outputs, digital governance audits, or performance records.

Third, the sample focuses on medium and large enterprises in Vietnam. Future research could examine small and micro-enterprises or compare firms across countries with different institutional and regulatory environments. Such comparative studies would help clarify whether the role of responsible innovation differs across firm size, industry, or national context.

Fourth, this study focuses on ethical pressure as a moderator. Future research may extend the model by examining other boundary conditions, such as ethical leadership, digital culture, regulatory quality, organizational learning, or top management commitment. These factors may further explain when and how responsible innovation implementation leads to stronger responsible digital transformation and innovation performance.

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Finally, future studies could investigate additional mechanisms linking responsible innovation and innovation performance, such as stakeholder trust, organizational legitimacy, digital capability, or green innovation capability. This would provide a deeper understanding of the pathways through which responsible innovation creates business and societal value.

6. CONCLUSION

This study demonstrates that responsible innovation is significantly hindered by barriers to responsible innovation, which supports the observation that a lack of resources, ethical competencies, and organizational flexibility reduces firms' ability to foresee risks, ethically reflect on them in relation to moral entrepreneurs, and include stakeholders in a responsible manner. Responsible Innovation Implementation (RII) is a key capability that enables not only responsible digital transformation but also contributes directly to innovation performance. This is consistent with the idea that accountability practices enhance legitimacy, reduce ethical hazards, and favor better-quality innovation.

Responsible digital transformation has the greatest impact on levels of innovation performance, highlighting trust factors such as fairness, transparency, privacy protection, and accountability that underpin successful digitalization in relations between stakeholders. Furthermore, ethical pressure also increases the positive impact of RII on Responsible Digital Transformation (RDT), suggesting that legal and social pressure prompt firms to react to institutional forces, thereby transforming principles of responsible innovation into corporate responses to responsible digitalization.

The mediating effect of RII shows that barriers affect RDT both directly and indirectly, highlighting the importance of investing in responsible innovation (in the sense of overcoming structural challenges). In sum, the results reposition RII as a dynamic capability that connects organizational constraints and ethical expectations with digital transformation outcomes, holding significant implications for firms located in emerging economies that pursue ethical and performance-enhancing digital innovation.

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APPENDIX. MEASUREMENT SCALES

All constructs were measured using multi item Likert scales ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). Items for barriers to responsible innovation (BAR) were developed based on conceptual discussions of organizational barriers in Blok and Lemmens (2015) and Khan et al. (2022). Items for responsible innovation implementation (RII) reflect the four dimensions of anticipation, reflexivity, inclusion, and responsiveness derived from Stilgoe et al. (2013), Owen et al. (2013), and Lubberink et al. (2017). Items for responsible digital transformation (RDT) were developed from Floridi (2018), van de Poel (2020), and Pappas et al. (2023), emphasizing fairness, transparency, accountability, privacy, and data protection in digital initiatives. Innovation performance (IPF) items were adapted from Del Río et al. (2023) and Prajogo and Sohal (2006), while ethical pressure (EP) items were developed drawing on Garriga (2021) and Pappas et al. (2023).

All items were originally written in English. Content and face validity were assessed through expert review by three academics and two senior managers who evaluated the clarity and relevance of each item. A pilot test with 30 managers from the target population was then conducted to check item comprehension and preliminary reliability. Feedback from this process informed minor wording refinements before the final survey was administered.

Construct	Code	Measurement Items	Source
Barriers to Responsible Innovation (BAR)	BAR1	Our organization lacks sufficient financial or human resources to conduct responsible innovation activities.	Blok & Lemmens (2015); Khan et al. (2022)
	BAR2	Employees lack the necessary ethical or technical competencies to implement responsible innovation.	
	BAR3	Rigid internal procedures hinder the implementation of responsible innovation.	
	BAR4	Short-term business pressures reduce the priority given to responsible innovation.	
	BAR5	The organization lacks tools or methods to assess ethical risks in innovation.	
Responsible Innovation Implementation (RII)			Stilgoe et al. (2013); Owen et al. (2013); Lubberink et al. (2017)
RII – Anticipation (RII_AN)	RII_AN1	Before launching digital innovations, we systematically assess possible social and ethical impacts.	
	RII_AN2	Scenario analysis is used to explore future risks of our digital projects.	
	RII_AN3	We regularly identify vulnerable groups that might be affected by our innovations.	
RII – Reflexivity (RII_RF)	RII_RF1	We critically reflect on the underlying values and assumptions of our digital projects.	
	RII_RF2	Managers question whether an innovation is desirable, not only whether it is technically possible.	
	RII_RF3	Lessons learned from previous ethical problems are used to improve future innovation processes.	
RII – Inclusion (RII_IN)	RII_IN1	We involve different stakeholder groups in discussions about our digital innovations.	

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	RII_IN2	Feedback from stakeholders is actively sought during the development of new digital services.	
	RII_IN3	Stakeholders' concerns are taken seriously and integrated into project decisions.	
RII – Responsiveness (RII_RS)	RII_RS1	We are willing to change or stop a digital project when serious ethical concerns arise.	
	RII_RS2	Our innovation processes can be adjusted quickly in response to stakeholder feedback.	
	RII_RS3	Policies and procedures are revised when we learn about new digital risks.	
Responsible Digital Transformation (RDT)	RDT1	Our digital systems are designed to ensure fairness and non-discrimination.	Floridi (2018); Van de Poel (2020); Pappas et al. (2023)
	RDT2	Digital initiatives promote inclusiveness and accessibility for diverse stakeholders.	
	RDT3	Decisions generated by digital technologies (e.g., AI) can be explained transparently.	
	RDT4	Users are adequately informed about how digital systems operate.	
	RDT5	Clear accountability mechanisms exist for addressing digital technology impacts.	
	RDT6	Digital transformation processes follow strict ethical guidelines for data use.	
	RDT7	Privacy protection is a key principle in deploying digital technologies.	
	RDT8	Strong data security measures are implemented to mitigate digital risks.	
Innovation Performance (IPF)	IPF1	Innovations have significantly improved the quality of our products or services.	Del Río et al. (2023); Prajogo & Sohal (2006)
	IPF2	Our organization has introduced new products or processes in recent years.	
	IPF3	Innovation activities have enhanced operational efficiency and reduced costs.	
	IPF4	Innovations developed by our organization contribute to a clear competitive advantage.	
	IPF5	Customers highly value the innovative solutions we deliver.	
	IPF6	Our innovation performance is superior to that of our competitors.	
Ethical Pressure (EP)	EP1	Our organization experiences strong pressure from customers to adopt responsible digital and innovation practices.	Garriga (2021); Pappas et al. (2023); Van de Poel (2020)
	EP2	Regulatory bodies expect our organization to comply with ethical standards in innovation.	

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	EP3	Society demands transparency and ethical conduct in our digital activities.	
	EP4	Business partners expect responsible behavior in implementing digital technologies.	
	EP5	Our organization receives strong public feedback if digital initiatives raise ethical concerns.	