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Narratives of total quality management, green management, risk-taking on organizational performance: The moderating role of IT infrastructure

Usman Mohammed[a] | **Shahmir Sivaraj Abdullah**[a] ✉ | **Shuhymee Ahmad**[a]

[a]School of Business Management, College of Business, Universit Utara Malaysia.

Abstract This study delved into examining the interplay among TQM, GM, RSK, and OP, alongside exploring the moderating influence of IT infrastructure within these relationships in organizations. Drawing from a sample of 361 owners/managers in north-western Nigeria, the research focused on managers due to their comprehensive understanding of organizational dynamics. Employing the PLS-PM algorithm, the analysis revealed that GM and TQM significantly influence OP directly, while the association between IT infrastructure and RSK was not statistically significant. Additionally, the study shed light on the moderating role of IT infrastructure, particularly in the relationship between GM and OP, an area less explored in previous research. These findings underscore the importance of proactive approaches and innovation to foster organizational success, with TQM and GM policies emerging as crucial factors for sustaining and enhancing OP in SME manufacturing organizations.

Keywords: total quality management (TQM), green management (GM), risk-taking (RSK), organizational performance (OP), small and medium enterprises (SMEs)

1. Introduction

Organizational performance serves as a fundamental criterion for evaluating organizations, reflected in its frequent use as both an independent and dependent variable in research (March & Sutton, 1997; Siddiq & Javed, 2014; Obeidat, 2016; Latif et al., 2020; Cheffi et al., 2021; Singh & Misra, 2021). In today's business landscape, it distinguishes one organization from another (Lakomski & Evers, 2011), encompassing both financial and non-financial dimensions (Kee & Rahman, 2017). Continuous translation of entrepreneurial capabilities into strategic actions is essential for achieving superior organizational performance (Javad et al., 2020; Nazarian et al., 2017). However, many manufacturers in developing countries lack clear green business strategies, despite the potential benefits of environmental management practices (Yasir et al., 2020; Javeed et al., 2020; Roscoe et al., 2019). Additionally, implementing risk management has been shown to lead to cost reductions and improved performance across various studies (Chen et al., 2019; Hoyt & Liebenberg, 2011; Pagach & Warr, 2011), particularly crucial for Small and Medium Enterprises (SMEs) facing heightened competition and economic uncertainties (Angeline & Teng, 2016; Altman et al., 2010; Wright et al., 2001). By identifying risks and opportunities, SMEs can enhance their resilience and innovative capacities, ultimately bolstering their competitiveness in the global market (Laforet & Tann, 2006; Rehman & Anwar, 2019; Falkner & Hiebl, 2015).

2. Theoretical background

2.1. Resource-based theory

Organizational performance within the SME domain has often been anchored in Resource-Based Theory (RBT), evident in studies by Aksoy (2017), Ch'ng et al. (2021), Saridakis et al. (2019), and Sok et al. (2013). RBT offers a foundational framework to discuss how resources and capabilities contribute to organizational performance. Total Quality Management (TQM), Green Management (GM), and Risk-taking enable SMEs to capitalize on market opportunities, mitigate threats, and cultivate unique capabilities that competitors struggle to replicate. Despite this, prior research has not extensively examined the impact of these constructs on SME performance (Aksoy, 2017; Mirvis et al., 2016; Rosenbusch et al., 2011). RBT underscores the critical role of internal and external resources in shaping organizational performance and competitiveness, highlighting the value of scarce,

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immobile, and difficult-to-imitate resources. By effectively managing these resources, firms can outperform their peers and gain a competitive edge (Seddon, 2014; Turel et al., 2017; Xu et al., 2016).

2.2. Literature Review

2.2.1. Organizational performance

Organizational performance serves as a commonly studied dependent variable in organizational and management research (Rodrigues & Pinho, 2010; Yeo, 2003; Zgrzywa-Ziemak, 2015), capturing the significance of various factors in organizational activities and strategies. However, the concept's scope and definition remain somewhat elusive and inconsistent (Kirby, 2005; Richard et al., 2009). March and Sutton (1997) note its pervasive presence in organizational research, often assumed without explicit justification of its definition and structure. Laeeq, Shahzad, Ramalu, and Fareed (2016) define organizational performance as an indicator of effective management and an organization's capacity to provide value to both customers and stakeholders. While Santos and Brito (2012) differentiate it conceptually from organizational effectiveness, in practice, organizational performance encompasses diverse indicators such as accounting returns, growth, and stock market performance. Fareed, Isa, Ahmad, and Laeeq (2016) emphasize that performance entails the realization of strategic goals to optimize employee performance and enhance overall organizational effectiveness.

2.2.2. Total Quality Management

Jimoh et al. (2018) define Total Quality Management (TQM) as the continuous enhancement of all organizational processes to ensure consistent customer satisfaction. Conversely, Aquilani et al. (2017) perceive TQM as an organizational strategy aimed at improving customer satisfaction by meticulously managing output quality. Furthermore, TQM is regarded as an integrated approach to acquiring and sustaining high-quality outputs. This approach emphasizes maintenance, continuous improvement, and prevention of failures across all levels and functions of the company to meet or surpass consumer expectations (Ghani et al., 2020).

2.2.3. Risk management

Risk management practices are defined as the capability of a firm to use its resources effectively to gain a competitive advantage and improve performance by reducing loss (Yang et al., 2018). Moreover, risk-management practices enhance firm performance by cost-effectively minimising risks and using time and resources to gain a competitive advantage (JalalKarim, 2013). Furthermore, previous studies explored that risk-management practices have a strong impact on firm performance. Risk management refers to enterprise risk management, the authority by which a corporation in a particular industry gains access to, controls, exploits, and monitors risks from all sources to maximize the firm's long-term and short-term value to its stakeholders, according to Shad et al. (2019).

2.3. Hypothesis development and the relationship between variables

Several research hypotheses were developed based on the research model shown in Figure 1 The following discusses them.

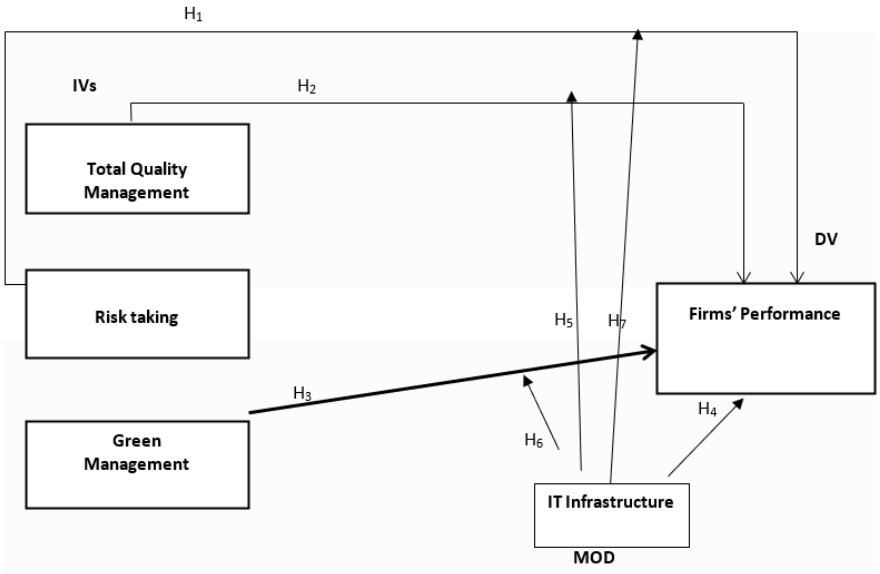


Figure 1 Research Framework.

2.3.1. Total quality management and organizational performance

Numerous researchers have investigated the relationship between Total Quality Management (TQM) and organizational performance across various dimensions, including financial, innovation, operational, and quality performance. While the impact of TQM on different aspects of performance may vary, there is a consensus that TQM positively influences quality performance. Advocates of TQM argue that its implementation not only improves overall organizational performance but also leads to higher-quality products. Several studies in the literature consistently support a positive and significant relationship between TQM and performance, as demonstrated by research conducted by Arumugam et al. (2008), Corredor and Goñi (2011), Faisal et al. (2011), Gunday et al. (2011), Hendricks and Singhal (2001), Joiner (2007), Miyagawa & Yoshida (2010), Shenaway et al. (2007), and Yeung & Chan (1998). Consequently, the following hypothesis is proposed for examination:

H1. The implementation of TQM has a consistent positive and significant impact on organizational performance.

2.3.2. Green management and organizational performance

Several studies have demonstrated that adopting Green Manufacturing (GM) practices significantly enhances organizational reputation and public image (Khan & Qianli, 2017; Zhu et al., 2007). Particularly in emerging economies, numerous studies have highlighted the pivotal role of green manufacturing in bolstering the competitiveness of manufacturing firms in the foreseeable future (e.g., Diabat and Govindan, 2011; Rehman et al., 2013; Rehman et al., 2016; Masri & Jaaron, 2017; Zaid et al., 2018; Afum et al., 2020). Afum et al. (2020) investigated the mediating effect of green supply chain practices on the relationship between GM practices and sustainable performance (economic, social, and environmental) in Ghanaian manufacturing SMEs, confirming the significant impact of GM practices on sustainable performance and the mediating role of green supply chain practices. In light of this expanding body of literature, the following hypothesis is proposed:

H2: There is a statistically significant correlation between the GM Practices and OP.

2.3.3. Risk management and organizational performance

Despite the increasing adoption of risk management, debates persist regarding its benefits, particularly concerning its negative net present value in frictionless capital markets where investors can mitigate risk through diversification (Beasley et al., 2008). However, risk management, including Enterprise Risk Management (ERM), has been associated with various potential benefits such as reducing expected corporate tax schedules, mitigating underinvestment, managing managerial compensation, minimizing costs of financial distress, and easing external financing (Pagach & Warr, 2011). Several studies (e.g., Barton et al., 2002; Lam, 2003; Stulz, 2003; COSO, 2004; Nocco and Stulz, 2006; Gordon et al., 2009; Hoyt and Liebenberg, 2011) have acknowledged the potential of risk management to enhance firm performance across diverse industries. ERM, in particular, has been linked to the creation of shareholder value and the maximization of wealth, aligning with the overarching goals of corporate entities (Bowen et al., 2006; Nocco & Stulz, 2006; Block et al., 1989; Brealey et al., 2006). Given the mixed findings surrounding these benefits, it is imperative to investigate the impact of risk management on organizational performance. Thus, the following hypothesis is proposed:

H3: Risk management has a significant impact on organizational performance**.**

2.4. IT infrastructure

IT infrastructure refers to the essential components necessary for the operation of IT systems and IT-enabled activities. These consist of software, composite hardware, network services, and resources. The infrastructure facilitates the delivery of services and solutions to consumers, partners, and employees by enterprises. In order to conduct corporate operations on a global scale, the presence of information technology (IT) is essential and crucial. IT plays a crucial role in international transactions and cannot be ignored. Multiple studies have also demonstrated the significance of information technology (IT) in corporate operations (Van Der Zed et al., 1999). Inter-organizational IT infrastructure brings several advantages, including enhanced operating performance for organizations that have information technologies that align with their supply chain (Malhotra et al., 2007; Obal & Lancioni, 2013).

2.4.1. IT infrastructure and organizational performance

Bharadwaj (2000) emphasizes that the combination of IT with complementary resources can result in long-lasting competitive advantages, eventually improving organizational performance. The development of IT capabilities in organizations enhances their distinctiveness and provides them with a competitive advantage (Dehning & Stratopoulos, 2003; Santhanam & Hartono, 2003). Furthermore, according to Teece et al.'s (1997) theory of dynamic capabilities, resources by themselves do not automatically result in competitive advantages. Instead, they must be converted into dynamic capabilities in order to enhance performance. Based on these observations, this paper proposes that:

H4: There is a statistically significant correlation between the IT infrastructure and OP.

2.5. The moderating role of IT infrastructure

IT infrastructure refers to a collection of shared, tangible IT resources that establish a framework for business applications (Broadbent & Weill, 1997; Duncan, 1995). These resources encompass platform technology, including hardware and operating systems, network and communication technologies, and essential software applications (Duncan, 1995; Bhatt et al., 2005). The effectiveness of IT infrastructure is contingent upon factors such as scalability, modularity, and compatibility, enabling the support of multiple business applications (Chen et al., 2015). This capability fosters efficient communication and facilitates information sharing across various departments within organizations (Byrd & Turner, 2001). Therefore, we propose:

H5: IT infrastructure positively moderates the relationship between TQM and organizational performance.

H6: IT infrastructure positively moderates the relationship between Green Management and organizational performance.

H7: IT infrastructure positively moderates the relationship between Risk-Taking and organizational performance.

3. Methodology and Research Design

3.1. Sampling design and data collection procedures

This study employed a quantitative research method to collect data and test hypotheses, aligning with the post-positivist worldview that values respondents' personal experiences. Utilizing a structured questionnaire survey method, the primary aim was to gather cross-sectional data from owner/managers of manufacturing SMEs in Nigeria in a quantitative, exploratory, and causal manner. Specifically focusing on the North-west region of Nigeria, encompassing Kano, Kaduna, and Jigawa states, known for their concentration of businesses ranging from large companies to small enterprises. These states were chosen for their homogeneity and status as industrial hubs within the region.

The research commenced with face validity interviews with industry players and associations to ensure the clarity and validity of the questionnaires. Subsequently, a pilot test involving 30 respondents was conducted to assess the validity and reliability of the questionnaires. Following satisfactory pilot test results, a field survey was undertaken. Employing a systematic sampling technique, 400 respondents were sampled, resulting in a response rate of 95%, with 361 usable questionnaires retained for data analysis after discarding incomplete responses.

3.1.1. Measures for organizational performance

The measurement of organizational performance was conducted using a single-attribute approach, as proposed by Gupta and Govindarajan in 2000. The key informants were requested to evaluate their organizational performance using a seven-point Likert scale, rating 10 specific aspects. These aspects, as identified by Asiaei and Jusoh (2015, 2017) and Asiaei et al. (2018), include return on investment, profit, cash flow from operations, cost control, the success of new product development, sales volume, market share, market developments, personnel advancements, and political-public affairs. The Likert scale ranges from 1, indicating significantly below average, to 7, denoting significantly above average. This scale has been extensively utilized and verified in the context of strategic management (Govindarajan and Fisher 1990).

3.1.2. Measures for TQM

The measurement of TQM is conducted using a ten-item instrument that was adopted by Claver-Cortés, Pereira-Moliner, Tarí, and Molina-Azorín in 2008. The research that was considered for this paper provided the basis for defining the ten TQM practices discussed here. The survey in this study utilized a seven-point Likert scale response, with 1 representing "totally disagree" and 7 representing "totally agree". The poll consisted of ten items. The Likert scale is a well-established research technique consisting of multiple items that allows for flexibility in scoring.

3.1.3. Measures for green management

The measurement of green management consisted of 14 components, which were derived from the research conducted by Adelegan (2018). These items were derived from the research conducted by Weng, Chen, and Chen (2015); and Videen (2010). The green management components were adopted from the work of Adelegan (2018). The section should be completed by the owner or management of the firm. However, if the firm is part of a large organization, the respondent is required to answer the questions specifically regarding their own manufacturing firm. The survey in this study utilized a seven-point Likert scale response, ranging from 1 (completely disagree) to 7 (absolutely agree), for the evaluation of these 14 topics.

3.1.4. Measures for risk-taking

RT was measured with 4 items adapted from the work of Herzog and Leker (2010) and Tellis et al. (2009). These 4 items employed a seven-point Likert scale response (1 = totally disagree to 7 = totally agree) for the survey of this study. The Likert scale response is an established multi-item research tool that gives room for scoring variability.

3.1.5. Measures for IT-infrastructure

IT infrastructure was assessed using a set of 12 items adapted from the research of Benitez, Ray, and Henseler (2018). These items were originally derived from the work of Benitez-Amado and Ray (2013), which built upon earlier scales developed by Chang, Wong, and Fang (2014); Miller and Friesen (1983); and Khandwalla (1977). The study utilized these items to measure Information Technology infrastructure, maintaining consistency with previous research by Benitez et al. (2018). Respondents rated these 12 items on a seven-point Likert scale (1 = totally disagree to 7 = totally agree), providing a well-established and versatile tool for capturing nuanced responses.

The proposed research employed partial least squares (PLS) modeling using SmartPLS version 4 (Becker et al., 2023), a methodology gaining popularity in social sciences and management due to its ability to analyze complex connections between observed and latent variables, overcoming limitations of traditional statistical analysis techniques. Notably, the variance-based PLS approach aims to enhance the explained variance of the outcome variable (Hair et al., 2014), making it suitable for this study. Guenther *et al.* (2023) highlighted a significant increase in the adoption of PLS over the past decade across various fields. PLS-SEM was chosen for its versatility in handling limited sample sizes, complex models, abnormal data, and various types of research purposes, including exploratory, predictive, explanatory, and confirmatory studies (Benitez et al., 2020). To mitigate potential Common Method Bias in the collected data, thresholds proposed by Kock & Lynn (2012) and Kock (2015) were applied, ensuring full collinearity among variables. The Variance Inflation Factor (VIF) values among constructs were within the suggested threshold of <3.3 (Kock & Lynn, 2012) and <5 Hair et al. (2022), indicating minimal single-source bias in the data.

3.2. Respondents profile

Table 1 presents a comprehensive overview of the socio-demographic characteristics of the respondents. Out of the 361 participants, 233 (64.5%) were male, while 128 (35.5%) were female. The age distribution varied, with the majority falling within the 31-35 age bracket (97.0%), followed by smaller percentages in other age groups. Regarding ownership type, participating firms were categorized into three groups: 85 (23.5%) were sole proprietorships, 127 (35.2%) were partnerships, and 149 (49.3%) were incorporated as limited liability companies.

TABLE 1 Respondents' demographic.

Item	Frequency	Percentage (%)
Gender		
Male	233	64.5
Female	128	35.5
Age		
31-35	350	97.0
23-26	6	1.7
27-30	4	1.1
18-22	1	3
Ownership		
Sole proprietorship	85	23.5
Partnership	127	35.2
Limited Liability Company	149	41.3
Firm Size		
Less than 50 employees	168	46.5
50-99 employees	5	1.4
100-249 employees	65	18.0
250-499 employees	33	9.1
500 or more employees	90	24.9
Industry		
Food and beverages	1	.3
Packaging/containers	2	.6
Metal and metal products	25	6.9
Printing and publishing	81	22.4
Agro-allied, furniture	105	29.1
Building materials	100	27.7
Others	47	13.0
Firm Age		
3 – 6 years	103	28.5
7 – 9 years	140	38.8
10 – 12 years	71	19.7
13 years or more	47	13.0

In terms of workforce size, 168 (46.5%) firms employed fewer than 50 employees, with varying percentages employing higher numbers of employees. Industry-wise, the distribution varied, with a minority of firms operating in sectors such as food and beverages (0.3%) and packaging/containers (0.6%), while others were involved in industries like metal and metal products (6.9%) and printing and publishing (22.4%). These demographic factors play a crucial role in understanding SME performance, offering insights into their challenges, opportunities, and competitive landscapes. Ownership influences decision-making, size correlates with resources and flexibility, and industry impacts market dynamics. Analyzing these demographics helps tailor interventions to enhance SME performance effectively.

3.3. Test and validation of conceptual model

This study aimed to assess the business potential of Total Quality Management (TQM), Green Management (GM), risk management (RSK), and the moderating role of IT infrastructure concerning environmental, technological, and performance-related impacts. Given the limited exploration of these interactions, particularly in SME performance research, there was no well-established theoretical basis for the latent constructs. Thus, it was imperative to investigate how effectively the independent variables (TQM, GM, RSK, and the moderating role of IT infrastructure) could predict the dependent variable (OP). Partial least squares (PLS) were chosen as the analytical tool for this study, facilitated by the Smart PLS software version 4.0.7.8, to evaluate the hypothesized causal paths illustrated in Figure 2 (Ringle et al., 2005).

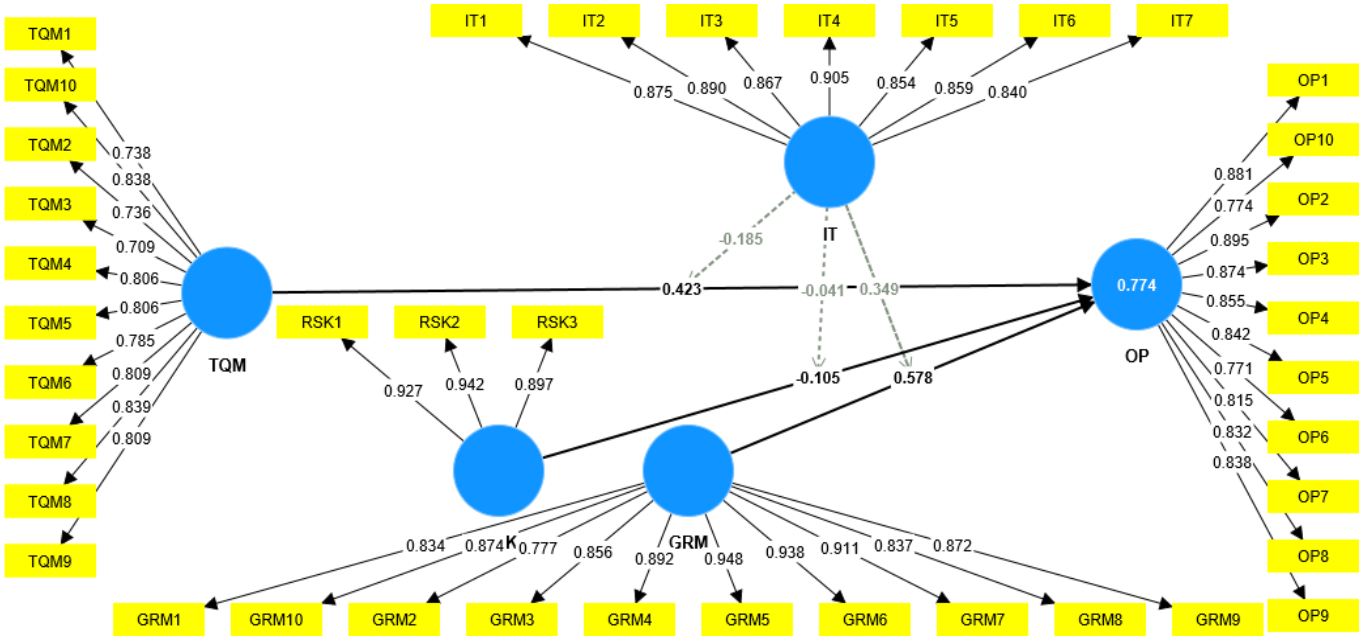


Figure 2 Measurement Model.

3.4. Measurement model

We rigorously examined several factors to ensure that our measurement model met the necessary criteria for retention. These criteria included internal consistency, indicator reliability, convergent validity, and discriminant validity. Table 2 displays key metrics such as item loadings, indicator reliability, composite reliability, average variance, and p-values for measurement model reliability. Through this evaluation, we confirmed that our model met the minimum parameters required for a reflective measuring model. Our assessment revealed indicator convergent validity through factor loadings exceeding 0.70 and significance at the 0.001 level. To refine the model, we retained only indicators with outer loadings surpassing the appropriate threshold, as recommended by Hair et al. (2014), while excluding those with latent variables between 0.40 and 0.70. Additionally, we assessed convergent validity at the construct level using the average variance extracted (AVE) values, which were all above 0.50. AVE refers to the grand mean value of the squared loadings of the indicators associated with the construct (i.e., the sum of the squared loadings divided by the number of indicators) (Abboh, Majid, Fareed & Abdussalaam, 2022). Furthermore, our constructs' composite reliability values exceeded 0.70, indicating reliability, which aligns with recommendations for exploratory testing. The calculation models and construct factor loadings are illustrated in Figure 2. Finally, discriminant validity was ensured by comparing the square root AVE of each latent variable with the correlation values for the other latent variables. The results of the measurement model evaluation in Table 3 confirm the appropriateness of our measurement model.

Table 2 Result of Convergent Validity.

Constructs	Items	Loadings	Cronbach Alpha	Composite Reliability	Average Variance Extracted (AVE)
Organizational Performance	OP1	0.881	0.953	0.955	0.703
	OP10	0.774			
	OP2	0.895			
	OP3	0.874			
	OP4	0.855			
	OP5	0.842			
	OP5	0.771			
	OP6	0.815			
	OP7	0.832			
	OP8	0.838			
	OP9	0.881			
Green Management	GRM1	0.834	0.966	0.968	0.766
	GRM10	0.874			
	GRM2	0.777			
	GRM3	0.856			
	GRM4	0.892			
	GRM5	0.948			
	GRM6	0.938			
	GRM7	0.911			
	GRM8	0.837			
	GRM9	0.872			
IT Infrastructure	IT1	0.862	0.947	0.950	0.757
	IT2	0.883			
	IT3	0.864			
	IT4	0.828			
	IT5	0.754			
	IT6	0.752			
	IT7	0.732			
Risk-Taking	RSK1	0.765	0.912	0.916	0.851
	RSK2	0.767			
	RSK3	0.737			
Total Quality Mgt	TQM1	0.626	0.932	0.933	0.622
	TQM10	0.749			
	TQM2	0.653			
	TQM3	0.606			
	TQM4	0.699			
	TQM5	0.678			
	TQM6	0.662			
	TQM7	0.685			
	TQM8	0.768			
	TQM9	0.725			

Table 3 Discriminant validity (HTMT).

	GRM	IT	OP	RSK	TQM
GRM					
IT	0.875				
OP	0.871	0.828			
RSK	0.877	0.811	0.742		
TQM	0.821	0.744	0.852	0.815	

3.5. Common method bias

Common Method Variance (CMV) can distort relationships in studies using self-reported data collected simultaneously from a single source (Podsakoff et al., 2012; Conway & Lance, 2010). To counter CMV, procedural and statistical measures including ensuring content validity, using reverse-worded questions, guaranteeing respondent anonymity, and emphasizing confidentiality and honesty in responses, were recommended (Podsakoff et al., 2003). This study utilized Harman's Single Factor (Podsakoff et al., 2003) and full collinearity evaluation to uncover this possible bias (Kock and Lynn 2012). Based on Bagozzi, Yi, and Phillips (1991) Harman single-factor test was conducted to establish that data is free from common method

bias/variance. The test revealed that no one factor accounted for more than 50% of the variance since the first factor accounted for only 29.22%.

3.6. Structural model

The structural model examines how elements within the proposed framework (Hair et al., 2014) are interconnected, providing a significant depiction of the relationships among diverse concepts. It aims to reveal empirical evidence supporting the theoretical framework by illustrating the connections between predictor and outcome variables. The study assesses the connections between variables using the inner model, which encompasses GM, RSK and TQM as the predictors, OP as the dependent variable, and IT as the moderating variable. As recommended by Hair Jr et al. (2022) and Cain et al. (2017), the study evaluated multivariate skewness and kurtosis. The findings indicated that the collected data did not exhibit multivariate normality, evident in Mardia's multivariate skewness and multivariate kurtosis. Therefore, in line with the suggestions of Becker et al. (2023), the path coefficients, standard errors, t-values, and p-values for the structural model were reported using a resampling bootstrapping procedure with 5,000 samples (Ramayah et al., 2018). Equally, addressing the critique that p-values alone are not a robust criterion for hypothesis significance testing, experts recommend employing a mix of criteria, including p-values, confidence intervals, and effect sizes (Hahn & Ang, 2017). Table 4 presents a summary of the criteria employed to assess the developed hypotheses. The investigation examined how GM, RSK and TQM influences OP by way of IT as a contingent variable. As illustrated in Table 4 and Figure 3, Figure 4 presented a comparative analysis of the relationship between GM and OP. The study found a substantial and positive correlation between GM and OP (β = 0.578, t = 5.995, p< 0.001). Similarly, TQM demonstrated a significant positive relationship with OP (β = 0.423, t = 5.597, p< 0.001). These results provided confirmation and backing for H1, and H4. However, the relationship between RSK and OP as well as IT and OP were not significant (β = -0.105, t = 1.170, p = 0.122) and (β = -0.108, t = 0.747, p = 0.228) which shows no support for both H3 and H2 respectively. Conversely, in assessing the moderating role of IT between GM, RSK and TQM on OP, the results demonstrates that the link IT → GM → OP (β = 0.349, t = 5.990, p< 0.001) was statistically significant. Hence, H6 was supported. However, IT did not moderate the relationship between RSK and TQM which shows no support for both H5 and H7. Subsequently, an evaluation of the structural model's quality was conducted. Regarding the predictive accuracy (R^2) values, the model accounted for (0.774) i.e., 77.4% of the variance in OP, indicating a satisfactory R^2 for the model (refer to Figure 2). Additionally, the effect size of the constructs was evaluated to measure the predictive power of the structural model utilizing Cohen's f^2 (Cohen, 1988). Upon examining the f^2 values presented in Table 4, it becomes evident that GM→OP (f^2 = 0.137), IT → OP (f^2 = 0.002), RSK →OP (f^2 = 0.002), and TQM →OP (f^2 = 0.002) demonstrated trivial effects respectively, in predicting R^2 for the model (Kenny, 2021).

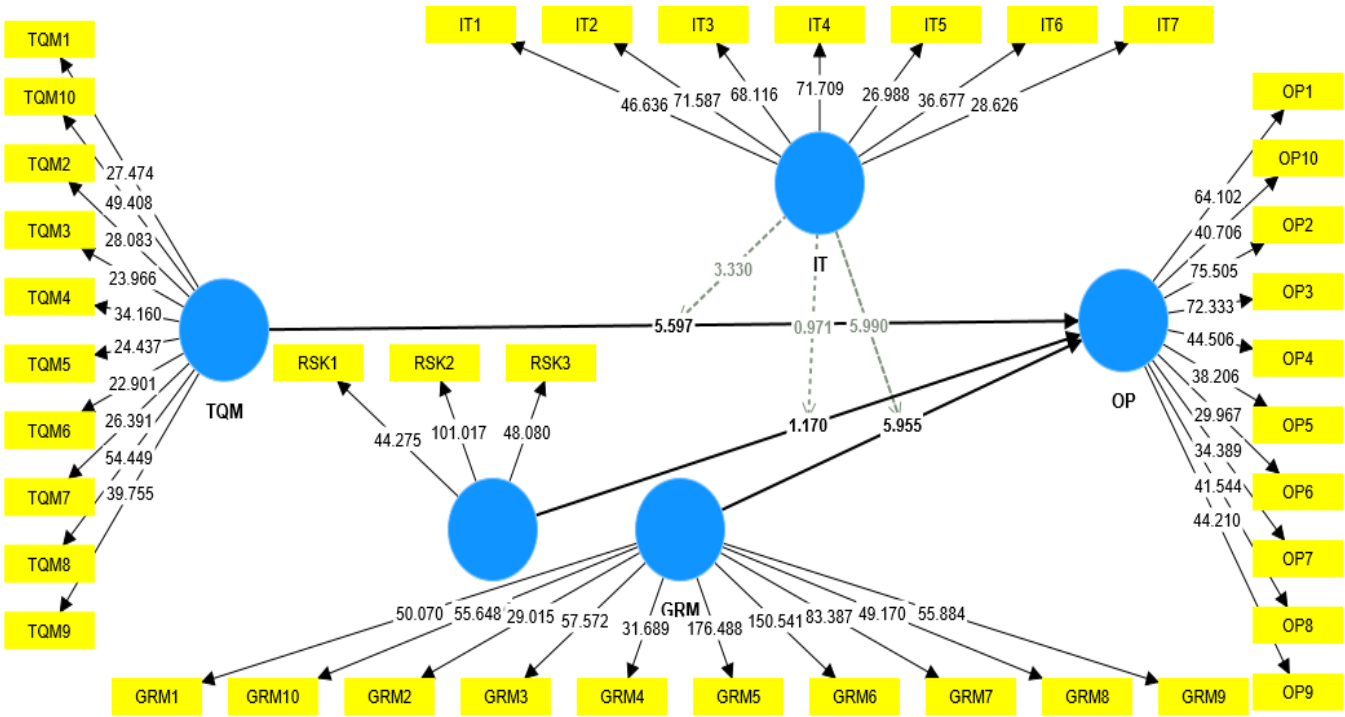


Figure 3 Structural Model.



Figure 4 Interaction Plot.

5. Result and Discussion

In the examination of direct relationships, H1 demonstrated that GM positively influenced OP, confirming previous research attributing a performance role to GM (Daddi et al., 2021; Mirčetić et al., 2022). However, contrary to expectations, both RSK and IT infrastructure (H2 & H3) did not exhibit a significant positive relationship (β = 0.108; β = 0.105) respectively. The lack of a positive relationship between risk-taking and OP may stem from organizational members' reluctance to innovate and take risks, hindering the introduction of new services and practices. Similarly, the absence of IT infrastructure can impact organizational performance, with proper IT support potentially enhancing performance by facilitating technology adoption and implementation. This aligns with findings from previous studies (Anggraini, 2013; Iranto, 2012; Djatikusumo, 2016; Rahayu, 2020). Regarding H4, TQM displayed a positive and significant relationship with OP, highlighting its contribution to organizational performance and affirming previous research (Alshourah, 2021; Cheah et al., 2022; Faeq et al., 2021; Kalogiannidis, 2021; Pambreni et al., 2019) (El-Kassar & Singh, 2019).

Table 4 demonstrates that the interaction coefficient between IT infrastructure and risk management had a non-significant and negative impact on organizational performance (β = 0.041), rejecting H5. This suggests that the relationship between risk management and OP remains unaffected by IT infrastructure. The insignificant negative effect indicates that even with an increase in IT level, the impact of risk management on OP diminishes. This could be attributed to the underutilization of strategic assets such as information technology in organizational activities (Meyer, 1996; Xinhua & Heda, 2008). Effective risk observation and response, crucial for enhancing performance, heavily rely on a robust IT infrastructure. Furthermore, H6 received support as IT infrastructure was found to positively moderate the relationship between GM and OP among SMEs in north-western Nigeria. The supported hypothesis, H6, highlights the critical role of organizations in actively embracing environmentally friendly practices, such as green management (GM), to bolster their competitive advantage and achieve organizational success. This becomes increasingly vital as firms face mounting internal and external pressures to engage in sustainable activities. GM implementation entails a spectrum of actions, from reducing energy consumption and pollution emissions to recycling wastes and designing eco-friendly products. Recent studies underscore the necessity of understanding the drivers of GM practices and the tangible benefits of adopting environmentally friendly activities.

In contrast, H7 was rejected, as IT infrastructure failed to moderate the relationship between Total Quality Management (TQM) and organizational performance (OP), exhibiting an insignificant and negative interaction coefficient (β = -0.185). This rejection highlights the challenges faced by SME managers and decision-makers in efficiently leveraging dynamic IT infrastructure to capitalize on their green marketing efforts. Moreover, addressing outliers in multivariate analysis, as

emphasized by Hair et al. (2010), is crucial for ensuring accurate study findings. Utilizing the Mahalanobis (D2) measure for outlier detection, this study found no multivariate outliers using linear regression in SPSS (Tabachnick & Fidell, 2013).

Table 4 Result of the Hypothesis assessment.

					Confidence Intervals						
Relationships		Std. Error	t-values	p-values	5%	95%	Inner VIF	R2	F2	Q2	Decision
Green Mgt -> Org Performance	0.58	0.055 4	5.955	0.000	0.377	0.688	2.415	0.774	0.137	0.621	Supported
IT Infr -> Org Performance	-0.108	-0.086	0.747	0.228	0.338	0.155	3.241		0.002	0.471	Not Supported
Rsk -> Org Performance	-0.105	-0.112	1.170	0.122	0.291	0.043	2.640		0.002	0.615	Not Supported
TQM -> Org Performance	0.423	0.434	5.597	0.000	0.317	0.556	2.210		0.002	0.627	Supported
IT x Rsk -> Org Performance	-0.041	-0.044	0.971	0.167			1.000		0.005	0.500	Not Supported
IT x Green Mgt -> Org Performance	0.349	0.356	5.990	0.000			1.000		0.133	0.445	Supported
IT x TQM -> Org Performance	-0.185	-0.192	3.330	0.001			1.000		0.131	0.417	Not Supported

6. Interaction plot

The significant interaction (H5) is plotted in the interaction plot (Figure 4) as recommended by Dawson (2014). Figures 4 reveal that when IT infrastructure is high, the positive relationship of GM and OP becomes stronger. Figures 3 shows that when IT infrastructure is high, the positive relationships for GM and OP of SME owner/managers become stronger.

7. Conclusion

The present study represents a pioneering empirical effort aimed at advancing our understanding of organizational performance (OP) by considering Total Quality Management (TQM), Green Management (GM), risk management (RSK), and the moderating role of IT infrastructure. This research holds significance on multiple fronts. Firstly, it contributes to enhancing comprehension and insight into the collective impact of TQM, GM, RSK, and IT management. Notably, there is a dearth of studies examining these factors in conjunction, particularly within manufacturing firms, especially in developing economies. The results align with Resource-Based View (RBV) theory, affirming the strategic value of these constructs in fostering competitive advantage. Furthermore, this study sheds light on the moderating influence of IT infrastructure, a pivotal intangible asset in contemporary organizational landscapes, on the relationships between TQM, GM, RSK, and OP. Notably, prior research has largely overlooked IT infrastructure as a potential factor that can amplify the effects of TQM, GM, and RSK on OP. The findings underscore the significance of TQM, GM, RSK, and IT in enhancing organizational performance, offering valuable insights for managerial decision-making. This study carries managerial implications, informing strategic planning and decision-making processes by highlighting the crucial role of IT infrastructure as a critical success factor in organizational performance enhancement.

7.1. Implications for theory and practice

This study introduces a foundational research framework comprising three predictors (TQM, GM, RSK), a moderator (IT infrastructure), and a criterion (SME organizational performance). Delving into the rationale behind these factors and their interrelationships, the study rigorously examines them using partial least squares analysis. The insights gleaned from this research offer invaluable guidance for SME manufacturers in shaping their strategic plans. Additionally, the tested model serves as a roadmap for investors, policymakers, and future researchers seeking to empower SMEs in optimizing their performance.

7.2. Limitation and future research directions

While the research population is confined to Nigeria, the findings offer a fresh perspective and broad insights into the journey of bolstering Total Quality Management (TQM), Green Management (GM), risk management (RSK), and IT infrastructure towards enhancing organizational performance for SMEs in similarly developing countries. This study lays the groundwork for future research endeavors exploring additional variables, such as various marketing environments and performance metrics, which could further enhance the achievements of manufacturing SMEs. Expanding upon these avenues

could yield valuable contributions to the field and provide actionable insights for stakeholders seeking to foster SME growth and success in similar contexts.

Ethical considerations

This article complies with the ethical standards set forth by [journal/publisher name] and adheres to the principles outlined in the [relevant ethical guidelines, such as the Committee on Publication Ethics (COPE) guidelines]. The authors also disclose any potential conflicts of interest that might have influenced the research or its outcomes. Furthermore, the work acknowledges and properly cites the contributions of others, acknowledging intellectual property rights and giving due credit to prior research in the field.

Conflict of Interest

The authors of this article declare that they have no conflicts of interest that could influence or be perceived to influence the research and its outcomes.

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