ESJ Social Sciences Peer-reviewed

The Complexity of E-Marketing and Its Influence on the Performance of Gas Companies in Tanzania: Insights from Innovation Diffusion Theory

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Doi:10.19044/esj.2025.v21n28p64

Submitted: 21 May 2025
Accepted: 28 October 2025
Published: 31 October 2025

Cite As:
Yohana, A., Shayo, F. & Mbura, S. (2025). *The Complexity of E-Marketing and Its Influence on the Performance of Gas Companies in Tanzania: Insights from Innovation Diffusion Theory.* European Scientific Journal, ESJ, 21 (28), 64.
https://doi.org/10.19044/esj.2025.v21n28p64

Abstract

This paper focuses on investigating the complexity of electronic marketing on the performance of gas energy companies in Tanzania, with insight from Innovation Diffusion Theory. Data were gathered using a structured questionnaire administered to a convenience sample of 302 employees from Gas Company Tanzania Ltd, Taifa Gas Ltd, Lake Gas Ltd, Oryx Gas Ltd, and Pan African Energy Ltd. The study employed an explanatory research design. Structural equation modeling was applied to analyze the data and identify the causal link between company performance and the complexity of electronic marketing. Results show a standardized path coefficient of .388 for COMPL5 <--- COMPL, indicating that COMPL5 is a key reference indicator for the construct COMPL. Additionally, the path coefficients for COMPL1 <--- COMPL (1.838, CR = 5.777, $p < 0.001$) and COMPL2 <--- COMPL (1.960, CR = 5.685, $p < 0.001$) provide strong evidence of significant relationships. The high critical ratios and statistical significance of these paths further support the conclusion that the complexity of electronic marketing positively influences the performance of gas energy companies in Tanzania. The study concluded that electronic marketing directly influences the performance of gas companies through the complexity

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

of technology. These results advise businesses in the gas sector to prioritize investments in training programs to enhance the ease of learning and application of electronic marketing tools. Organizations should also ensure that staff has access to structured learning opportunities and user-friendly systems. Reducing the entry barrier for staff through simplified tool interfaces and consistent training can help maximize their efficiency in using electronic marketing solutions. Gas businesses should also focus on developing internal knowledge and fostering a culture of appreciation for the advantages of electronic marketing.

Keywords: Complexity of Electronic Marketing, Company Performance, Gas Energy Sector in Tanzania, Innovation Diffusion Theory, Structural Equation Modeling

Introduction

In today's dynamic market environment, companies can no longer rely solely on technological evolution or functional differentiation to maintain a competitive edge (Hur & Kim, 2023). Beyond operational efficiency, design and digital innovation have become critical drivers of profitability and competitiveness. For energy organizations, particularly gas companies, adopting digital technologies is essential, as these innovations enhance efficiency, reduce risks and costs, and ultimately improve overall industry performance (Al-Rbeowitz, 2023).

The rapid advancement of information and communication technologies (ICT) has transformed business operations, making digital tools indispensable for creating and sustaining organizational value. Electronic marketing (e-marketing), in particular, has emerged as a key determinant of firm performance in today's complex business environment (Alalawneh et al., 2022). By adopting e-marketing, companies can expand their market reach, strengthen customer engagement, and gather valuable data for more targeted strategies. These innovations not only improve customer experience and brand awareness but also drive customer acquisition, retention, and loyalty, ultimately boosting sales and profitability (Arokodare et al., 2020; Tahaniana et al., 2021).

However, the relationship between e-marketing adoption and organizational performance is not straightforward. While digital innovation fosters growth and sustainability, its impact is mediated by contextual factors such as firm size, marketing capacity, and technological readiness (Yu et al., 2020). Smaller firms often face financial and technical resource constraints, whereas larger firms may struggle with agility in adopting new systems. Within this dynamic, the complexity of e-marketing emerges as a central challenge. Rogers (2003), in his Diffusion of Innovation Theory (IDT),

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

highlights complexity as one of the critical factors influencing the adoption of innovations, referring to the extent to which an innovation is perceived as difficult to understand or use. The higher the perceived complexity, the slower the adoption. In the case of gas companies, e-marketing does not present complexity, which in turn streamlines processes and promotes high adoption rates. This aligns with Rogers (2003), who suggested that innovations should be simple and easy to use to encourage higher adoption rates among users.

Although e-marketing offers opportunities to reduce communication costs, improve strategic decision-making, and promote sustainable performance (Gao et al., 2023), its adoption in the energy sector remains uneven. Studies show that inadequate IT adoption, poor strategic foresight, and limited organizational agility have caused oil and gas firms in markets such as Nigeria to suffer competitive disadvantages (Arokodare & Asikhia, 2020; Oyerinde et al., 2018). Furthermore, the digitalization of the energy sector is itself a complex process that demands significant organizational transformation, from billing and payments to customer service and smart metering (Mihai et al., 2022; Zakharkina et al., 2022). Guided by Innovation Diffusion Theory, this study seeks to examine how the complexity of electronic marketing influences the performance of gas companies in Tanzania.

Statement of Problem

Despite significant advances in digital technologies, the complexity of electronic marketing continues to pose challenges across many organizational settings, often leading to inefficiencies and financial losses. These challenges include difficulties in technological integration, limited digital literacy among employees, and resource constraints that hinder effective implementation. Within the framework of the Innovation Diffusion Theory (IDT), the construct of complexity remains underexplored, particularly regarding its influence on organizational performance outcomes in specific sectors. In the case of gas companies, e-marketing should not present complexity, which in turn streamlines processes and promotes high adoption rates. This research gap is critical, as neglecting the complexity dimension risks oversimplifying the realities faced by gas companies in adopting e-marketing tools. Addressing this issue by examining the complexity of e-marketing and its influence on the performance of gas companies in Tanzania provides an opportunity to make both theoretical and practical contributions. Theoretically, it extends the applicability of IDT; practically, it offers actionable insights for managers seeking to overcome adoption barriers.

According to Park and Mithas (2020), the complexity of digital strategies and interventions frequently emphasized in information systems research creates significant challenges that justify further investigation.

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Guided by the Innovation Diffusion Theory, this study therefore seeks to examine how the complexity of electronic marketing influences the performance of gas companies in Tanzania.

Study Objectives

General Objective

To assess the complexity of e-marketing and its influence on the performance of gas companies in Tanzania: Insights from Innovation Diffusion Theory.

Specific Objectives

i. To examine how the perceived complexity of e-marketing influences its adoption among gas companies in Tanzania.
ii. To analyze the effect of e-marketing complexity on the operational efficiency of gas companies in Tanzania.
iii. To assess the relationship between the complexity of e-marketing tools and the performance outcomes of gas companies in Tanzania.

Research Questions

RQ 1: How does the perceived complexity of e-marketing influence its adoption among gas companies in Tanzania?
RQ 2: What is the effect of e-marketing complexity on the operational efficiency of gas companies in Tanzania?
RQ 3: What is the relationship between the complexity of e-marketing tools and the performance outcomes of gas companies in Tanzania?

Hypothesis

Alternative H1*: The complexity of electronic marketing has significant influence on the performance of gas energy companies in Tanzania.*

Scope of the Study

The scope of this study focuses on examining how e-marketing practices shape the performance of gas companies in Tanzania, with specific attention to adoption patterns and challenges. It explores the applicability of Innovation Diffusion Theory in explaining how technological innovations in marketing are embraced within the sector. The study is limited to selected gas companies in Tanzania, emphasizing managerial, operational, and consumer perspectives.

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Literature Review

Theoretical Literature Review: Innovation Diffusion Theory (IDT)

The Innovation Diffusion Theory (IDT), first introduced by Rogers (1962), explains how new technologies or ideas spread within a social system and influence adoption by individuals and organizations. The theory emphasizes that diffusion occurs through communication channels over time and is shaped by social structures. Rogers (2003) identified five key attributes that influence adoption decisions: relative advantage, compatibility, complexity, trialability, and observability. Among these, complexity refers to the degree to which an innovation is perceived as difficult to understand or use. The more complex an innovation is perceived to be, the slower its rate of adoption.

In the context of electronic marketing (e-marketing), the construct of complexity plays a central role in shaping adoption and performance outcomes. Prior studies, such as Tokarčíková and Kucharčíková (2015) and Kocak et al. (2013), have highlighted how attributes like relative advantage, compatibility, and complexity affect the adoption of e-marketing channels. Similarly, Moctezuma and Rajagopal (2016) argue that e-marketing facilitates the diffusion of information through communication channels, enhancing awareness and adoption. Da Silva et al. (2010) also found that electronic tools, when effectively adopted, can significantly improve organizational performance.

Despite these insights, limited research has examined the specific influence of complexity on e-marketing adoption and its subsequent impact on organizational outcomes, particularly in the energy sector of emerging economies. This study therefore applies IDT with a deliberate focus on complexity to address three objectives. First, it seeks to examine how the perceived complexity of e-marketing influences its adoption among gas companies in Tanzania, recognizing that high complexity may discourage employees and managers from fully embracing digital tools. Second, it analyzes how e-marketing complexity affects operational efficiency, acknowledging that integration difficulties and user challenges may slow processes, increase costs, or create inefficiencies. Third, it assesses the relationship between the complexity of e-marketing tools and performance outcomes, highlighting how overly complex systems can either constrain or, when managed effectively, enhance company performance.

By grounding these objectives in the Innovation Diffusion Theory, the study extends theoretical understanding of the complexity attribute while offering practical insights into how gas companies in Tanzania can overcome e-marketing challenges to improve performance.

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Empirical Literature Review

The Perceived Complexity of E-marketing Influences its Adoption among Gas Companies in Tanzania

Pérez-Luño et al. (2018) investigated business performance in relation to complexity, cross-functional integration (CFI), knowledge intricacy, and product innovation. The study focused on examining how a given CFI mechanism affects the link between product performance and innovation within companies. From a contingency point of view, the study explored how these dynamics differ depending on the degree of organizational knowledge complexity. Data from 105 Spanish wineries were examined using regression analysis with interaction effects, incorporating both subjective and objective company performance metrics. Regarding company performance, the results revealed a notable triple interaction effect among CFI, knowledge complexity, and product innovation. The study emphasized a negative moderating influence of CFI on the innovation-performance link, which changes with the degree of knowledge complexity. The report suggested that integrating technicians across sectors for coordination may drain resources from innovation initiatives, thereby harming performance, unless companies face high degrees of information complexity.

With a focus on government impact, Huynh et al. (2023) investigated how technological innovation, complexity, and co-creation affect organizational performance. Emphasizing how technical complexity and co-creation enhance innovation and performance, the study sought to identify factors influencing technological innovation and its contribution to organizational outcomes. Structural equation modeling was used to analyze data gathered from a survey of 323 management professionals in Vietnam's manufacturing sector. The findings showed that co-creation, government influence, and technological complexity greatly increased technological innovation, which in turn improved organizational performance. The research also revealed indirect effects of government influence on organizational results, advising the industrial sector to apply these concepts to promote creativity within their environments.

Focusing on small and medium-sized Jordanian restaurants, Alalawneh et al. (2022) examined the complexity of interactions between social media platforms (SMPs) and organizational effectiveness. With competitiveness intensity acting as a moderating variable, the study investigated the link between SMP usage and organizational outcomes. Using partial least squares (PLS) techniques, data from 331 restaurants revealed a positive correlation between SMP usage and performance indicators, including financial, marketing, and operational outcomes. Moreover, the link between SMP use and marketing performance was significantly mediated by competition level.

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The Effect of E-marketing Complexity on the Operational Efficiency of Gas Companies in Tanzania

Hur and Kim (2023) studied the interaction among company performance, design creativity, and technological complexity. The study focused on determining how design innovation might help offset the negative effects of technological complexity on performance. Examining data from 16,565 U.S. companies covering 1980–2015, the researchers computed technological complexity based on structural variety within technologies. Results confirmed that design innovation is a strategic resource that enables companies to maximize complex technologies and generate financial benefits through their more efficient use. By recognizing design innovation as a competitive advantage in managing technological complexity, the study contributed to the resource-based view of the firm.

Chicha (2024) investigated the factors influencing the adoption of e-marketing as a mode of marketing by SMEs in Zambia. The study involved a sample of 286 respondents selected using the Taro Yamane formula from the hotel industry in Livingstone. The research was based on the Unified Theory of Acceptance and Use of Technology (UTAUT) model. The analysis was performed using the Statistical Package for the Social Sciences (SPSS). The results found that the adoption of e-marketing by SMEs in Zambia is mainly influenced by factors such as technological readiness, cost-effectiveness, managerial attitudes, customer demand, internet accessibility, and perceived competitive advantage.

Kazungu et al. (2015) examined impediments to the adoption of e-marketing by Tanzanian small and medium sized enterprises using an explanatory model. The study aimed to determine the extent of e- marketing utilization among small and medium enterprises, the challenges facing SMEs in relation to the application of e-marketing, and new strategies that would promote its adoption in the country. A structured questionnaire with a 5-point Likert scale was used to collect information from owners and operators of 120 SMEs. Obstacles such as limited understanding of the potentials of e-marketing, high costs of technology adoption, lack of internet accessibility, and the absence of a regulatory framework to guide e-marketing were found to inhibit the adoption process. The study concluded that e-marketing is vital for the growth and performance of SMEs. It recommended intervention strategies such as reducing the cost of ICT facilities and Internet access, increasing government support for e-marketing initiatives, providing education and training on ICT and e-marketing for small operators, and creating shared portals to facilitate information sharing and networking among business communities.

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The Relationship between the Complexity of E-marketing Tools and the Performance Outcomes of Gas Companies in Tanzania

Yohana et al. (2024) investigated *Social Media Marketing and Performance of Gas Energy Companies: A Systematic Literature Review.* The study applied a systematic literature review to assess social media marketing variables in relation to the performance of gas companies. The study aimed to synthesize findings from multiple studies, allowing researchers to see the bigger picture and identify patterns, trends, and consistencies of phenomena. In addition, the paper employed a systematic literature review method to summarize the phenomena under study. A systematic review of 48 papers from seven academic databases and publishers on social media marketing was conducted, analyzing themes, countries, scope, methodology, methods, and publication trends. The study revealed that there is a positive effect of social media marketing on the performance of gas companies. In conclusion, gas companies may maintain their market share and develop devoted clientele by effectively utilizing the Social Network Marketing (SNM) factors. Facebook, Instagram, and Twitter were the most utilized platforms by many studies to support the gas industry, particularly in Russia, France, and the UK.

Yohana et al. (2024) also studied *Social Media Marketing and Performance of Gas Energy Companies: A Systematic Literature Review*. The study applied the Innovation Diffusion Theory to examine the impact of the relative advantage of technology on firm performance in the gas energy sector of Dar es Salaam, Tanzania. The study employed a quantitative research design and collected data from several gas energy firms in Dar es Salaam using a questionnaire survey. A sample size of 302 respondents was involved in the study, and data were analyzed using structural equation modeling to examine the relationship between e-marketing and company performance. The results show that businesses using innovation achieved better cost control, regulatory compliance, and production efficiency.

Ngochi and Kihara (2019) assessed the effect of digital marketing strategies on the growth of small and medium enterprises in liquefied petroleum gas distribution in Nairobi City County. The study specifically sought to establish the effects of mobile marketing, search engine marketing, media marketing, and email marketing on the growth of SMEs in LPG distribution in Nairobi County, Kenya. The study was anchored on the Technology Acceptance Theory, Transaction Cost Innovative Theory, Expectation Confirmation Theory, and Resource-Based View Theory. The target population comprised 895 SMEs dealing with LPG distribution in Nairobi County. Fisher's sampling formula was adopted to obtain a sample of 268 SMEs. The unit of observation comprised owners/managers of the SMEs under examination. The instrument for primary data collection in this research

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was a numerical 5-point Likert scale questionnaire. The study used a Cronbach's alpha threshold value of 0.7 for internal consistency of the research instrument. The information collected was analyzed using descriptive statistics and inferential analysis with the Statistical Package for Social Science (SPSS) version 21 and MS Excel software. Descriptive statistics involved the calculation of the mean, frequency, percentages, and standard deviation, while the Pearson correlation coefficient and multiple regression were the inferential statistics applied in the study.

The study found that most SMEs ensured the timely sending of messages to their customers on the availability of products and contacted both existing and prospective customers directly to inform them of their products. The study also found that most SMEs had a Facebook page for advertising their products, a Twitter account for their businesses, and posted their range of products on various Facebook pages to enhance customer reachability. The study concluded that mobile marketing had the greatest influence on the growth of SMEs in LPG distribution in Nairobi County, Kenya followed by email marketing, then search engine marketing, while social media marketing had the least influence on the growth of SMEs in LPG distribution in Nairobi County, Kenya.

Methods

The aim of this study was to assess the complexity of e-marketing and its influence on the performance of gas companies in Tanzania, drawing insights from Innovation Diffusion Theory (IDT). Specifically, it sought to examine how the perceived complexity of e-marketing affects adoption, analyze its impact on operational efficiency, and assess its relationship with overall performance outcomes. An explanatory research design was employed to identify correlations and potential causal relationships (Creswell & Creswell, 2017). The study targeted employees and management staff of five gas companies in Dar es Salaam - Gas Company Tanzania Ltd, Tifa Gas Ltd, Lake Gas Ltd, Oryx Gas Ltd, and Pan African Energy Ltd - yielding a total sample of 302 respondents. Structured questionnaires with closed-ended questions measured on a 5-point Likert scale were used to collect quantitative data on perceptions of e-marketing complexity and its organizational impact, in alignment with the constructs of IDT.

Data were coded, cleaned, and analyzed using IBM SPSS Statistics version 20, while Structural Equation Modeling (SEM) in IBM SPSS Amos 23 assessed the measurement model for the complexity (COMPL) construct and evaluated cause-effect relationships. Confirmatory Factor Analysis (CFA) ensured construct validity, with significance set at $p < 0.05$ and critical ratios (C.R.) around 1.96. This methodology allowed precise quantification of the influence of e-marketing complexity on organizational performance, tested the

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relevance of complexity within the IDT framework, and evaluated the strength and significance of causal links. Overall, it provided robust, generalizable insights into how e-marketing complexity shapes adoption and performance outcomes in Tanzania's gas sector.

The analysis and interpretation of the measurement model, based on the individual construct of technological complexity in relation to the performance of gas energy companies in Tanzania, aligns with scholarly justifications for testing constructs individually. Jöreskog et al. (2016), who pioneered the application of Structural Equation Modeling (SEM), emphasized the value of assessing individual constructs to better understand their measurement properties and explanatory power. Similarly, Bollen and Long (1993) demonstrated that testing structural equation models enhances the understanding and interpretation of construct significance within SEM, while also providing techniques to control Type I errors when evaluating individual parameters. Extending this line of reasoning, Skrondal et al. (2007) advocated for the development of more general latent variable models and advanced SEM approaches that can be applied across diverse research designs. These perspectives collectively justify the analysis of individual constructs such as relative advantage within the SEM framework to ensure more precise insights into their contribution to organizational performance. For example, Mwakatage et al. (2024), in their study on the effects of perceived vulnerability on enhancing prevention intentions against fire outbreaks in public markets in Dar es Salaam, Tanzania, used this approach.

Results

Confirmatory Analysis Results

Measurement Model for Complexity (COMPL)

IBM SPSS Amos 23 was employed to evaluate the measurement model fitness for the COMPL construct, which comprised five factors: COMPL1, COMPL2, COMPL3, COMPL4, and COMPL5. The model fit indices computed in the first stage of Confirmatory Factor Analysis (CFA) were used to evaluate the alignment between the observed data and the proposed model. With CMIN/DF = 3.139, GFI = 0.981, AGFI = 0.942, CFI = 0.973 and RMSEA = 0.085, the first set of fit indices indicated that, although several indices reached reasonable limits, the overall findings showed that the model fell short of the benchmark levels. Thus, it was necessary to further modify and change the model to attain suitable fit indices and to raise the validity of the construct. The refinement procedure followed the advice given by Schumacker and Lomax (2004), who advised prioritizing the removal of variables with high covariance and strong regression weights in the modification indices (MI), thereby enhancing model performance. Candidates for deletion also included items with standardized regression weights (SRW)

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below the essential threshold of 0.5. These steps ensured that the final model retained only those items that really added value to the construct.

Examining the AMOS output closely revealed problematic items influencing the fit of the model. For example, the item e4 -->e2 was reported for removal under COMpl4 with a MI of 7.586 and a parameter change of -0.051. Eliminating this item corrected its negative impact on the general fit of the model, as shown in Table 1. This change was a major step toward bettering the measuring model. Methodically eliminating elements that compromised the validity of the construct helped to improve the latent variable representation. The changes guaranteed that the construct was shown more precisely and clearly from the other elements. These changes laid the foundation for later validation and hypothesis testing by helping to produce a model stronger and more suited for additional study.

Table 1: Covariances Second Run For Complexity (COMPL)

			M.I.	Par Change
e3	<-->	e1	4.085	.035
e4	<-->	e2	7.586	.051

Source: Researcher (2024)

Following the removal of the found problematic items, the Confirmatory Factor Analysis (CFA) performed using IBM SPSS Amos 23 showed that the updated model suited the data really remarkably. The notable improvement in the fit indices attests to the fact that the changes implemented during the refinement phase sufficiently corrected the prior flaws. With CMIN/DF = 0.815, GFI = 0.997, AGFI = 0.686, CFI = 1.000, RMSEA = 0.000, and SRMR = 0.0126, the revised fit statistics indicated that the model either meets or surpasses all generally accepted criteria for model fit, thereby closely matching the observed data. The individual fit indices provide a comprehensive view of the overall model performance. The highly acceptable degree of parsimony is reflected in the CMIN/DF value of 0.815, which is well below the conventional cut-off of 3.0, indicating no notable difference between the model and the observed data. The Goodness of Fit Index (GFI) of 0.997 and the Adjusted Goodness of Fit Index (AGGI) of 0.686 both exceed the generally accepted criterion of 0.90, reflecting an excellent fit to the data. The Comparative Fit Index (CFI) of 1.000 indicates a perfect fit, suggesting that the revised model fully explains the relationships among the observed variables relative to a baseline model. With a value of 0.000, the Root Mean Square Error of Approximation (RMSEA) indicates an exceptional model fit, as it is far below the acceptable upper limit of 0.08, demonstrating minimal approximation error in the population. Finally, the Standardized Root Mean Residual (SRMR) value of 0.0126 is significantly below the threshold of 0.05,

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showing minimal residual discrepancies between the observed and predicted correlations and confirming an excellent fit.

Together, these indices confirm that the updated model is now suitable for further analysis and provides a robust representation of the observed data. Importantly, the retained items exhibit high internal consistency and strong standardized regression weights, contributing significantly to the latent construct. The modified model is presented in Figure 1, highlighting the improved connections between the latent variables and their associated items. The figure illustrates how these changes improved the validity and structure of the model, ensuring consistency with both empirical evidence and theoretical expectations. This stage marks significant progress in the analytical process, offering a solid foundation for interpreting results and conducting further hypothesis testing.

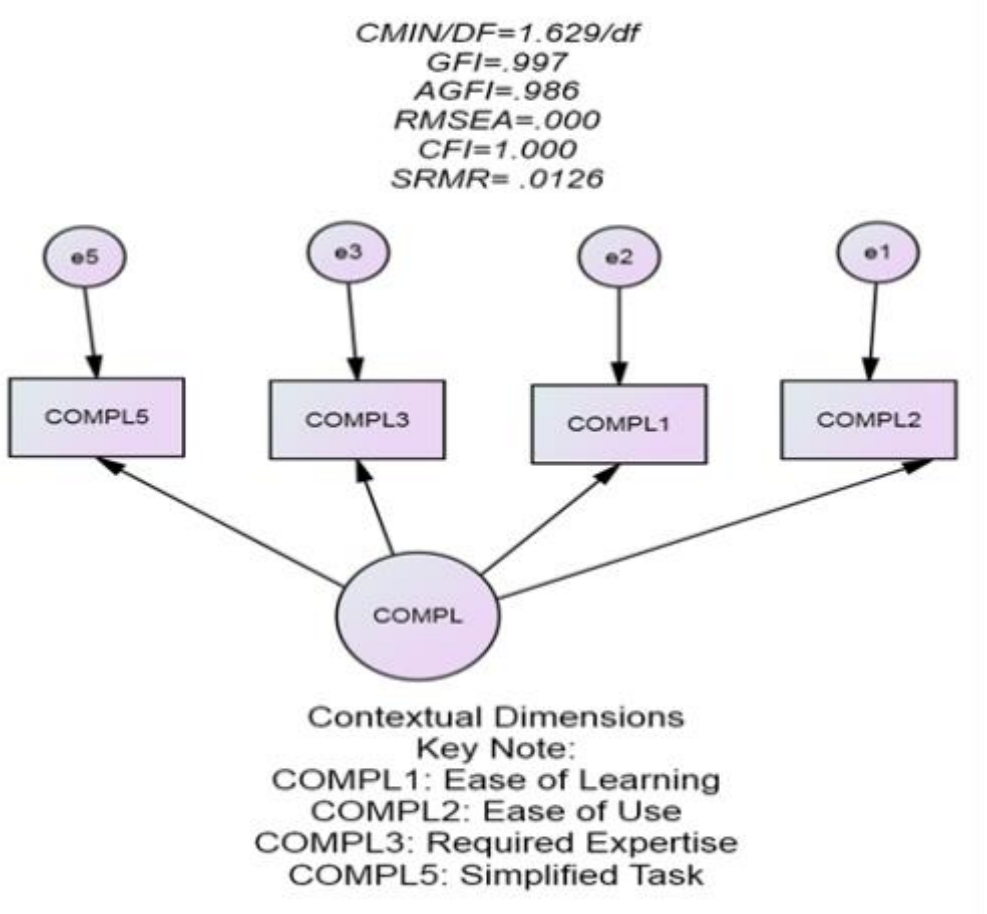

Figure 1: Measurement Model for COMPL

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Measurement Model for the Company Performance (CP)

IBM SPSS Amos 23 was employed to assess the measurement model fitness for the CP construct, which was comprised of five factors: CP1, CP2, CP3, CP4, and CP5. The analysis involved conducting Confirmatory Factor Analysis (CFA) to evaluate how well the proposed measurement model aligned with the observed data. The CFA process produced the following fit indices: CMIN/DF = 1.934, GFI = 0.937, AGFI = 0.961, CFI = 0.978, RMSEA = 0.056, and SRMR = 0.0260. Each of these indices fell within the acceptable range or exceeded the thresholds specified, thereby providing strong evidence that the measurement model achieved a good fit.

The CMIN/DF value of 1.934 indicates an appropriate level of parsimony, suggesting that the model adequately balances goodness of fit with model complexity. The Goodness of Fit Index (GFI) of 0.937 and the Adjusted Goodness of Fit Index (AGFI) of 0.961 are both well above the conventional minimum threshold of 0.90, signifying excellent alignment between the model and the data. The Comparative Fit Index (CFI) of 0.978 further highlights the strong performance of the model, as values above 0.95 indicate a near-perfect fit. Additionally, the Root Mean Square Error of Approximation (RMSEA) value of 0.056 lies within the acceptable upper limit of 0.08, confirming minimal error in approximating the population covariance matrix. Finally, the Standardized Root Mean Square Residual (SRMR) value of 0.0260, being well below the threshold of 0.05, underscores the negligible differences between the observed and predicted correlations.

As the model satisfied the necessary fit criteria, no further refinement or modifications were required. Typically, as recommended by Schumacker and Lomax (2004), model refinement involves identifying and removing items with high covariance or low standardized regression weights (SRW) based on the modification indices (MI). Items that fail to meet these criteria can detract from the model's fit and are considered for deletion. However, in this instance, the model exhibited a strong fit without the need for such adjustments, indicating that all five factors (CP1, CP2, CP3, CP4 and CP5) contributed effectively to the overall construct.

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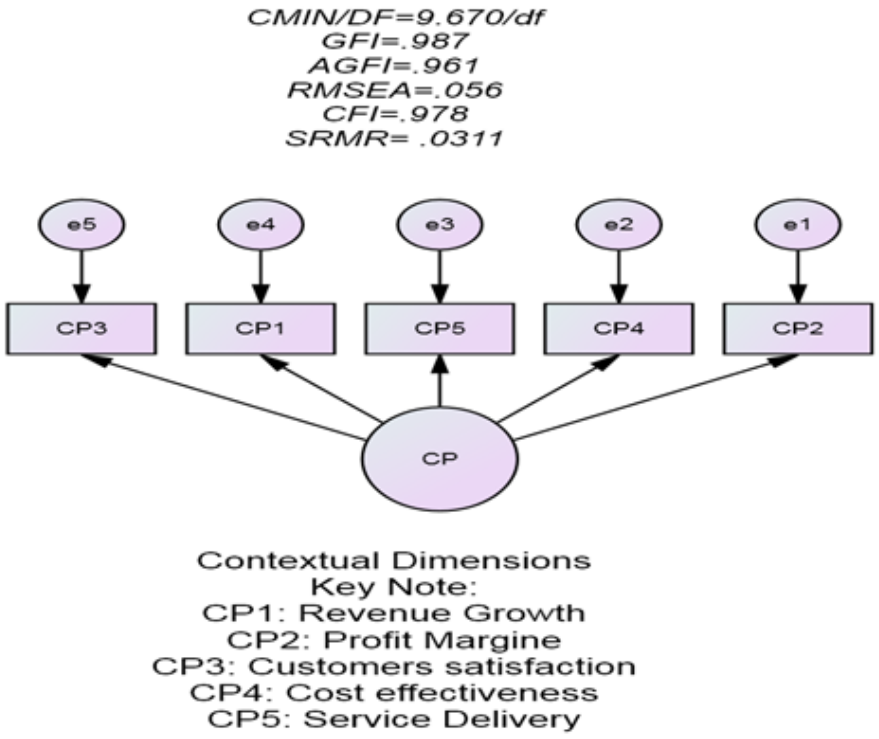

Figure 2: Measurements Model for CP

Structural Model

Effect of Complexity of Electronic Marketing and its Influence on Company Performance

Little is known about the effect of the complexity of technology on the performance of gas energy companies in Tanzania. Based on this fact, the researcher sought to confirm the effect of complexity on the performance of gas energy companies in Tanzania, and the following hypothesis was developed as stated below:

Alternative H1: The complexity of electronic marketing has a significant influence on the performance of gas energy companies in Tanzania.

To test the stated hypothesis, descriptive statistical analysis was first conducted to profile the impacts of each measurement of complexity on the performance of gas energy companies in Tanzania. The measurements of complexity included Ease of learning (COMPL1), Ease of use (COMPL2), and Perception of Cognitive (COMPL5).

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Table 2: Characteristics of Complexity Measurements

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
COMPL1	294	1.00	5.00	3.8912	.04208	.72148
COMPL2	294	1.00	5.00	3.8946	.04306	.73835
COMPL5	294	1.00	5.00	3.9898	.04659	.79882

Source: Researcher (2025)

Table 2 presents the characteristics of complexity measurements for three items - COMPL1, COMPL2, and COMPL5 - based on a sample of 294 respondents. The table shows the minimum, maximum, mean, standard deviation, and standard error for each item, providing a detailed view of how respondents evaluated complexity.

For COMPL1, the mean score is 3.89, suggesting that respondents perceive the complexity level to be moderate to high. The standard deviation is 0.72, indicating a moderate level of variation in responses. This variability suggests that while many respondents agree on the level of complexity, there are still notable differences in how individuals perceive it.

COMPL2 has a similar mean of 3.89, indicating a comparable level of perceived complexity to COMPL1. The standard deviation is slightly higher at 0.74, implying a bit more dispersion in responses compared to COMPL1. However, this still suggests that respondents have a generally consistent view of complexity, with some variation in individual assessments. COMPL5 shows the highest mean score of 3.99, indicating that respondents tend to view this aspect of complexity as somewhat more prominent. The standard deviation for COMPL5 is 0.80, the highest of the three items, reflecting a higher degree of variation in responses. This suggests that while the overall perception of complexity is still moderate to high, there are greater differences in how individuals assess this item compared to COMPL1 and COMPL2. These insights are useful for understanding the general trends in complexity perception and may guide further analysis or refinement of the measurement model for complexity.

Further analysis was conducted using Structural Equation Modeling (SEM) to examine the positive and significant effect of complexity on the performance of gas energy companies in Tanzania. The results of this SEM analysis, as shown in Table 3, reveal a positive and significant relationship between complexity and the performance of gas energy companies. The analysis of complexity, as illustrated in Table 3, is a critical component of the study, as it highlights the importance of understanding how perceptions of new technologies and innovations can influence business outcomes. This insight is not only valuable for academic understanding but also for practitioners in the

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gas energy sector, who can use this information to inform their marketing strategies and improve overall performance.

Table 3: Basic Model Standardized Estimate and SRW

Path			Estimate	S.E.	C.R.	P	Label	SRW	Remarks
CP	<---	COMPL	.179	.090	1.987	.047	par_17	.206	Accepted
COMPL5	<---	COMPL	1.000					.388	Accepted
COMPL1	<---	COMPL	1.838	.318	5.777	***	par_1	.789	Accepted
COMPL2	<---	COMPL	1.960	.345	5.685	***	par_16	.822	Accepted

Source: Researcher (2025)

The path from complexity to the performance of gas energy companies in Tanzania, as shown in Table 3, is analyzed to explore the relationship between complexity and the performance of these companies. The positive path coefficient ($\gamma = 0.206$), derived from the standardized estimate results in Table 3, suggests that complexity is positively associated with the performance of gas energy companies in Tanzania. These findings align with Hoe (2008), who argued that a standardized path coefficient (γ) of at least 0.2 should be considered significant and meaningful for discussion. The results of the current study confirm a moderate relationship between the complexity of technology and the performance of gas energy companies in Tanzania.

In addition to the standardized coefficient, further analysis was conducted using the critical ratio and p-value to assess the impact of complexity of technology on the performance of gas energy companies in Tanzania. The findings indicate a positive critical ratio (C.R = 1.987), which exceeds the threshold of 1.96, and a p-value of 0.047. These results align with Hox and Bechger (2014), who suggested that a relationship with a critical ratio greater than 1.96 and a p-value less than 0.05 is considered statistically significant.

This result is further supported by the findings from the item with a standardized path coefficient of .388 for COMPL5 <--- COMPL, indicating that COMPL5 is a key reference indicator for the construct COMPL. Additionally, the path coefficients for COMPL1 <--- COMPL (1.838, CR = 5.777, $p < 0.001$) and COMPL2 <--- COMPL (1.960, CR = 5.685, $p < 0.001$) provide strong evidence of significant relationships. The high critical ratios and statistical significance of these paths further support the conclusion that complexity positively influences the performance of gas energy companies in Tanzania. Due to these findings, the study confirmed that the Alternative H1 - Complexity of technology has positive and significant influence on performance of gas energy companies in Tanzania - was accepted.

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Discussion of Findings

This study looks at how complexity affects Tanzanian gas energy company performance. With a standardized route coefficient of $\lambda = 0.206$, the results show a somewhat favorable association between complexity and organizational success. This implies that good management of complexity can improve business performance, along with Hoe's (2008) finding that a standardized path coefficient of 0.2 or above shows a significant correlation. Although the results underline the relevance of complexity as a performance-enhancing element in Tanzania's gas energy industry, the results are much below this level.

Key elements of complexity, including ease of learning, simplicity of use, and cognitive demand connected with systems and processes, greatly influence employees' interactions with technology, promote innovation, and maintain operational efficiency. Further statistical study validates the strength of the association between complexity and performance. With a critical ratio (C.R.) of 1.987 (above the 1.96 threshold) and a p-value of 0.047 (below the conventional significance level of 0.05), Hox and Bechger's (2014) criteria for statistical dependability line up. Individual complexity indicators also showed strong explanatory ability. With critical ratios exceeding the threshold and p-values below 0.001, the standardized path coefficients for ease of learning (COMPL1), ease of use (COMPL2), and cognitive perception (COMPL5) were 1.838, 1.960, and 1.000, respectively. These results stress the need for user-friendly solutions in maximizing organizational results in gas energy enterprises.

The results align with research by Smith and Johnson (2015), which found that in manufacturing organizations using technical support systems, technological complexity and performance showed a favorable correlation. Their findings were that complexity promotes creativity and adaptation, which speaks to the impact of simplicity of learning (COMPL1) and simplicity of use (COMPL2) on efficiency in this study.

In the same vein, Cheng and Liu (2015) underlined that investments in system integration and staff training define the advantages of complexity. Their efforts in telecommunications complement the focus of this study on two fundamental aspects: ease of learning (COMPL1) and ease of usage (COMPL2). Garcia and Lopez (2015) also showed that lowering retail sector employee workflow complexity raised job satisfaction and output. This corresponds with the need for cognitive perception (COMPL5) in lowering mental demands and improving performance, as this study emphasizes. Regarding logistics, while complexity might raise running expenses, Kumar and Sinha (2015) pointed out that it also encourages innovation and customizing, which has long-term advantages. Their twin viewpoint emphasizes the importance of industry-specific tactics while reflecting the

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results of this investigation. Park et al. (2015) also found that well-structured complexity increases adaptability in volatile markets. Therefore, this conclusion corresponds with the adaptive techniques reported among Tanzanian gas energy businesses.

According to Harrison and Grant (2015), addressing the impact of complexity on international businesses mostly depends on organizational culture and good leadership. Their focus on technology integration and training fits the suggestions in this paper for leadership interventions. Conversely, citing inefficiencies in pharmaceutical and financial institutions, respectively, Ravi and Patel (2015) and Miller et al. (2015) advised against the hazards of mismanaged complexity. These results highlight the part contextual and industry-specific elements play in deciding the impact of complexity.

Finally, Tanaka and Nakamura (2015) investigated automotive industry complexity and found that teamwork improves performance. This viewpoint fits the results of the research, especially in relation to ease of learning (COMPL1) and its function in negotiating technological systems.

The results of this research also fit Rogers' (1962) Innovation Diffusion Theory (IDT), which describes how knowledge of innovation travels over time, therefore impacting its acceptance. As a variable in IDT, complexity is quite important in deciding how innovations are included in companies to raise performance. Emphasizing simplicity of learning (COMPL1), ease of use (COMPL2), and cognitive perception (COMPL5), Tanzanian gas firm executives are advised to include complexity-orientated initiatives in view of these results. This would increase staff performance and confidence in organizations. Leaders have to give continuous employee support top priority so that they may solve problems and improve system integration, thus promoting long-term efficiency and creativity.

Conclusions

The analysis revealed a positive relationship between complexity and the performance of gas energy companies, with a standardized path coefficient ($\gamma = 0.166$). This implies that under its particular characteristics, complexity contributes to defining corporate performance. Deeper understanding of the relevance of this relationship comes from additional statistical analysis applying the critical ratio (C.R.) and p-value. The findings revealed a critical ratio (C.R. = 1.987), over the 1.96 threshold, and a p-value of 0.047, which falls below the traditional significance criterion of 0.05. These results fit the criteria set by Hox and Bechger (2014), who state that a relationship is regarded as statistically significant when the p-value is less than 0.05 and the critical ratio surpasses 1.96.

These results lead the research to infer that the performance of gas energy firms in Tanzania is favorably and significantly improved by

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

complexity. This suggests that, under proper control, the natural complexity of technologies and procedures might improve the performance of gas energy companies.

These findings emphasize the need for knowing and handling complexity in the gas energy sector. Companies should give tactics to properly handle complexity top priority: investing in staff training, streamlining processes, and using cutting-edge technologies to expedite operations are of top importance.

Recommendations

The results should drive gas sector businesses to give training program investments in simplicity of learning and application of electronic marketing tools top priority. These covers give staff members easy systems and organized training opportunities to improve their competency. Simplifying interfaces and guaranteeing consistent skill development will help to lower adoption obstacles and raise productivity.

Companies should also foster internal knowledge and help stakeholders to understand the strategic worth of electronic marketing. Hiring qualified experts and including technologies in important corporate activities would improve consumer involvement, simplify processes, and stimulate income generation. Promoting more acceptance and adoption also depends on teaching stakeholders about the benefits of electronic marketing.

Future Research Areas

This study presents many directions for more investigation on the intricacy of electronic marketing in the gas energy industry. Using a longitudinal perspective, one might look at the long-term effects of implementing electronic marketing tools on organizational performance, thereby pointing out elements that either maintain or improve benefits over time.

Comparative studies spanning sectors including industry, renewable energy, or oil could potentially highlight sector-specific opportunities and difficulties. This would offer understanding of the flexibility and potency of electronic marketing in many environments.

Future research could look at how adoption of electronic marketing is influenced by external elements, including government policies and laws. Knowing how supportive or constrictive policies influence the spread of innovation could help companies and legislators advance digital transformation. Furthermore, studies of consumer opinions on electronic marketing tools with an eye toward their function in enhancing user experiences will enable companies to create more customer-centric.

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At last, newly developed technologies like artificial intelligence (AI) offer interesting research prospects. Research could assess how predictive analytics and chatbots improve the efficacy of organizational efficiency and electronic marketing. In the Tanzanian setting, cultural elements in technology adoption also need investigation since they might expose particular regional or demographic insights that enable customization of policies for more general acceptance and use.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All data are included in the content of the paper.

Funding Statement: The authors did not obtain any funding for this research.

Declaration for Human Participants: This study was conducted in accordance with the ethical principles outlined by the Open University of Tanzania. All participants, who were employees of the selected institutions, were informed of the study's purpose and voluntarily consented to participate. Anonymity and confidentiality were strictly maintained throughout the research process, and no personal identifiers were collected to ensure privacy and data protection.

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