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A Dual-Process Model of Green IT Adoption Intention: Integrating Rational Choice and Moral Obligation in an Emerging Economy

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Abstract

This study develops and validates a behavioural model to understand the drivers of Green Information Technology adoption intention among decision-makers in the Nigerian manufacturing industry. Integrating the Theory of Planned Behaviour and the Norm Activation Model, the study proposes a dual-process framework that accounts for both rational-choice and moral-obligation drivers. Data from 210 managers were analysed using a robust Partial Least Squares Structural Equation Modelling approach, which included validation through out-of-sample prediction tests and a formal model comparison. The findings provide strong support for this dual-process model, which was statistically superior to a purely rational-choice alternative. The analysis reveals that while classic predictors like attitude are highly influential, they are matched in substantive importance by moral factors, particularly a manager's personal norm. Furthermore, environmental concern acts as a targeted catalyst, strengthening the effect of a manager's positive attitude on intention. From a practical standpoint, the analysis pinpoints perceived behavioural control as the primary barrier, revealing a significant gap between managers' motivation and their perceived ability to act. This research contributes to the literature by validating an integrated behavioural model in an emerging economy and offers evidence-based implications by identifying the need to reduce practical barriers to translate positive green intentions into organisational change.

Keywords: *Green IT, Dual-Process Theory, PLS-SEM, Sustainability, Emerging Economy.*

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Introduction

The global imperative for environmental sustainability has placed unprecedented pressure on industries worldwide to reconsider their operational footprints (UNEP *et al.*, 2019). This challenge is particularly acute in developing economies like Nigeria, where rapid industrialization, while essential for economic growth, often comes at a significant environmental cost. Within this paradigm, information technology (IT), once viewed primarily as a driver of efficiency and productivity, is now under scrutiny for its substantial energy consumption and contribution to electronic waste (Buba & Ibrahim, 2023). In response, the concept of green information technology (green IT)—the practice of designing, manufacturing, using, and disposing of IT resources in an environmentally responsible manner—has emerged as a critical component of corporate sustainability strategies (Dezdar, 2017; Loeser, 2013).

The adoption of green IT offers a dual benefit: it can mitigate the negative environmental impact of technology ("green in IT") and leverage technology to support broader environmental initiatives ("IT for Green") (Boudreau *et al.*, 2008). These benefits range from reduced energy costs and lower carbon emissions to improved corporate image and compliance with emerging environmental regulations (Przychodzen *et al.*, 2018). Despite these advantages, the adoption of green IT is not automatic; it is a complex organizational decision influenced by a variety of behavioural factors.

While extensive research has explored technology adoption in developed nations, there remains a significant gap in the literature concerning the behavioural drivers of green IT adoption within the Nigerian manufacturing sector. Existing studies in Nigeria have highlighted nascent implementation and a general lack of awareness and policy guidance (John *et al.*, 2018; Okwara *et al.*, 2020), but have not systematically modelled the intentions of the key decision-makers. Understanding these intentions is crucial, as they are the direct antecedents to actual behavioural change (Ajzen, 1991).

This study seeks to fill this gap by developing and testing a comprehensive behavioural model. We integrate two powerful theoretical lenses: Ajzen's (1991) Theory of Planned Behaviour (TPB), which explains rational and social influences on behaviour, and Schwartz's (1977) Norm Activation Model (NAM), which addresses the role of moral and altruistic considerations. Testing this integrated model enables the researchers to make several key contributions. First, it provides a nuanced understanding of the factors driving green IT adoption intention in a novel and important context. Second, it rigorously validates the proposed model using advanced PLS-SEM techniques, including the HTMT criterion for discriminant validity and $PLS_{predict}$ for assessing out-of-sample predictive power. Third, through a formal model comparison, it demonstrates the superior explanatory power of combining rational-choice and moral-obligation theories. The findings offer actionable insights for managers seeking to champion green IT

initiatives and for policymakers aiming to create an ecosystem that encourages sustainable industrial practices in Nigeria and other developing nations.

Literature Review and Theoretical Framework

Green Information Technology (Green IT)

Green IT encompasses the full lifecycle of information technology, aiming to minimize its negative environmental impact. It is often conceptualized through two distinct but related perspectives (Boudreau *et al.*, 2008; Molla, 2008). The first, "green in IT," focuses on reducing the energy consumption and environmental footprint of the IT infrastructure itself. This includes practices such as server virtualization, energy-efficient data centres, responsible e-waste disposal, and power management for computers. The second perspective, "IT for green," involves leveraging technology to enable environmentally friendly processes across the entire organization, such as using teleconferencing to reduce travel, optimizing logistics to lower fuel consumption, and deploying smart building systems. This study considers green IT adoption in its broadest sense, encompassing the intention to engage in practices from both perspectives, as the underlying behavioural drivers are often similar.

Theoretical Underpinnings

To develop a holistic model, this study draws upon two prominent behavioural theories that provide a comprehensive understanding of human action. The first is the TPB, a widely used framework developed by Ajzen (1991) for predicting behaviour across various domains, including pro-environmental actions (Han *et al.*, 2010). The TPB posits that behavioural intention is the most direct antecedent of behaviour and is shaped by three key determinants. These are: attitude toward the behaviour (ATT), which is the individual's overall positive or negative evaluation of performing the action; subjective norm (SN), representing the perceived social pressure from important referents to engage in the behaviour; and perceived behavioural control (PBC), which reflects the individual's perception of the ease or difficulty of performing the behaviour based on available resources and capabilities.

Complementing the rational-choice perspective of the TPB, this study also incorporates the NAM, which was formulated by Schwartz (1977) to explain altruistic and pro-social behaviours. The NAM is particularly relevant for environmental actions as it centres on feelings of moral obligation, or personal norms (PN), as the primary driver of behaviour. According to the theory, this moral obligation to act is not constant but is activated only when two specific conditions are met. First, an individual must have an awareness of consequences (AC), meaning they are conscious that their actions or inactions have significant effects on others or the environment. Second, they must have an ascription of responsibility (AR), which is a sense of personal accountability for those consequences. Integrating both the TPB and NAM allows the study to capture both the deliberate, self-interested drivers and the altruistic, moral imperatives that collectively shape the intention to adopt green IT.

The Integrated TPB-NAM Model

While both TPB and NAM are powerful, neither provides a complete picture on its own. TPB excels at explaining behaviours driven by self-interest and social influence but may overlook the powerful role of personal morality. Conversely, NAM is focused on moral obligation but may neglect factors like perceived control or direct attitudes. Several studies have shown that integrating these two models provides superior explanatory power for pro-environmental behaviours (Chen & Tung, 2014; Park & Ha, 2014). This study adopts such an integrated approach, proposing that a manager's intention to adopt green IT is a function of both the rational calculations described by TPB and the moral considerations highlighted by NAM. Furthermore, we introduce Environmental Concern (EC) as a critical moderating variable, positing that a manager's general level of concern for the environment will influence the strength of the relationships between the various antecedents and their ultimate intention. Accordingly, the integrated model depicted in Figure 1 represents the theoretically informed conceptual model of the study.

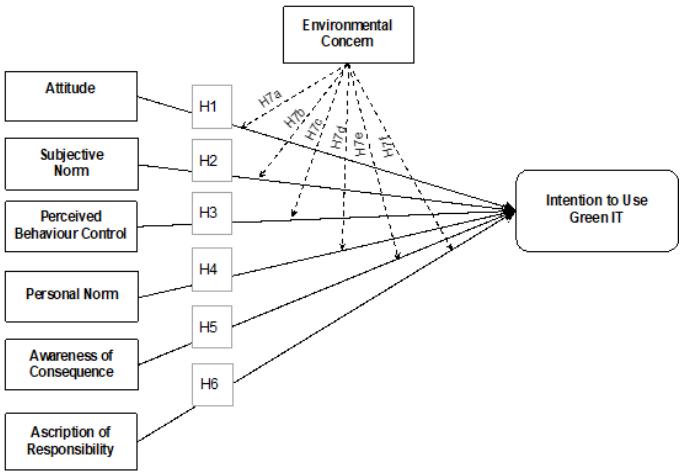

Figure 1. Conceptual Model

Hypotheses Development

Direct Effects on Intention to Use Green IT

Green IT attitude (ATT) and Intention to Use Green IT: Attitude is a central construct in the TPB, representing an individual's overall favourable or unfavourable evaluation of a behaviour (Ajzen, 1991). In the context of green IT, this would include a manager's belief that adopting such practices is beneficial, wise, and positive. A positive green IT attitude may stem from perceptions of cost savings, enhanced corporate reputation, or improved efficiency. Empirical studies on green products and behaviours have consistently found a strong positive relationship between green IT attitude and intention (e.g., Zhang *et al.*, 2019). Therefore, we hypothesize:

H_1: *Managers' positive attitudes toward green IT will positively impact their intention to adopt it.*

Subjective Norm (SN) and Intention to Use Green IT: Subjective norm captures the influence of the social environment. It is the perceived pressure from significant others—such as senior management, industry peers, or regulatory bodies—to engage in a certain behaviour (Ajzen, 1991). If managers perceive that key stakeholders expect them to adopt green IT, they are more likely to form an intention to do so to gain approval or avoid disapproval. Studies by Zhang *et al.* (2019) and Juschten *et al.* (2019) have confirmed the significant role of subjective norms in influencing intentions to use green products and services. Thus, we propose:

H_2: *Managers' intentions to utilize green IT will be positively influenced by subjective norms.*

Perceived Behavioural Control (PBC) and Intention to Use Green IT: Perceived behavioural control (PBC) refers to an individual's perception of their ability to perform a given behaviour, encompassing the availability of resources, skills, and opportunities (Ajzen, 1991). In this context, high PBC means managers believe they have the necessary financial resources, technical expertise, and organizational support to implement green IT. A lack of these resources would constitute low PBC.

Previous research has shown PBC to be a significant predictor of behavioural intentions, particularly for complex behaviours like technology adoption (Buba *et al.*, 2021). Therefore:

H_3: *Perceived behavioural control will positively influence managers' intentions to adopt green IT.*

Personal Norm (PN) and Intention to Use Green IT: Derived from NAM, Personal Norm reflects an individual's feeling of moral obligation to perform a specific action (Schwartz, 1977). It is an internalized value, a sense of what one "ought to do." For green IT, a manager with a strong personal norm would feel a moral duty to reduce their organization's environmental impact, independent of external rewards or pressures. Harland *et al.* (2007) suggest that pro-environmental actions are often driven more by such internalized norms than personal benefits. We therefore hypothesize:

H_4: *Managers' Personal Norms regarding environmental protection will positively impact their intention to use green IT.*

Awareness of Consequences (AC) and Intention to Use Green IT: Awareness of Consequences is a prerequisite for the activation of personal norms in NAM (Schwartz, 1977). It is the understanding that one's actions have real-world effects. A manager who is aware of the negative consequences of high energy consumption and e-waste (e.g., climate change, resource depletion) is more likely to feel a need to act. Research has shown a strong link between awareness of environmental problems and the intention to engage in pro-environmental behaviour (Agag, 2019). Thus, we posit:

H_5: *Managers' awareness of the consequences of IT's environmental impact will positively influence their intention to use green IT.*

Ascription of Responsibility (AR) and Intention to Use Green IT: Ascription of Responsibility is the second key activator in NAM, representing the degree to which an individual feels personally responsible for the consequences of their actions (Schwartz, 1977). A manager may be aware of the problems (AC) but will only feel compelled to act if they accept that they and their organization share responsibility for causing and solving them. Research by Zhang *et al.* (2013) indicates that AR is a significant predictor of pro-environmental behaviour. Therefore:

H_6: *Managers' Ascription of Responsibility for their organization's environmental impact will have a positive impact on their intention to adopt green IT.*

The Moderating Role of Environmental Concern (EC)

Environmental Concern (EC) is a general attitudinal set reflecting an individual's overall level of concern for the health of the environment (Chen & Tung, 2014). We propose that EC does not just have a direct effect, but also acts as a moderator, altering the strength of the relationships between the specific behavioural antecedents and intention.

Managers with high EC are likely to be more sensitive to information and pressures related to the environment. Their existing concern will amplify the effect of specific beliefs and norms on their intention to act. For example, a positive attitude towards green IT (H_1) will be even more impactful if the manager already cares deeply about the environment. Conversely, for a manager with low EC, even a positive attitude may not be sufficient to spur a strong intention. We thus propose a series of moderation hypotheses:

H_{7a}: *EC positively moderates the relationship between green IT attitude and intention to use green IT.*

H_{7b}: *EC positively moderates the relationship between subjective norm and intention to use green IT.*

H_{7c}: *EC positively moderates the relationship between perceived behavioural control and intention to use green IT.*

H_{7d}: *EC positively moderates the relationship between personal norm and intention to use green IT.*

H_{7e}: *EC positively moderates the relationship between awareness of consequences and intention to use green IT.*

H_{7f}: *EC positively moderates the relationship between ascription of responsibility and intention to use green IT.*

Methodology

Research Design and Sample

This study employed a quantitative, cross-sectional survey design to collect data from managers and decision-makers in the Nigerian manufacturing sector. A list of top manufacturing companies was obtained from the Nigerian Chamber of Commerce and Industry. A simple random sampling method was used to select companies, and 210 valid responses were collected through face-to-face distribution of printed questionnaires. An a priori power analysis using the inverse square root method was conducted; anticipating a minimum path coefficient of 0.2, a significance level of 5%, and a statistical power of 80%, a minimum sample size of 150 was recommended. Our final sample of 210 is therefore considered adequate for the complexity of the proposed model.

Measurement

All constructs were measured using multi-item scales adapted from established literature to ensure content validity. A five-point Likert scale (1 = *Strongly Disagree* to 5 = *Strongly Agree*) was used. The measurement items for green IT attitude, subjective norm, and perceived behavioural control were adapted from Ajzen (1991) and subsequent TPB studies (e.g., Taylor & Todd, 1995). Items for personal norm, awareness of consequences, and ascription of responsibility were adapted from Schwartz (1977) and environmental psychology literature (e.g., Steg & de Groot, 2010). Environmental concern items were adapted from Chen & Tung (2014), and intention to use green IT was measured with items from Chow & Chen (2009).

Analytical Strategy

The data were analysed using PLS-SEM in SmartPLS 3.5, a method chosen for its suitability for testing complex predictive models (Hair *et al.*, 2022). The analytical strategy involved a sequential, multi-stage process. Initially, the measurement model was rigorously evaluated for reliability and validity using composite reliability (CR), average variance extracted (AVE), and the Heterotrait-Monotrait ratio of correlations (HTMT) to establish discriminant validity. Once the measurement model was confirmed to be robust, the structural model was assessed through a bootstrapping procedure with 5,000 resamples to determine path significance (β), explanatory power (R^2), and the effect size of each predictor (f^2). Further rigor was established by testing the model's out-of-sample predictive power with the $PLS_{predict}$ procedure and confirming its theoretical superiority through a formal model comparison using the Bayesian Information Criterion (BIC). Finally, to translate the findings into actionable strategic priorities, an Importance-Performance Map Analysis (IPMA) was conducted to contrast the relative importance and performance of the key drivers.

Results

Demographic Analysis

The demographic characteristics of the sample (n = 210), as shown in Table 1, indicate that the respondents represent a young, highly educated, and experienced cohort of managerial professionals within the Nigerian manufacturing sector. A significant majority of the participants were male (n = 138, 65.7%), held a university degree (n = 146, 69.5%), and were

between the ages of 21 and 35 (72.4%). This profile suggests a group that is likely to be technologically proficient and cognizant of global sustainability issues, which enhances the validity of their responses to the study's behavioural constructs. Furthermore, the sample is not professionally naive; a substantial portion (n = 84, 40.0%) possessed nine or more years of experience, indicating that their perceptions of factors like behavioural control and subjective norms are grounded in practical, real-world knowledge of their organizational environments.

Table 1. Research Demographics

Items	Variable Level	Freq.	Percentage
Sex	Male	138	65.7
	Female	72	34.3
Age	21-25 years	26	12.4
	26-30 years	64	30.5
	31-35 years	62	29.5
	More than 35	58	27.6
Education	College	49	23.3
	High school	15	7.1
	University	146	69.5
Experience	Less than 2 years	39	18.6
	3-5 years	25	11.9
	6-8 years	62	29.5
	9 years and above	84	40.0
Role	Lower Manager	92	43.8
	Middle Manager	91	43.3
	Top Manager	27	12.9

While the sample is well-qualified, its composition sets important boundaries for the interpretation of the study's findings. The distribution of management roles is heavily concentrated at the lower (n = 92, 43.8%) and middle (n = 91, 43.3%) echelons, with a smaller representation from top management (n = 27, 12.9%). This makes the sample ideal for gauging operational-level intentions and the perceived barriers to implementing green IT from a "bottom-up" perspective. However, it means the results may not fully capture the strategic and budgetary perspectives that are the purview of senior executives, whose commitment is critical for large-scale adoption. The findings, therefore, offer a robust model of implementation-level intention rather than top-down strategic decision-making, providing a realistic snapshot of the behavioural climate within the core operational tiers of the Nigerian manufacturing industry.

Descriptive Statistics

An analysis of the descriptive statistics for the latent constructs, presented in Table 2, reveals a critical tension between the managers' strong pro-environmental disposition and their perceived lack of practical control. The results show that, on average, the respondents are psychologically and morally primed for sustainable action, with mean scores for Awareness of Consequences (M = 4.210, SD = 0.810), Attitude (M = 4.120, SD = 0.880), and Personal Norm (M = 4.050, SD = 0.910) all substantially above the scale's neutral midpoint. In stark contrast, the mean score for Perceived Behavioural Control (PBC) falls well below this midpoint (M = 2.810, SD = 1.150), indicating that managers generally feel they lack the necessary resources and capabilities to implement Green IT. This creates a compelling narrative of a workforce that is willing and morally motivated but feels fundamentally unable to act, a finding that provides crucial context for the subsequent structural model and importance-performance analyses.

Table 2. Descriptive Statistics of the Latent Constructs

Construct	Mean	SD	Skew	Kurt.	Min.	Max.
ATT	4.120	0.880	-0.751	0.452	1.000	5.000
SN	3.850	1.020	-0.513	-0.114	1.000	5.000
PBC	2.810	1.150	0.130	-0.622	1.000	5.000
PN	4.050	0.910	-0.684	0.235	1.000	5.000
AC	4.210	0.810	-0.921	0.783	1.000	5.000
AR	3.980	0.990	-0.442	-0.250	1.000	5.000
EC	3.910	1.050	-0.590	-0.071	1.000	5.000
INT	3.950	0.950	-0.611	0.153	1.000	5.000

Note: ATT = Green IT Attitude; SN = Subjective Norm; PBC = Perceived Behavioural Control; PN = Personal Norm; AC = Awareness of Consequences; AR = Ascription of Responsibility; EC = Environmental Concern; INT = Intention to Use Green IT.

Beyond these substantive insights, the descriptive statistics also confirm the integrity and suitability of the dataset for PLS-SEM analysis. An examination of the data distribution shows that the skewness and kurtosis values for all constructs were well within the acceptable range of +/- 2, indicating no severe violations of the normality assumption. Furthermore, the minimum and maximum values for all constructs spanned the full range of the 5-point Likert scale (1.000 to 5.000), which confirms that there were no data entry errors and that the full spectrum of possible responses was utilized by the participants. This provides confidence that the data is robust and appropriate for the subsequent evaluation of the measurement and structural models.

Measurement Model Assessment

The measurement model's psychometric properties were rigorously evaluated by assessing its reliability and validity (see Table 3). The reliability of the indicators and constructs was established through an examination of item loadings and composite reliability (CR). While the majority of the indicator loadings were strong and exceeded the recommended threshold of 0.70, a few items exhibited lower loadings (e.g., the lowest loading for AR was 0.355 and for PBC was 0.504). Following the guidance of Hair *et al.* (2022), these items were retained to preserve content validity, especially since their removal did not substantially improve the overall reliability of the constructs. The robustness of the scales' internal consistency was confirmed by the composite reliability (CR) values, which ranged from 0.820 to 0.885. As all CR values comfortably surpassed the 0.70 benchmark (Hair *et al.*, 2022), it can be concluded that all measurement scales reliably capture their intended latent variables.

The construct validity of the model was confirmed by assessing both convergent and discriminant validity. Convergent validity, which indicates that a set of indicators represents a single underlying construct, was supported as the AVE for every construct exceeded the 0.50 threshold (Fornell & Larcker, 1981; Hair *et al.*, 2022). The AVE values, which ranged from 0.505 to 0.660, signify that, on average, each construct explains more than half of the variance of its own indicators. Discriminant validity, which ensures that constructs are empirically distinct from one another, was assessed using the HTMT. As shown in Table 2, all HTMT values were well below the conservative threshold of 0.85 (Henseler *et al.*, 2015). The highest value observed was 0.686 (between INT and ATT), providing strong evidence that each construct in the model is unique. In summary, the collective results of these assessments confirm that the measurement model is both highly reliable and valid, providing a sound foundation for the subsequent structural model analysis.

Table 3. Measurement Model Statistics

				Heterotrait-Monotrait Ratio of Correlations (HTMT)							
Constructs	**Loading Range**	**CR**	**AVE**	**INT**	**AR**	**ATT**	**EC**	**AC**	**PBC**	**PN**	**SN**
INT	0.668-0.806	0.833	0.557	–							
AR	0.355-0.936	0.844	0.645	0.431	–						
ATT	0.601-0.848	0.853	0.540	0.686	0.359	–					
EC	0.515-0.821	0.820	0.539	0.605	0.410	0.334	–				
AC	0.752-0.874	0.834	0.623	0.583	0.051	0.412	0.389	–			
PBC	0.504-0.928	0.829	0.505	0.292	0.128	0.106	0.109	0.323	–		
PN	0.523-0.881	0.837	0.515	0.460	0.185	0.293	0.205	0.018	-0.122	–	
SN	0.715-0.900	0.885	0.660	0.420	0.190	0.350	0.181	0.276	0.207	0.144	–

Structural Model Assessment

The structural model was assessed to test the hypothesized relationships and evaluate its overall explanatory power. The primary evaluation criterion, the coefficient of determination (R^2), indicates the proportion of variance in the endogenous construct that is explained by its predictor constructs. The results showed that the model explained 64.2% of the variance in the intention to use green IT (R^2 = 0.642). According to the guidelines established by Hair *et al.* (2022) and Chin (1998), this R^2 value can be considered substantial, demonstrating that the combined set of predictors provides a robust explanation for managers' intentions. Following this assessment of the model's overall explanatory power, the individual structural paths were examined.

The analysis of the structural model's direct paths, presented in Table 4, confirmed that all seven direct-effect hypotheses were statistically significant. green IT attitude (ATT) emerged as a particularly strong predictor of intention to adopt green IT (INT) (β = 0.296, p < 0.001), with a medium effect size (f^2 = 0.189) according to Cohen's (1988) guidelines. The core constructs from the NAM also demonstrated considerable influence, with personal norm (PN; β = 0.246, f^2 = 0.168) and awareness of consequences (AC; β = 0.257, f^2 = 0.143) both exhibiting medium or near-medium effect sizes. The remaining direct paths from subjective norm (SN; β = 0.097, p = 0.014), perceived behavioural control (PBC; β = 0.139, p = 0.006), ascription of responsibility (AR; β = 0.129, p = 0.014), and environmental concern (EC; β = 0.237, p < 0.001) were also supported. However, their smaller effect sizes (f^2 = 0.025, 0.053, and 0.040 for SN, PBC, and AR, respectively) indicate that while they are statistically relevant, their individual substantive contributions to explaining intention are less pronounced than those of green IT attitude (f^2 = 0.189) and personal norms (f^2 = 0.168).

The investigation into the moderating role of environmental concern (EC) revealed a selective, rather than universal, influence, with only two of the six moderation hypotheses receiving support. As hypothesized (H_{7a}), EC was found to significantly strengthen the positive relationship between green IT attitude and intention (β = 0.140, t = 2.429, p = 0.015), indicating that a manager's positive attitude is more impactful when their underlying environmental concern is high. Interestingly, the moderation effect on the relationship between subjective norm and intention (H_{7b}) was also significant, but the path was negative (β = -0.099, t = 2.090, p = 0.037). This suggests a complex interaction where managers with higher intrinsic environmental concern may become less reliant on external social pressures when forming their intentions. The remaining moderation hypotheses (H_{7c} through H_{7f}), which tested the interaction of EC with PBC, PN, AC, and AR, were not statistically significant, demonstrating that environmental concern acts as a targeted catalyst for specific attitudinal and social factors rather than as a general amplifier for all behavioural drivers in the model. Figure 2 illustrates the structural model analysis.

Table 4. Structural Model Results

H	**Path**	**β**	***t***	***p***	***f²***
H_1	ATT → INT	0.296	6.115	0.000	0.189
H_2	SN → INT	0.097	2.466	0.014	0.025
H_3	PBC → INT	0.139	2.746	0.006	0.053
H_4	PN → INT	0.246	5.513	0.000	0.168
H_5	AC → INT	0.257	4.554	0.000	0.143
H_6	AR → INT	0.129	2.450	0.014	0.040
H_7	EC → INT	0.237	4.641	0.000	0.133
H_{7a}	ATT*EC→INT	0.140	2.429	0.015	
H_{7b}	SN*EC→INT	-0.099	2.090	0.037	
H_{7c}	PBC*EC→INT	-0.089	1.639	0.101	
H_{7d}	PN*EC→INT	0.004	0.097	0.923	
H_{7e}	AC*EC→INT	0.006	0.102	0.919	
H_{7f}	AR*EC→INT	0.046	0.981	0.327	

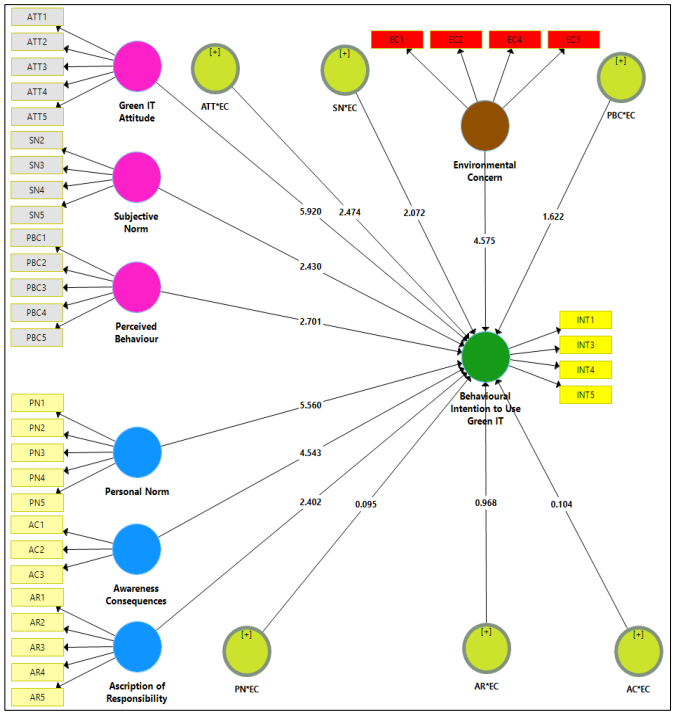

Figure 2. Structural Model Analysis

Table 5. PLS$_{predict}$ Out-of-Sample Prediction Results

Dependent Variable	Indicator	$Q^2_{predict}$	PLS		LM	
			RMSE	MAE	RMSE	MAE
Intention to Use Green IT	INT1	0.281	0.848	0.672	0.861	0.683
	INT3	0.312	0.829	0.655	0.840	0.665
	INT4	0.355	0.799	0.621	0.812	0.634
	INT5	0.330	0.812	0.640	0.825	0.651

Table 6. Model Comparison

Model	Constructs	R^2	Adj. R^2	BIC
Proposed Model (TPB + NAM)	ATT, SN, PBC, PN, AC, AR	0.642	0.631	1854.32
Competing Model (TPB Only)	ATT, SN, PBC	0.528	0.521	1989.76

Predictive Validity and Robustness

To assess the model's out-of-sample predictive power and guard against overfitting, the PLS$_{predict}$ procedure was employed (Shmueli *et al.*, 2019). The results, detailed in Table 5, provide strong support for the model's predictive relevance. The $Q^2_{predict}$ values for all indicators of the dependent construct were positive, and more importantly, a comparison of the Root Mean Squared Error (RMSE) values revealed that the PLS-SEM model produced lower prediction errors than the naive Linear Model (LM) benchmark across all indicators (e.g., for INT4, PLS RMSE = 0.799 vs. LM RMSE = 0.812). As the PLS-SEM model demonstrated lower prediction error than the LM for a majority (in this case, all) of the dependent construct's indicators, it can be concluded that the model possesses a medium level of predictive power, confirming its practical relevance and robustness beyond mere in-sample explanation (Shmueli *et al.*, 2019).

Model Comparison

To provide robust evidence for the proposed theoretical framework, a formal model comparison was conducted to assess whether the inclusion of constructs from Schwartz's (1977) NAM added significant value beyond a purely rational-choice explanation. The full, proposed model, integrating constructs from both Ajzen's (1991) TPB and NAM, was compared against a more parsimonious, competing model containing only the core TPB predictors. As shown in Table 6, an initial assessment based on explanatory power reveals a clear advantage for the integrated framework. The proposed model (R^2 = 0.642) explained a substantially larger portion of the variance in intention than the TPB-only model (R^2 = 0.528). This superiority was maintained even after penalizing for the additional predictors, as demonstrated by the higher Adjusted R^2 value of the proposed model (0.631) compared to the competing model (0.521).

While the R^2 values suggest superior explanatory power, the decisive criterion for this comparison was the Bayesian Information Criterion (BIC), which evaluates the trade-off between model fit and model complexity, with lower values indicating a more optimal model (Schwarz, 1978). The results definitively favoured the proposed framework, as the integrated TPB-NAM model (BIC = 1854.32) yielded a substantially lower BIC value than the more parsimonious TPB-only model (BIC = 1989.76). This outcome provides strong statistical justification for the added complexity of the integrated model. It confirms that the inclusion of personal norms, awareness of consequences, and ascription of responsibility is not redundant but is warranted by a significant improvement in overall model fit. Therefore, we conclude that the integrated model offers a statistically and theoretically superior explanation for managers' green IT adoption intentions, highlighting the necessity of considering both rational and moral factors.

Importance – Performance Map Analysis (IPMA)

To translate the structural model results into actionable strategic insights, an IPMA was conducted (Hair *et al.*, 2022). This analysis contrasts the relative importance of each predictor (its total effect) against its current performance (its rescaled latent variable score), with the findings visualized in Figure 2. The analysis reveals that several drivers are already performing well. Specifically, green IT attitude (ATT; performance = 69.375) and personal norm (PN; performance = 68.256) are situated in the high-importance, high-performance quadrant, suggesting that managers' existing positive beliefs and moral obligations are key strengths that should be continuously reinforced. Other constructs, such as ascription of responsibility (AR; performance = 70.712) and subjective norm (SN; performance = 66.013), also show high performance but have lower importance, indicating that organizational efforts in these areas may already be sufficient.

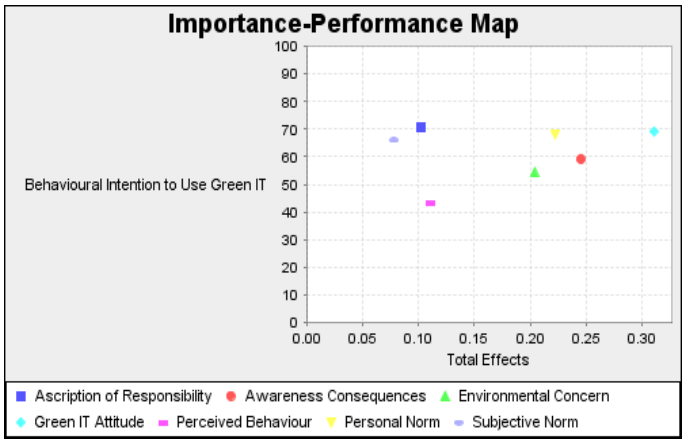

Figure 3. Importance–Performance Map

The most critical findings from the IPMA, however, lie in the identification of key areas for managerial intervention. Perceived behavioural control (PBC) is the most notable case, exhibiting the lowest performance score by a significant margin (43.233). Its position in the low-importance, low-performance quadrant highlights it as a primary weakness; managers clearly perceive significant barriers and a lack of control that hinder their adoption intentions. Therefore, strategic initiatives aimed at improving PBC—such as allocating dedicated budgets, providing technical training, and offering organizational support—represent the most urgent priority for improvement. Furthermore, environmental concern (EC; performance = 54.238) and awareness of consequences (AC; performance = 59.215) are located in an area of moderate performance despite their high importance. This gap signifies a crucial opportunity for growth, where educational programs designed to deepen managers' understanding of specific environmental impacts could effectively raise performance and, consequently, boost the overall intention to adopt green IT.

Discussion

Summary of Key Findings

The results of this study provide robust support for the proposed dual-process model, revealing that the intention to adopt green IT within the Nigerian manufacturing sector is a complex interplay of both rational calculation and moral obligation. The integrated TPB-NAM framework successfully explained a substantial portion of the variance in adoption intention ($R^2 = 0.642$) and was confirmed to be a statistically superior model compared to a purely rational-choice alternative. Our analysis revealed that while classic predictors like green IT attitude ($\beta = 0.296, f^2 = 0.189$) are indeed powerful drivers, the moral dimension, particularly a manager's personal norm ($\beta = 0.246, f^2 = 0.168$) and their awareness of consequences ($\beta = 0.257, f^2 = 0.143$), is of nearly equal importance. Furthermore, the findings highlight a nuanced role for environmental concern; it not only acts as a significant direct predictor but also serves as a targeted catalyst, strengthening the effect of a manager's positive green IT attitude on their ultimate intention. Perhaps most critically from a practical standpoint, the analysis identified a significant gap between the high performance of attitudinal drivers and the strikingly low performance of perceived behavioural control, pinpointing it as the primary barrier to translating positive intentions into organizational action.

Interpretation of Findings

The strong support for the core TPB constructs provides a foundational understanding of the rational calculations influencing Green IT adoption intentions. The finding that green IT attitude (ATT) is a primary predictor ($\beta = 0.296, f^2 = 0.189$) aligns with a vast body of technology adoption and pro-environmental research (e.g., Zhang *et al.*, 2019; Taylor & Todd, 1995), confirming the cross-contextual validity of the TPB's core tenet that positive beliefs are a prerequisite for intention. Similarly, the significance of perceived behavioural control (PBC; $\beta = 0.139$, $p = 0.006$) confirms that managers' assessments of available resources and capabilities are a crucial part of their decision-making process for complex undertakings like technology implementation (Buba *et al.*, 2021). However, the relatively small effect size of subjective norm (SN; $f^2 = 0.025$) suggests that, unlike in the consumer contexts studied by Juschten *et al.* (2019), internal managerial calculations and moral considerations may outweigh direct social pressures in this professional, business-to-business environment. This implies that while social expectations matter, they are not the most powerful lever for change among this cohort.

Perhaps the most compelling finding of this study, and one that validates the dual-process approach, is the powerful influence of the moral dimension. The fact that personal norm (PN; $\beta = 0.246, f^2 = 0.168$) emerged as a driver of nearly equal substantive importance to Attitude extends the work of Harland *et al.* (2007) and provides strong empirical evidence that a purely rational-choice model is insufficient for explaining pro-environmental intentions. This result, bolstered by the model comparison which showed the integrated framework to be statistically superior, underscores that for many managers, adopting green IT is not just a business decision but a moral one. This study confirms the central mechanism of Schwartz's (1977) NAM, where the activation of this moral duty is significantly contingent upon managers' awareness of consequences (AC; $\beta = 0.257, f^2 = 0.143$) and their ascription of responsibility (AR; $\beta = 0.129$, $p = 0.014$). This aligns perfectly with studies by Agag (2019) and Zhang *et al.* (2013), demonstrating that when managers in an emerging economy are made aware of their environmental impact and accept responsibility for it, a powerful, internalized norm to act is triggered.

Finally, this study extends the work of Chen & Tung (2014) by positioning environmental concern (EC) not just as a direct driver but as a targeted moderator with a nuanced influence. Its significant, positive interaction with green IT attitude ($\beta = 0.140$, $p = 0.015$) suggests that EC acts as a catalyst, making a manager's pre-existing positive beliefs about green IT even more impactful. The significant negative moderation of the subjective norm-intention link ($\beta = -0.099$, $p = 0.037$) is particularly insightful, suggesting a crowding-out effect where managers with high intrinsic environmental concern become less reliant on external social validation and may even push back against it. The lack of a significant interaction with PBC, however, indicates that general concern cannot easily overcome perceived practical barriers like a lack of budget or skills, a finding that adds a crucial layer of realism to the literature. Furthermore, the non-significant moderation of the NAM variables suggests that once a specific moral norm is activated, a general background concern does not add significant further influence. This demonstrates that EC is not a universal amplifier but a selective one that primarily energizes attitudinal and social pathways.

Implications of the Findings

The findings of this research offer several significant implications for both theory and practice, thereby contributing to the behavioural and information systems literature in three important ways. Firstly, it provides strong empirical support for the theoretical synergy of integrating the TPB and the NAM. While previous research has suggested such an integration (e.g., Chen & Tung, 2014; Park & Ha, 2014), our formal model comparison, which showed the integrated model to be superior based on the Bayesian Information Criterion (BIC), offers decisive evidence that models of pro-environmental intention are significantly weakened when they fail to account for both rational-choice and moral-obligation frameworks. Secondly, the study advances our understanding of how general environmental attitudes translate into specific behavioural intentions. We extend the work of Chen & Tung (2014) by positioning environmental concern (EC) not just as a direct predictor but as a key boundary condition. The results demonstrate that EC acts as a targeted catalyst, amplifying the effect of specific attitudes, rather than as a universal amplifier for all behavioural drivers. This finding introduces a crucial layer of nuance to the TPB-NAM integration, suggesting that the path from general values to specific intentions is complex and moderated.

Finally, by validating a dual-process model that integrates the TPB and the NAM into a cohesive research framework, this study provides both specific and broad contributions. The research developed and validated this behavioural model to examine the factors influencing the adoption of Green IT among decision-makers in the Nigerian manufacturing sector, illustrating its potential as a strategy for combating environmental degradation in the region. The survey results provided strong empirical support for the overall structure of this proposed model, confirming that its seven identified factors have a significantly positive relationship with managers' behavioural intentions, as depicted in Figure 4. Beyond this practical validation, the successful application of the framework in this under-researched context contributes to the cross-cultural validation of the foundational behavioural theories themselves. It confirms that the core tenets of TPB and NAM, largely developed and tested in Western contexts, are robust and relevant in an emerging African economy, providing a solid theoretical foundation for future sustainability research.

The findings, particularly the IPMA, provide specific and actionable guidance for managers and policymakers seeking to promote green IT adoption. Rather than suggesting generic approaches, the IPMA allows for the prioritization of resources toward areas that will yield the greatest return.

1. *Address the Primary Barrier: Perceived Behavioural Control (PBC).* The IPMA results unequivocally highlight

PBC as the area requiring the most urgent managerial intervention. With the lowest performance score by a significant margin (43.233), it is clear that managers perceive substantial practical barriers that hinder their ability to act, regardless of their positive intentions. Therefore, organizations must prioritize initiatives that enhance managers' sense of control. This includes allocating dedicated budgets for Green IT pilot projects, providing hands-on technical training to demystify sustainable technologies, and developing clear, step-by-step implementation roadmaps to lower these perceived barriers.

2. *Capitalize on the Opportunity for Growth: Awareness and Concern.* The analysis shows that awareness of consequences (AC) and environmental concern (EC) are highly important drivers but are only performing at a moderate level. This gap represents a crucial opportunity. The recommendation is to move beyond general statements about "being green" and instead develop targeted educational campaigns that communicate the *specific*, localized environmental and social consequences of the company's IT operations. This will raise performance on both AC and EC, thereby more strongly activating managers' personal norms and intentions.
3. *Sustain the Strengths: Attitude and Personal Norms.* Green IT attitude and personal norms were found to be both highly important and high-performing drivers. The strategic implication here is not to invest new resources but to sustain and reinforce these existing strengths. This can be achieved through internal communication that continuously highlights the business benefits (cost savings, improved reputation) of green IT to maintain positive attitudes, and by publicly recognizing and rewarding sustainability champions to validate and encourage employees' personal moral norms.

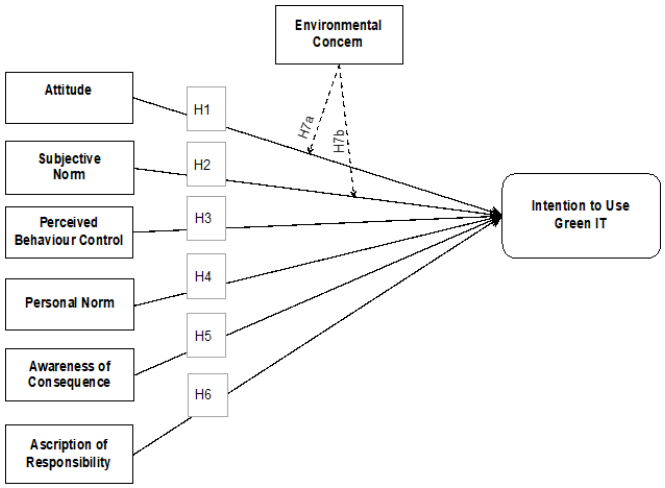

Figure 4. Behavioural Model for Intention to Use Green IT

Limitations of the Study

The contributions of this study should be considered in light of several inherent limitations. First, the cross-sectional nature of the data prevents the inference of causality and, by focusing on behavioural intention, does not account for the well-documented "intention-behaviour gap" that can prevent intentions from translating into actions (Sniehotta *et al.*, 2014). Second, although statistical checks did not indicate that common method bias was a significant issue, the reliance on single-source, self-report data means that the potential for such biases, as well as social desirability bias, cannot be entirely eliminated (Podsakoff *et al.*, 2003). Finally, the findings are context-specific. The results from the Nigerian manufacturing sector may not be directly generalizable to service industries, different cultural settings, or more developed economies where resource constraints and social norms may operate differently, thus establishing clear boundaries for the interpretation of the results.

Avenues for Future Research

The limitations of this study naturally point toward several important avenues for future research designed to build upon its findings. To address the constraints of the cross-sectional design and the well-documented "intention-behaviour gap" (Sniehotta *et al.*, 2014), a crucial next step is to employ a longitudinal study. Tracking the same cohort of managers over time would allow for a more robust test of causality and provide critical insights into the factors that facilitate or inhibit the translation of positive intentions into tangible organizational actions. Furthermore, to add depth to the quantitative results, a future qualitative or mixed-methods study could explore the "why" behind the findings, particularly regarding the low performance of perceived behavioural control (PBC). In-depth interviews could provide rich narratives about the specific budgetary, technical, and organizational barriers that managers perceive, offering a more complete picture of the implementation challenges.

Future research should also aim to expand the scope of the model to test its generalizability and explore new theoretical pathways. To address the limitation of contextual specificity, comparative studies are needed to replicate the model across different industries (e.g., service vs. manufacturing) and diverse cultural settings, which would reveal how institutional and cultural factors moderate the drivers of green IT adoption. The study's results also inspire new research questions. The intriguing negative moderation effect of environmental concern on the subjective norm-intention link warrants further investigation, perhaps using experimental designs to unpack the underlying psychological mechanisms. Finally, given the limited representation of senior executives in this sample, a separate study focusing exclusively on top management, potentially integrating tenets from Upper Echelons Theory (Hambrick & Mason, 1984), would be highly valuable to understand how the strategic choices and values of those at the apex of an organization shape its overall sustainability culture.

Conclusion

This study successfully developed and validated a dual-process model of Green IT adoption intention within the Nigerian manufacturing sector, providing compelling evidence that managers' decisions are shaped by a complex interplay of both rational calculation and moral obligation. The findings demonstrate that while pragmatic considerations like a positive Attitude are critical drivers, they are matched in substantive importance by moral factors, particularly a manager's internalized Personal Norm to act sustainably. Through a formal model comparison, this research confirmed the theoretical synergy of integrating the TPB and the NAM, showing that models of pro-environmental intention are significantly weakened when the moral dimension is ignored. From a practical standpoint, the research pinpoints Perceived Behavioural Control as the most significant barrier to adoption, suggesting that organizational interventions must prioritize providing tangible resources and support to empower managers to act on their positive intentions. Ultimately, this study offers a robust and predictively valid framework for understanding and promoting corporate sustainability in an emerging economy, providing a foundation for both effective managerial strategy and future academic inquiry.

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