

Green digital operations and employee productivity in Nigerian fintech: The moderating role of digital literacy

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Abstract

Green Digital Operations (GDO) are widely promoted as a route to both environmental sustainability and better employee productivity, yet recent evidence from Nigerian service and fintech firms reports that this relationship is weak, non-significant, or even negative, a pattern this paper labels the digital transition paradox. Existing studies have mostly tested the direct effect of GDO on productivity without explaining the conditions under which the effect strengthens, weakens, or reverses. The objective of this paper is to develop and justify a conceptual framework that explains how digital literacy shapes the direction and strength of the relationship between GDO practices and employee productivity in Nigerian fintech organisations, and to derive testable hypotheses from it. Using a conceptual literature review design focused on theory development, the paper integrates the Natural Resource-Based View, Social Exchange Theory, and the Job Demands-Resources model. It argues that GDO practices are organisational resources whose productivity value depends on employees having enough digital literacy to use them; where literacy is low, the same practices can add cognitive and technical demands that offset or reverse their benefit. Three hypotheses are advanced, and directions for testing them using moderated regression or structural equation modelling are outlined. The paper contributes an integrated explanation of when and why GDO adoption succeeds or fails to raise productivity, and shows practitioners that digital literacy development is a precondition for gaining the benefits of green digital investment.

Keywords: Boundary condition; conceptual framework; digital literacy; employee productivity; fintech; green digital operations; Nigeria.

1. Introduction

Green Digital Operations (GDO), the environmentally conscious integration of digital technologies into organisational processes to minimise ecological footprints while sustaining operational efficiency, have become a strategic priority for organisations across emerging markets, including Nigeria's fast-growing fintech sector (Iqbal et al., 2019; Murugesan, 2008). Practices such as paperless workflows, energy-efficient information technology infrastructure, and digital collaboration platforms are typically

promoted on the assumption that their adoption will yield gains in employee productivity alongside environmental benefits. Yet adoption of environmentally oriented IT practices in Nigerian organisations remains modest and is held back by low awareness, weak regulation, and limited infrastructure (Odeyemi et al., 2024).

A growing body of empirical evidence also complicates the productivity assumption. Recent studies of Nigerian service and fintech firms have found the relationship

between GDO adoption and employee productivity outcomes to be weak, statistically non-significant, or, in some cases, significantly negative (Muogbo et al., 2024; Ochor et al., 2024). This pattern, which this paper labels the digital transition paradox by analogy with the IT productivity paradox (Brynjolfsson, 1993), suggests that the presence of green digital tools does not automatically confer productivity benefits, particularly in infrastructurally volatile, transitional contexts. Similar caution has been raised in the South African fintech sector, where productivity gains from sustainable digital infrastructure were conditional on training quality and infrastructure reliability rather than adoption alone (Anusi & Dlamini, 2025).

The problem can be stated in terms of the variables of this study. GDO practices (the independent variable) are expected to raise employee productivity (the dependent variable), but the evidence shows that the effect is inconsistent: positive in some settings, absent in others, and negative in others still. When the same practice produces different results across similar organisations, the likeliest explanation is that a third variable is shaping the relationship. This paper proposes that the missing variable is employee digital literacy (the moderator), that is, the technical skill, self-efficacy, and adaptability employees bring to digital tools. Employees who can use GDO tools well are likely to convert them into faster, better work; employees who cannot are likely to experience them as an added burden.

A close reading of the literature reveals an important gap. Existing studies have overwhelmingly tested the direct, main effect of GDO practices on productivity outcomes, without theorising or empirically examining the boundary conditions, that is, the circumstances under which the relationship holds, weakens, or

reverses. Where explanations for inconsistent findings are offered, they tend to be post-hoc and descriptive (for example, attributing a negative finding to incomplete training or unreliable infrastructure) rather than grounded in an explicit, testable conceptual framework. Digital literacy has been tested as a moderator of the link between technology adoption and staff performance in other settings (Garba et al., 2026; Oladimeji et al., 2024), but not for GDO practices in Nigerian fintech.

The objective of this paper is therefore to develop a conceptual framework, grounded in an integration of the Natural Resource-Based View, Social Exchange Theory, and the Job Demands-Resources model, that explains how digital literacy shapes the direction and strength of the relationship between GDO practices and employee productivity, and to propose a set of testable hypotheses to guide future empirical research. More specifically, the paper (a) defines and justifies the constructs, (b) explains the theoretical mechanism through which digital literacy conditions the GDO-productivity relationship, (c) derives three hypotheses, and (d) outlines how the hypotheses can be tested. The paper is organised into six further sections: methodology, literature review, theoretical framework, conceptual model and hypotheses, discussion, and conclusion with recommendations for future research, which also outlines how the hypotheses can be tested.

2. Methodology

2.1 Research Design

This study adopts a conceptual literature review design focused on theory development and mechanism specification. Such an approach is suitable where focal constructs are dispersed across related disciplinary traditions, conceptual relationships require further clarification, and the conditions under which particular

relationships hold remain under-specified (Snyder, 2019; Torraco, 2016). Unlike meta-analytic reviews that aggregate effect sizes or systematic reviews primarily concerned with comprehensive evidence coverage, the present review seeks to synthesise relevant theoretical and empirical scholarship to develop a coherent explanation of the relationship between Green Digital Operations (GDO) and employee productivity, with particular attention to the moderating role of digital literacy.

The objective is not comprehensive descriptive coverage of all publications relating to digital transformation, environmental sustainability or employee performance. Rather, the review focuses on conceptually relevant literature that helps explain how environmentally oriented digital practices may influence employee productivity and why their effects may differ according to employees' digital capabilities. This distinction is important because the adoption of digital technologies and improvements in environmental performance do not necessarily translate into corresponding gains in individual employee productivity. The design is particularly appropriate because research on GDO intersects with several related but partially disconnected areas, including green information technology, digital transformation, employee productivity, digital literacy and technology-related work demands. These streams provide insights into the organisational benefits of sustainable digital practices and the individual capabilities required to use digital technologies effectively. However, their integration into an explanatory framework addressing the GDO-productivity relationship in Nigerian fintech remains underdeveloped. The review therefore emphasises construct clarity, theoretical coherence and explanatory precision as the

principal criteria guiding the development of the conceptual framework.

2.2 Literature Identification

Literature was identified through searches of Scopus and Web of Science, with Google Scholar used for retrieval extension and backward and forward citation searching of relevant studies. The search focused primarily on recent publications, particularly those published between 2023 and 2026, to capture contemporary developments in green digital operations, digital transformation, employee productivity and digital literacy. Earlier publications were retained where they provided foundational theoretical explanations or established conceptualisations relevant to the study.

Search strings combined the principal constructs and their relationships. These included "green digital operations"; "green information technology" OR "green information systems"; "digital transformation" AND "employee productivity"; "employee performance" AND "digital technology"; "digital literacy" OR "digital competence"; "digital literacy" AND "employee productivity"; "green technology" AND "workplace productivity"; and "fintech" AND "Nigeria". Additional searches addressed the theoretical foundations of the study, including "Natural Resource-Based View", "Social Exchange Theory" and "Job Demands-Resources model".

Backward and forward citation searching was used to identify additional relevant publications connected to the literature initially retrieved. This approach was particularly relevant for identifying foundational theoretical works and studies that examined related constructs under different terminology. The process was intended to support the development of a theoretically grounded conceptual framework rather than to establish an exhaustive inventory of every publication relating to digital transformation,

sustainability and employee performance. Consistent with a purposive conceptual review (Snyder, 2019), more than 150 articles were reviewed, and those judged most relevant to the framework were retained for synthesis. Table 1 lists the empirical studies that informed the framework, and the remaining citations are conceptual or theoretical sources.

2.3 Inclusion and Exclusion Criteria

Studies were selected primarily on the basis of their conceptual and theoretical relevance to the research objectives rather than exhaustive enumeration. Inclusion criteria covered peer-reviewed journal articles and foundational theoretical publications that contributed to at least one of the following areas: conceptual clarification of GDO or related green technology practices; theoretical or empirical explanations of employee productivity and performance in technology-enabled work environments; examination of digital literacy or digital competence as a determinant of employee outcomes; evidence linking digital technologies or sustainability-oriented practices to work-related outcomes; or application of the Natural Resource-Based View, Social Exchange Theory or Job Demands-Resources model to explain organisational capabilities, employee responses or technology-related work outcomes.

Studies were excluded from the substantive synthesis where their connection to the focal constructs was marginal, where they addressed technology adoption without meaningful consideration of employee or organisational outcomes, or where their conceptual focus did not contribute to explaining the relationships under investigation. Research examining broader organisational outcomes, including environmental performance and digital transformation, was considered where it provided relevant theoretical or contextual

insights. However, such studies were not automatically treated as direct evidence of individual employee productivity.

The review also distinguished between evidence concerning organisational-level outcomes and evidence concerning individual employee-level outcomes. This distinction was necessary because improvements in corporate environmental performance, technological adoption or general operational efficiency do not necessarily demonstrate improvements in employees' task efficiency or quality of work output. Studies conducted outside Nigeria were considered where their theoretical or empirical contributions were relevant, while recognising that differences in technological infrastructure, organisational practices and employee capabilities may influence the applicability of their findings to Nigerian fintech organisations.

2.4 Literature Organisation and Analytical Domains

The selected literature was organised around the principal constructs, their proposed relationships and the theoretical perspectives underpinning the conceptual framework. The analysis focused on five related domains: GDO and environmentally oriented digital practices; employee productivity and individual work performance; digital literacy and employees' capacity to use digital technologies effectively; the mechanisms through which green digital practices may enhance or constrain productivity; and the theoretical explanations provided by the Natural Resource-Based View, Social Exchange Theory and the Job Demands-Resources model. Table 1 summarises the empirical studies that informed this organisation.

Table 1. Empirical studies informing the review

Study	Setting	Focus and design (sample where reported)	Main finding
Muogbo et al. (2024)	Nigerian service firms	Digital operational efficiency and task performance	Weak, non-significant, or negative effect
Ochor et al. (2024)	Nigerian organisations	Digital resource availability and task performance	Weak, non-significant, or negative effect
Anusi & Dlamini (2025)	South African fintech	Sustainable digital infrastructure and employee performance	Gains conditional on training quality and infrastructure reliability
Mittal & Mittal (2025)	North American IT firms	Sustainable digital infrastructure and employee performance	Positive association
Sun et al. (2025)	Firms (China-based evidence)	Digital transformation and corporate green performance (organisation-level)	Positive association
Oladimeji et al. (2024)	Nigerian local government	Survey of 113 employees; PLS-SEM	Digital literacy raises productivity; ICT access strengthens the effect
Garba et al. (2026)	Nigerian polytechnic	Survey of 349 staff; PLS-SEM	Digital literacy moderates the technology adoption and performance link
Odumu et al. (2025)	Nigerian deposit money banks	Survey of 85 employees; correlation and regression	ICT adoption significantly influences adaptive performance
Fettahoğlu & Yıkılmaz (2025)	Accounting and financial reporting professionals	Survey of 388 professionals	Technostress affects performance indirectly, through techno-eustress
Anggraini & Wulandari (2026)	Employees (survey)	Survey of 201 respondents; PLS-SEM	Digital workload and technostress affect performance through digital fatigue
Odeyemi et al. (2024)	Nigerian banking	Review of literature, reports, and cases	Green IT adoption modest; limited by awareness, regulation, infrastructure
Benitez-Amado et al. (2015)	Firms (organisation-level)	IT infrastructure capability, talent management, and operational environmental sustainability	Environmental benefit of IT infrastructure operates through talent management

Note. Direction of effect is as reported by the cited authors. Sun et al. (2025) and Benitez-Amado et al. (2015) report organisation-level outcomes and are treated as contextual, not direct, evidence on employee productivity.

This organisation provided a basis for examining the connections between organisational digital practices and employee-level outcomes. Particular

attention was given to the distinction between the potential efficiency benefits of green digital tools and the additional cognitive or technical demands that may

arise when employees lack the capabilities required to use them effectively. Digital literacy was consequently examined as a potential boundary condition that may help explain differences in the productivity implications of GDO practices.

2.5 Synthesis Procedure

The conceptual synthesis proceeded through three analytical stages.

Stage 1: Construct mapping. The first stage examined how GDO, employee productivity and digital literacy were conceptualised across the relevant literature. This involved clarifying the distinction between green digital practices and digital transformation more broadly, identifying the relevant dimensions of employee productivity, and examining digital literacy as an individual-level capability. The purpose was to establish conceptual clarity and identify the relationships requiring further theoretical explanation.

Stage 2: Mechanism identification and reconciliation. The second stage examined the potential mechanisms connecting GDO with employee productivity. These included process efficiency, reduced duplication of tasks, improved information access and the automation of routine activities, alongside potential constraints arising from technological adjustment, cognitive demands and difficulties in using digital tools. The literature on digital literacy was then considered to explain why employees exposed to similar digital practices may experience different productivity outcomes. This analysis informed the argument that digital literacy may influence whether GDO practices function primarily as resources that facilitate task completion or as additional demands that constrain employee performance.

Stage 3: Theoretical integration and hypothesis development. The final stage integrated the identified mechanisms with the Natural Resource-Based View, Social

Exchange Theory and the Job Demands-Resources model. The Natural Resource-Based View provides a basis for understanding environmentally responsible organisational capabilities as potential sources of value. Social Exchange Theory explains how employees may respond to organisational investments and practices through reciprocal behaviour, while the Job Demands-Resources model explains how digital tools may function as job resources or generate additional demands depending on employees' capabilities and working conditions.

The integration of these perspectives informed the conceptual framework in which GDO represents the independent construct, employee productivity represents the dependent construct, and digital literacy functions as the moderating variable. The synthesis culminated in three hypotheses addressing the relationship between GDO and employee productivity at different levels of digital literacy and the moderating role of digital literacy in this relationship. These hypotheses are intended to guide future empirical investigation rather than represent relationships already established through statistical testing.

Conceptual rigour was maintained by linking the proposed relationships to the relevant theoretical arguments, distinguishing direct evidence on employee productivity from evidence concerning broader organisational outcomes, and making explicit the mechanisms through which digital literacy may influence the productivity implications of green digital practices. The emphasis was on theoretical coherence and explanatory value rather than numerical aggregation of research findings.

2.6 Methodological Limitations

The conceptual review design has limitations. The literature was selected for its relevance to the development of the

proposed framework rather than through an attempt to provide an exhaustive systematic review of all research on green digital operations, digital transformation and employee productivity. Consequently, the framework reflects the scope and quality of the literature considered, and potentially relevant studies may not have been captured.

Furthermore, evidence drawn from other industries and geographical settings may not fully reflect the institutional, technological and organisational conditions of Nigerian fintech firms. The proposed relationships have not been tested using primary data from employees in the sector. Section 7.0 therefore outlines how future research should examine the hypotheses using employee-level data and an appropriate moderation analysis, to determine whether digital literacy changes the strength or direction of the relationship between GDO and employee productivity.

3. Literature Review

3.1 Green Digital Operations

Green Digital Operations refer to the strategic embedding of environmental sustainability principles into an organisation's digital processes (Murugesan, 2008). Two practices are central in this paper. Paperless workflows and electronic documentation replace physical, paper-based routines with electronic systems for creating, processing, storing, and transmitting information. Energy-efficient information technology infrastructure comprises the hardware, servers, and computing arrangements designed to minimise energy consumption while sustaining reliable digital service delivery. These two practices are chosen because they are core operational routines of the green IT agenda (Murugesan, 2008) and because both change how employees do their daily tasks, which is the channel through which productivity effects are expected to occur. Evidence on how widely each is adopted in Nigerian fintech

is limited, so the framework does not assume a level of adoption. Both are widely promoted as sources of operational efficiency and environmental benefit in the fintech sector (Mittal & Mittal, 2025; Sun et al., 2025). Employee-level outcomes of green initiatives also depend on organisational conditions such as green climate and capabilities (Iqbal et al., 2019). Firm-level research on IT and environmental sustainability points the same way: the benefits of IT infrastructure were found to operate through talent management, that is, through how well people are developed and deployed (Benitez-Amado et al., 2015). In Nigerian banking, however, sustainable IT adoption remains modest compared with global benchmarks (Odeyemi et al., 2024), which means that many firms are still in the transition phase in which the digital transition paradox is most likely to appear.

3.2 Employee Productivity

Employee productivity is conceptualised through established dimensions of individual work performance, including task efficiency, the speed and accuracy with which employees execute their prescribed roles, and quality of work output, the standard and reliability of the work produced (Koopmans et al., 2011). These two dimensions are retained because they are the aspects of individual performance most directly exposed to changes in digital tools, such as moving documentation online or changing computing infrastructure; other dimensions of individual work performance identified in the same literature (Koopmans et al., 2011), such as contextual performance, are outside the scope of this paper. Individual-level productivity is also the level at which GDO tools are experienced, so it is the right level at which to test whether green digital investment pays off.

3.3 Digital Literacy

The term originates with Gilster (1997) and is now understood as a capability that can be developed through learning and practice rather than a fixed trait (Ng, 2012). For this paper, digital literacy is defined as an individual's technical skill, self-efficacy, and adaptability in using digital tools and systems to accomplish work tasks. Work on technostress among Nigerian bank employees treats technology as a source of strain as well as help (Okolo et al., 2018), which is why individual capability matters for whether technology investments translate into performance gains. Recent Nigerian evidence is consistent with this view. Digital literacy was found to improve productivity among local government employees in Ilorin, with access to ICT strengthening the effect (Oladimeji et al., 2024), and it moderated the relationship between technology adoption and staff performance among academic staff of a Nigerian polytechnic (Garba et al., 2026). In Nigerian banks, ICT adoption has also been linked to employees' adaptive performance (Odumu et al., 2025). These studies support the idea that adoption alone is not enough, but none of them examines GDO practices or fintech firms.

3.4 The GDO-Productivity Relationship and the Digital Transition Paradox

International evidence, largely from China and North America, reports positive associations between sustainable digital infrastructure or digital transformation and employee performance (Mittal & Mittal, 2025) and corporate green performance (Sun et al., 2025). Evidence from Nigerian and other African contexts has been considerably more conditional, with several studies reporting weak, non-significant, or negative effects (Anusi & Dlamini, 2025; Muogbo et al., 2024; Ochor et al., 2024). The difference suggests that what separates the settings is not the tools themselves but the capability of the

workforce and the reliability of the environment in which the tools are used. This pattern echoes the IT productivity paradox, in which large investments in information technology coincided with weak measured productivity gains (Brynjolfsson, 1993). Later evidence showed that returns varied widely between firms and were associated with organisational factors rather than technology spending alone (Brynjolfsson & Hitt, 1998). Drawing on that analogy, this paper uses the term digital transition paradox as a working label for the case in which investment in green digital tools coincides with flat or declining employee productivity while employees are still learning to work with them; it is not presented as an established construct.

3.5 Technostress and Digital Literacy as a Boundary Condition

Where digital literacy is low, technology adoption can generate technostress, defined as stress arising from an inability to cope with new technologies in a healthy manner, which has been shown to undermine rather than enhance employee performance (Salanova et al., 2013; Tarafdar et al., 2007). Recent work refines this picture. Technostress did not directly lower the performance of accounting and financial reporting professionals but affected it through whether employees appraised technology demands as a chance to grow (Fettahoğlu & Yıkılmaz, 2025). In a similar way, digital workload and technostress affected employee performance through digital fatigue rather than uniformly (Anggraini & Wulandari, 2026). These findings imply that the same digital demand can help or harm depending on the employee's capacity to cope, which is what digital literacy captures.

Taken together, the literature shows (a) mixed direct effects of GDO on productivity in emerging markets, (b) evidence that digital literacy conditions the effect of technology adoption on

performance in other settings, and (c) evidence that technology demands harm performance when coping capacity is low. What is missing is a framework that joins these strands for GDO practices in Nigerian fintech. That is the central gap this paper addresses.

Theoretical Framework

This paper integrates three complementary theoretical perspectives. The Natural Resource-Based View (Hart, 1995) holds that firms which strategically develop environmentally responsible capabilities can achieve competitive advantage through rare, valuable, and hard-to-imitate organisational routines. Recent reviews show that the perspective has increasingly been used to link environmental capabilities to firm performance (Yorulmaz, 2024). Applied here, it implies that GDO tools are organisational resources whose value depends on the firm's capability to deploy them effectively, rather than on their acquisition alone. Social Exchange Theory (Blau, 1964; Cropanzano & Mitchell, 2005), operationalised through the construct of perceived organisational support (Eisenberger et al., 1986), explains employee responses to organisational investment through the norm of reciprocity: employees who perceive GDO investment as a genuine expression of organisational care are theorised to reciprocate with improved effort and performance, but this reciprocity is unlikely to materialise where the investment instead produces friction or added burden.

The Job Demands-Resources model (Bakker & Demerouti, 2007) provides the theoretical mechanism linking these firm-level perspectives to the individual employee. The model distinguishes between job demands, which require

sustained effort and can be costly if unmet, and job resources, which help employees cope with those demands and achieve their goals. A decade of later work confirms that personal resources, such as skills and self-efficacy, help employees meet demands and turn resources into performance (Bakker et al., 2023). Within this framework, digital literacy functions as a personal resource: for digitally literate employees, GDO tools operate as intended organisational resources that ease task completion; for employees with low digital literacy, the same tools instead constitute an additional job demand, requiring cognitive and technical effort that can deplete rather than enhance productivity. The three theories are combined because each answers a different question. The Natural Resource-Based View explains why GDO tools should matter at the firm level and why their value depends on capability. Social Exchange Theory explains why employees should respond to the investment with effort. The Job Demands-Resources model explains the individual-level mechanism that decides whether the response is positive or negative. Integrating them provides a coherent explanation for why the same GDO practices can produce divergent productivity outcomes depending on the digital literacy of the workforce deploying them.

4. Results and Discussion

Conceptual Model and Hypotheses

Figure 1 presents the proposed conceptual model. Green Digital Operations practices are positioned as the independent construct, employee productivity as the dependent construct, and digital literacy as a boundary condition moderating the strength and direction of the relationship between them.

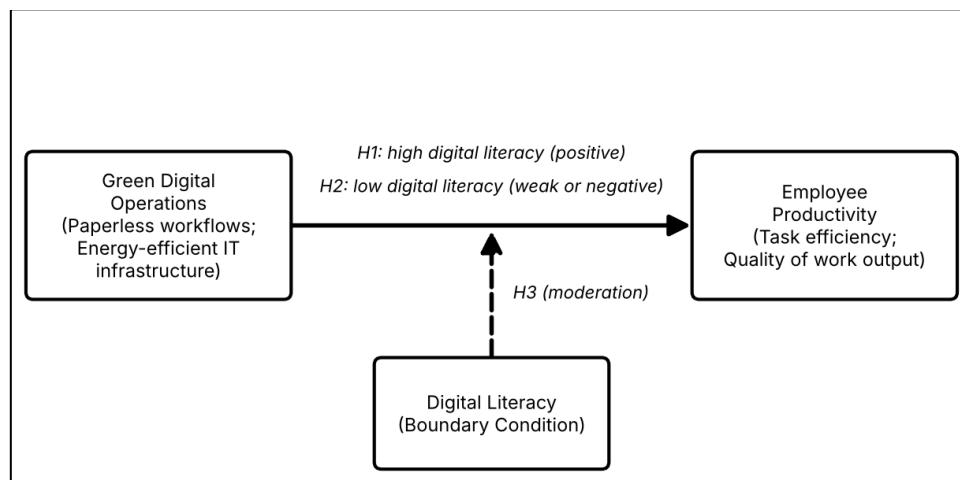


Figure 1. Conceptual framework of digital literacy as a boundary condition

Based on this model, three hypotheses are advanced. H3 is the primary, confirmatory hypothesis; H1 and H2 state the conditional effects (simple slopes) that H3 implies, so that the framework can be tested in full. Each is supported by the theory and evidence reviewed above.

Hypothesis 1 follows from the Natural Resource-Based View and Social Exchange Theory. If GDO tools are valuable organisational resources, employees able to use them should work faster and more accurately, and should see the investment as support worth reciprocating. Evidence from outside Nigeria reports positive links between sustainable digital infrastructure and employee performance (Mittal & Mittal, 2025) and between digital transformation and corporate green performance (Sun et al., 2025). Nigerian evidence that digital literacy raises productivity (Oladimeji et al., 2024) is indirect support only, because it concerns digital literacy and productivity rather than GDO practices; this is why H1 is stated as a conditional prediction to be tested.

H1: Green Digital Operations practices (paperless workflows and electronic documentation, and energy-efficient information technology infrastructure) are positively associated with employee productivity (task efficiency and quality of

work output) among employees with high digital literacy.

Hypothesis 2 follows from the Job Demands-Resources model. For employees with low digital literacy, GDO tools become added demands that raise technostress and drain effort (Salanova et al., 2013; Tarafdar et al., 2007), so any benefit is offset. This is consistent with the weak, non-significant, or negative effects reported in Nigerian studies (Muogbo et al., 2024; Ochor et al., 2024). Because those studies did not separate employees by digital literacy, their results fit this prediction but cannot confirm it.

H2: Among employees with low digital literacy, the relationship between Green Digital Operations practices and employee productivity will not be positive: it will be zero or negative.

Hypothesis 3 combines the first two and states the moderation directly. If the effect is positive at high literacy and flat or negative at low literacy, then the strength of the relationship should rise with literacy. Moderating effects of digital literacy have been reported for the link between technology adoption and staff performance (Garba et al., 2026), and personal resources are expected to strengthen the effect of resources on performance (Bakker et al., 2023).

H3: Digital literacy moderates the relationship between Green Digital Operations practices and employee

productivity, such that the positive association between Green Digital Operations practices and employee productivity becomes stronger as digital literacy increases (a positive interaction between GDO practices and digital literacy).

Discussion

As this is a conceptual paper, there are no empirical results to report. This section therefore discusses the framework against theoretical, empirical, and practical evidence and then sets out the researcher's own argument. The framework offers a theoretical explanation for a pattern that has so far been documented but not systematically theorised in the Nigerian GDO literature: that green digital tool adoption can coincide with flat or declining productivity outcomes. Rather than interpreting such findings as evidence that GDO investment is ineffective, the framework reframes them as evidence of an unmeasured boundary condition, digital literacy, whose absence converts an intended organisational resource into an additional job demand. This reframing is consistent with, and extends, existing calls for research attention to training quality and infrastructure reliability as conditions for realising green digital investment benefits (Anusi & Dlamini, 2025; Ochor et al., 2024).

Theoretical Evidence

Each of the three theories supports the framework. The Natural Resource-Based View treats environmental capabilities as sources of advantage only when firms can deploy them (Hart, 1995; Yorulmaz, 2024), so a tool without the human capability to use it should not yield advantage. Social Exchange Theory predicts reciprocity only when investment is experienced as support (Cropanzano & Mitchell, 2005; Eisenberger et al., 1986), and a tool that frustrates users is unlikely to be read as support. The Job Demands-Resources model explains the individual

mechanism: resources help only when employees have the personal resources to use them, and otherwise they add to demands (Bakker & Demerouti, 2007; Bakker et al., 2023). Firm-level evidence on IT infrastructure and environmental sustainability supports the same capability logic, because its benefits were found to operate through talent management (Benitez-Amado et al., 2015). Integrating the three perspectives is the main theoretical contribution, because prior Nigerian GDO studies have typically applied only one of them in isolation.

Empirical Evidence

The empirical record is consistent with the framework even though it has not tested it directly, and it is useful to separate four strands. First, evidence on direct effects is mixed. Nigerian studies report weak, non-significant, or negative GDO effects (Muogbo et al., 2024; Ochor et al., 2024), which fits the prediction for low-literacy employees (H2), while evidence from outside Nigeria is more positive (Section 3.4). The longer history of the IT productivity paradox points the same way, since measured returns to technology varied widely between firms (Brynjolfsson, 1993; Brynjolfsson & Hitt, 1998). Second, Nigerian studies of digital literacy report positive productivity effects and moderation of technology adoption effects (Garba et al., 2026; Oladimeji et al., 2024), which fits H1 and H3. Third, studies of technostress show that digital demands harm performance depending on how employees appraise and cope with them (Anggraini & Wulandari, 2026; Fettahoğlu & Yıkılmaz, 2025; Salanova et al., 2013; Tarafdar et al., 2007). Fourth, the modest and constrained adoption of green IT in Nigerian banking (Odeyemi et al., 2024) suggests that infrastructure and awareness gaps coexist with the literacy gap, which is why infrastructure is recommended as a control in future tests (Section 7.0).

The evidence also has clear limits. None of the studies in Table 1 measures GDO practices and digital literacy together, so none can confirm the moderation proposed here. Several rely on cross-sectional, self-reported surveys with modest samples (for example, 85 employees in Odumu et al., 2025, and 113 in Oladimeji et al., 2024), and the technologies they study differ from GDO practices. The evidence is therefore best read as consistent with the framework, not as a test of it.

Practical Evidence and Implications

Fintech organisations should not treat digital literacy development as a peripheral training exercise but as a precondition for realising the productivity benefits of green digital investment. The practical case rests on three strands of evidence. Studies of the IT productivity paradox found that returns to technology depended on organisational factors beyond the technology itself (Brynjolfsson & Hitt, 1998); firm-level research on green IT found that the benefits of IT infrastructure operated through talent management (Benitez-Amado et al., 2015); and digital literacy has been shown to be teachable in educational settings (Ng, 2012), while personal resources help employees meet job demands (Bakker et al., 2023). Together these suggest four practical steps. First, assess employees' digital literacy before rolling out paperless workflows or new infrastructure. Second, sequence or bundle training with each rollout, rather than training after problems appear. Third, give extra support, such as peer champions or help desks, to employees with lower literacy during the transition. Fourth, monitor productivity at the employee-group level, not only at the firm level, so that a loss among low-literacy groups is not hidden by gains elsewhere. Introducing GDO tools without first, or simultaneously, building workforce digital literacy risks the very outcomes reported in recent empirical studies of the sector. These steps are

derived from the framework and the cited evidence and remain to be tested in the sector.

Critical Interpretation of the Digital Transition Paradox

This paper advances the argument that the digital transition paradox may partly reflect an averaging effect. Studies estimating a single average relationship across employees with different levels of digital literacy may combine positive productivity effects among digitally capable employees with weak or negative effects among employees who struggle to use digital tools effectively. The resulting aggregate relationship may therefore appear weak or statistically non-significant, even where meaningful differences exist between employee groups. This interpretation is consistent with the broader IT productivity debate, in which average returns to technology concealed substantial differences in performance across firms (Brynjolfsson & Hitt, 1998). From this perspective, weak or negative findings in the Nigerian literature do not necessarily establish that Green Digital Operations are ineffective. Rather, they raise the possibility that the productivity implications of these practices differ across employees according to their digital capabilities. If this explanation holds, fintech organisations may be able to realise environmental and productivity benefits simultaneously by treating workforce digital literacy as an integral component of green digital investment rather than as a separate training concern.

This argument nevertheless requires qualification. First, digital literacy is unlikely to be the only condition shaping the relationship between Green Digital Operations and employee productivity. Infrastructure reliability, training quality and management support may also influence whether employees can translate digital resources into improved performance. Future research should

therefore examine these factors alongside digital literacy. Second, weak or statistically non-significant relationships may also arise from measurement error, small sample sizes, self-report bias or limited variation in the extent of GDO adoption across organisations. The averaging effect should consequently be considered one plausible explanation among several, rather than a definitive account of the observed findings. Third, the argument remains conceptual and is supported by indirect evidence; it should therefore be treated as a theoretically informed explanation requiring empirical testing, not as an established finding.

5. Conclusion and Recommendations for Future Research

This paper has developed a conceptual framework proposing digital literacy as a moderating variable, or boundary condition, on the relationship between Green Digital Operations and employee productivity in Nigerian fintech organisations, integrating the Natural Resource-Based View, Social Exchange Theory, and the Job Demands-Resources model. The framework offers a theoretically grounded explanation for the weak, non-significant, or negative effects reported in recent empirical studies of the sector, reframing them as evidence of a capability gap rather than a failure of green digital investment itself.

The main limitation of the paper is that the framework and its three hypotheses have not yet been tested with data, and it examines only one moderator. Future empirical research should test the hypotheses using moderated regression analysis or structural equation modelling,

with digital literacy measured directly and modelled as a moderator of the relationship between specific GDO practices and productivity dimensions. A cross-sectional survey of employees in Nigerian fintech organisations is the minimum design. Digital literacy should be measured with a validated digital skills and self-efficacy scale, productivity with established individual work performance items covering task efficiency and quality of output (Koopmans et al., 2011), and infrastructure reliability should be included as a control because it is a rival explanation. The primary test is H3, the interaction between GDO practices and digital literacy; H1 and H2 can then be examined as the effect of GDO on productivity at high and low levels of digital literacy, reporting confidence intervals as well as significance tests. Such research should use primary data collected for that purpose, ideally through a longitudinal or multi-wave design capable of tracing how the capability gap narrows as organisations and their employees mature in their digital transition. Future studies should also add infrastructure reliability, training quality, and perceived organisational support as further moderators or mediators, and compare fintech with other Nigerian service sectors. Fintech organisations are, in the interim, encouraged to pair green digital investment with structured digital literacy and change-management programmes, since the framework suggests that tool adoption alone, without corresponding investment in workforce capability, is unlikely to yield the productivity benefits typically assumed.

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