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REVIEW

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Technological environment and sustainable performance of oil and gas firms: a structural equation modelling approach

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Abstract

This study draws from the dynamic capabilities theory to examine how sustainable performance measured along with financial, environmental, and social performance are impacted by technology infrastructure, technology knowledge, and technology applications. Copies of the questionnaire were administered to the Operations and Information Technology department staff of selected oil firms in the Niger Delta region of Nigeria. Out of the three hundred (300) copies of the questionnaire administered, two hundred and forty-three (243) were validly filled. Sixteen (16) of the responses were deleted due to the presence of an outlier in the dataset. The remaining two hundred and twenty-seven (227) responses were used for data analyses. The research model was estimated using structural equation modelling to establish relationships among the variables. The study found that technology infrastructure has a positive but insignificant impact on the sustainable performance of oil and gas firms. However, technology knowledge and application positively and significantly impact sustainable performance. The study recommends that oil and gas companies continually employ, reward, and train individuals to absorb and utilize acquired technologies to develop a standard for addressing the social and environmental problems in the Niger Delta region.

Keywords Niger Delta, Oil and gas, Performance, Sustainability, Technology

Introduction

Sustainability disclosure is becoming a strategy through which organizations enhance their legitimacy, transparency, image, and reputations that appeal to investors. Unfortunately, many organisations need help to perform well based on sustainability indicators such as energy consumption, material usage, greenhouse gases (GHG) emissions, and so on [1]. This is particularly evident in developing countries such as Nigeria, where many firms are spilling oil, toxic waste, and emitting harmful substances while partially responding to the social and environmental problems they instigated [2]. This is one of the most significant challenges facing oil firms in Nigeria. The challenge is evident among most oil firms in Nigeria that were sued in the law court and compelled by the court to compensate for damaging host communities through the failure to prevent and clean the oil leakages that have caused widespread environmental pollution (British Broadcasting Corporations (BBC) [3]). The court case was compounded by the failure of oil firms to be sensitive and respond to the social needs/challenges facing the community of operation they have over time improvised through oil spillage [3], which has over the years been the root source of incessant conflict between oil firms and many host communities in Niger Delta of Nigeria.

The performance of firms in the oil and gas sector in the Niger Delta region of Nigeria would have been higher if they create, develop, and leveraged relevant technology capacities. This assumption, which was tested in this

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study, flows from the dynamic capabilities theory that the acquisition, deployment, and leveraging of relevant technology infrastructural and human resources are core features that enable the transformation of existing business models. It also disrupts traditional organisational processes to effectively adapt and solve environmental and social problems affecting firms, the planet, and people, including the customers, employees, and the community [4]. They enhance the agility, adaptability, and alignment of business processes to changing environments in addressing stakeholders' rapidly evolving sustainability expectations.

Central to the dynamic capabilities of a firm is the possession of relevant technology infrastructures, knowledge, and applications [5]. The combined capabilities are expected to facilitate the sensing, learning, seizing, and reconfiguring the production process, marketing process, and other organizational routines to align with sustainable practices or achieve congruence with the changing business environment. This assertion, as explained by Nova and Bitencourt [6], aligns with applying the dynamic capabilities theory that technology stimulates an organisation's ability to sense, scan, reconfigure, and renew existing internal and external competencies to match the requirements of a changing environment.

However, investment in technology infrastructures and human resources (knowledge) can lead to rising operational costs in the short run, undermining sustainable financial performance. This is especially when the sales of the products developed through the ideas generated and implemented from the application of the technologies acquired exceed the growth rate of expenditure on the technology [7]. Moreover, technology infrastructures, human technology skills, and the application of the technologies were only found to induce sustainable performance through the firm's strategic capabilities [8] and knowledge management and organizational learning [9]. Similarly, they needed to be more sufficient to generate and maintain a competitive advantage and command sustainable financial performance directly [10].

Contrary, a few studies emerged that information technology (IT) capabilities (IT infrastructure quality, IT human resources competence, and environmental IT competence) have a positive influence on environmental performance [6, 11, 12], sustainable financial performance [13–15], Hao et al. [16] and sustainable social performance [17]. These extant studies, however, should have addressed the influence of technology infrastructure, knowledge, and applications on sustainability's three dimensions (economic, social, and environmental performance). Moreover, they should have considered the influence of these variables on the sustainable performance of Nigeria's oil and gas sector. Firms in the sector are facing the challenge of eliminating oil spills, gas flares, and waste at the same time while making a profit without relenting in addressing prevailing poverty/social problems within the community of operations. In light of the above, this study draws from the dynamic capabilities theory to examine the relationship between the technological environment and the sustainable performance of oil and gas firms in the Niger Delta region of Nigeria.

Literature review

Sustainable performance of firms

Sustainable performance at a firm level is defined as the extent to which a firm promotes social well-being, while at the same time generating economic value without harming the environment it operates [18]. It is simply meeting customers' present financial obligations and social needs without polluting the environment with toxic waste, emissions, and other substances harming the environment and future generations [19]. This definition flows from the triple bottom line (TBL) approach, which remains the most relevant framework for understanding, measuring, and implementing the performance management of a firm from a sustainable perspective. The triple bottom line (TBL) developed by Elkington in [20] integrated a firm's social, environmental, and economic dimensions to measure its sustainable performance. The TBL adds the social and environmental values created by a firm to its economic value to measure a firm's sustainable performance to guide organisations in conducting business operations. Henao and Sarache [21] described sustainable performance as a company's ability to operate in a way that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. As explained by Dana et al. [22], sustainable performance can be achieved by creating reliable, high-quality products at fair costs. Rounaghi et al. [23] also identified the critical role of price, quality, and time in promoting the sustainability of corporate activities and operations. Each of the dimensions of sustainable performance of firms (social, environmental, and economic/financial values generated by a firm) is discussed below.

Sustainable financial performance

Sustainable financial performance is the extent to which a firm continually generates economic value through its operations for the owners of the firm [24]. Sustainable financial performance has also been assessed through the financial viability, financial security, and financial stability of a firm, which is the extent to which firms generate profit, increase the value of invested capital, and repay their short- and long-term liabilities at the same time [15]. In light of the above, sustainable financial performance is operationalised in this study as continual generations of income sufficient to sustain the costs of present and future operations of a firm. The financial performance of firms is sustained based on how efficiently and effectively firms utilize available resources to produce output, serve customers better, expand product portfolio, and successfully enter and develop a new market. The more a firm continues to generate sufficient income, the more the firm is free from the risk of bankruptcy, insolvency, or inability to pay debt and finance future operations [18].

Sustainable environmental performance

It is also known as green environmental performance. Environmental performance is one of the most critical aspects in determining a company's success [25]. Sustainable environmental performance is defined as the extent to which a firm excels in protecting the environment through its carbon footprint emanating from its operations [26]. It is more of environmental care and hence measured by the extent to which firms comply with environmental law. It is the extent of implementing an eco-friendly environment and cleaner production policies that is central to safeguarding the natural environment for future generations and preventing the destructive effects of climate change [27]. Sustainable environmental performance involves continuous recycling of waste products, reduction of energy use, and continuous reduction in carbon credits and emissions in operations as well as saving energy by changing machines or equipment or replacing their energy resources from fuel to renewable energy resources [28]. There has been increasing advocacy in the global arena in light of the environmental pollution occasioned by the daily operations of organizations, which has brought untold significant climate change, carbon credits, and global warming that is increasingly threatening the lives of humans, plants, agriculture, and wildlife [29]. Despite this, many oil firms in Nigeria must comply with environmentally friendly laws and policies to prevent and reduce widespread environmental pollution [30]. This is probably because of the unabated oil spillage, greenhouse gasses, plastic/chemical waste, and gas flares emanating from oil firms' operations in the Niger Delta Region of Nigeria that have damaged the quality of air, farmlands, and rivers, which have disengaged youths in the Niger Delta region from farming and fishing.

Sustainable social performance

Sustainable social performance is an extension of corporate social responsibilities, which has, over time, remained a narrow view of corporate sustainability [31]. It is an executive action directed towards furthering some social good beyond the firm's interests, which is required by law. It is how well an organisation meets its social responsibilities of obeying the law, abiding by ethical values in operations, and fulfilling stakeholders' welfare, needs, and expectations. These stakeholders include the consumers, employees, and the immediate communities where the companies are operating, which are usually disclosed in the annual financial report of a firm [17]. Sustainable social performance also covers not only the steps taken by the management of an organization towards the accomplishments of corporate social responsibilities but also the actual results/outcomes of the corporate social responsibility initiatives. Hence, it is the measurement of outcomes of the collection of social responsibilities that a firm takes up in society [32]. The first step, according to Carroll [31], is that a firm must define, understand, and embrace corporate social responsibilities, which are economic, legal, ethical, and discretionary (philanthropic) responsibilities/expectations that society has of organizations at a given point in time. The second step is embracing philosophies, modes, or strategies of social responsiveness relating to the identified social issues facing communities, employees, and customers. The most common social issues facing communities, employees, and customers across the globe are health and safety. These social issues have renewed the sense of urgency on firms to operate safely to protect public health and uphold the security of life of the host community. These social practices have, however, not been sustained among oil firms in Nigeria, particularly in the Niger Delta, as the oil spillage and gas flares emanating from their operations have been reported to have continually harmed the safety, health, and well-being of the host community of the Niger Delta [33]. Moreover, most oil firms in the region still need to fully comply with the law court to end oil spillages, clean up the oil spills, and compensate the affected host oil communities in the region [30]. This failure of oil firms to be socially, ethically, and legally responsible in meeting the social needs of host communities remains the source of conflict between oil firms and Niger Delta oil communities that have resulted in disruptions, destructions, and relocations of the operations of many multinationals exploiting and producing crude oil within the region.

Technological environment of oil and gas firms

Technological environment consists of the changes in companies' outputs, methods of production, equipment usage, and quality of products. It includes scientific innovations in production technologies that bring about product improvement. Improvement in technological innovations has radically altered the oil and gas industry's competitive landscape via reduced energy consumption and environmental pollution and damage. As opined by Guo et al. [34], technology enhances the exploration, mapping, and identification of petroleum deposits under the earth and the detection of equipment failure or leakages. Technology enables firms to adapt, integrate, and reconfigure internal and external organizational skills, resources, and functional competence to match the requirements of a changing environment [35]. Drawing from the above, this study investigated how the following three dynamic capabilities-based technological environments construct: technology infrastructure, technology knowledge, and technology applications impact the oil and gas sustainability performance.

Technology infrastructure

Technology infrastructures involve the firm's architecture, data management services, and digital software application platforms [14]. Technology artefacts, tools, and other technology resources contribute to acquiring, processing, storing, disseminating, and using information [36]. Technology infrastructures of firms include the possession of hardware, software, and networks on which systems are built, as well as possession of smart technologies, big data, cloud, and social media platform applications to generate data and information for users with appropriate levels of accuracy, timeliness, reliability, security, and confidentiality [37]. In today's environment, the shift to big data, analytics, cloud, mobile, and social media platforms constantly transform organizations' responses to changing business landscapes and environmental and social issues [38]. Digital technologies are driving innovations and reshaping business models by ushering in unique changes in business operations, business processes, and value creation [10]. They are more capable of scaling up to fit and integrate their multiple business applications that enable organizational members to quickly access the right amounts of information at the right time to execute assigned tasks [14].

Technology knowledge

Organizations can acquire technology infrastructures such as big data, cloud computing, and analytics, but the employees' knowledge and skills to absorb and apply the acquired technology infrastructures may need to be improved [5]. In this regard, technology knowledge is the mastery of the technologies appropriate for the work being undertaken and the ability to absorb and adapt the technologies into local settings and integrate technologies across the business value chain [39]. It is measured by the ability to recognize the value of new information technology, assimilate it, and apply it to commercial ends [6]. This measurement is aligned with the absorption capacity of the firm, which is a set of organizational routines and processes by which organizations acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability [40].

Technology applications

Technology applications, also known as technology operation, are defined as leveraging the acquired technology infrastructures and technical skills to scale up business processes [41]. It is the use of technologies to scale up business processes and improve the quality of products and services [15]. Technology application is defined as the degree to which a firm uses information technology infrastructures (hardware, software and network, big data, social media placations) to improve decision-making in all areas [5]. It is disintegrated into informational technology proactive stance, which is the ability of a firm to actively and constantly use information technology resources to search, identify, and create new opportunities and ideas, as well as technology business spanning, which is the ability to envisage and apply information technology resources to support business goals and objectives [14, 38].

Theoretical framework

This study is based on the dynamic capabilities theory. The theory is an extension of the resource-based view theory, which Williamson pioneered in 1975. Dynamic capabilities are firms' abilities to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments. It is an ability to reconfigure and transform resources in an uncertain or erratic setting to achieve innovative forms of competitive edge [6]. The theory opined that a firm could only create a competitive edge when it has the resources to enhance and modify existing processes or practices to make them more valuable, rare, imperfectly imitable, non-substitutable, and adequate to adapt, cope, and survive in a fiercely competitive and changing environment [42]. According to the theory of dynamic capabilities, the core of the resources is technology infrastructure, technology knowledge, and technology applications [5]. These resources enable an organization to sense, scan, and reconfigure and renew other competencies needed to improve effective interaction with customers, the environment, and society [6].

Methodology

Research design, population, and sample

This study adopted a cross-sectional survey research design. This form of quantitative research design is chosen because data needed on variables were collected from the sample respondents at a specific time. Oil and gas firms in the upstream sector constituted the population of this study. Three hundred (300) copies of questionnaire were administered to the staff of the operations, and information technology departments of fifteen (15) selected oil firms in the Niger Delta region of Nigeria.

Instrumentation

The scales developed by Nwankpa and Roumani [14] and Antoni et al. [11] on IT capability (IT infrastructure quality, IT human resources competence, environmental IT competence, and IT operations) were adapted for technology infrastructure, knowledge, and applications. The scales developed by Ahmad et al. [17], Antoni et al. [11], Nova and Bitencourt [6], and Ahmad et al. [17] on corporate sustainability were adapted for sustainable financial, environmental, and social performance in this study.

The questionnaire's pool of items was evaluated by experts consisting of human resources experts, seasoned academics, and practitioners in the oil and gas sector. The comments and suggestions on the content of the questionnaire were incorporated, thus enriching the quality of the final scale that was administered. The reliability of the data collection instrument was determined by carrying out a pilot test using the questionnaire. The reliability of the instrument of research, which seeks to assess the extent to which the items on the instrument produce consistent results, was determined using Cronbach's alpha test. This was done by administering twenty (20) copies of the questionnaire to staff in the Operations and Information Technology departments of Nigerian Petroleum Development Company (NPDC) and Panocean Oil firms in Benin City. The data obtained from the respondents were tested with Cronbach's alpha using Statistical Packages for Social Sciences (SPSS). Cronbach's alpha values ranged from 0.712 to 0.957, suggesting that the items on the questionnaire administered were consistent with the purpose of this study following the assumption of Nova and Bitencourt [6] that a reliability coefficient result of 0.70 is considered appropriate in establishing the reliability of the test instrument.

Model specification and operational measurement of the variables

The model specified in this study followed the theoretical and empirical reviews provided in extant literature. The model for this study is the adaption and modification of Nwankpa and Roumani's [14] model. The model is diagrammatically presented in Fig. 1:

The research variables are operationally defined and measured as follows:

Technology infrastructure is the possession of information technology architecture, data management services, and digital software application platforms [14]. Technology knowledge is the ability to recognize the value of new information technology, assimilate it, and apply it to commercial ends [6]. Technology applications involve using information technologies (big data management services, cloud, and social media applications, among others) to modify, improve, span, and support business goals and

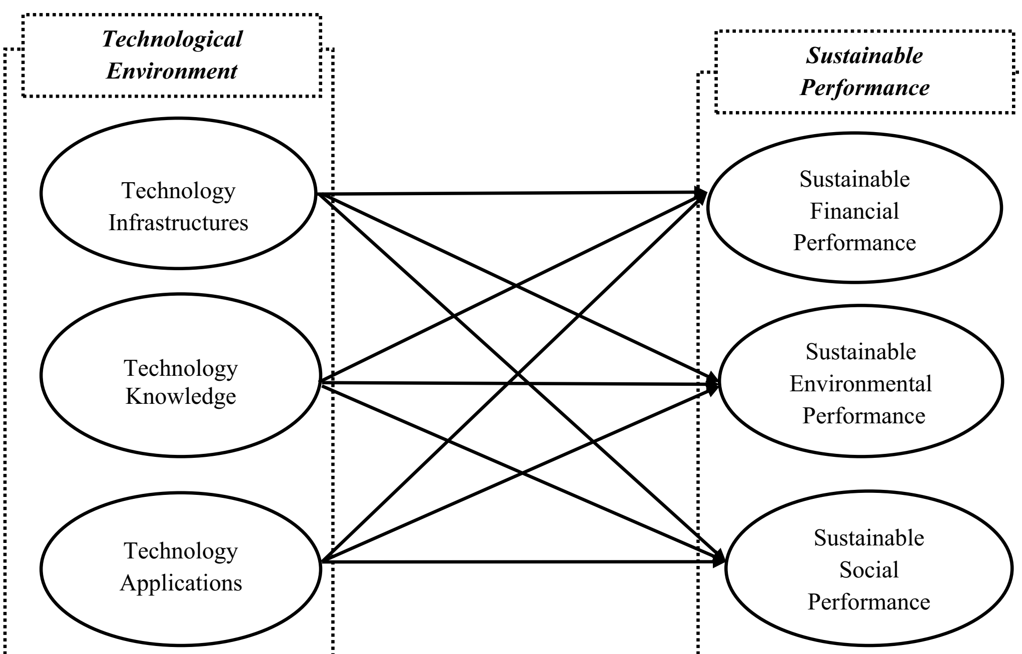

Fig. 1 Conceptual framework. *Source:* Researchers' conceptualization (2022)

objectives [14]. Sustainable financial performance is the extent to which a firm generated a higher profit margin in the past 5 years compared with the industry average as well as maintains positive cash flow that is enough to meet its short- and long-term commitments. Sustainable environmental performance is the extent to which a firm reduces the number of greenhouse gasses released into the atmosphere [27], while sustainable social performance is the extent to which a firm responds to the social needs and problems in the community of operations [17].

Estimation technique
The data collected from the sampled respondents were analysed using descriptive and inferential statistics. The descriptive statistics used include frequency tables, mean, and standard deviation. Structural equation modelling (SEM) was used to estimate the research model. SEM makes the simultaneous estimations of various independent variables on more than one dependent variable possible [43, 44]. Collier ([44]: 1) further argued that SEM is "capable of testing an entire model instead of just focusing on individual relationships". In this study, the influence of the predictor variables, namely: technology infrastructures, technology knowledge, and technology applications on sustainable performance constructs, was simultaneously estimated using covariance-based SEM (CB-SEM) using Analysis of Moment Structures (AMOS) software.

Empirical analyses and results
Out of the three hundred (300) copies of questionnaire administered, two hundred and forty-three (243) were validly filled. Sixteen (16) of the responses were deleted due to the presence of an outlier in the dataset. The remaining two hundred and twenty-seven (227) responses were used for data analyses.

Description of respondents' demographics
Table 1 shows the demographics of the respondents that filled the questionnaire.

Table 1 reveals that the majority of the respondents are males, which are 201 representing 88.5% of the respondents. In total, 26 (11.5%) of the respondents are females. The results also show that 59 (26%) of the respondents were single, while 168 (76%) were married. The age distribution shows respondents who were 30 years old and below jointly accounted for 9.6%. In total, 83 (36.6%) were 31–40 years old, and 98 (43.2%) respondents were between 41 and 50 years old. Other respondents (24, 10.6%) were above 50 years old. Table 1 shows that majority of the respondents 49.8% possess a first degree (HND/B.Sc/B.Engr Degree) as their highest qualification.

Table 1 Demographics of respondents

S/N	Demographics	Category	Frequency	Percent (%)
1	Gender	Male	201	88.5
		Female	26	11.5
		Total	227	100
2	Marital status	Single	59	26
		Married	168	74
		Total	227	100
3	Age	Below 21 years old	6	2.6
		21-30 years	16	7
		31-40 years	83	36.6
		41-50 years	98	43.2
		51 years and above	24	10.6
		Total	227	100
4	Highest educational qualification	First degree and equivalent	113	49.8
		Masters	109	48
		PhD	5	2.2
		Total	227	100

Respondents with masters and PhD qualifications accounted for 48% and 2.2%, respectively.

Preliminary analyses of data
The preliminary analyses conducted include the test for the presence of outliers in the dataset, normality test, and common method bias (CMB) test.

Test for the presence of outliers: Mahalanobis distance approach was used to detect outliers in the dataset. Sixteen (16) responses that demonstrated the presence of an outlier in the dataset were deleted.

Normality test: Normality test was done using skewness and kurtosis. At the item level, the absolute values of skewness ranged between 0.341 and 2.267, while the absolute values of kurtosis ranged between 1.300 and 5.805. The values reported are below Kline's [45] benchmark of 3.0 and 8.0 for skewness and kurtosis, respectively.

Common method bias test: Armstrong and Overton [46] pointed out that addressing the problem of bias in research is important. Harman's single factor was used to test for CMB's presence or otherwise, as Podsakoff et al. proposed [47]. The result, which is 31.855, showed that CMB does not affect the data. Based on the result, no common method bias is found in the dataset.

Estimation of measurement and structural models
This section contains the results of item statistics, standardised estimates, validity, reliability scores, and confirmatory factor analyses (CFA) model fit. The estimated SEM is also presented in this section.

Validity and reliability of the instrument

Average variance extracted (AVE) establishes convergent validity as Fornell and Larcker [48] stipulated. The value should be greater than 0.5. The AVE of the variables: technology infrastructure, technology knowledge, technology applications, sustainable financial performance, sustainable environmental performance, and sustainable social performance are 0.609, 0.580, 0.698, 0.609, 0.583, and 0.653, respectively. The results revealed that the AVE of all the variables is above 0.5.

Composite reliability (CR) and Cronbach's alpha test were used to establish the reliability of the instrument. The CR ranged between 0.845 and 0.903, which is in line with Hair et al. [49] benchmark of 0.7. In line with Nunnally's [50] benchmark of 0.7, all the variables satisfied Cronbach's alpha condition as the results ranged between 0.838 and 0.904.

Confirmatory factor analyses

Table 2 shows that the standardised factor loading or estimates of the indicators on the various variables were all greater than 0.7 as recommended by Collier [44]. The overall goodness of fit of the model was evaluated using the model fit statistics such as CMIN/DF (1.779), NFI (0.884), RFI (0.865), IFI (0.945), TLI (0.936), CFI (0.945), and RMSEA (0.059). The results are within the acceptable range as stipulated by Bagozzi and Yi [51], and Hooper et al. [52].

The results in Table 3 show that technology infrastructure has a positive but non-significant impact on SF_Perf ($\beta = 0.147$, $t = 1.480$), SE_Perf ($\beta = 0.056$, $t = 0.622$), and SS_Perf ($\beta = 0.108$, $t = 1.209$). Table 3 further shows that technology knowledge has a positive and significant impact on SF_Perf ($\beta = 0.263$, $t = 2.574$), SE_Perf ($\beta = 0.215$, $t = 2.307$), and SS_Perf ($\beta = 0.249$, $t = 2.720$).

Table 2 Measurement model

Variable	Indicator	Mean	Estimate	C.R	AVE	Cronbach alpha	Composite reliability
Technology infrastructure	TNI1	4.18	0.814	***	0.609	0.885	0.886
	TNI2	4.09	0.808	13.438			
	TNI3	4.11	0.801	13.297			
	TNI4	4.20	0.700	11.191			
	TNI5	4.31	0.774	12.718			
Technology knowledge	TNK1	4.47	0.854	***	0.580	0.838	0.845
	TNK2	4.22	0.633	9.949			
	TNK3	4.47	0.714	11.579			
	TNK4	4.57	0.827	13.855			
Technology applications	TNA1	3.11	–	–	0.698	0.871	0.874
	TNA2	2.76	0.800	13.585			
	TNA3	2.87	0.855	14.607			
	TNA4	2.70	0.850	***			
Sustainable financial performance	SFP1	3.51	0.806	***	0.609	0.861	0.861
	SFP2	3.41	0.715	11.383			
	SFP3	3.49	0.757	12.208			
	SFP4	3.44	0.836	13.823			
Sustainable environmental performance	SEP1	3.56	0.768	***	0.583	0.864	0.848
	SEP2	3.54	0.706	11.208			
	SEP3	3.66	0.804	13.081			
	SEP4	3.62	0.773	12.469			
Sustainable social performance	SSP1	3.61	0.863	***	0.653	0.904	0.903
	SSP2	3.65	0.857	16.946			
	SSP3	3.81	0.774	14.262			
	SSP4	3.66	0.753	13.651			
	SSP5	3.71	0.785	14.563			

Model fit statistics
CMIN (χ^2) = 460.695, df = 259, CMIN/df = 1.779, NFI = 0.884, RFI = 0.865, IFI = 0.945, TLI = 0.936, CFI = 0.945, RMSEA = 0.059

Note: AVE = Average variance extracted; C.R. = critical ratio; TNA1 was deleted because the factor loading was < 0.5. ***Items constrained for identification purposes

Table 3 Estimated results of the structural model

Path	Standardized estimate	*t*-statistics	*p*-value	Decision
H_{1a}: Technology Infrastructure SF_Perf	0.147	1.480	0.139	Not supported
H_{1b}: Technology Infrastructure SE_Perf	0.056	0.622	0.534	Not supported
H_{1c}: Technology Infrastructure SS_Perf	0.108	1.209	0.227	Not supported
H_{2a}: Technology Knowledge SF_Perf	0.263	2.574	0.010	Supported
H_{2b}: Technology Knowledge SE_Perf	0.215	2.307	0.021	Supported
H_{2c}: Technology Knowledge SS_Perf	0.249	2.720	0.007	Supported
H_{3a}: Technology Applications SF_Perf	0.836	7.671	0.000	Supported
H_{3b}: Technology Applications SE_Perf	0.961	7.675	0.000	Supported
H_{3c}: Technology Applications SS_Perf	0.968	8.518	0.000	Supported

Squared multiple correlation (R^2)
Sustainable financial performance (SF_Perf) = 0.668; Sustainable environmental performance (SE_Perf) = 0.893; Sustainable social performance (SS_Perf) = 0.899

Model Fit Statistics
CMIN (χ^2) = 686.325, d*f* = 263, CMIN/d*f* = 2.610, NFI = 0.827, RFI = 0.802, IFI = 0.885, TLI = 0.868, CFI = 0.884, RMSEA = 0.077

Similarly, the relationship between technology applications and sustainable performance constructs [SF_Perf (β = 0.836, t = 7.671), SE_Perf (β = 0.961, t = 7.675) and SS_Perf (β = 0.968, t = 8.518)] are positive and statistically significant.

The squared multiple correlation, otherwise known as R^2 for SF_Perf, SE_Perf, and SS_Perf, are 0.668, 0.893, and 0.899, respectively, implying that the predictor variables jointly explain 66.8%, 89.3%, and 89.9% variations in sustainable financial performance sustainable environmental performance, and sustainable social performance, respectively. The overall goodness of fit of the model was evaluated using the model fit statistics such as CMIN/DF (2.610), NFI (0.827), RFI (0.802), IFI (0.885), TLI (0.868), CFI (0.884), and RMSEA (0.077). The results fall within the range stipulated by Bagozzi and Yi [51], and Hooper et al. [52].

Discussion

The study found that technology infrastructure has a positive but insignificant impact on sustainable performance constructs such as sustainable financial, environmental, and social performance. This outcome shows the relevance of technology infrastructure in promoting sustainable performance in the oil and gas sector are yet to be significantly felt. Nwankpa and Datta [38] found that today's business environment is shifting to big data analytics, cloud, mobile, and social media platform to constantly transform how organizations respond to changing business landscapes and environmental and social issues. Similarly, Perez-Lopez and Alegre [10] acknowledged digital technologies as driving innovations and reshaping business models by ushering in notable changes in business operations, processes, and value creation. With the deployment of appropriate technology infrastructure, Nwankpa and Roumani [14] emphasized that business operations can be scaled up to fit and integrate multiple business applications that enable organizational members to quickly access the right amounts of information at the right time in executing assigned tasks.

The study also found that technology knowledge significantly impacts sustainable performance. However, the relationship is negative. As García-Sánchez et al. [40] argue, technology knowledge represents the absorption capacity of the firm consisting of a set of organizational routines and processes by which organizations acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability. The technical knowledge of employees, which is the ability to find, integrate, and develop new technical knowledge and skills, is important for a firm to achieve competitive success. The knowledge is not only concerned with the degree to which the organization understands the capabilities of existing and emerging information technology but also the ability to internalize new information technology knowledge essential to gain competitive advantage. If this is lacking, the technology knowledge of the organization may not positively drive performance.

Finally, the study found that technology applications positively and significantly impact sustainable performance. As acknowledged by Tippins and Sohi [9], Perez-Lopez and Alegre [10], Rahim et al. [8], and Aduloju [53], companies' ability to deploy technologies in solving problems is more important than mere possession of technologies that cannot be used to gain knowledge about social and customers' needs. As found by Shahzad et al. [54], technology operations or applications remain the core internal capability of firms through which sustainability practices are assimilated, shared, and learnt. This is because the application of technologies increases firms' sensing capabilities, further stimulating their ability to generate value for stakeholders and promote sustainability [55].

Conclusion and recommendations

This paper confirmed the applicability of the dynamic capacities of firms occasioned by technology adoption and usage in enhancing the sustainable performance of oil and gas firms in the Niger Delta region of Nigeria. The paper concluded that investments in technology infrastructures are insufficient to enhance the region's sustainable financial, social, and environmental performance. The investments in technology knowledge and technology applications have commanded a superior performance in the three indicators (social, environmental, and financial) of sustainability. This suggests that the applications of acquired technology knowledge are critical in sustaining financial stability while addressing the region's social and environmental issues. These social and environmental issues include the prolonged oil spillage that is escalating floods, damaging air quality, killing fishes in the rivers, and degrading the soil nutrients in the region, making it difficult to grow crops in farmlands in the many parts of the region.

Based on the research outcome, the study recommends that oil and gas firms operating in the Niger Delta not only acquire relevant technology infrastructures but also continually employ, reward, and train individuals to absorb and utilize acquired technologies. This would help develop a standard for detecting, reporting, inspecting, auditing, and responding to the social and environmental problems in the regions.

Abbreviations

AMOS	Analysis of moment structures
AVE	Average variance extracted
BBC	British Broadcasting Corporations
CB-SEM	Covariance-based structural equation modelling
CFA	Confirmatory factor analyses
CMB	Common method bias
CR	Composite reliability
GHG	Greenhouse gases
IT	Information technology
NPDC	Nigerian Petroleum Development Company
SEM	Structural equation modelling
SPSS	Statistical Packages for Social Sciences
TBL	Triple bottom line

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Author contributions
OG, the first author, initiated the idea for the study. He drafted the introductory and literature review sections. He also drafted, administered, and retrieved the questionnaire used for the study. OG also vetted or proofread the entire manuscript after the completion of the study. SA, the second as well as the corresponding author, drafted the methodology section. He analysed and interpreted the data collected from the field work. SA also drafted the conclusion and recommendation section and harmonized the different sections of the paper in line with the Journal Template. All authors read and approved the final manuscript.

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Availability of data and materials
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The Ethic Committee comprising senior academics (Senior Lecturers, Associate Professors, and Professors) in the Department of Business Administration reviewed and approved the proposal for the study. Consent Letters were issued by the Department which were submitted to the selected organisations used for the study. The research participants were assured that their responses will be treated with utmost confidence and that any information supplied will be used for academic purposes only.

Consent for publication
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Competing interests
The authors declare that they have no competing interests.

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