Volume: 25, Issue: 1
Page: 210-228
2023

International Journal of Science and Business

Journal homepage: ijsab.com/ijsb

Information Technology Infrastructure and Organisational Sustainability of Petroleum Tank Farms in South-South, Nigeria

Thomas C. Okoisama & Karibo B. Bagshaw

Abstract

The examination assessed the connection between information technology infrastructure and organisational sustainability (with environmental sustainability and economic sustainability as proxies) of petroleum tank farms in South-South, Nigeria. The theory of technology-organisation-environment framework was the underlying theory and the underpinning philosophy is positivism. A cross-sectional survey approach was used, and questionnaire was used to collect primary data. The Krejcie & Morgan's formula was used to determine a sample size of 262, from a population of 820 key managers. The sample size was adjusted by 10% to 288 respondents, to provide for non-responses and outliers. The hypotheses were tested using the structural equation model, at 0.05 level of significance. The analyses showed that information technology infrastructure has positive significant relationship with the proxies of organisational sustainability. The investigation concludes that information technology infrastructure positively and significantly enhances organisational sustainability. This underscores the need for managers to recognize the pivotal role of information technology infrastructure in boosting environmental sustainability and economic sustainability. Therefore, Managers of petroleum tank farms should effectively provide their teams with IT support for collaborative work regardless of time and place. Also, Management of petroleum tank farms should put in place, appropriate technology that allows effective recording and reporting of outcome for people using their services and ensuring that the selection, implementation, use, maintenance and improvement of technological solution, is included in their organizations' strategic service planning.

IJSB
Accepted 10 July 2023
Published 20 July 2023
DOI: 10.58970/IJSB.2196

ISSN: 2520-4750 (Online) 2521-3040 (Print)

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Keywords: *Economic Sustainability, Environmental Sustainability, Information Technology Infrastructure, Organisational Sustainability, Petroleum Tank Farms.*

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1. Introduction

Petroleum tank farms are key assets of the downstream oil and gas business, often consisting of tankage and gantries for product discharge onto road tankers or barges. According to Akintayo (2017), Nigeria imports approximately 4.8 billion litres of petroleum products per quarter, and approximately 136,364 tankers with an average capacity of approximately 33,000 litres are required to transport the products from the petroleum tank farms to various parts of the country. The importance of organisational sustainability cannot be overstated. According to Ballinger (2011), the challenges of globalisation, calls for enhanced monitoring of businesses by external stakeholders, and the desire to reduce the number of corporate scandals have all contributed to the push for a more sustainable approach to business. According to Colbert and Kurucz (2007), sustainability is the capacity to keep the firm running. Hence, organisational sustainability lies at the heart of the cultural system's relationship structure (Lavanderos & Fiol, 2010). Another definition of organisational sustainability is the process through which a company efficiently manages its economic, environmental, and social components (Munck & Souza, 2009). Researchers have developed several indices of organisational sustainability. Hubbard (2009), for example, stated that the ability to fulfill stakeholder interests can be a true indicator of organisational sustainability (Elkington, 1999; Nicolăescu, Alpopi, & Zaharia, 2015; and Cella-De-Oliveira, 2015). However, this study uses environmental and economic sustainability as metrics of organisational sustainability. According to Morelli (2011), environmental sustainability is achieved when human society's needs are met without taxing the ability of ecosystems to regenerate the services necessary to meet those needs, and without our actions reducing biological diversity. According to Basiago (1999), an economically sustainable manufacturing system is one that can keep up with present consumption without compromising future needs. In their definition of economic sustainability, Stavins, Wagner, and Wagner (2003) write, "the preservation of present well-being through a focus on international equity, dynamic efficiency, and inter-temporal distributional equality." The environmental and economic consequences of insufficient organisational sustainability strategies in petroleum tank farm operations are essentially unquantifiable. Furthermore, studies have stated that many practitioners, both public and private, have only showed a very limited comprehension, resulting in the adoption of relatively poor methods for the implementation of important sustainability concepts in practice (Atkinson, 2008). As a result, considerable policy and practice changes are required to enhance the sustainability requirements and performance of constructed facilities (Van-Bueren & De-Jong, 2007). As a result, a number of existing policy frameworks for sustainable built environment initiatives focus an undue emphasis on substance at the expense of the procedures required to execute such rules (Van-Bueren & De-Jong, 2007). As a result, policies and assessment systems, as well as decision-making processes involving sustainability initiatives, are unable to integrate a meaningful socioeconomic sustainability benefit (Tadros, 2020; Itsekor, 2018; Ubong & Edwin, 2018; Oboh & Osuala, 2017; Enaravba, Izelu, Oreko & Emagbetere, 2016).

Scholars (Savitz & Weber, 2007; Maggi, 2006; Biggemann, Williams & Kro, 2014; Chen & Uzelac, 2015; Ross, 2017; Obradovic-Wochnik & Dodds, 2015) have suggested various organizational sustainability strategies such as eco-efficiency; management competences; competitiveness; product differentiation, adequate regulation and protection of the ecosystem. While several studies have looked into potential solutions to the issue of inadequate organisational sustainability, few have focused on the role that IT infrastructure plays. This study sets out to close that knowledge gap by assessing the interplay between petroleum tank farms in South South, Nigeria's IT infrastructure and their long-term viability as an organisation. Accordingly, the study's specific goals are to evaluate the association between IT infrastructure and environmental sustainability and IT infrastructure and economic

sustainability. On the basis of the above discussion, following hypotheses are made in the petroleum tank farms context as:

H1: Information technology infrastructure does not significantly relate to environmental sustainability.

H2: Information technology infrastructure does not significantly relate and economic sustainability.

2. LITERATURE REVIEW

2.1 Theoretical Review

T-The theories of technology, organisation, and environment provide the theoretical foundation for this investigation (Tornatzky & Fleischer, 1990; Tornatzky & Fleischer, 1990). A universal set of components may be found in the well-known O-E framework. Relevant contexts include organisational circumstances, business and organisational reconfiguration, and the industrial environment (Kowath & Choon, 2001). Technology, organisation, and environment are all interconnected, thus the term T-O-E (Gangwar, Date, & Raoot, 2014). According to Awa, Ukoha, and Emecheta (2016), there are several elements that influence whether or not a technology is adopted. The number and quality of existing technologies, the anticipated benefits, technical and organisational compatibility, complexity and learning curve, global visibility, and novelty are all important considerations in the design of a new technology. Previous research has shown that when a company expands, it becomes better able to take advantage of human capital quality, scale, and size-related difficulties including internal spare capacities and specialisation. The degree to which the company's management is centralised, formalised, and vertically differentiated is also reflected. Awa et al. (2016) state that factors like as competitive pressure, the preparedness of trade partners, sociocultural difficulties, government encouragement, and technical support infrastructures like availability to competent ICT consultants are examples of enablers and disablers that may affect an organization's operations. The Technology, Organisation, and Employees (T-O-E) framework is applicable to this study because it provides an explanation for adoption based on the variety of technologies available to the organisation (both internal and external), their relative perceived usefulness, their technical and organisational compatibility, and the level of complexity they entail.

2.2 Conceptual Review

Information Technology Infrastructure was adopted as a single predictor variable from Verma and Jayasimha (2014), while environmental and economic sustainability were adopted as measures of the criterion variables from Cella-De-Oliveira (2013) and Nicolaesal, Alpopi, and Zacharia (2015) respectively.

2.2.1 Information Technology Infrastructure

Dependable service for a business depends on its IT infrastructure, which consists of a number of parts and requires both technical and administrative expertise. Information technology infrastructure, as defined by Turban et al. (2007), entails the hardware, software, and management that keep an organization's computers running smoothly. Support services cover areas including operations, documentation, integration, and upkeep (Wali, 2013). Information technology infrastructure, as posited by Mckay and Brockway (1989), is the backbone of the information system function that is common to numerous departments and divisions. Duncan (1995) added that IT infrastructure is the "network of recognisable components" that supports the present and future of a company's operations. Computers, software, networks, and telecommunications systems, as well as databases and information processing programmes, are all examples of such materials cited by Broadbent and Weill (1997). According to Duncan

(1995), IT infrastructure is achieved when IT strategy, IT architecture, and IT personnel skills are all in sync with one another and with the goals of the company.

2.2.2 Organisational Sustainability

Organizational sustainability, as defined by Boudreau and Ramstad (2005), is the means by which a company meets present demands without jeopardising its ability to do so in the future. Yet, as Cella-De-Oliveira (2013) pointed out, when an organisation is subjected to outside forces, it may decide to take the first measures towards sustainability (legislation, consumer pressure, etc.). Each person and organisation has a responsibility to advance the common good, as defined by the concept of "holistic sustainability," which denotes the incorporation of all relevant factors into an enterprise in an effort to improve life and ensure its survival (Cella-de-Oliveira, 2012; 2013).

2.2.3 Environmental Sustainability

Ecological sustainability, which includes environmental sustainability, is the junction of these two concepts. According to Goodland (1995). A sustainable ecosystem is one where human civilization may thrive while yet respecting the natural biophysical constraints. The insufficiency for preserving sustainability is projected to increase more in the foreseeable future, as stated by Nicolăescu, Alpopi, and Zaharia (2015). A sustainable ecosystem endures for as long as people remain within the planet's regenerative and absorptive capability.

2.2.4 Economic Sustainability

To be economically sustainable means to "maximise long-term monetary benefit while minimising costs associated with resource depletion" (Abubakar, 2014). To survive in the long run, businesses need to think about how their actions will affect more than just their bottom line (Daly, 1991). Basiago (1999) argues that the supply of resources of nature that could be exploited as inputs is crucial to the sustainability of economic progress.

2.3 Empirical Review

Many researchers have used empirical methods to examine the interplay between the various concepts. Continuous innovation as a crucial facilitator of sustainable business practises was studied by Madonsela, Mukwakungu, and Mbohwa (2017), for instance. The essay proposes a reasonable strategy for implementing sustainable business practises from the perspective of the global market. One of South Africa's main steel producing companies was the focus of a single case study conducted using a qualitative research methodology. Thirteen professionals in the field of ICT were assessed. Qualitative content analysis was used to examine the data. Sustainable business practises, according to the findings, rely on ongoing innovation rather than cutting-edge industrial technologies. Laura (1999) did similar research, looking into how advances in manufacturing technology have altered the traditional maintenance function. The study uses information from 180 factories and the opinions of 222 factory managers and maintenance directors to draw conclusions on the relationship between high-tech manufacturing and JIT. The study established that just-in-time was linked to a greater involvement of operators in performing simple maintenance tasks, computerised maintenance management systems, worker education, expert maintenance personnel, and preventative maintenance all increased as industrial technology progressed. On the other side, Simatupang and Widjaja (2012) looked at the practise of innovation capability benchmarking in the digital sector. This article makes use of the dynamic capacity theory to analyse the creative digital content industry in Indonesia from the perspective of innovation strategies. Five Indonesian digital content companies were interviewed face-to-face to prove they have the potential to acquire and develop ideas into commercial items before releasing them to the public.

Organisational structures that are not too rigid allow for employees to learn on the job and adapt to new technologies without being stifled by complex bureaucracy, which has been found to be a major factor in a company's ability to innovate.

3. RESEARCH METHODS

The examination adopted the cross-sectional design informed by positivist philosophy. Information obtained from the Nigerian Midstream and Downstream Petroleum Regulatory Authority (https://www.nmdpra.gov.ng) indicates that 37 of Nigeria's 124 petroleum tank farms are situated in the country's southern region. In South-South Nigeria, the Independent Petroleum Products Importers (IPPIs) own 29 of the petroleum tank farms, while NNPC/PPMC and major marketers each own 3 and 5 farms, respectively. The 29 petroleum tank farms in South-South Nigeria which are owned by IPPI members were the primary subject of this research. Members of the Independent Petroleum Products Importers, who control all 29 of the petroleum tank farms in South-South Nigeria, make up this demographic. The states of Rivers, Akwa Ibom, Delta, and Cross River in South-South Nigeria are home to these tank farms. A total of 820 managers and executives from South-South Nigeria's 29 petroleum tank farms belonging to associates of the Independent Petroleum Products Importers make up the sample population. Krejcie and Morgan's algorithm yielded an initial sample size of 262, which was then raised by 10% to allow for non-responses, for a total of 288. We utilised Bowley's technique to distribute samples proportionally between tank farms, and used simple random sampling to choose the actual samples. This made certain that every individual in the entire population had a fair chance to be chosen for the study. Only 230 valid surveys were gathered and analysed using Structural Equation Modelling to test the hypotheses at the 0.05 significance level.

4. DATA PRESENTATION AND ANALYSIS OF DATA

Table 1: Questionnaire Distribution

Number of Questionnaire Distributed	235	100%
Number of Questionnaire Retrieved	217	92.3%
Number of Usable Questionnaire	202	86.0%

There were 288 total copies of the instrument handed out; 241 were brought back for reuse (or 83.68%), whereas 47 were lost (or 16.32%). Only 11 out of 241 copies (3.82%) were considered not seful due to incomplete responses, while the remaining 230 copies (79.86%) were found to be complete and useful.

3.1 Assessment of Normality:

Table 2: Normality Statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
INFORMATION TECHNOLOGY INFRASTRUCTURE	230	6	30	21.00	5.274	-.342	.160	-.456	.320
ENVIRONMENTAL SUSTAINABILITY	230	9	35	20.28	5.321	.160	.160	-.457	.320
ECONOMIC SUSTIANABILITY	230	6	30	19.69	5.287	-.234	.160	-.439	.320
Valid N (listwise)	230								

Source: Researcher's Desk, SPSS 25.0 Outputs 2023.

Each item in the dataset was found to follow a normal distribution with a skewness of +1.0 and a standard error of 0.160, and a kurtosis of +1.0 and a standard error of 0.320, as recommended

by the many suggestions. The mean, standard deviation, skewness, and kurtosis of each construct are shown in Table 2. This shows that the data were not significantly out of normalcy.

Table 3: Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
INFORMATION TECHNOLOGY INFRASTRUCTURE	Based on Mean	1.589	4	225	.178
	Based on Median	1.661	4	225	.160
	Based on Median and with adjusted df	1.661	4	221.218	.160
	Based on trimmed mean	1.597	4	225	.176
ENVIRONMENTAL SUSTAINABILITY	Based on Mean	.537	4	225	.709
	Based on Median	.502	4	225	.735
	Based on Median and with adjusted df	.502	4	221.747	.735
	Based on trimmed mean	.544	4	225	.704
ECONOMIC SUSTIANABILITY	Based on Mean	1.139	4	225	.339
	Based on Median	1.142	4	225	.338
	Based on Median and with adjusted df	1.142	4	171.374	.339
	Based on trimmed mean	1.076	4	225	.369

Source: Researcher's Desk, SPSS 25.0 Outputs 2023

3.3 Assessment of Homogeneity of Variance: Levene's test was run in SPSS 25.0 to check for variance homogeneity (see Tables 3) using the respondents' ages as a non-metric variable on a one-way ANOVA. The findings indicated that the data variance was constant across all age groups, suggesting that the components of the proposed model fluctuated at the same rate across all age groups. Both the analysis of variance and Levene's test concluded that none of the latent variables were statistically significant ($p>0.05$), hence the assumption of variance homogeneity was not violated.

Table 4: Descriptive Statistics for Information Technology Infrastructure

	N	Minimum	Maximum	Mean	Std. Deviation
Our team is provided with IT support for collaborative work regardless of time and place.	230	1	5	3.48	1.340
Our team is provided with IT support for communicating among other teams.	230	1	5	3.84	1.179
Our team is provided with IT support for searching and accessing necessary information.	230	1	5	3.47	1.294
Our team is provided with IT support for systematic storing.	230	1	5	3.53	1.273
Our organization has appropriate technology that allows us to effectively record and report on outcome for people using our services.	230	1	5	3.63	1.301
The selection, implementation, use, maintenance and improvement of technological solution, is included in our organizations strategic service planning.	230	1	5	3.05	1.381
Valid N (listwise)	230				

Source: Researcher's Desk, SPSS 25.0 Outputs 2023.

The distribution of IT facilities is shown in Table 4. There are a number of skills and experiences that must be combined in order to give reliable support to the business. The central tendency of the indicators emphasises the vast and consequential variable distributions. - Respondents mostly agree with the statement "Our team receives IT assistance for collaborative work regardless of time or location" (3.48 on average, 1.34 standard deviation), but not completely. The statement, "Our team receives IT assistance for communication with other teams," was given a mean score of 3.84 and a standard deviation of 1.18, indicating that the great majority of respondents agreed with it.

Moderate and statistically significant (mean = 3.47, s.d. = 1.29), indicating that the vast majority of respondents believe the item to be true.ITI3: Our team has access to technological resources to help with information gathering and analysis. ITI4: Our team is provided with IT support for systematic storage is another largely accepted statement (mean = 3.53, SD=1.1.27). The high and statistically significant mean of ITI5 (mean = 3.63, SD=1.30) indicates that most respondents find this statement to be true. With the help of our advanced technology, we are able to keep track of the outcomes for all of our clients. The majority of respondents (mean = 3.05, SD=1.08) give the statement a positive evaluation, as shown by the moderate and significant mean of ITI6. ITI6: Our company's strategic service planning incorporates the selection, installation, usage, maintenance, and enhancement of technical solutions. Information technology data from the replies shows that all six markers for the latent construct are strongly expressed.

Table 5: Descriptive Statistics Environmental Sustainability

	N	Minimum	Maximum	Mean	Std. Deviation
My organization makes public its environmental and social objectives.	230	1	5	2.83	1.194
My organization usually analyzes sustainability-related risks and chances with stakeholders.	230	1	5	2.88	1.156
Environmental sustainability is embedded in the corporate strategy of my organization.	230	1	5	2.80	1.126
In our firm, there is a mechanism for the prevention of pollution and contamination by environmentally hazardous substances e.g. PMS, AGO, DPK.	230	1	5	2.73	1.154
In our company, environmentally hazardous substances management policy is clear.	230	1	5	3.06	1.390
My company has a programme for monitoring our current level of environmental performance.	230	1	5	3.11	1.385
In my company, there is an appointed person with responsibility for environmental matters.	230	1	5	2.86	1.114
Valid N (listwise)	230				

Source: SPSS 25.0 Outputs 2023.

Table 5 shows the statistical distribution of Environmental Sustainability metrics. The first indicator of organisational sustainability is the degree to which human society is self-sufficient in meeting its requirements without impairing the capacity of ecosystems to renew the services required to do so or causing a loss of biological variety. The data suggest that the variable distributions are roughly normal and quite large. The statement "ES1: My organisation makes its environmental and social goals known" has a moderate and substantial mean (mean = 2.83, SD = 1.19), indicating that respondents agree with the statement. The vast majority of respondents agreed with the statement ES2: My company often examines risks and opportunities connected to sustainability with stakeholders (mean = 2.88, SD = 1.16). Similarly, ES3: Environmental sustainability is entrenched in my organization's business plan had strong support from responders (mean = 2.80, standard deviation = 1.13). The moderate and significant mean (mean = 2.73, SD = 1.15) for ES4: Our company has a system in place to avoid pollution and contamination from chemicals like PMS, AGO, and DPK, which are harmful to the environment. means that the vast majority of people agree with this assertion. The majority of respondents (mean = 3.06, SD = 1.39) believe that our organisation has a well-defined stance on ES5 compounds that pose a threat to the environment. In ES6, respondents indicated moderate and considerable agreement with the statement, "My organisation has a strategy in place to monitor our existing level of environmental performance" (mean = 3.11, SD=1.39). The majority of respondents feel the statement truly reflects their opinions, as indicated by the moderate but sizable mean (mean = 2.86, SD = 1.11) for ES7: At my business, there is an allocated person with responsibility for environmental problems. All seven statement items

describing respondents' and their companies' environmental sustainability practises are highly evident in the data, suggesting that the latent construct is operational. This proves that the study accurately depicts environmental sustainability.

Table 6: Descriptive Statistics for Economic Sustainability

	N	Minimum	Maximum	Mean	Std.
My organization honours the taxes, tributes, fees, and other government contributions that enhances economic sustainability.	230	1	5	2.95	1.155
My organization does not practice disloyal competition, trust, monopoly or dumping on economic sustainability issues.	230	1	5	3.07	1.113
My organization‘s economic sustainability decisions are taken based on a formal strategic planning that encompasses the organization as a whole, made by professionals.	230	1	5	3.44	1.191
My organization focused on risk management plans and evaluations, My organization focused on risk management plans and evaluations, with concern of the company's capacity to honour financial commitment with collaborators and shareholders.	230	1	5	3.55	1.224
My company has restructuring plans in case of exceptional events (economic market crash, natural phenomena, etc.).	230	1	5	3.12	1.392
My organisation is punctual in the payment of salaries, benefits, and contracts with suppliers and other partners.	230	1	5	3.56	1.165
Valid N (listwise)	230				

Source: Researcher’s Desk, SPSS 25.0 Outputs 2023.

The breakdown of Economic Sustainability is seen in Table 6. Producing products and services at current consumption levels without compromising future potential is a second sign of a sustainable firm. The study of the indicators shows that their mean values are often high. With a standard deviation of 1.15, the mean level of agreement with the statement "my organisation honours taxes, tributes, fees, and other government payments that improve economic sustainability" (ECS1) is 2.95, and the average level of agreement is also 2.95. For ECS2: “My organisation does not participate in dishonest competition, trust, monopoly, or dumping for the sake of economic sustainability,” the vast majority of respondents are in agreement with the statement, as demonstrated by a large and statistically significant mean (mean =3.07, SD = 1.11). This shows that the majority of respondents agree with the statement. The majority of respondents, with a mean score of 3.44 and a standard deviation of 1.19, are in agreement with ECS3's position that choices on economic sustainability should be made through formal, enterprise-wide strategic planning by experienced specialists. ECS4: “My organisation was concerned about the company's ability to follow financial agreements with collaborators and shareholders, therefore we concentrated on risk management strategies and evaluations.” The fact that this has a substantial and evident mean (the mean is 3.55, and the standard deviation is 1.22), which indicates that the majority of respondents agree with the statement, and they are concerned about the capacity of their organisation to follow such obligations, indicates that this has a large and obvious mean. The majority of respondents, consisting of 3.12 points out of a possible 5, are in agreement with the statement "my company has restructuring plans in case of exceptional events" (ECS5). A mere 1.39 is the value of the standard deviation. For ECS6, the mean level of agreement with the statement that "my company is punctual in payment of salaries, benefits, and contracts with suppliers and other partners" was relatively significant (mean = 3.56, standard deviation = 1.17). Given this reality, most respondents agree that we need a production system that can keep up with present needs without compromising those of the future.

3.4 Measurement Model

The measurement model which rides on the common factor model is represented by: yj = λj1 ŋ1 + λj2 ŋ2 + . . . + λjmŋm + εj; where yj represents the j the of p indicators obtained from a sample of n independent subjects, λjm represents the factor loading relating variable j to the mth factor ŋ, and εj represents the variance that is unique to indicator yj and is independent of all ŋs and all other εs (Ukoha, 2010). To check if a model provides a good fit to the data, the goodness of fit indices are RMSEA (0.6), SRMR (0.8), CFI (0.95), TLI (0.95), GFI (0.90), NFI (0.95), PCLOSE (0.5), and AGFI (0.90), as recommended by Byrne (2013). Root Mean Squared Error of Approximation, Comparative Fit Index, Turker-Lewis Index, Goodness-of-Fit Index, Adjusted Goodness-of-Fit Index, Standardised Root Mean Residual, Normed Fit Index, Probability of Close Fit, and Normed Fit Index all play roles in this expression. Parameter estimates are best performed using a factor loading (Standardised regression weight) of 0.5 or greater (Byrne, 2006; Ukoha, 2010).

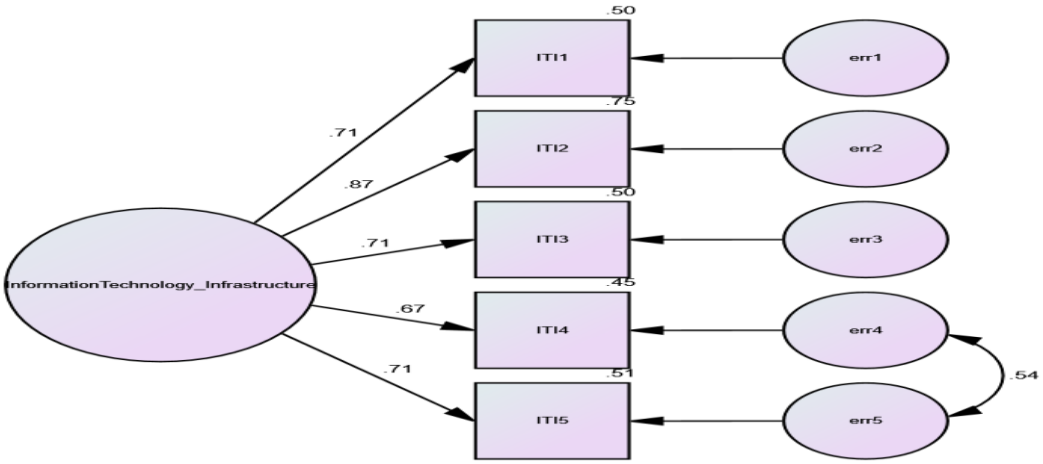

Figure 1: Modified Measurement Model of Information Technology Infrastructure

Source: Amos 24.0 output on research data, 2023

Table 7: Modified Measurement Model Analysis of Information Technology Infrastructure

Model	Chi-Square(df), Significance	NFI	TLI	CFI	RMSEA	Variable	Factor Loading Estimates	Error VAR
Information Technology Infrastructure	(4df) =19.511, P=0.001	0.967	0.932	0.973	0.130	ITI1	0.711	0.50
						ITI2	0.782	0.75
						ITI3	0.714	0.50
						ITI4	0.674	0.45
						ITI5	0.713	0.51
						ITI6	deleted	-

Source: Amos 24.0 output on research data, 2023

In order to determine if the model was a good match, we looked to (1) Hu and Bentler (1999) and their criteria for a good fit. RMSEA (0.6), CFI (0.95), TLI (0.95), PCLOSE (0.5), and NFI (0.95) are some of the indices given by Hair (2006) to show appropriate fit. There was a CFI>0.90, AGFI>0.80, and RMSEA0.08. Due to the variety of information they provide, several indices were used to assess the quality of a model's fit, including absolute fit, parsimony correction, and comparative fit. Combining these metrics allows for a more thorough and conservative evaluation of the proposed solution. Byrne (2006) states that in order to obtain reliable parameter estimates, factor loading (Standardised regression weight) must be higher than 0.5 and, ideally, more than 0.7. The error variances, factor loading estimates, and goodness-of-fit indices are all summarised in Table 1.7. Removing ITI6 and adding a covariance between the error terms between err4 and err5 considerably improved the fit to the data for the one-factor model (chi-square (4df)=19.511, 2/df=4.878, p=0.000, RMSEA=0.130, CFI=0.973, NFI=0.967, and TLI=0.932). Estimates of the weights assigned to each indication suggest that the other five have a strong correlation with the latent component representing IT infrastructure. For indicators ITI1-ITI5, the factor loadings were 0.711, 0.782, 0.714, 0.674, and 0.713, and the error variances ranged from 0.50 to 0.75. These standards provide credence to the claim that they are reliable markers of IT infrastructure development.

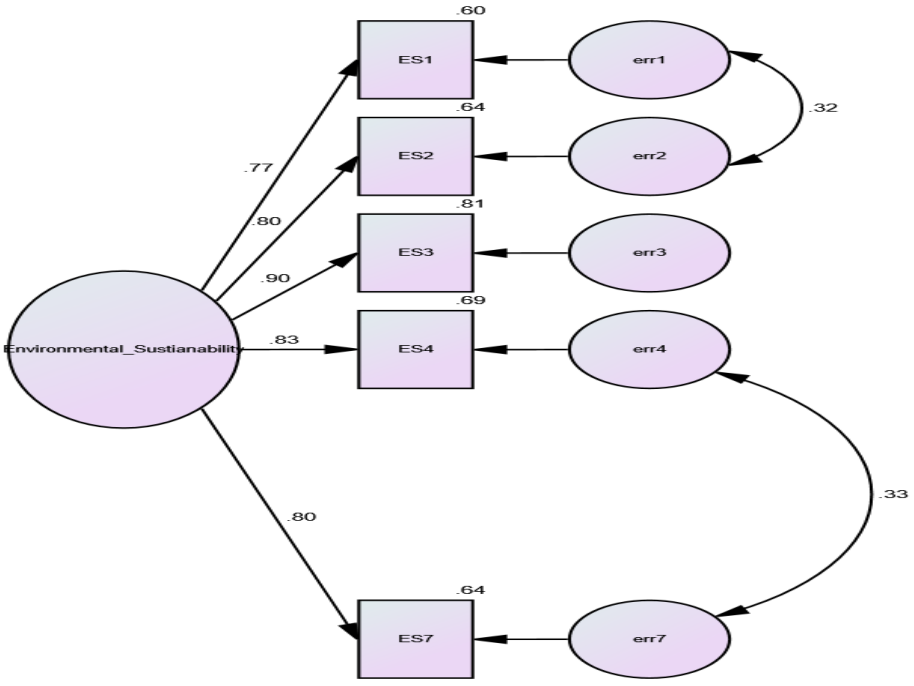

Figure 2: Modified Measurement Model of Environmental Sustainability
Source: Amos 24.0 output on research data, 2023

Table 8: Modified Measurement Model Analysis of Environmental Sustainability

Model	Chi-Square(df), Significance	χ^2/df	NFI	TLI	CFI	RMSEA	Variable	Factor Loading Estimates	Error VAR
Environmental Sustainability	(3df) =5.228 P=0.156	1.743	0.994	0.991	0.997	0.057	ES1	0.774	0.60
							ES2	0.802	0.64
							ES3	0.901	0.81
							ES4	0.833	0.69
							ES5	deleted	-
							ES6	deleted	-
							ES7	0.797	0.64

Source: Amos 24.0 output on research data, 2023

Eliminating ES5 and ES6 led to an increase in the factor loadings of 0.795, 0.820, 0.875, 0.859, and 0.828 for ES1, ES2, ES3, ES4, and ES7, respectively. The model's fit to the data is poor, with a chi-square (5df) = 42.630, a 22 (df) = 8.526, a p = 0.000, an RMSEA (squared) = 0.181, a CFI (squared) = 0.955, an NFI (squared) = 0.949, and a TLI (squared) = 0.909. Goodness-of-fit indices were enhanced by inserting coveriances between err1 and err2 and err4 and err7, as seen in Figure 2. The results of the analysis showed that a one-factor model provided a satisfactory fit to the data (chi-square (3df)=5.228, 2/df=1.743, p=0.000, RMSEA=0.057, CFI=0.997, NFI=0.994, and TLI=0.991), with the model producing significant estimates of 0.774, 0.802, 0.901, 0.833, and 0.797 for items ES1-ES4. When examined at random, all standardised parameters demonstrated statistical significance. According to the idea, these numbers accurately reflect environmental sustainability.

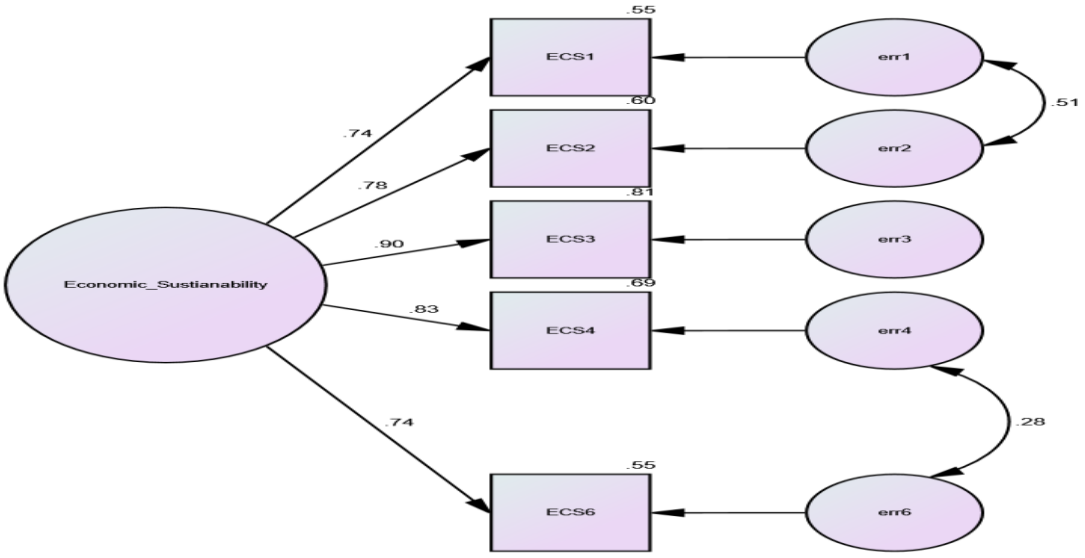

Figure 3: Modified Measurement Model of Economic Sustainability
Source: Amos 24.0 output on research data, 2023

Table 9: Modified Measurement Model Analysis of Economic Sustainability

Model	Chi-Square(df), Significance	χ^2/df	NFI	TLI	CFI	RMSEA	Variable	Factor Loading Estimates	Error VAR
Economic Sustainability	(5df) =67.559 P=0.000	7.504	0.915	0.875	0.925	0.169	ECS1	0.744	0.55
							ECS2	0.776	0.60
							ECS3	0.901	0.81
							ECS4	0.830	0.69
							ECS5	deleted	-
							ECS6	0.744	0.55

Source: Amos 24.0 output on research data, 2023

Goodness-of-fit indices, estimate values, and error variances are all summarised in Table 9. One-factor model goodness of fit was subpar (RMSEA=0.169, CFI=0.923, NFI=0.998, and TLI=0.875; chi-square (9df)=67.559, 2/df=7.504, p=0.000, chi-square = 0.000, 2/df=7.504, p=0.000). The factor loadings were 0.806, 0.827, 0.863, 0.835, 0.061, and 0.761, while the error variances were 0.65, 0.68, 0.74, 0.70, 0.00, and 0.58 for indicators ECSL1-CL6. Because of its weak loading strength, the ECS5 indicator was taken out of service. The fit to the first order measurement model was enhanced by including a covariance between the error components for ECS4 and ECS6 (chi-square (3df)=1.435, RMSEA=0.000, CFI=1.000, NFI=0.998, and TLI=1.007). The five indices and the latent component measuring economic sustainability were shown to be statistically related (new estimates: r=0.744, r=0.776, r=0.901, r=0.830, and r=0.744).

Table 10: Correlations and Average Variance Extracted

Variable	ITI	ES	ECS	AVE	Sq. Root of AVE
ITI	**1.0**	0.362	0.391	**0.518**	**0.720**
ES	0.362	**1.0**	0.641	**0.698**	**0.836**
ECS	0.391	0.641	**1.0**	**0.642**	**0.801**

Where: ITI= information technology infrastructure, ES= environmental sustainability, ECS= economic sustainability, AVE= average variance extracted, Sq. Root of AVE= square root of average variance extracted.
Correlation is significant at the 0.01 level (2-tailed).

Source: Research data, 2023

3.4.1 Convergent Validity

Over-identification occurs across all models since no degrees of freedom are zero. According to Tables 1.10, all variables had AVE values higher than the Fornell and Larcker (1981) suggested threshold of 0.50. Since the AVE is more than 0.5 and the standardised estimates are greater than 0.7, it is necessary and sufficient to infer that the model contains evidence of convergent validity.

3.4.2 Discriminant Validity

Using the "square root of AVE of each construct must be greater than its correlations with other constructs" criterion proposed by Fornell and Larcker (1981), the model demonstrates Discriminant validity.

3.5 Structural Model

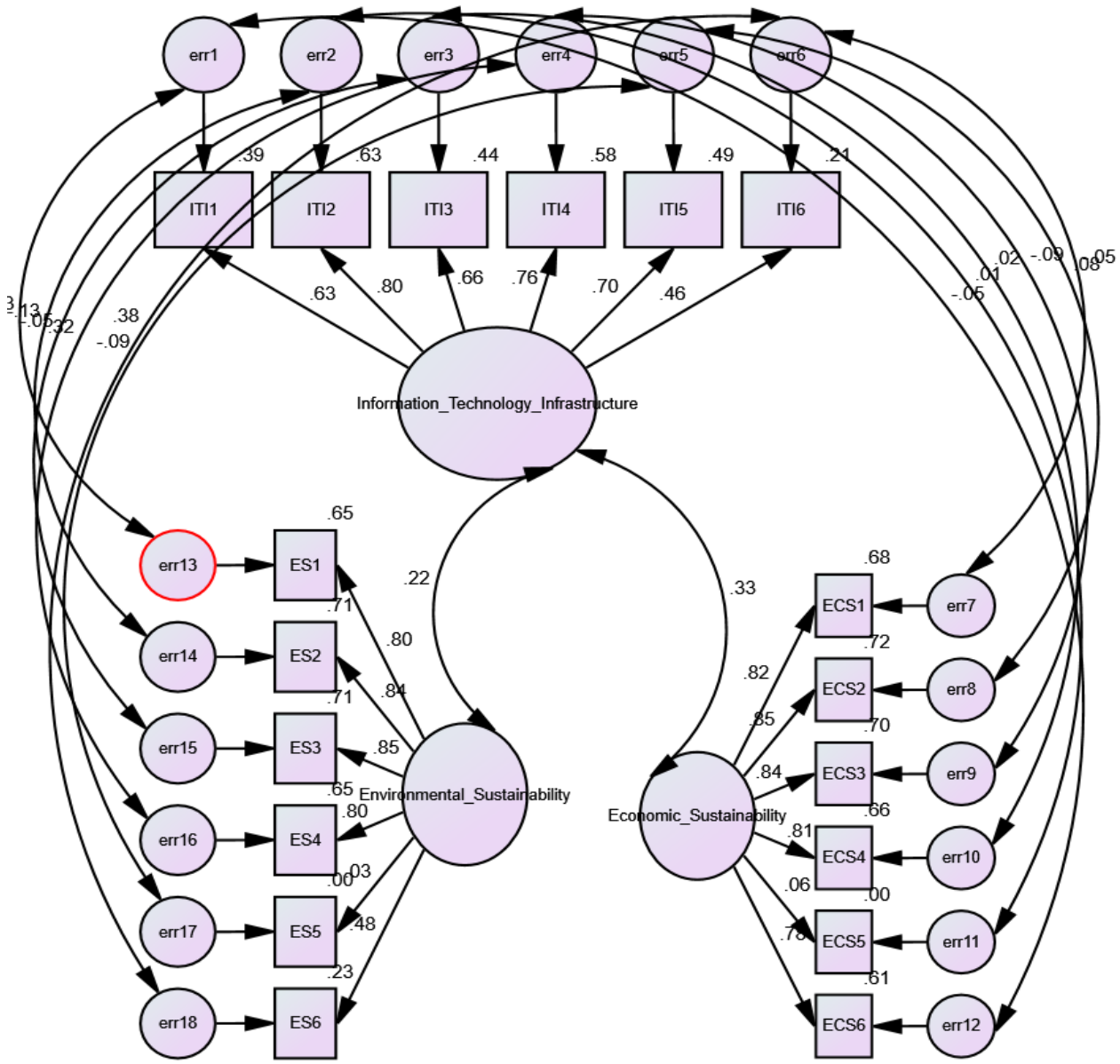

Figure 1.4 Structural Equation Model (linking the hypotheses)
Source: Amos 24.0 output on research data, 2023
The model is recursive.

Table 11: Test of Hypotheses

S/N	Mediation Stage	Hypotheses	Standardized Estimate (Beta value) ≥ 0.7	Critical Ratio (C.R) the t-value) ≥ 1.96	P-value < 0.05	Remark	Decision
1	ITI →ES (Hypothesis 1)	There is no significant relationship between information technology infrastructure and environmental sustainability.	0.552	3.002	0.003	Positive and Significant	Not supported
2	ITI →ECS (Hypothesis 2)	There is no significant relationship between information technology infrastructure and economic sustainability.	0.604	4.221	0.001	Positive and Significant	Not Supported

Source: Amos 24.0 output on research data, 2023

3.6 Interpretation of Results (Inferential Analysis)

The first hypothesis (Ho:1) indicates that IT infrastructure does not significantly correlate with environmental sustainability. However, as shown in Table 1.9, there is a positive and statistically significant relationship between the sustainability of petroleum tank farms in South-South Nigeria and their investment in IT infrastructure (β=0.552, C.R=3.002, p=0.003). Therefore, Ho:1 was rejected, and the alternate hypothesis is accepted. According to the findings, the degree to which petroleum tank farms in Nigeria's South-South area are environmentally sustainable is strongly correlated with their level of investment in information technology infrastructure. Statistics show that a boost in IT infrastructure is associated with a 55.2% improvement in ecological sustainability. Therefore, a system to prevent pollution and environmental degradation will be in place once management commits to delivering state-of-the-art information technology infrastructure. There is a statistically significant difference between the regression weight for IT infrastructure in predicting environmental sustainability and zero. The second hypothesis (Ho:2) states that IT infrastructure does not significantly correlate with long-term economic viability. On the other hand, as shown in Table 1.9, there is a positive and statistically significant correlation between the availability of IT infrastructure and the long-term financial health of South-South Nigeria's petroleum tank farms (β=0.604, C.R=4.221, p=0.001). Therefore, Ho:2 was disproved, and Ho:1 is now the preferred explanation. This indicates that petroleum tank farms can achieve economic sustainability by using a state-of-the-art IT system. Statistics show that a 60.4% improvement in economic sustainability may be attained for every 1 unit increase in IT infrastructure. To ensure the firm can meet its financial obligations to partners and shareholders, management will prioritise risk management plans and assessments as they work to build up a solid IT infrastructure.

3.7 Discussion of Findings: The study's overarching goal is to learn how the IT infrastructure of petroleum tank farms in South-South Nigeria affects the sustainability of the organisations themselves, as evaluated by environmental and economic factors. The T-O-E Framework (Tornatzky & Fleischer, 1990) provided the theoretical underpinnings for the research.

3.7.1 Relationship between Information Technology Infrastructure and Environmental Sustainability

The first defined objective (Ho:1) was to look into the connection between IT infrastructure and environmental sustainability. The result contradicted the hypothesis. It demonstrates that the environmental sustainability of petroleum tank farms in South South, Nigeria is positively and significantly correlated with investments in IT infrastructure. This shows that greener

practises may be supported by a more sophisticated IT infrastructure. Consistent with this finding is the analysis of benchmarking of innovation capability in the digital industry by Simatupang and Widjaja (2012), who discovered that the quality of a company's human resources is primarily what determines its ability to innovate, so long as the workforce is open to and capable of continuously learning and adapting to technological trends. This result lends credence to the T-O-E Framework's (Tornatzky & Fleischer, 1990) theory of adoption, which takes into account a firm's technological options, their compatibility with one another from a technical and organisational standpoint, and the challenge of putting them into practise.

3.7.2 Relationship between Information Technology Infrastructure and Economic Sustainability

This question, "What is the relationship between IT infrastructure and economic sustainability?" is encapsulated in the second hypothesis, Ho:2. The data analysis proved that the theory was incorrect. The findings demonstrate a robust and statistically significant correlation between South-South Nigeria's petroleum tank farms' economic viability and the region's underlying information technology infrastructure. This data points to a correlation between a solid IT infrastructure and sustained economic growth. This lends credence to the findings of Laura (1999), who found that the usage of computerised maintenance management systems, staff training, professional maintenance employees, and preventative maintenance all increased in tandem with the adoption of state-of-the-art manufacturing equipment. This result lends credence to the T-O-E (Technology-Organisation-Environment) paradigm (Tornatzky & Fleischer, 1990), which postulates that three distinct factors within a company's environment influence the adoption and implementation of innovations; thus business and organisational restructuring, technological progress, and general market and industry shifts (Kowath & Choon, 2001; Kauffman & Walden, 2001).

3.8 Conclusion and Recommendations:

The study concludes that information technology infrastructure positively and significantly enhances organisational sustainability. This emphasises the significance of IT infrastructure in promoting environmental and economic sustainability, and the necessity for management to realise this fact. Managers of petroleum tank farms should provide their teams with the necessary information technology resources to allow them to efficiently collaborate at any time and in any location. More so, petroleum tank farm management should also include the selection, implementation, use, maintenance, and improvement of technological solutions as part of their strategic service planning and use this technology to effectively record and report outcomes for those who use their services.

Contributions to knowledge

The findings of this study lends support to the T-O-E Framework, via the empirical evaluation of a model that quantifies the close structural relationship between IT infrastructure and long-term business viability. The findings from the study enrich decision making on requisite ways of improving the environment and reducing the economic burden of petroleum tank farm operations.

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Cite this article:

Thomas C. Okoisama & Karibo B. Bagshaw (2023). Information Technology Infrastructure and Organisational Sustainability of Petroleum Tank Farms in South-South, Nigeria. *International Journal of Science and Business, 25*(1), 210-228. doi: https://doi.org/10.58970/IJSB.2196

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