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Unleashing work engagement: Sighting the influence of technology self-efficacy and the mediating role of ICT adoption

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Abstract The study aims to investigate the influence of technology self-efficacy on work engagement, with a specific focus on the mediating effect of ICT adoption in tertiary higher institutions in Nigerian public universities. Using a sample of 264 academic staff from the selected Universities in southwest Nigeria, data was collected through systematic random sampling measures. Structural equation modelling was employed to analyse the proposed relationships. The findings indicate a significant positive relationship between technology self-efficacy and work engagement, suggesting that individuals with higher levels of technology self-efficacy tend to exhibit greater work engagement. Moreover, the study reveals that ICT plays a mediating role in the relationship between technology self-efficacy and work engagement. Specifically, ICT adoption completely mediates the positive association between technology self-efficacy and work engagement. These results emphasize the importance of technology self-efficacy in fostering work engagement, with ICT serving as a significant mechanism through which this relationship is facilitated. Universities in Nigeria can promote work engagement by developing employees' technology self-efficacy through training programs, providing user-friendly ICT tools and support, and encouraging a technologically empowering work environment. The implications of this research highlight the need for organizations to recognize the role of technology self-efficacy and ICT adoption in enhancing work engagement. By empowering academic staff with the necessary technological skills and resources, Universities can create an environment that nurtures their engagement and maximizes their productivity. Further research may explore additional mediators or moderators that influence the relationship between technology self-efficacy, ICT, and work engagement.

Keywords: technology self-efficacy, ICT adoption, work engagement

1. Introduction

The rapid development of technology has resulted in significant changes in the workplace, altering how employees perform their duties and interact with their work environment (Bertello et al, 2021; Castro 2019). Employees are more likely to stay with a company and put in extra effort if they enjoy what they do (Bibi et al 2018). According to Gallup (2023), only 13.65% of employees in Nigeria are engaged, while 74.24% are not engaged and 12.12% are actively disengaged in the year 2020, 2021, and 2022. Demoralized workers are common because they lack the resources necessary to fully immerse themselves in the tasks at hand (Onyekwulunne 2020; Bellandi et al 2021; Karatepe et al 2018).

Many scholars have recently defined work engagement through main viewpoints based on organizations and institutions with various definitions (Lyu and Fan 2020; Banerjee et al 2020; Ogbonnaya et al 2017). Work engagement is a psychological condition defined by energy, dedication, and immersion (Agarwal et al 2020). Furthermore, Jaharuddin and Zainol (2019) state that "work engagement is a common term but has not been comprehensively defined in industrial, human resources management, and organizational psychology." Using the word involvement in all elements of leadership and literature revealed various labels that were used interchangeably. Work engagement, role engagement, and personal engagement are all terms that can be used to describe how people feel about their jobs (Jaharuddin and Zainol 2019; Nikolova et al 2019; Wang et al 2019; Tsaur et al 2019; Fletcher 2019; Park et al 2019; Tian and Zhang 2020).

Organizational and tertiary institution skill requirements are always evolving. Researchers investigated new (Technology) and how it is used in lecture hall activities (Scherer and Siddiq 2015), and an important set of these abilities is linked to understanding a concept known as technological self-efficacy for teaching. In this sense, technology and ICT adoption by the global workforce is essential to involve academics in classroom delivery and teaching. Higher education employees are burdened with the required obligation due to inadequate facilities, infrastructure, and other faults.

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Furthermore, their relationships with students will have an impact on their ability to contribute meaningfully to organizations and society at large, both mentally and ethically (Jena and Pradhan 2017; Castro 2019).

Faculty members are the only ones who are knowledgeable and skilled teachers, researchers, and innovators who are actively engaged and committed to their teaching work. Student interaction with institution workers promotes academic engagement (Rojaz-Mendez 2009). Some scholars propose that ICT is the skills that enable individuals to use computers and other technology to achieve a wide variety/range of work-related and individual goals in the workplace (Hua et al 2020; Kozanoglu and Abedin 2020). It leads to staff involvement rather than issue strategy systems (Wang et al 2020; Cooke et al 2019; Victor and Hoole 2017; Costantini et al 2017; Cesário and Chambel 2017; van Woerkom et al 2016), and for maximum efficiency, a company's business strategy should complement its organisational setup (Saidia et al 2021).

The term technology self-efficacy (TSE) is a construct developed by Bandura (1982) from the theory Social Cognitive Theory SCT. Technology self-efficacy, on the other hand, is defined as various ICT self-efficacy for teaching, digital competence in the classroom, and other phrases that have been used to describe, academics' perspective of their abilities to employ modern technology in educational tasks, university ICT competence (Trowers 2020; Antonetti 2020; Castro Sánchez and Chirino Alemán 2011; Ghavifekr et al 2016; Goodyear 2020; Parsons et al 2019; Wang 2020; Moreira-Fontán et al 2019).

ICT usage also spurs economic growth. It incorporates public development into the government strategy for healthcare, transportation, education, and food security, which is optimistic. Infrastructure quality affects development rankings. Edame and Fonta (2014) examined government investment in Nigerian infrastructure using a co-integration and error correction formulation. The study examined data but did not assess policy consequences. Mitchell (2005) examined government spending and US economic growth. The study includes undeveloped countries such as Nigeria, where such research is scarce and non-existent.

The study's objectives are to (1) explore the influence of TSE on work engagement at Nigerian tertiary institutions, and (2) investigate the relationship between technology self-efficacy and ICT adoption. (3) To look into how ICT adoption affects the link between technological self-efficacy and work engagement. According to the theory ideas, individual and psychological/cognitive components, including self-efficacy and ecological events, collaborate and affect each other in a dynamic manner. Bandura (1994) defines self-efficacy as individuals' belief in their ability to generate a specified execution level that changes a life event. Self-efficacy influences the capability of individuals to achieve performance in accordance to pre-set goals by the organization (Badlishah et al 2019). Personal efficacy perspectives in academics are defined by Bandura (1997) as assessments of one's abilities to achieve desired learning outcomes and student engagement. Academics of technology self-efficacy include, for example, self-efficacy in fundamental or expert capacities, or the use of a computer for educational purposes (Scherer et al 2015; Scherer and Siddiq 2015; Siddiq et al 2016).

2. Literature Review

2.1. Work Engagement

Work engagement can be traced back to the 1970s concept of job burnout, which characterized it as a condition of weariness, where an employee is unsure of his or her performance capabilities and is stressed about work-related values (Mihail and Kloutsiniotis 2016; Mudallal, et al 2017; Leiter and Maslach 2016; Sabagh et al 2018; Herrmann et al 2019; Agarwal et al 2020). Work engagement is a process that motivates an organization's people resources to participate in and contribute to the organization's financial and strategic goals and values (Aboramadan et al 2020). According to the texts, work engagement refers to many conceptualizations of employees impacted by vigour, dedication, and absorption. According to Kahn (1990), employee engagement is "particularly associated with the employees' presenting and absenting themselves throughout task performances." To put it another way, self-participation in effort is important (Kahn 1990; Meyer et al 2010). Based on Kahn's (1990) conceptual or psychological existence/attendance, work engagement is described as the polar opposite of burnout (Schaufeli et al 2002). In contrast, recent research has isolated burnout from various emotional absorption components (Schaufeli et al 2006).

As a predictor in the previous literature, technological self-efficacy must investigate the various tasks as the critical aspects that influence an individual's good results when utilizing computers for instructional reasons (Conrad and Munro 2008; Igbaria and Iivari 1995; Joo et al 2018; Badura 1997; Agbatogun 2010; Albrecht and Marty 2020; Ibrahim 2019). The studies on ICT have been reported to be positively linked to workplace individuals' propensity to participate in the activity at work in different settings and countries (Moreira-Fontán et al 2019; Li et al 2019; Orth and Volmer 2017; Park et al 2020). Academics influence value (Kolympiris and Klein 2017; Jakovljevic 2018; Vickers et al 2017; Ihnatenko et al 2020), and institutional support influences novelty technology ICT support (Vickers et al 2017; Ihnatenko et al 2020).

2.2. Technology Self-Efficacy

Technology self-efficacy describes the personal effects of engaging in a given behaviour, particularly in the context of university education (Bandura, 2001). Technology self-efficacy is advocated/proposed to encourage and facilitate roles in

organisational inventiveness and innovation/novelty, with significant insinuations for influencing the process (Bandura 1997; Puente Daz 2016; Moreira-Fontán et al 2019). The concept is defined as personal believes in creative ideas and efforts to attain innovative achievements (Wadaani 2015; Shahzad et al 2017; Purwanto et al 2021). The word "self-efficacy" refers to a person's belief in their ability to complete a job assignment with a specific action in a given situation (Bandura 2001). Bandura (1997) and Puente-Daz (2016) offer technology self-efficacy as a means of encouraging and facilitating roles in resourcefulness and innovation in enterprises, with major consequences for deciding the process. Bandura (1982) defined technological self-efficacy as a subjectively developed concept of cognitive theory of social interaction. Individual and psychological/cognitive components, including self-efficacy and ecological events, interact/collaborate and affect each other in a dynamic manner, according to the theory principles.

2.3. ICT Adoption

The concept of Information and Communications Technology (ICT) infrastructure adoption characterises as the equipment and software required to implement organisational operation systems that incorporate networks for communications services (Mexmonov 2020), as well as support applications, digital content, and e-learning in the area of software, and related services for an effective organization's running (Mexmonov 2020). According to Arifin and Fontana and Wijanto (2016) using IT can enhance output by 81%, reduce labour costs by 40%, improve company-wide efficiency and productivity, and increase profitability.

However, infrastructure has been identified as a significant impediment to both public and private sector growth. The condition of a country's infrastructure influences its development rankings. Infrastructure is important for Nigeria's economic development. Even though ICT infrastructure adoption interacts with the economy via various processes, the cost of power outages in the business and education sectors is complex. A fresh concept input is now in the process. As a result, changes in the quality and quantity of infrastructure have an impact on educational production and service profitability, as well as revenue and ICT adoption output. Furthermore, infrastructure services improve productivity and service factors (Sulistyowati 2014). Contradictions in investigative findings are concerning, particularly when it comes to concerns affecting the well-being of populations/citizens.

3. Hypotheses Development

3.1. Technology Self-Efficacy and Work Engagement

The majority of studies have identified technology self-efficacy as a factor of work engagement (Moreira-Fontán et al 2019; Ojo et al 2021). Although there are some echoes between technological self-efficacy and digital ICT technologies (Sanusi et al 2022), it is separate because it takes a more complete and all-encompassing approach that can promote work engagement more successfully. Technology self-efficacy describes a being's belief in his or her ability to get things done by engaging in specified behaviour to obtain desired results (Bandura 1977). As stated by Setiawan and Wibisono and Purwanegara (2022), that emotional investment may lead to greater mental and behavioural involvement. It creates the expectation that personal efforts will result in positive outcomes (Black and Mendenhall, 1991). The benefits of technological self-efficacy and work engagement, on the other hand, emphasise the importance of linked ICT traits for academic work. Academics have long been recognised for their importance in bringing technology into instruction through innovative work engagement (Wu et al 2022).

Furthermore, technology self-efficacy can assist people in gaining new knowledge and expertise, as well as motivate them to seek innovative goals by using their intellectual abilities and capabilities. Work engagement can result in good informative practices, resulting in a more comprehensive learning experience (Coates 2006; Hodge et al 2017). As a result, it is said that workers who use technology in their jobs are more engaged in their jobs. Previous research, on the other hand, discovered a clear link between self-efficacy technology and work engagement in tertiary institutions (Doo et al 2020; Orth and Volmer 2017; Moreira-Fontán et al 2019). It was a few studies that concentrated on the higher education context. It discovered a strong link between technology and work engagement (Jugend et al 2018; Orth and Volmer 2017; Kim and Park 2017; Nazir and Islam 2020; Moreira-Fontán et al 2019). According to the literature, little study has been conducted on the relationship between TSE and work engagement in the higher education context. The literature is based on the following hypotheses:

H1: There is a significant association between technology self-efficacy and work engagement.

3.2. Technology self-efficacy and ICT adoption

Thompson (2010) stressed the importance and necessity of technological self-efficacy in ICT adoption. Furthermore, theoretical considerations show a positive association between technology self-efficacy and ICT adoption (Balapour et al 2019; Li et al 2016; Mensah and Mi 2019). According to Yusoff et al (2009), users who have a high level of self-efficacy believe that technology is easy to use. As a result, technology self-efficacy has a considerable impact on ICT adoption (Tsai

et al 2019; Zainab 2017). However, Arpaci (2017) proved that technology self-efficacy had no effect on user satisfaction with system adoption. The responders' continual involvement with the system explains this. As a result, technology self-efficacy became irrelevant and had no influence on user enjoyment. Furthermore, Hatlevik and Hatlevik (2018) discovered no link between technological self-efficacy and the perceived utility of ICT. These results contradict previous studies on system acceptability in learning environments. This is thought to be due to the diversity of the sample and the study conditions. Some study participants were discovered to be skilled at using technology and ICT.

This study covers technology self-efficacy because learner requires the use of technology and thus staff employees must be tech-savvy before they can engage in academic activities. This is a similar argument to one made in a Nigerian article on ICT literacy. According to Davis and Rhodes (2020), civil servants, even those in senior administrative positions, are still learning how to use information technology. Furthermore, because of the differences in technology self-efficacy outcomes, the variable should be re-examined. Researchers are interested in the influence of ICT adoption (Bahrini and Qaffas 2019; Cui et al 2018). According to the findings, (ICTs) have a substantial impact on infrastructure adoption in the corporate sector. Technology self-efficacy, on the other hand, has a direct impact on ICT infrastructure adoption in higher education (Ameen et al 2019; Roffeei et al 2018; Teeroovengadum et al 2017). The following hypothesis was made based on the literature:

H2: Technology self-efficacy influences ICT adoption significantly.

3.3. ICT adoption and work engagement

The importance of determining how much adoption is tied to the role that ICT plays in sparking engagement and performance. Prior research has looked on the relationship between ICT adoption or use and improved organisational effectiveness. Despite the fact that ICT techniques and activities have been highlighted as vital for workplace engagement (Demerouti et al 2017), it is still unknown how adoption interacts with organisational resources such as ICT and engagement. This could be explained by the fact that ICT adoption contains the components needed to improve performance and engagement in the setting of a rapidly changing educational sector (Hamidi and Chavoshi 2018; Williamson and Hogan 2020). Earlier research that looked at the relationship between ICT adoption and engagement highlighted the importance of ICT adoption methods in obtaining a competitive advantage (Farrukh et al 2019). The impact of ICT adoption on workplace engagement has been studied (Anasori et al 2021; Kuijpers et al 2020). A few studies have investigated the impact of ICT adoption on work engagement in higher education (Kurilovas and Kubilinskiene 2020). As a result, this study proposed:

H3: ICT adoption has a direct impact on work engagement.

3.4. The mediating effect of CT adoption

Some studies in academic research have studied the mediating effects of numerous variables using structural equation modelling (SEM). ICT adoption is a critical component of an organization's value-generation process (Rico-Bautista et al., 2021). According to the literature (Lawrence and Tar 2018; Lama et al 2020; Cuevas-Vargas et al 2022), technological tools that store, process, and permit information communication in diverse ways have been identified. These technologies also aid in the integration of ICT adoption initiatives at various internal and external levels. Even when cooperative activities are exceedingly intricate, such as the engagement process, the use of ICTs ensures the continued cooperation of those engaged (Parthiban et al 2021). Furthermore, ICT adoption influenced how students' desire to engage in project-based learning in the classroom was influenced by their technological self-efficacy (Dong et al 2020). Individual and organisational value coherence has a positive impact on work engagement as a result of ICT adoption. The impact of self-efficacy on job engagement was positively mediated by ICT responsibility in teaching. With ICT, self-efficacy influences work engagement (Buri and Macuka 2018; Mateucci et al 2017; Moreira-Fontán et al 2019). Following the mediated relationship hypotheses:

H4: ICT adoption mediates the relationship between technology self-efficacy and work engagement.

4. Theoretical framework

Many studies on the relationship between these variables received little attention in the context of tertiary institutions. Previous study findings highlight how the school uses mobile technology as an instructional strategy with evidence-based teaching practices to increase academic performance in classroom delivery. Furthermore, the study outcomes demonstrate the need for a well-designed professional development training program and technology training to assist academics who want to improve their teaching by introducing technology into classrooms for effectiveness. Based on the theoretical foundation, the framework of the study is illustrated in Figure 1.

5. Methodology

This study examined academic staff's technology self-efficacy, ICT adoption, and work engagement in Nigerian universities. The sample size was reduced to 342 surveys by employing Krejice and Mogan's (1970) sampling procedures. Furthermore, this study develops a questionnaire that incorporates all of the items from the pilot study (35 items). The questionnaires for this study were prepared in the English language because the respondents involved are academics and presumably proficient in the use of the English language. Each respondent received the questionnaire through the training and research department of the Academic staffs Union of Universities (ASUU). Participants were asked to score their agreement with statements concerning change on a five-point Likert scale ranging from 1 strongly disagree (SD-1) to 5 strongly agree (SA-5). Then, seventeen (17) items adapted from Schaufeli, Bakker and Salanova (2006) were used to assess work engagement. The independent variable, technological self-efficacy, was assessed using ten (10) items adapted from (Compeau & Higgins, 1995), while ICT adoption was assessed using eight (8) items adopted from Ogundile et al (2019); Teeroovengadum et al (2017). Table 1 depicts the variable measurement as well as data for its source and dependability.

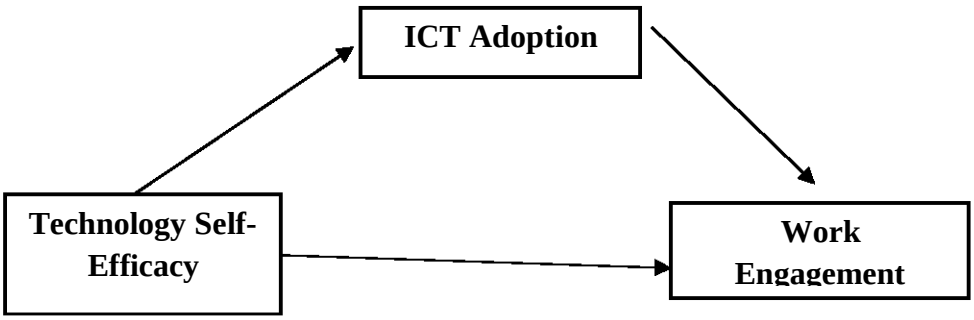


Figure 1 Theoretical Framework.

Table 1 Measurement of the Variables with Reliability and Sources.

S/N	Variables	Items	Reliability	Sources
1	Work Engagement	17	0.720 0.823	Schaufeli, Bakker, & Salanova, (2006).
2	Technology Self-efficacy	10	0.725 0.815	De Pablos-Pons et al. (2013); Compeau & Higgins (1995).
3	ICT Adoption	8	0.732	Ogundile et al. (2019); Teeroovengadum et al. (2017).

The last section of the questionnaire includes socio-demographic variables. The variables were measured to know descriptive and control issues. The elements consist of age, academic qualification, the total amount of basic salary received, job tenure (years), and position. This information was required to determine how representative the sample is; to ensure an adequate generalization to the broader population of the institution and academics.

6. Data collection

The population for the study is made up of instructors from three Nigerian public universities. The research sampling technique used to pick the decided sample size is quota sampling (Mooi et al 2018). The first step is to categorize university technology and innovation by zone. There are three public universities in the tertiary institution. The second stage is to categorize the institutions depending on their location and select a sample based on the location/area selected % from each sampling zone. Hair et al (2018) are cited in the research's overall model. The core data were gathered using Google Forms and questionnaires. Out of the 3,132 academic staff members from the three universities considered for this study, 342 were chosen as samples using stratified and systematic sampling approaches. The questionnaires were distributed to the various universities using stratified approaches based on their population. Table 2 shows the distribution of surveys to the various universities.

Table 2 Sample Frame.

S/N	Name of University	Population	Stratum
1	University of Lagos (Unilag)	1736	189
2	Federal University Oye Ekiti (FOYE)	491	54
3	University of Agriculture (UNAB)	905	99
	Total	3,132	342

The data was collected from July to September 2022. Finally, 342 questionnaires were delivered to academic staff at the three universities (the University of Lagos, the University of Agriculture, and the Federal University of Oye Ekiti). 285 questionnaire copies were completed and returned, accounting for 83% of the total questionnaire distribution. Only 264 surveys remained after data filtering for the study. Finally, Hair et al (2018) revealed that PLS-SEM was used to assess as a

widely confirmed/recognized model to explain the theory utilizing observation data. This program is a helpful instrument for educational research since it allows for the interplay of data collection and theory, which illustrates the value given the present level of research/paper.

The data was acquired as part of a larger study of university academics' teaching experiences, namely their use of ICT technology. Survey Monkey and a self-administered online questionnaire were used to conduct the survey. Academics who teach were sent a cover letter and questionnaire, along with directions to access the target survey by clicking on a web link.

Table 3 displays demographic characteristics of the respondents investigated in this research involve gender, age, marital status, position, level of education, job tenure, ethnicity, and universities.

Table 3 Demographic Characteristics of the Respondents.

Details	Frequency	Percentage (%)
Gender		
Male	221	64.6
Female	121	35.4
Age		
Below 30yrs	18	5.3
31 – 40yrs	100	29.2
41 – 50yrs	141	41.2
51yrs and Above	83	24.3
Marital Status		
Single	40	11.7
Married	276	80.7
Widowed	6	1.8
Divorced	20	5.8
Position		
Professor	47	13.7
Associate Professor	50	14.6
Senior Lecturer	76	22.2
Lecturer I	44	12.9
Lecturer II	40	11.7
Assistant Lecturer	45	13.2
Graduate Assistant	40	11.7
Education		
First Degree	30	8.8
Master Degree	66	19.3
Doctorate Degree	246	71.9
Job Tenure		
Below 1yr	63	18.4
1 – 5yrs	80	23.4
6 – 10yrs	117	34.2
11 – 15yrs	82	24.0
Ethnicity		
Yoruba	180	52.6
Igbo	82	24.0
Hausa	14	4.1
Others	66	19.3
Universities		
University of Lagos (Unilag)	189	55.3
Federal University Oye Ekiti (FOYE)	54	15.8
University of Agriculture (UNAB)	99	28.9
Total	342	100.0

According to Table 3, there were 221 male respondents in the sample, or 64.6% of all respondents, and 121 female respondents, or 35.4%. The gender of the respondents has also been shown to have a similar distribution in other investigations. For instance, the current study replicates the findings of a study by deLara and Tacoronte from 2007 in which men (64.6%) outnumbered women (35.4%) as the majority of university academics.

In terms of age, 41.2% of the participants were between the ages of 41-50yrs. The next category is individuals between the ages of 31-40, with 100 respondents, 29.2% of the sample. Below 30yrs 18 respondents, 5.3% of the sample. were in the age range within 21 to 30. The age group, 51 yrs., and above, included 83 respondents (24.3%), making up the lowest age group. According to Table 3, the majority of respondents (80.7%) were married, followed by those who were single (11.7%), divorced (5.8%) and widowed (1.8%).

Table 3 also reveals the position respondents' status, with 47 (13.7%) of them being Professor, followed by Associate Professor is 50 (14.6%), Senior Lecturer 76 (22.2%), Lecturer I-44 (12.9%), Lecturer II- 40 (11.7%), Assistant Lecturer 45 (13.2%), and Graduate Assistant 40 (11.7%). Only 34.2% of participants had worked in universities for six to ten years, 24% had worked there for eleven to fifteen years or longer, 23.4% had worked there for one and five years, and 18.4% had worked there for below than a year.

On top of that, Table 3 also reveals that a sizable number of the respondents 71.9 %, or 246 respondents had a doctorate's degree. With a master degree, this followed by 19.3% of the group, while the remaining 30 people, with 8.8%, had first degree. The sample's high percentage of doctorate degree holders is a reflection of Nigerian President Goodluck Jonathan's claim that 60% of instructors at different Nigerian colleges have enough of PhD but they are shot of management innovation support (Odiegwu 2012).

Moreover, Table 3 also shows that the respondents were from a variety of ethnic origins, including Yoruba, Igbo, Hausa and other. A little over 52.6 % of the participants were Yoruba, followed by 24% Igbo, 4.1% Hausa, and 19.3% from other ethnic minority groupings. In addition, Table 3 reveal the universities where the academics staff are working like UNILAG had 189 respondents with 55.3%, followed by UNAB 99 (28.9%), and FOYE -54 (15.8).

7. Data analysis and Results

Measurement model of the study employed SmartPLS4 that measures individual item reliability, internal consistency reliability, convergent validity, and discriminant validity (Hair et al 2017; Henseler et al 2009). The items in this study are reflective-formative, it is suggested that researchers should first, analyze the reflective model, to confirm both the validity and reliability before assessing the structural model (Hair et al 2012). The measurement or outer model assesses each item's in demonstrating the input associated constructs and measures how well the entire group set of items represent the construct (Hair et al 2014). As seen in Figure 2, researchers frequently, evaluate measurement (outer) models by ascertaining measurement validity (content validity, convergent validity, and discriminant validity) and measurement reliability (individual item reliability and internal consistency reliability) (Hair et al 2014; Henseler et al 2009). To evaluate the outer model in this research, hence, measurement reliability and validity were tested. The reflective items of first-order constructs in the outer model should exhibit satisfactory, acceptable reliability and validity.

The reliability indicators are varying and it is important to evaluate each indicator's reliability (Henseler et al 2009). Item reliability is the portion or part of indicator variance that elucidated by latent variable. According to Hair et al (2014); and Hulland (1999), stated that the indicator reliability is examined through exploring the outer loadings of each variable measures. According to the general rule of thumb that any item with an outer loading of <0.6 should be detached or removed (Hair et al 2014; Hulland 1999), thus, all items that is below the cut-off or threshold of 0.6 should be removed. As displayed in Table 4 and Figure 2.

Internal consistency reliability defines as the degree to which all indicators on a given scale are measuring the same notion (Sun et al 2022). The first step is assessing composite reliability to estimate internal consistency reliability of the construct measures (Jaafar & Ramayah, 2017). Cronbach's alpha has been used as a standard, but composite reliability provides a more accurate measure of internal consistency reliability because, first, in accord with the PLS-SEM algorithm's working standard, which prioritizes the items according to their individual reliabilities when estimating the model, composite reliability does not rely on the assumption that all items are the same loading. Additionally, Cronbach's alpha is a sensitive to the number of indicators in the scale, and thus typically underestimate the true/actual reliability of the model (Peterson & Kim 2013). By employing composite reliability, PLS-SEM is capable to contain a varied of indicator reliabilities (i.e. variances in the item loading), while avoids underestimation of Cronbach's alpha (Hair et al 2012). Furthermore, composite reliability and Cronbach's alpha, was recommended to be utilized (Hair et al 2017), since it has been regarded as a measure of "true reliability". However, in this research, both Cronbach's alpha, and composite reliability were utilized and showed in Table 4.

Measurement validity known as (construct validity) refers to the degree to which a measure, an item, an instrument, or a scale, captures its core concept. Satisfactory measurement validity is established if the measure evaluates the intended construct accurately and appropriately. There are four basic kinds of measurement validity: criteria validity, content validity, convergent validity and discriminant validity. However, the most usually utilized forms of validity are the latter two (external validity). Therefore, this study evaluated the two external types of validity to determine the validity of the reflective measurement models, (convergent and discriminant validity). The composite reliability (CR) and AVE is latter assessed by examining the loadings (Rasoolimanesh et al 2017). The loadings in this research investigation were all greater than value of 0.6 (Hair et al., 2012; Hair et al., 2011), as shown in Table 4 and Figure 3, with CR> 0.7 and AVE > 0.5 (Hair et al., 2014). As a result, the model test and passes the convergent validity.

According to Hair et al (2017), the convergent validity, construct reliability, and discriminant validity of the measurement model were all investigated in this study. This study began by looking at the composite reliability and Cronbach alpha to see how they may be improved.

Meanwhile, as shown in Table 4, the CR of the measurement model spans from 0.907 to 0.942, and the Cronbach alpha value ranges from 0.797 to 0.909. According to Hair et al (2017) the results are more than the specified value of 0.7, indicating that the measurement model is reliable and sufficient for the model (Abboh et al 2022). The AVE demonstrated the instruments' convergent validity (Henseler 2012). Thus, the average variance obtained from the constructs was more than the threshold value of >0.50, indicating that this model's convergent validity has been accepted as recommended by (Hair et al 2016). Accordingly, Table 4 summarizes the convergent validity and construct reliability test as shown in Figure 2.

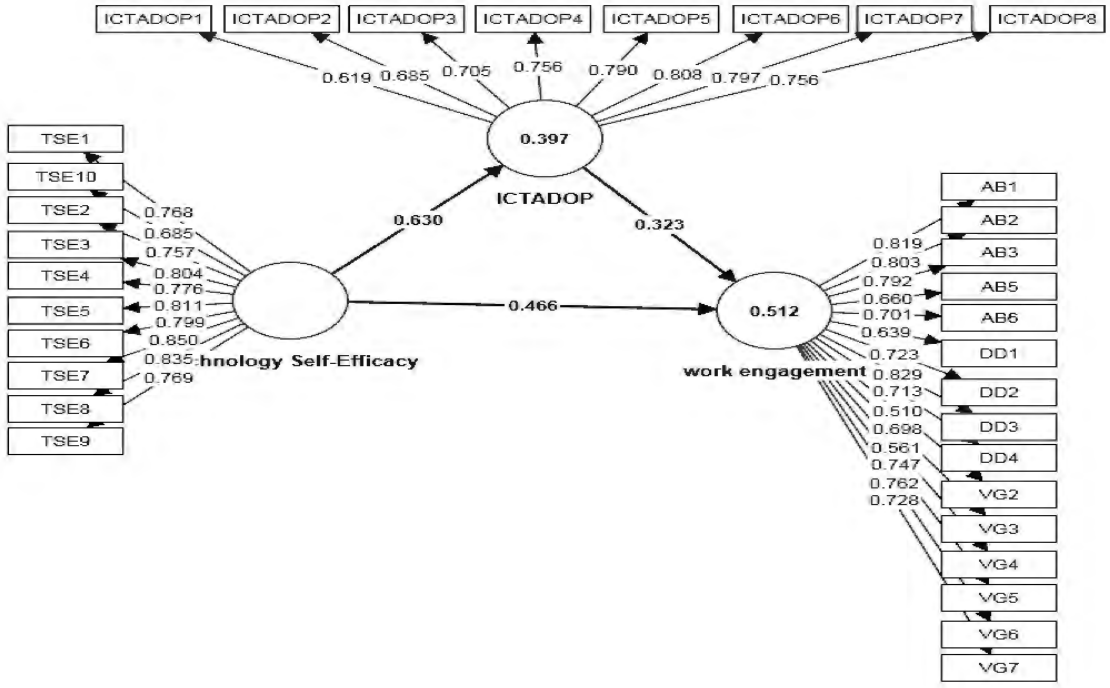


Figure 2 Measurement Model Result (Direct Relationship).

Table 4 Summary of the measurement Model Result for construct Validity and reliability and R^2.

Variables	items	Loadings	Cronbach's alpha	CR	(AVE)	R^2
Work Engagement	AB1	0.819	0.931	0.940	0.515	0.512
	AB2	0.803				
	AB3	0.792				
	AB5	0.660				
	AB6	0.701				
	DD1	0.639				
	DD2	0.723				
	DD3	0.829				
	DD4	0.713				
	VG1	0.801				
	VG3	0.698				
	VG4	0.561				
	VG5	0.747				
	VG6	0.762				
ICT Adoption	ICTADOP2	0.685	0.882	0.907	0.550	0.397
	ICTADOP3	0.705				
	ICTADOP4	0.756				
	ICTADOP5	0.790				
	ICTADOP6	0.808				
	ICTADOP7	0.797				
	ICTADOP8	0.756				
Technology Self-Efficacy	TSE1	0.768	0.931	0.942	0.619	
	TSE10	0.685				
	TSE2	0.757				
	TSE3	0.804				
	TSE4	0.776				
	TSE5	0.811				

	TSE6	0.799
	TSE7	0.850
	TSE8	0.835
	TSE9	0.769

Note: CA: Cronbach Alpha, CR= Composite reliability, AVE= Average Variance Extracted, Rsquare = R^2.

HTMT could be evaluated by using two approaches. It is either by using it as a statistical test or as a criterion. The first requires matching it to a certain threshold. When its value exceeds the cut-off, then discriminant validity is said to be absent. Although, its exact threshold is debatable, some researchers recommend a cut-off of 0.90 (Teo, Srivastava & Jiang, 2008) or 0.85 (Kline, 2011). This latter denotes as HTMT inference. It is evaluated via bootstrapping, which enables the HTMT to have creating confidence interval. The value of one in a confidence interval indicates that there is absence of discriminant validity. However, these constructs are said to be empirically distinct, if the value is <1. Table 5 indicate HTMT. Following that, the discriminant validity was evaluated using the Heterotrait-Monotrait Ratio and Fornell-Larcker. Table 5 above, summarizes the findings of this investigation (HTMT, Hair et al 2017). The mean and standard deviation were also evaluated and employed. According to Henseler et al (2015), the off-diagonal correlation in the column and row is greater than the square root of the AVE as diagonal elements, demonstrating that the HTMT requirement was met. Furthermore, the HTMT criterion components appear to be smaller than 0.85. Finally, the combined findings of the Fornel-Lacker (1981) criterion and descriptive statistics revealed that the data's discriminant validity is satisfactory as shown in Table 6 below.

Table 5 Discriminant Validity: HTMT.

Constructs	Mean	SD	ICTADOP	TSE
ICTADOP	4.52	.753		
Technology Self-Efficacy	4.33	.915	0.692	
Work Engagement	3.75	.845	0.671	0.716

The square roots of the AVE, HTMT represented in bold number.

Table 6 Fornel Larcker.

Construct	ICTADOP	Technology Self-Efficacy	Work engagement
ICTADOP	0.742		
Technology Self-Efficacy	0.63	0.787	
Work Engagement	0.617	0.67	0.718

Additionally, we used PLS-SEM to assess the R^2, R-square adjusted and F^2 values, in Table 7, demonstrating that the model summary validating the constructs.

Table 7 Summary for the Outcome of Construct Model for F-Square.

Construct	R2	R-square adjusted	ICTADOP	Technology Self-Efficacy	WE
ICTADOP	0.397	0.396			0.129
Technology Self-Efficacy			0.659		0.268
Work Engagement (WE)	0.512	0.509			

8. Structural model (direct relationship)

Following the creation of the hypothetical model in accordance with the research objectives. It is designed to study the relationships between variables. In this study, which contained the hypothesis from the two-step contexts, the correlations between the variables were studied, as was the relevance of direct path analysis using set constructions, where the path coefficient was obtained using 5000 bootstrapping samples. As a result, the R^2 value is utilized as an endogenous notion to assess the explanatory strength of the structural model. The structural model in academic staff work engagement at the selected universities, which confirms extrapolative validity as proposed by Hair et al (2016), explained 45% of the variance. The path coefficient (beta value), t-value, and p-value are all employed in this study to investigate the direct relationship between an external (exogenous) notion and academic staff engagement at work at the selected universities. The structural model's outcomes/effects are shown in Table 8, and the diagram is shown in Figure 2.

Table 8 Structural Model Results (Direct Relationship - Testing of Hypotheses).

Hypotheses	Beta	STDEV	T-value	P values	Decisions
ICTADOP -> work engagement	0.323	0.062	5.194	0.000	Supported
Technology Self-Efficacy -> ICTADOP	0.630	0.047	13.379	0.000	Supported
Technology Self-Efficacy -> Work Engagement	0.466	0.075	6.196	0.000	Supported

Based on the results in Table 8, the result of technological self-efficacy reveals a substantial beneficial influence on work engagement among academic staff at the selected universities at (B= 0.466; t= 6.196; p0.000). As a result, technology

self-efficacy is a critical factor in academic staff engagement at the selected universities. As a result, hypothesis H1 is supported. Furthermore, technology self-efficacy has a substantial relationship with ICT adoption at (B= 0.630; t= 13.379; p0.000). As a result, H2 was enabled. However, ICT use has a direct impact on academic work engagement at (B= 0.323; t= 5.194; p=0.000). As a result, H3 was approved.

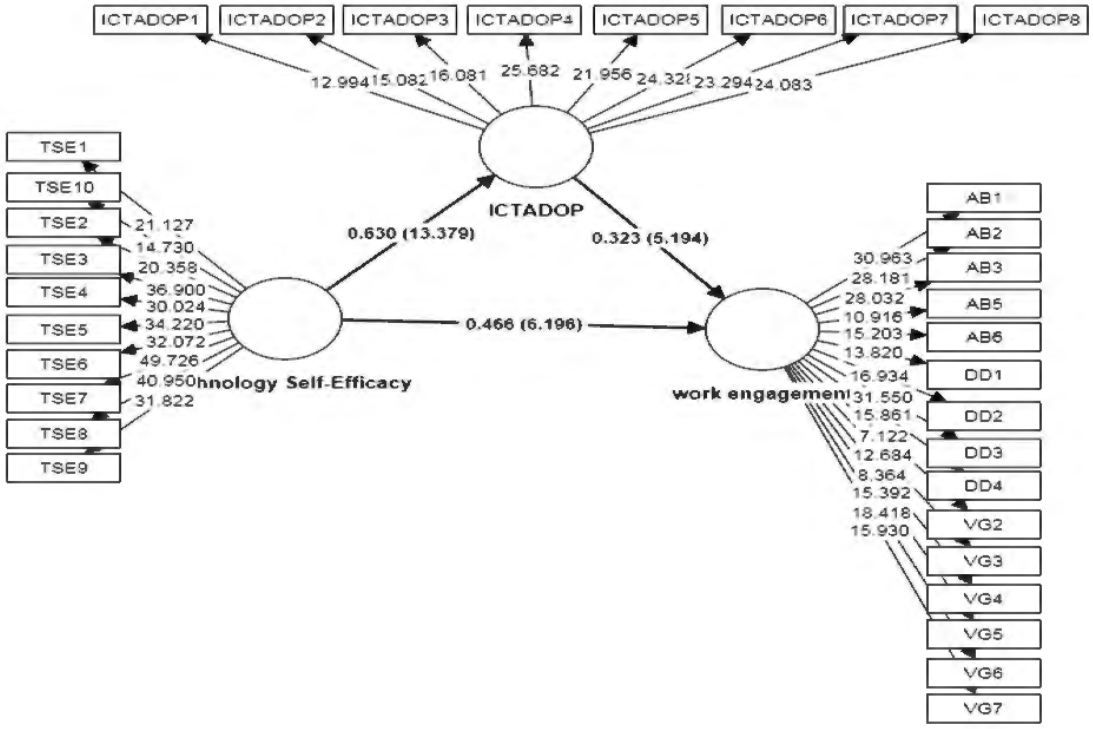


Figure 3 Structural Model Result (Direct Relationship).

9. Mediating effect of ict adoption

In this investigation, the mediating impact was discovered. ICT adoption mediates the relationship between Technology self-efficacy and job engagement of academic staff at the selected universities (B= 0.204; t= 4.358; p=0.000). As a result, H4 was granted approval. The hierarchical model is developed to study the relationships between variables. This study explored the significance of employing 5000 bootstrapping samples to determine the route coefficient in indirect path analysis with set constructs, which incorporated the hypothesis from the two-step contexts. As a result, the outcome is shown in Table 9.

Table 9 The Indirect Effects.

Hypotheses	Beta	Standard deviation	T statistics	P values	Decision
Technology Self-Efficacy -> ICTADOP -> Work Engagement	0.204	0.047	4.358	0.000	Supported

The blindfolding strategy was used to obtain the suitable Q^2 value models (Hair et al 2017). A Q^2>0 represents the model's predictive relevance, according to Fornell and Cha (1994). On the other hand, the model cannot be given predictive relevance if Q^2>0. The results of the predictive relevance analysis for the endogenous constructs used in this inquiry are shown in Table 10.

Table 10 Predictive Relevance Q^2.

Latent Variables	Q^2predict	RMSE	MAE
ICTADOP	0.387	0.789	0.591
Work Engagement	0.436	0.757	0.503

10. Discussion

The literature reviewed in this research included several studies on workers' interaction with digital technologies. According to the report, there is little agreement on what constitutes academic involvement in engagement through teaching with digital technology. Various approaches and assessments have been employed to assess job engagement involvement due to a lack of agreed understanding. The range of perspectives in engagement literature was amplified by the variation in meaning and measures. Because the definition of work engagement is ambiguous, researchers have used a

range of factors to evaluate it. ICT adoption and WE benefit from self-efficacy technology. Their use of ICT has a profound impact on professors and students in higher education institutions. Nonetheless, there is a mediating effect because ICT adoption completely mediated the effects of TSE on work engagement. Their use of ICT mitigates the impact of TSE on work engagement. Increasing academic work participation in higher education could boost the credibility and instructional service of higher education institutions. To increase job engagement, public tertiary institutions should improve their academic skills, as ICT adoption is a crucial mediating variable in increasing work engagement at public tertiary institutions.

Furthermore, the technology self-efficacy suggests a significant improvement in the work engagement of the academic staff at the selected universities. These findings indicate that TSE is an important driver of academic staff engagement at the selected universities. As a result, (β= 0.466; t= 6.196; p<0.000), H1 is supported. This result signifies that technology self- efficacy plays a significant role in the preparation and implementation of academicians who can successfully use educational technology to enhance learning as a positive predictor of work engagement in Nigerian tertiary institutions. A significant number of studies support this result (ELDaou 2016; ELDaou & Kazan 2016; Birisci & Emin 2019; Chaudhary et al 2012; Al-Hamdan & Bani Issa 2022). Technology self-efficacy described as the resources available to an individual and management utilized through academics teaching participation and interaction with the aim of learning. As proposed by Moreira-Fontán et al (2019) as well as Liu (2019) surveyed finding exhibited teaching technological self-efficacy and formal support through high school teaching as well as secondary school. In support tested, technology self-efficacy and work engagement found a positive result among 328 part-time MBA students. The findings extend previous results and show that occupational self-efficacy can predict work engagement. Hence, this study hypothesized that technology self-efficacy is significantly related to work engagement. In the previous studies and therefore this study hypothesized that there is significant positive relationship between TSE and work engagement.

Drawn upon different literature of the research findings conducted by Lu et al (2018), which advocated that 707 employees from72 teams in enterprises telecommunications in southern China found self-efficacy in supports of the positive relationship between follower optimism and work engagement (Lu et al 2018). Likewise, Moreira-Fontán et al (2019) surveyed three hundred and fifty public school teachers in north-western Spain, finding exhibited teaching technological self-efficacy and formal support through high school teaching (7th to 10th grade) as well as secondary school (11th to I2th degree). In support tested, technology self-efficacy and work engagement found a positive result among 328 part-time MBA students in China. In the same vein, Ghani et al (2019), who demonstrated that 300 managerial staff of Malaysian SMEs of a higher level of autonomy and self-efficacy ensure the job designing has a positive effect resulting in the production of the higher level of work engagement.

The findings solidify the existing evidence on positive of TSE and work engagement relationship. This gives the earlier study, in prior of this chapter, that technology self- efficacy TSE could be part of the whole of advantage of WE that enhance academicians target teaching work and performance of Nigerian tertiary institutions through effective of embracing of technology self-efficacy (TSE). Despite the fact that the tools are not enough to carry out the teaching learning situation role assigned to academics. The effects of TSE and WE achievement subject upon the embracing a dynamic systematic way of teaching to enhance work engagement.

Furthermore, technology self-efficacy has a substantial relationship with ICT adoption. As a result, (β= 0.630; t= 13.379; p<0.000), H2 was supported. The findings also indicate that ICT usage is a predictor of academic staff work engagement at the selected universities. As a result, (β= 0.323; t= 5.194; p=0.000) H3 was supported. The hypothesis testing revealed that ICT adoption had a significant mediation influence on the relationship between technological self-efficacy and work engagement among academic staff at the selected universities in Nigeria. The mediation effect of ICT adoption has influenced academic self-efficacy technology and ICT adoption at the selected universities. This suggests that ICT adoption as a mediating influence predicts academic work engagement at the selected universities. This demonstrates that ICT adoption has a complementary complete mediation function in the link between TSE and WE. As a result, it was supported.

Finally, as Helal et al (2018) point out, larger samples and more variables can be used in investigations. Institutions may consider undertaking the challenging task of determining academic work engagement predictors, which can be influenced by a variety of factors including financial, motivational, demographic, cultural, and academic background. Academic work engagement, like any other variable, has a variety of variables that might influence a student's success. One could even argue that addressing those numerous variables at the engagement level can aid in the understanding of employee outcomes in institutional settings employing digital technologies.

For tertiary institutions that need to assess the engagement of employees, the practical implications of the outcome are the following. First, there is a degree, which will help them to have a clear understanding of their variable, and next, it is good that the institution itself finds the key drivers of engaging the employee in the area of national ICT infrastructure are quite different, even institutional value. The idea of work engagement is a universal perception with the same norms across the universities or institutions that may not be a factual fact that the measurement of engagement with a global instrument possibly will not give an accurate explanation of Nigeria's engagement of work. As a result, an institution must consider the key drivers of workers' engagement. Therefore, it is required that they have a better construct understanding of knowledge to boost work engagement.

11. Conclusions

The findings of this study contribute to the existing body of knowledge on higher education. However, it is important to use caution while decoding and interpreting these findings, as they are subject to certain limitations inherent in the study. The present study provides empirical evidence that supports the proposed associations between exogenous and endogenous factors. However, it is important to note that the study's narrow scope, which concentrates solely on academics in universities located in the southwest geopolitical zone of Nigeria, significantly restricts the generalizability of its findings. In order to establish generalizability, further investigation is necessary involving individuals employed outside of academia across diverse university settings. It is imperative to conduct research and undertake comparative analyses between universities and other forms of postsecondary institutions, including colleges, polytechnics, and mono-technics. Further investigation is warranted to explore the determinants that could deter individuals from engaging in workforce activities. Further research is needed in order to explore the potential moderating impact of ICT adoption on the relationship between technological self-efficacy and work engagement.

Ethical considerations

I confirm that I have obtained all consent required by the applicable law to publish any personal details or images of patients, research subjects, or other individuals used. I agree to provide Multidisciplinary Science Journal with copies of the consent or evidence that such consent has been obtained if requested.

Conflict of interest

The authors declare no conflicts of interest.

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