



DIFFUSION OF ICT IN NIGERIAN UNIVERSITIES: CHALLENGES AND SUSTAINABLE INNOVATIONS (A CASE OF NIGER DELTA UNIVERSITY)

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Abstract – Information and Communication Technology (ICT) has been recognized as an important technological tool that can be used to explore almost all human activities. Hence, this study seeks to assess the diffusion of ICT facilities in Nigerian universities using Niger Delta University (NDU) as a case and investigate what factors influence the use of ICTs by lecturers in the university. A quantitative data analysis method was adopted and primary data were obtained from a questionnaire distribution to 200 lecturers in the university with an 80% return-rate. From the result, it was shown that about 140 lecturers use ICTs to perform their professional job of course content development, delivery and administration. Over 80% had acquired ICT hardware and software skills, and below 50% had basic maintenance skills. 140 laptops and desktops with internet facilities in 135 are readily accessed within the university campus mostly in lecturer's offices (70%) and are used daily to develop course content (80%). The lack of access of reliable ICT infrastructure was topmost in the factors that hinders the use of ICTs, resulting to the slow pace of ICT diffusion in the university. More training in basic ICT maintenance skills, installation of ICTs gadgets in the classroom with maximum protection, increase use of ICTs facilities for course administrative were some of the recommendations. Hence, the diffusion rate of ICTs in NDU is explicitly fare and have some implications to use as a result of the ICT skills of lecturers.

Keywords: Diffusion of ICTs, Infrastructure, ICT, Lectures, NDU, University

1. Introduction

Information and Communication Technology (ICT) has been recognized as an important technological tool that can be used to explore almost all human activities. The extent of adoption of ICTs has touched every sector of the economy including the educational sector which is seen as a critical sector for national development. In Nigeria, according to the Federal Ministry of Communication Technology (FMCT) progress report in 2014, the ICT industry has grown so high since 2003 becoming the fourth pillar of the economy in terms of its contribution to the gross domestic product (GDP) [3, 29]. The ICT sector is the fourth largest industry in Nigeria that contributes over 10.43% to the country's gross domestic point (GDP), the sector consists of telecommunications, Information Technology (IT) and postal sub-sectors [29]. In recognition of the strategic role of ICT in national development, competitiveness and employment, the FMCT (2014) reported that the Federal Government of Nigeria created the National Information Technology Development Agency (NITDA), and the Nigerian Communication Commission (NCC) to collaborate with the FMCT to ensure that ICTs are universally accessible, properly utilized and sustained for economic growth and development [29]. The university being the main focus of ICT adoption, ICT spread and usage impact is yet to be fully adopted within the learning and teaching modulus of operandi in Nigerian universities. Lecturers who are the key drivers are constrained in many aspects and thus faced with several challenges to effectively use the ICT facilities for rich-quality course-content development, delivery and administration. According to [25], ICTs in education is used to develop course material, deliver and sharing content; communicate between learners, teachers and the outside world; create and deliver presentation and lectures, conduct academic research and support administrative activities such as student enrolment etc.

The Federal Executive Council of Nigeria in 2001 approved the National Information Technology Policy (NITP), with the foresight to make Nigeria an ICT capable country in Africa and a key player in the Information Society by the year 2020, that is, to use ICT as the engine for sustainable development and global

competitiveness for education [3]. Undoubtedly, Nigeria educational system recognizes the role of ICT in education and thus developed a national policy on computer education to implement the integration of ICT into the Nigerian educational system [1]. The National Policy emphasized that the integration of ICT in Nigerian educational system should go beyond the use of only computers to the use of ICT facilities [1]. This initiated a drive in Bayelsa state to make the state ICT Smart State. Giving a lecture at the 3rd National Council on Communications Technology (NCCT) (2014), the Permanent Secretary of the Bayelsa State Ministry of Science and Technology and Manpower Development (BYMSTMD) highlighted the state government is bent on making Bayelsa a global ICT hub [16]. Based on this huge financial investment were made to create ICT centres across the state, making ICT facilities available in schools especially tertiary institutions of which NDU was a partaker [22]. However, NDU attested of benefit from other bodies such as Tertiary Education Trust Fund (TET Fund), Nigerian Communication Commission (NCC), Nigeria Communications Satellite (NigComSat), Commercial Banks (Diamond Bank Plc), Oil Companies (Chevron and Shell Plc.), etc; in terms of ICT facilities among others [16]. Unfortunately, with the huge financial investment on ICT in the university, the extent of adoption and diffusion is yet to be estimated in the use of professional development to meet the policy requirement of ICT adoption in Nigerian Educational System [9].

ICT innovation is still seen as an embryonic stage in Nigerian University [19] as the diffusion rate is very slow. This is due to the first diffusion study of ICTs in education carried out by [23]. It identified that ICT diffusion is being affected because of inadequate utilization and one major challenge is technophobia [18]. That despite the huge investments made in ICT for education in Nigerian universities, lecturers of the university have some perceived fear to use the technologies. From the study on 'Technophobia and Mobile Device Design', it was pointed that many people generally have some fears when it comes to the use of ICTs which may be as a result of intimidation or the possibility of damaging the technology, the increasingly complexities of the technologies, belief systems, and possibly because of the negative influence it has on users [10]. Hence, this study is aimed at assessing the diffusion of ICT in NDU using the roger's diffusion theory and the Technology Acceptance Model (TAM) to determine the level of implementation (use) of ICTs based on their perception to use and ease of use of ICTs facilities in the university for academic activities and to further determine sustainability measures to maintain the existing standard and improve on it. Thus, to develop a sustainable ICT-diffusion framework to access the ICT usage of lecturers in Nigerian Universities, using Niger Delta University (NDU) as a case. Explicitly, the study attempts to address the following four research questions: 1.) what is the perception of ICT use by the lecturers in NDU? 2.) What is their perception on the ease of ICT usage? 3) What is the extent of use of the available ICTs? and 4) What are the factors that may affect the sustainability of ICT usage in NDU?

The significance of this case study would provide a clearer view of the major sustainable options to the continuous use of ICTs in the university and demonstrates the extent to which ICT has diffused in the university. This research would also contribute significantly to the initiatives of government, Non-Governmental Organizations (NGOs), private companies, Tertiary Education Funds (TET Funds), Education Trust Funds (ETF), etc; in ICT adoption in universities and suggest a sustainable action plan for ICT in education, with the aim of the establishing easy and quick ICT accessible places within university campuses. Furthermore, the study would inform lecturers the need to acquire ICT skills and utilize it for building an enriched course content, especially in this covid-19 pandemic era, to make lectures notes accessible to students from anywhere across the globe, for continuous access, reviews, referencing; having interactive time-based session with students (online/offline) and keeping accurate records of participating students and their contribution.

2. Literature Review

The traditional learning and teaching methodological approach has experienced a shift to a technological learning style in most developed countries. Students now learn and participate in class actively because of the interactive nature of computer technology and collaborative teaching. ICT diffusion is the usage of ICTs, ease of accessibility and maintainability of the technological asset. However, the use of ICTs to perform professional activities effectively and frequently with the ease to use appropriate technologies for specific purposes is the key of an effective ICT strategy as supported by [27], saying that the understanding and mastering of the basic skills and concepts of the computer is very crucial in education. This they said adds value to the processes of teaching-learning and to the university organization and administration. Similarly, [20] stated that the frequent and appropriate use of ICTs by university lecturers to performing their academic task would give them a competitive

advantage, although this may not be visible without acquiring the ICT skills to use the technology. Therefore, an assessment of NDU lecturer's skills in the use of ICTs to develop their course(s) content, deliver course(s) content in an interactive technological environment and organize the database of student records for administrative purpose of their courses as the main focus of this research.

2.1. Adoption and Diffusion of ICTs

ICT adoption and diffusion is novel act (in terms of technology) in Nigerian universities and have spread across all faculties of learning over the years. According to [30] the adoption of IT facilities refers to the availability and accessibility and utilization of ICT facilities. The diffusion of innovation (DOI); which according to [15] is "the process by which an innovation is communicated through certain infrastructural channels over time among members of a social system". Authors in [15] Stated that Innovation, communication, time and the nature of the social system where the technology is adopted are the four major factors that influence the diffusion process. The new technology is either accepted for adoption by technology leaders. On the other hand, the rate of adoption could be influenced partially by the perceived innovative characteristics of the proposed users such as their perceived relative advantage of the technology, compatibility, trialability, complexity and observability of the adopted technology [30]. This would further require that the users acquire the skills to use both the hardware and software component of the technology. This is however not a one-time training requirement but a continuous improving of the skills to use as the technologies are evolving constantly with time [26]. The IT skills necessary for the lecturers to acquire are the hardware, software and maintenance skills for an effective usage and ability to sustain the innovative practice. ICT innovation in education in the university environment has many implications for its sustainable diffusion. According to [18] ICT innovations in education are the adoption of basic to advanced ICT facilities for the purpose of teaching and learning processes. This happens when the management of the university has first gains awareness of the role of ICTs in education. Though this can be influenced by the university's cultural values, safety of the environment, political and climate conditions to explore the newly adopted technologies [2, 20] identified that the adoption of technologies is in three dimensional phrases. The first phase, the author called 'The planning phase', where the strategies to present practice is aligned with the future outcomes to improve the overall performance. The second phase is the implementation phase, where efforts are required to select and implement the new technology, develop necessary skills, and measure the effectiveness of the new technology, and the third phase is the diffusion phase where the technology is managed to change and adopt new solutions for the institution [2].

Therefore, in this study the Rogers' theory of diffusion was considered defining it as 'a process that occurs over time through five stages namely; Knowledge, Persuasion, Decision, Implementation and confirmation, as the knowledge of the role and advantage of the technology was firstly determined, after which, a positive attitude is formed towards the technology which comes with a decision to accept or reject the new technology, and finally, if the decision is accepted, the user proceeds to actually use of the technology with a confirmatory approach to sustain the decision [11]. The figure below shows the DOI process of diffusion.

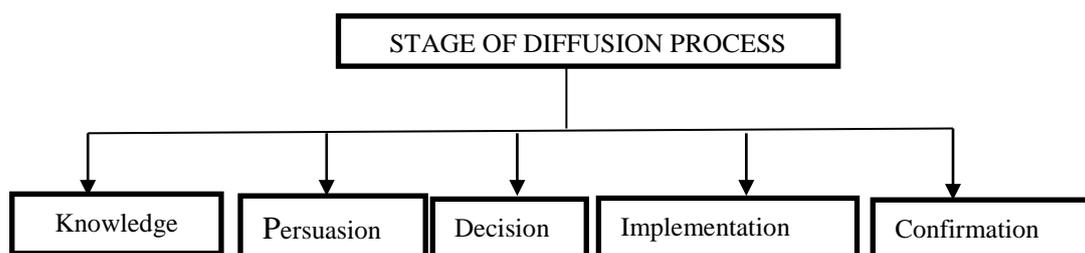


Figure 1: Diffusion of Innovation Theory [11]

This study precisely is interested in the implementation stage of diffusion which examines the extent of use of the ICTs, assessing the level of skills acquired to effectively and sustainably use the technology. In this light, the Technology Acceptance Model (TAM) as propounded was reviewed to predict the factors that could affect ICT

adoption and diffusion [20]. [7] Revealed that this model was derived from the Theory of Reason Action investigating the reason why teachers use ICTs. Whereas, [15], explained the TAM as “the decision of users to accept and use a new technological infrastructure” using these two key factors: the perceived usefulness of the technology and its perceived ease of use. They further explained that TAM focuses on the actual use of a new technology since users have the perception of the usefulness and the ease of use of the technology, this may indirectly affect users’ attitude and behavioural intention to use the technology. The model is illustrated in figure 2.

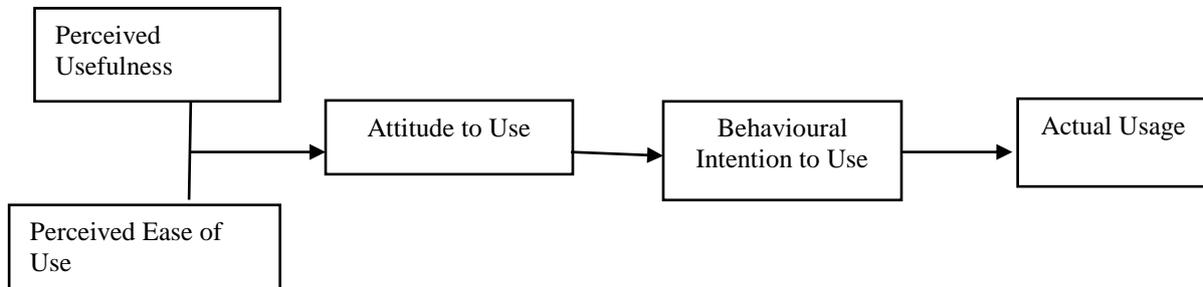


Figure 2: Technology acceptance model [7]

Perceived Usefulness (PU) is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" and Perceived Ease of Use (PEOU) is defined as "the degree to which a person believes that using a particular system would be free from effort" whereas the remaining boxes indicates the attitudes, behaviour and actual usage of Technology [7].

2.2. ICT Users Skills

Authors in [6] investigated that use ICTs, requires the acquisition of adequate knowledge, development of positive attitude and the skills to use the ICT facilities are key to ICT diffusion. ICT Skills is the ability to use both the hardware and software of facilities effectively and frequently. Authors in [11] noted that the ability to effectively use the ICTs hardware and software infrastructures by lecturers would build up confident in their ability and competence to handle computers and introduce the technology to their class. It was identified by [13] that ICT skill levels possessed by faculty members in Jordan University of Science and Technology and the extent to which they use these skills in their instruction delivery. Authors in [20] similarly studied the professional skills of academic staffs in using ICTs. He found out that academic members of staff that was using ICTs performed better in their given tasks than those who were not using ICTs. ICT skills are the most prerequisites for every user to effectively use the ICT facility, improve their confidence, competence and expertise. Authors in [6] identified that the competence in ICT usage by presupposed users emboldens them to develop positive attitudes to its use, understanding of the potential impact of ICTs and thereby improve the ability to use the ICTs effectively in their daily operations, managing the tools well through the development of technical skills. Authors in [11] finally added that the effective, timely and continuous training to promote the skilful usage of ICTs is the key to sustaining the innovation.

However, ICTs are made up of hardware and software facilities. The hardware facility as identified by [14] is referred to the physical or tangible facilities of Information Technologies. This could include: desktops, laptops, smart phones, digital cameras, projectors, smart boards, pen pointers, scanners, printers, etc. Thus, the use of IT hardware is the capability to perform basic operations on the technology such as knowing how to set-up the system, connecting the cables correctly within and between different ICT infrastructures networking sharing of files, the printer, the projector and internet bandwidth. Further, the author in [14] pointed out that storage devices are also ICT hardware which are to be protected from computer viruses and physical damage. However, when viruses are detected, anti-viruses such as Avast, Norton, Kasperskey, McAfee, etc are used to protect the system but if physically damaged, would have to be replaced. And the ICT Software examples which includes the soft-skill to use: word processor, spread sheet, graphical and presentation software, geographical information software, audio/visual software (e.g. windows media player) [14]. Moreover, basic maintenance skills are also very necessary for every ICT user to acquire; these are techniques used to manager and sustain the ICTs assets throughout its life cycle. ICTs are assets that have a life cycle like every other physical asset. The author in [18]

Pointed out that teachers have phobia in the use of technologies and so lack the skills to operate them. The technophobia caused them to delegate the responsibility of ICT maintenance to others.

Authors in [5] pointed that to maintain an ICT facility means to keep it in a good working condition and in existence for continuous use. This implies that the maintenance of ICT facilities is a strategic measure to keep ICT facilities in continuous good working conditions using a preventive maintenance approach rather than a corrective maintenance approach as identified by [31]. Due to the technicality of ICTs, the skill to maintain it is rare and maintenance culture is sadly at its lowest in Nigeria [31]. It is also reiterated by [31] that the introduction of preventive maintenance approach would reduce the probability of occurrence of failure and avoid sudden failure, referring to this strategy as time-based maintenance, planned maintenance or cyclic maintenance. Effective usage of ICT with a predetermined plan at regular fixed intervals, which could be daily, weekly, monthly, bi-yearly and yearly are possible measures to sustain its usage and speedy diffusion [31].

2.3. ICT for Professional Use

Using ICTs to perform professional task is an added advantage for lecturers. [20] Attested that lecturers that are skilful in the use of ICTs perform their jobs better than those who are not skilful in ICT usage. Hence, this research seeks to examine lecturers in NDU that are using of ICTs to perform their professional task of developing their course content, deliver course content and organize the administration of their courses. Course Content Development is the process of using ICT Infrastructure to develop the content of lecture notes. An example could be browsing online for educational resource that is used to plan, develop and organise course content and this cuts across all field of study. This is because the internet according to [21], is large in its scope, accurate and ease to access anywhere, thereby making it a wealthy access for information. Meanwhile, [27] opined that the internet has become an essential tool in the administration of pedagogy.

In the same vein, Course Content Delivery (CCD) is the delivery or presentation of the lecture notes to a whole-class. Having evolved from the traditional use of chalkboard to the use of modern facilities where the chalkboard was the most commonly used in the classroom for course delivery. According to [8], the learning approach has moved from a teacher-centred approach to an interactive approach where interactive ICT infrastructures are used. Furthermore, Course Administration is the culture of safe keep of record otherwise known as student database management. This is the process of keeping student continuous assessment (assignments, test and exams), by implication student's data is established and managed using ICT tools for instance, the use of an electronic dashboard to developed 'an Enterprise Resource Planning (ERP)' tool to take a quick and analytical view of each student performance in the course(s), attendance records, etc [12, 13, 17]. Thus, students' performance can easily, quickly, and accurately be communicated and shared with the universities exams and record department and to the students. Sharing and communication can be done with the use of emails, file sharing software, social media (limited to only the class group), intranet, etc, thereby, ensuring the rapid replacement of the use of ICTs instead of paper file record keeping [27].

2.4. Factors that Influence the Diffusion of Information Technology

Many factors have been identified as in [24] that could influence the use of ICT innovations in universities. In similar view, the author in [18] pointed out that limited ICT facilities and ICT literacy; technophobia; inadequate internet connectivity; software license acquisition, high costs for maintenance and technical support are some of the factors that could influence the use of ICTs especially in Nigeria Universities. According to [4] the acquisition and utilization of ICT in teaching-learning poses great challenges to lecturers because it requires them to continuously adapt to the changes brought about by the technological revolution. [6] argued that time pressures, lack of personal tutor and opportunities for apprenticeship, low bandwidth and Internet downtime as factors that affects users' ability to use ICTs. [17] Also noted government's reluctance to provide adequate funds to manage the ICT facilities, lack of computer culture, and lack of knowledge on the importance of ICT in the educational sector. Adding to this argument, [15], identified that the influencing factors of ICT diffusion are low ICT adoption, low ICT competency, inadequate ICT infrastructure, high cost of funding ICT training programmes, complexity, perception of ICT usage, and reluctance of ICT policy implementation. The authors in [11] Reported that the most important reason teachers give up in using ICTs is that they are not familiar with it or they feel uncertain about the new technology. Acquisition and utilization of ICT in the teaching-learning

process poses a great challenge to academic staff because it requires them to continuously adapt to the changes brought about by the technological revolution.

Furthermore, [28] pointed out that failed technology leadership, fear of change, limited infrastructures and redundant policies are some of the challenges faced in ICT diffusion. He stressed that Nigerians are held back due to the lack of ICT leadership, vision and willpower of the techno-educational professionals and policy makers. [28] Said one major factor that influences ICT diffusion in universities is the resistance to change. However, educational professionals are to uphold the task of enlightening school management boards and leaders of the positive impact of ICTs in education and the need for its wide diffusion.

3. Methodology

This study employed a descriptive research design. A questionnaire comprising of 220 items, was designed and distributed to two hundred (200) lecturers of NDU. One hundred and fifty-nine (159) copies were retrieved and found suitable for analysis resulting in 80 % response rate. The data analysis first represented respondents' socio-demographic characteristics followed by other presentation of each of the research questions. Lecturers were approached in the offices and those willing to respond to the research instrument did willingly. The nature and source of data used by the researcher for this study were obtained from only primary sources. The structured questionnaire comprises of six sections (A, B, C, D, E and F) used to request for responses from the lecturers in the selected university. Section A, sorted information on lecturers' socio-demographics characteristics and general information on IT skills. Section B focused on the hardware skills and level of competence of the respondents. Section C examined the software application skills and the level of competency of NDU lecturers, Section D focused on the basic maintenance skills and level of competence. Section E assessed the professional Use of the ICTs by respondents and their frequency of use and finally Section F identified the factors that influenced lecturers' use of ICTs. A few questions were structured based on the concepts as stated in literature. The items in the questionnaire followed a four-point assessment scale of highly skilled to lowly skilled, except for some that were based on binary responses of 'Yes' or 'No'. Data obtained from the study is evaluated using descriptive statistics. Specifically, descriptive statistics such as frequency counts and percentage distribution are computed. All raw data are cleaned, edited, coded before they are entered into the statistical software for analysis with the aid of Statistical Package for Social Sciences (SPSS) 17 edition and Microsoft Excel. SPSS was used to model latent variables both under normal and non-normal conditions whereas Excel was used to generate and refine graphs and charts.

4. Results and Discussions

4.1. Demographic Characteristics of Respondents

Out of the 159 valid responses, 114 or 71.7% were males; the remaining 28.3% were from females. Respondent's educational level were ranged from BSc. MSc. and PhD with (6.3%, 50.3% and 43.4%) respectively. A complete analysis of respondents' characteristics is illustrated in Table 1.

Table 1: Demographic Characteristics of Respondents

		Total Respondents	Percent
Gender	Male	114	71.7
	Female	45	28.3
Educational level	B.Sc.	10	6.3
	M.Sc.	80	50.3
	PhD	69	43.4
	Graduate Assistant	10	6.3
	Lecturer II	41	21.4
	Lecturer I	39	28.9
Rank	Senior Lecturer	40	16.4
	Associate Prof.	11	12.6

	Professor	18	14.5
	Yes	140	85.0
IT literate	No	19	15.0

4.2. Information Technology Skills for Professional Use

There is need to understand the role of ICTs in pedagogy activities as the actual use to meet professional needs and determine the pace of diffusion. Aligning with their framework, the study considered the primary pedagogy activities with the use of ICTs which includes learning, teaching, research, and database management, collaboration between colleagues and students and training. Figure 3 below shows high percentage level of ICT professional use by lecturers in the NDU, 140 of the lecturers use ICTs for developing their course content, 132 for course content delivery and 129 for course administration, this attributes to the readiness of the lecturers in the University in relation to the skills in using the ICT infrastructures for pedagogy activities and this is in line with e-Readiness Assessment Belize National ICT Policy (2007).

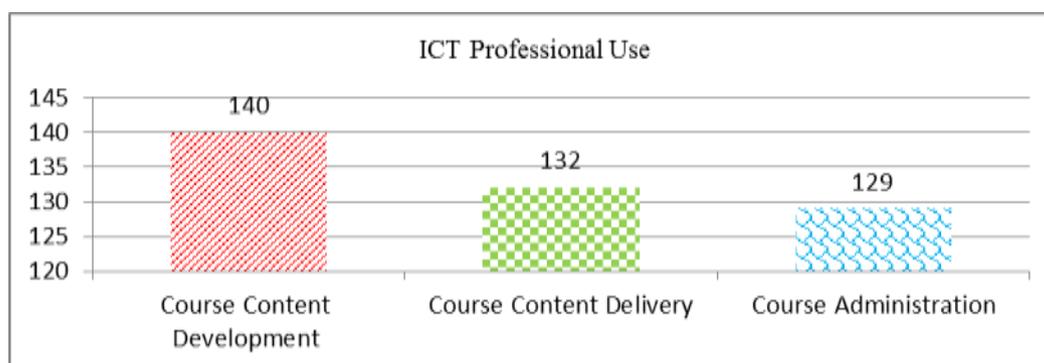


Figure 3: The Professional Use of ICT

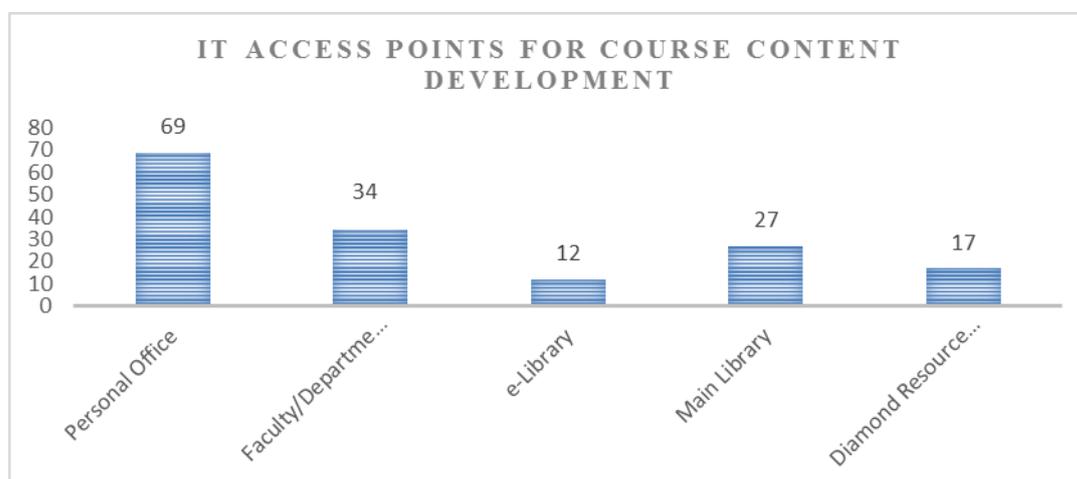


Figure 4: Information Technology Access Point

However, the lecturers had to access these infrastructures from different access points. And from figure 4, it was observed that the infrastructural accessed in personal office were 43%, whereas faculty/department labs, e-library, main library and Diamond Resource Centre constitutes 21%, 8%, 17% and 11% respectively. While the Cisco and the Zinox are not in use at the time of this research and the entrepreneurial centre is reserved strictly as Jamb Exam Centre. In relation to the use of ICTs for professional activities, the NDU lecturers use the ICTs for their pedagogy activities and this reflected in the assessment test in table 2 below.

Table 2: Assessment Test for Professional Task Using Information Technologies

S/N	ICT Professional Use Course Content Development	Yes	No
i.	I use the Desktop Computer to develop and prepare my course content	118(74.2)	41(25.8)
ii.	I use the Laptop to develop and prepare my course content	140(88.1)	19(11.9)
iii.	I use the Tablet to develop and prepare my course content	22(13.8)	137(86.2)
iv.	I use the Notebook to develop and prepare my course content	22(13.8)	137(86.2)
v.	I browse the internet to source for educational resources to develop and prepare my course content	115(78.6)	34(21.4)
vi.	I use Microsoft word to develop and prepare my course content	140(88.1)	19(11.9)
vii.	I use PowerPoint slides to develop and prepare my course content	137(86.2)	22(13.8)
viii.	I use courseware to develop and prepare my course content	60(37.7)	99(62.3)
ix.	I use modelling software to develop and prepare my course content	54(44.0)	105(66.0)
x.	I use simulation software to develop and prepare my course content	60(37.7)	99(62.3)
xi.	I use the email to send and receive educational materials from colleagues	60(37.7)	99(62.3)
xii.	I use the email to send lesson notes and assignments and receive answers to and from students	21(13.2)	138(86.8)
Course Content Delivery			
xiii.	I use the projector and the projector screen to deliver my course content	135(84.9)	24(15.1)
xiv.	I use the computer and the monitor to deliver my course content	22(13.8)	137(86.2)
xv.	I use the television screen to deliver my course content	6(3.7)	153(96.3)
xvi.	I use the PowerPoint slides to deliver my course content	137(86.2)	22(13.8)
xvii.	I use the Microsoft Word to deliver my course content	17(10.7)	142(89.3)
xviii.	I use the Microsoft Excel to deliver my course content	6(3.7)	153(96.3)
xix.	I use Modelling software to deliver my course content	60(37.7)	99(62.3)
xx.	I use Simulation software to deliver my course content	54(44.0)	105(66.0)
xxi.	I use Courseware to deliver my course content	115(78.6)	34(21.4)
Course Administration			
xxii.	I use Microsoft Access to keep the database of all the students participating in my course	15(9.4)	144(90.6)
xxiii.	I use Microsoft Excel to keep the database of all the students participating in my course	39(24.5)	120(75.5)
xxiv.	I use Microsoft Word to keep the database of all the students participating in my course	65(40.9)	94(59.1)
xxv.	I use Microsoft Access to report and track the results of all the students participating in my course	15(9.4)	144(90.6)
xxvi.	I use Microsoft Word to report and track the results of all the students participating in my course	39(24.5)	120(75.5)
xxvii.	I use Microsoft Excel to report and track the results of all the students participating in my course	65(40.9)	94(59.1)

The table 2 indicated that majority of the respondents use the ICT infrastructure. 88% use the laptop, and 74% the desktop to develop the content of their course and 78% sourced the internet for educational materials. 88% and 86% use the Microsoft Word and Microsoft PowerPoint to prepare their lecture notes and presentation slides. The projector and PowerPoint are the most used ICT infrastructure for lecture presentation with 86% respondents affirming to the effective use. Although other software applications are used to present course such as the courseware (38%), simulation (44%) and modelling (38%) of which the use of projectors (86%), computer desktop (13%) or television screen (6%) are used for a whole class delivery.

Finally, the respondents affirmed their use of ICTs for administration purposes. Results records were kept and tracked using Access (9%), Excel (25%), and Word (41%). The database of students is communicated to the department and faculty exam record officers with the use of the Internet-emailing by very few lecturers (38%), this may be due to the lack of computer culture adopted in the university as in [17] that identified that the lack of ICT culture affects the diffusion of the technology.

4.3. Frequency of ICTs Use

The availability of ICT infrastructures and the skill to use determines the frequency of use. Technology phobia is overcome, confidence and interest to use is increased with the continuous use of the technology. The respondents in NDU in figure 5 indicated their frequency of use of the aforementioned ICT infrastructure for their pedagogy task. This is in agreement with the assessment of secondary teachers in Nigeria where the teachers use ICTs between 11-15 hours per week rating very high frequency of use [24].

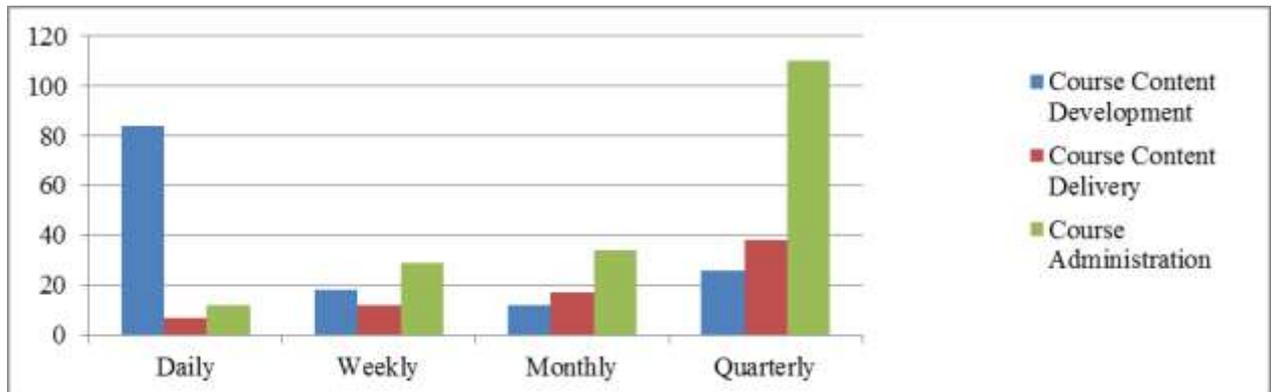


Figure 5: Frequency of ICT Use for Professional Task

The figure 5 above indicated that respondents use the ICT infrastructures mostly for course development on a daily basis and on quarterly basis for course administration. This is because of the periods when these activities are on top gear, that is at the beginning of a new academic session where lecturers are required to develop their course content and continuously update it to the end of the session and at the end of the session, they are required to present the grades of each student that participated in their course(s) to the exams record unit of the department and faculty.

Table 3: Assessment Test for the frequency of Information Technology Use for professional Task

Professional task	ICT Frequency of Use			
	Daily	Weekly	Monthly	Quarterly
Browsing the internet for educational resources	63(39.6)	49(30.8)	17(10.7)	9(5.7)
Sending and receiving emails from colleagues	12(7.5)	26(16.4)	23(14.5)	77(48.4)
Sending and receiving emails from students	24(15.1)	29(18.2)	35(22.0)	50(31.4)
Using Microsoft Word	101(63.5)	16(10.1)	15(9.4)	8(5.0)
Using Microsoft Excel	22(13.8)	17(10.7)	26(16.4)	29(18.2)
Using Microsoft PowerPoint	57(35.8)	33(20.8)	33(20.8)	14(8.8)
Using Microsoft Access	6(3.8)	8(5.0)	14(8.8)	22(13.8)
Using Modelling Software	18(11.3)	11(6.9)	9(5.7)	15(10.1)
Using Simulation Software	11(6.9)	20(12.6)	14(8.8)	15(9.4)
Using Courseware	24(15.1)	28(17.6)	35(22.0)	38(23.9)
Using Desktop	56(35.2)	29(18.2)	20(12.6)	13(8.2)
Using Laptop	104(65.4)	20(12.6)	18(11.3)	3(1.9)
Using Notebook	70(44.0)	40(25.2)	28(17.6)	0(0.0)
Using Tablet	95(59.7)	20(12.6)	17(10.7)	4(2.5)
Using Projector	15(9.4)	43(27.0)	27(17.0)	50(31.4)
Using Printer	64(40.3)	40(25.2)	21(13.2)	9(5.7)
Using Scanner	15(9.4)	21(13.2)	40(25.2)	62(39.0)
Using Digital Camera	4(2.4)	10(6.3)	33(20.8)	64(40.3)
Disk cleaning and scanning using anti-virus	19(11.9)	62(39.0)	30(18.9)	29(18.2)
File arrangement, organization and safe storage	32(20.1)	54(34.0)	20(12.6)	29(18.2)

Table 3 shows that most respondents use ICT infrastructures daily. ICT hardware used most regularly on a daily bases are Laptops (65%), Tablet (60%), Notebook (44%), and printer (40%). ICT software applications used daily by respondents are word (64%), PowerPoint (36%) and modelling (11%) and on the other hand, it was found that only few respondents daily perform basic preventive maintenance activities such as disk cleaning and scanning with the use of Antivirus (12%), however 39% do weekly and 34% also arrange and organize their files and folders weekly and 20% on a daily basis.

4.4. Factors Influencing Diffusion of ICTs

ICT diffusion is a process that goes through several stages. As identified by Rogers in [11], there are five (5) stages of diffusion over time; Knowledge, Persuasion, Decision, Implementation and Confirmation stages. While going through these stages of diffusion, there are factors that could influence the decision of a potential adopter or user to either accept or reject the technology. Thus, in this research, respondents were asked to identify factors that are affects their decision to use the adopted ICT infrastructures. The table 4 below shows the influencing factors as indicated by respondents in their decision to use ICTs especially using the ICTs as available in the university.

Table 4: Influencing Factors of Information Technology Diffusion

S/N	ICT Diffusion influencing factors	Frequency	Percentage
i.	Lack of time to use	84	14.0
ii.	Slow and unreliable internet connection	95	16.0
iii.	Lack of funds to upgrade hardware/software infrastructures	105	18.0
iv.	Lack of adequate technical skill	101	17.0
v.	Lack of ITs in lecture classes and halls	38	7.0
vi.	Lack of IT training sponsorship	118	20.0
vii.	Working condition of IT infrastructures	47	8.0

Table 4 shows that 20% of the respondents indicated that the lack of training sponsorship, 18% lacks funds to upgrade both the hardware and software infrastructures and 17% lack IT technical skills as the factors that affects the use of the IT infrastructures. Training programmes are usually not affordable depending on the training package and the number of participants. Universities most times organize group training programmes that are sponsored by the university or other private partners. The lack of funds to upgrade outdated and non-functional parts of the ITs is an aspect that influences the working conditions and desire to use. This occurs in an instance while using the IT infrastructure, an update message pop-up, if that update is not done after a period of time, the application of the infrastructure would no longer functions. However, other factors as the time to use (14%), unreliable and slow internet (16%) and the working conditions of the infrastructures (8%).

5. Conclusion

The importance of the use of ICTs in University cannot be over emphasized. Although the assessment of diffusion of ICT was conducted in one university in the Bayelsa State, the results may not differ much in other higher institutions in the state and Nigeria as a whole. As lecturers' skills in the use of ICTs is highly appreciated and their perception to the usefulness of the technology to perform professional activities is positive, the diffusion rate of ICTs in the Niger Delta University is commensurate among the academic staff and it indicates that the university lecturers acknowledge the ease of use of ICTs for their content development, delivery and administration and thus have developed the intention to use the technology but are moreover limited with the availability and accessibility of these technologies for use. Therefore, the following are recommendations for an effective extent of the diffusion of ICT innovations in education especially in this covid-19 pandemic era.

6. Recommendations

Based on the findings and conclusions drawn from this study, it is hereby recommended that:

- i. NDU management should organize regular free training opportunities for the lecturers especially in basic ICT maintenance skills. This training would equip the lecturers with basic ICT skill to help them sustain the continuous use of the ICT facilities at the present situation of adopting e-learning strategies.
- ii. Government and other NGOs should intervene in the installation of ICTs in the classroom and provide maximum protection to avoid theft and vandalization.
- iii. NDU management should incorporate the Enterprise Resource Planning (ERP) software for student performance indication across all levels and department/faculty. That means an increased use of ICTs and enhanced modification for course administrative purposes.

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