

APPLICATION OF INFORMATION COMMUNICATION TECHNOLOGY (ICT) IN IMPROVING SERVICE DELIVERY AND REVENUE CAPACITY IN UNIVERSITY OF NIGERIA TEACHING HOSPITAL, ITUKU OZALLA, ENUGU STATE, NIGERIA

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Abstract

The state of public hospitals in Nigeria has been abysmal ranging from very poor service delivery to financial leakages and wastages. In a bid to seek solution and turn things positively, the management of University of Nigeria Teaching Hospital Ituku Ozalla decided to overhaul the decaying system by deploying Information Communication Technology (ICT) facilities to the hospital. The aim was to automate every segment of the hospital's operation with a view to improving services and abating corruption, thereby shoring up revenue. This paper investigated the outcome of this policy implementation. In doing so, two research questions and two hypotheses were formulated. Primary and secondary data were used. Our respondents included one hundred patients of the hospital and twenty I.T. consultants. Information infrastructure theory was used as the theoretical foundation of the study. Findings were made through primary data by testing our hypotheses using regression analysis and supported by secondary data of hospital financial records. The research found out that deployment of ICT in UNTH Ituku Ozalla brought about availability of high level of service delivery and helped the hospital experience net increase in revenue as a result of increased operational efficiency and transparency. A recommendation of the paper was that automation of every department in the hospital should be sustained.

Keywords: ICT, Service delivery, Revenue, Hospital automation.

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Introduction

The state of hospitals in Nigeria has been very bad and calling for attention. Budget allocations by various governments to the health sector have been nothing but inadequate and the insufficient funds allotted have variously found its way to individual pockets in a corruption process that has since become synonymous with Nigeria. Nigeria Federal Ministry of Health (2004) collaborated this by asserting that the performance of Nigeria's health care system was seriously undermined by nearly two decades of military rule. Giving a concrete instance, Nigeria Federal Ministry of Health (2004) noted that between 1985 and 1993, per capita investment in health had stagnated at about \$1.00 per person compared to the international recommended level of \$34.00 per person. In 2020, the situation has not changed. 2020 health budget in Nigeria stood at ₦5.5bn which is less than 5% of the annual budget of the country. This is against the African Union (AU) recommendation of 15 percent of annual national budgets of African countries to health sector. World Bank (1991) declared that public health institutions in Nigeria, like other public institutions, suffer from gross mismanagement and corruption, consequently resulting in inefficient use of the productive capital. The situation is still the same today. Ogohi (2014) observed that in Nigeria, research has shown that public health institutions do not perform their public service functions effectively and efficiently. According to the 2009 communiqué of the Nigerian National Health Conference captured in Menzibeya (2011), Nigeria's health care system remains weak as evidenced by lack of coordination, fragmentation of services, dearth of resources, including drug and supplies, inadequate and decaying infrastructure, inequity in resource distribution and access to care and very deplorable quality of care.

This situation has brought public hospitals to its knees. Their performances have become abysmal and the government needs to improve on the situation. This can be achieved through the intervention of Information Communication Technology (ICT). Using ICT, majority of the needs of the public health care organizations can be met. It is expected that with ICT, overall efficiency and revenue realization will be achieved. The service is expected to provide for collective resource planning with 24-7 access to information for effective hospital management as well as automated revenue collection, realization and conciliation. Through leveraging on ICT, public hospitals are also expected to meet current and future challenges. This thesis is an effort on how to change the ugly narrative of state of public hospitals in Nigeria and instigate a course of change that will usher in an efficient health care delivery system.

Statement of the Problem

Public institutions are created in all countries of the world to accelerate economic and social development. Yet, evidence indicates that most public institutions "either do not contribute strongly to national development or do not perform their public service functions effectively and efficiently" (Ogohi, 2014: 24). Public health institutions in Nigeria fall under this category. They seem to be mired by problems of inefficiency, non-profitability and outright financial deficit, embezzlement of public funds, low quality personnel and in fact total service failure. They are bugged down seemingly also by poor performance and massive wastages/leakages. These are some

of the suspected failures of public health institutions in Nigeria and indeed other sectors of the country's public institutions. They have likely been mired with staff inadequate in knowledge and use of information technology (I.T). These have resulted in poor quality of service delivery and escalating administrative costs.

Against the backdrop of these failures and challenges, this study seeks to investigate the effect of deployment of ICT facilities in University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu State, as a means of achieving process improvement, service delivery, patients' satisfaction and revenue assurance.

Research Questions

The following research questions were raised by the study:

- (i) How has ICT improved services in University of Nigeria Teaching Hospital?
- (ii) How has ICT improved revenue generation in University of Nigeria Teaching Hospital?

Objectives of the Study

The long term objectives of this study are to:

- (i) Discover how ICT has improved services in University of Nigeria Teaching Hospital Ituku Ozalla.
- (ii) Enquire how ICT has improved revenue generation in University of Nigeria Teaching Hospital Ituku Ozalla.

Literature Review

Information and Communication Technology (ICT) is a trending concept in both public and private organizational domains. It means different things to many people. Ewuim, Igbokwe-Ibeto and Nkomah (2016) conceive it as encompassing a lot of activities involving the acquisition, storage, processing and dissemination of information through the use of appropriate software and hardware designed facilities for that purpose. Bature (2007) sees ICT as those technologies that provide access to information through telecommunications. It is seen by Olasanmi, Ayoola and Kareem (2012) as computer systems, telecommunication, networks and multi-media application that enhance knowledge for the execution of given task which entails skills and processes necessary for carrying out activities in a given context. Wangwe (2010) submitted that ICT is an integrated system that incorporates the technology and infrastructure required to store, manipulate, deliver and transmit information, the legal and economic institutions required to regulate ICT access and usage and the social and inter-personal structures which allow information to be shared, facilitate access to the ICT infrastructure and through which innovation takes place.

Oshioma and Aimuan (2017) postulate that ICT ensures that the public sector is at the service of all and that it impacts positively on human resource performance, improves documentation processing and efficient filling system. Aimuan and Aigbe (2019) posit that ICT

innovation and revolution has no doubt brought considerable potential to initiatives aimed at fighting corruption and increasing the participation of citizens in the institutions of government. To Aimuan and Aigbe (2019), ICT has opened a new e-governance space or route that has huge potential for improving opportunities for the participation of citizens in governmental affairs. Oshioma and Aimuan (2019) identified five prospects or benefits of ICT application to include: reduced cost of administration; improved fast and accurate service delivery; creating access to transparent, accountable and participatory governance; enhancing networking and inter-governmental relations; and improving competitiveness which ensures responsive service delivery. These benefits accruing from the application of ICT have in the views of Ayoade (2017) promoted good customer relations services and also facilitated effective service delivery.

Oladimeji and Folayan (2018) note that ICT has become the foundation of every sector of every economy in the world and has been able to: reduce transaction costs thereby improving productivity; offer immediate connectivity; substitute for other, more expensive means of communicating and transacting, such as physical travel; increase choice in the market place and provide access to otherwise unavailable goods and services; widen the geographic scope of potential markets; and, channel knowledge and information of all kinds. Agreeing with the above findings, Oloruntoyin and Adeyanju (2013) observe that over the past decade, new applications of ICT have improved service delivery, transparency and public access in national development. They maintain that it is a unique tool capable of encouraging sustainable economic and social development in the society.

Emberg (1999) in Oloruntoyin and Adeyanju (2013) argues that there is a potentially large market for ICT tools needed by business, research institutions and public services in developing countries. Specifically, Idowu (2003) opines that the use of ICT in Nigeria Teaching Hospitals will help all patients including ones in life threatening situations. Idowu (2003) suggests three ICT tools to be deployed to teaching hospitals to help enhance delivery of services. They include personal computers, mobile phones and internet facilities. Accordingly, Idowu (2003) asserts that majority of the medical experts make use of public cybercafé and he attributed that to lack of connectivity and personal computers in most teaching hospitals. But with connectivity and availability of mobile phones, health services could be improved significantly. This is so because of the ability to utilize them to access the communication gap between medical practitioners and patients as well as medical colleagues.

Olaniyi (2018) posits that application of ICT in public sectors has a positive and statistically significant effect on its management. There is a bi-directional causality between ICT and public sector management (Olaniyi, 2018). He suggested that ICT spurs public sector management which, in turn, spurs ICT even further. The outcome of application of ICT in public sectors therefore leads to efficiency of administration and improvement of public sector services (Amegavi, Bawole and Buabeng, 2018; Evans 2018; Karanja, Sang and Ndiraugu, 2018). It is a truism therefore, that ICT has facilitated government operations and greatly influenced the way public services are provided (Olaniyi, 2018; Liu & Yuan, 2015).

To this end, ICT application and deployment in society has unprecedentedly cut across wider spectrum of human endeavor, thereby creating and sustaining innovative concepts used in the management and administration of both public and private institutions as evident in the concepts such as e-Governance, e-government, e-Administration, e-Business, e-Voting, e-Marketing, telemedicine, e-Health, e-Learning, e-Society, e-Citizens etc. which are leveraged on to deliver effective and efficient, faster, reliable, affordable, responsive and timely services to citizens and clients.

Theoretical Foundation of the Study

This paper hinges its foundation on information infrastructure theory. This theory was made popular by Hanseth (2002) who sees information infrastructure as a shared, evolving, open, standardized and heterogeneous base. Pironti (2006) also views information infrastructure as all of the people, processes, procedures, tools, facilities, and technology which supports the creation, use, transport, storage and destruction of information. This theory is fruitful to information and communication technology because it has changed their operating systems from manual to networks allowing a global and emergent perspective on information systems. Information infrastructure is a technical structure of an organizational form, an analytical perspective.

Organizations model their information system operations on information infrastructure theory. They introduce technical and information technology structures that support innovations. Information infrastructure changes organization's unserious attitudes to serious and essential factors. In fact, Matsepe and Van der Lingen (2022) postulate that emerging innovative technologies present various opportunities for organizations. Narrowing it down to health sector, Braa, Hanseth, Heywood, Mohammed and Shaw (2007) postulate that information infrastructure is the sum of technological and human components, networks, systems, and processes that contribute to the functioning of the health information system.

Theoretical application of the information infrastructure theory in this study depicts the A-Z automation of core processes in University of Nigeria Teaching Hospital, Ituku Ozalla such as building the capacity and capability of the hospital to generate, gather, store and deliver data. In fact, all the deployed IT infrastructure that provide high-availability service delivery are reflections of the operational realities on the utilization of information infrastructure theory that helps to explain, describe, analyze, predict and consequently make informed decisions that enhance service delivery, minimize corruption, wastage, keep and track records in the hospital. To this end, Strohmeier and Kabst (2014) pinpointed two major perspectives called '*automational* and *informational*' strategic system of overhauling organization to be productive using ICT tools.

Statement of Hypotheses

Culling from the theoretical foundation of this study, the following alternate hypotheses were propounded:

1. Deployment of ICT in University of Nigeria Teaching Hospital, Ituku Ozalla has improved services in the hospital.

2. Revenue generation has improved in University of Nigeria Teaching Hospital, Ituku Ozalla since the deployment of ICT in the hospital.

Methodology

The study was carried out in University of Nigeria Teaching Hospital, Ituku Ozalla. The study participants included the I.T consultants that were hired by the hospital’s management to install and operate I.T infrastructure and patients in the hospital who are not critically ill/sick to respond to interactions and questionnaire. Twenty (20) I.T. consultants and one hundred (100) patients that were randomly selected served as respondents to our questionnaire.

Data gathering

Empirical evidence for this study was obtained through the use of questionnaire. Likert scale was used to generate data from the questionnaire. The information was put in a weighted scale with numerical values attached to them in the questionnaire as follows: Strongly Agree = 5, Agree = 4, Undecided = 3, Disagree = 2, Strongly Disagree = 1. The data were analyzed using descriptive and inferential statistics. The descriptive statistics involved computation of means and standard deviations from the responses of the respondents to the questionnaire items. The decision rule was to accept any item that has a mean score of 2.50 and above. The hypotheses were tested using regression analysis.

Table 1: Model Summary for Deployment of ICT and Improved Service Delivery

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin - Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.344 ^a	.118	.114	1.13178	.118	27.064	1	202	.000	.734

a. Predictors: (Constant), Deployment of ICT.

b. Dependent Variable: Improved Service Delivery

Source: SPSS 23.0 Output

The coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (service delivery) as explained by the element of independent variable.

The model summary illustrates the (R square) value which helps in explaining variance in the dependent variable (service delivery). Based on the results in Table 1 the (R square) value is .344. This means that the independent variables (Deployment of ICT) predict the dependent variable (service delivery) by 34%, thus, leaving out 66% (100%-34%) unexplained.

In a nutshell, this means that there are other extra independent variables that were not put into consideration in this study that is significant in explaining variation in organizational performance.

Table 2: ANOVA^a for Deployment of ICT and Improved Service Delivery

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34.666	1	34.666	27.064	.000 ^b
	Residual	258.746	202	1.281		
	Total	293.412	203			

a. Predictors: (Constant), Basic ICT infrastructure is fully functional in the Institutions

b. Dependent Variable: Improved Service Delivery

The ANOVA was performed to test the statistical significance of the regression model on whether it is a good descriptor for the relationship between the predictor variables (ICT deployment) and the dependent variable (Service delivery). Therefore, based on the results, the model is a good descriptor of the relationship between independent variables (ICT deployment) and the dependent variable (service delivery) ($F= 27.064$; $p=0.000$). Thus, this means that the independent variable (ICT deployment) is significant in explaining the variation in the dependent variable (service delivery).

Step 2: Statement of Decision Criteria

1. Reject H_0 if the P-Value $cal < 0.05$ at 5% level of significance.
2. Otherwise, accept the null hypothesis (H_0).

Table 3: Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.580	.238		19.233	.000
	Basic ICT infrastructure is fully functional in the Institution	-.324	.062	-.344	5.202	.000

a. Dependent Variable: Improved Service Delivery

The coefficients table helped the researcher to compare which of the predictor variable of deployment of ICT contribute the most to the variation of service delivery. Therefore, to make the comparison, the Beta standardized coefficients were used.

Through the use of SPSS the figure in table 3 above was and the regression equation obtained;

$$Y = -3.24 + 4.560X_1$$

From the above regression equation, it showed that the coefficient of Deployment of ICT is positive for the predictor variable; proving that the presence of the ICT deployment would lead to a positive effect on service delivery of the hospital (4.580). A unit increase in deployment of ICT in the health institution will lead to an increase in service delivery. This shows that deployment of ICT is a key organizational aspect that the health institution must consider in order to improve service delivery

Step 3: Decision Rule:

3. Reject Ho if the P-Value ≤ 0.05 at 5% level of significance.
4. Otherwise, accept the null hypothesis (Ho).

From the regression analysis in Table 3 based on the t-value of 19.233 and P-value of 0.00, in table 3 was found that Deployment of ICT in University of Nigeria Teaching Hospital Ituku Ozalla, has improved services in the hospital and this influence is statistically significant at 5% level of significance as the P-value is within 5% significance level. This result, therefore suggests that we should accept alternate hypothesis one (H_1) which states that Deployment of ICT in University of Nigeria Teaching Hospital has improved services

Test of Hypothesis Two

Revenue generation has improved in University of Nigeria Teaching Hospital Ituku Ozalla since the deployment of ICT in the hospital

Table 4: Model Summary for Revenue Generation and Deployment of ICT

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.476 ^a	.227	.223	1.05991	.227	59.177	1	202	.000	1.006

a. Predictors: (Constant), Deployment of ICT

b. Dependent Variable: ICT availability has improved the revenue generation of the hospital

In table 4, R-squared and its adjusted R-squared values were (0.476) and (0.227) respectively. This is an indication that all the independent variables jointly explain about 48% of the systematic variations in revenue generation in the health institution while 52% of the systematic variations are captured by the error term.

Table 5: ANOVA^a for Revenue Generation and Deployment of ICT

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	66.481	1	66.481	59.177	.000 ^b
	Residual	226.931	202	1.123		
	Total	293.412	203			

a. Predictors: (Constant), Deployment of ICT

b. Dependent Variable: ICT availability has improved the revenue generation of the hospital

The ANOVA was performed to test the statistical significance of the regression model on whether it is a good descriptor for the relationship between the predictor variables (ICT deployment) and the dependent variable (Revenue Generation). Therefore, based on the results, the model is a good descriptor of the relationship between independent variables (ICT deployment) and the dependent variable (Revenue generation) (59.177; $p=0.000$). Thus, this means that the independent variable (ICT deployment) is significant in explaining the variation in the dependent variable (Revenue generation).

Table 6: Coefficients^a for Revenue Generation and Deployment of ICT

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.774	.192		24.868	.000
	ICT availability has improved the revenue generation of the hospital	-.440	.057	-.476	-7.693	.000

a. Dependent Variable: ICT availability has improved the revenue generation of the hospital

The coefficients Table 6 helped the researcher to compare which of the predictor variable of deployment of ICT contribute the most to the variation of revenue generation. Therefore, to make the comparison, the Beta standardized coefficients were used.

Through the use of SPSS the figure in table 6 above was and the regression equation obtained;

$$Y = -.440 + 4.774X_1$$

From the above regression equation, it showed that the coefficient of dependent variable is positive for the predictor variable; proving that the presence of the ICT deployment would lead to a positive effect on revenue generation of the hospital (4.774). A unit increase in deployment of ICT in the health institution will lead to an increase in revenue generation.

Step 4: Decision Rule:

1. Reject H_0 if the P-Value ≤ 0.05 at 5% level of significance.
2. Otherwise, accept the null hypothesis (H_0).

From the regression analysis in Table 6 based on the t-value of 24.868 and P-value of 0.00, in table 6 was found that Deployment of ICT in University of Nigeria Teaching Hospital has improved revenue generation in the hospital and this influence is statistically significant at 5% level of significance as the P-value is within 5% significance level. This result, therefore suggests that we should accept alternate hypothesis one (H_1) which states that revenue generation has improved in University of Nigeria Teaching Hospital since the deployment of ICT in the hospital

Discussion

Prior to the years preceding 2012, services in UNTH were anything but satisfactory. There were complaints by patients on the provision of services by the hospital. Card/folder administration was poor; time taken to see a doctor on a visit was too long because of the manual registration involved; collection and payment of bills were cumbersome, again because of the manual retrieval of a patient's data; etc. As a response to these anomalies, the management of the hospital engaged an information technology (IT) consultant to bring in technology based facilities that will help improve services in the hospital. The consultant (Health Station) is a health care solution service provider that is committed to preparing public hospitals to meet current and future challenges through leveraging on ICT. They commenced work in 2012 and were saddled with the responsibilities of automation of core processes around Electronic Medical Records, Billing and Invoicing, Drug Inventory and Prescription Management, Patient Clerking, Accounts and Collections Management, E-Payment and NHIS Management. In fact, they deployed IT infrastructure for high-availability service delivery.

Based on the automation of these infrastructures, services as evidenced by the response of our respondents who are the patients showed that there was a tremendous improvement in services rendered by the hospital. With I.T infrastructure, one hospital card that tracks the activities of all departments in the hospital is issued. In that sense, all departments are now interconnected thereby saving time and money, reducing stress and making card/folder administration more efficient. Relatedly, with I.T infrastructure, all record duties are automated and once a patient arrives, the patient is logged in with their name and all medical details and record of the patient retrieved, making consultation with medical personnel quick and easy. Indeed deployment of ICT in UNTH improved services in the hospital.

Poor internally generated revenue also necessitated the deployment of ICT infrastructure in UNTH. Table 1 shows the UNTH cash submission voucher from 2010-2012 before the use of I.T was deployed in the hospital.

**Table 7: UNTH Cash Submission Voucher 2010-2012
(Before the deployment of I.T infrastructure)**

Year of Submission	Amount
2010	264,872,586.82
2011	257,303,806.85
2012	244,211,971.85

Source: Health Station, 2021

From the table above, it can be observed that revenue accruing to the hospital was yearly going down. This concern was a reason for deployment of I.T facilities in the hospital. Eight years after the deployment of I.T facilities, internally generated revenue has tremendously increased as can be seen from table 7 below.

**Table 8: UNTH Cash Submission Voucher 2013-2020
(After the deployment of I.T Infrastructure)**

Year of Submission	Amount
2013	488,950,277.20
2014	577,907,146.70
2015	673,331,427.39
2016	682,444,202.50
2017	698,756,110.40
2018	770,140,353.10
2019	824,610,225.80
2020	373,152,415.20

Source: Health Station, 2021

From the table above, the I.T consultants let us know that revenue generation in UNTH increased tremendously because of the deployment of I.T. infrastructure in the hospital's accounting system except in 2020 due to the incidence of COVID-19 pandemic with its lockdown and devastating economic effects. Therefore, the deployment of ICT in this public institution has helped it experience net increase in revenue as a result of increased operational efficiency, transparency and revenue assurance.

Conclusion

The idea to deploy I.T. infrastructure to University of Nigeria Teaching Hospital, Ituku Ozalla was a novel and noble idea. The hospital previously was replete with poor and unsatisfactory services rendered to patients and obvious financial leakages that led to poor revenue generation. The engagement of I.T. consultants in a scheme reminiscent of a public private partnership (PPP) was timely to save this peculiar public institution. Facts from our primary and secondary data indicate that the introduction of I.T. infrastructure has achieved a great feat in repositioning the hospital. The scheme has achieved automation of core processes around electronic medical records, billing and invoicing, drug inventory and prescription management, radiology management, patient

clerking accounts and collections management, e-payment and NHIS management. It has brought about high-availability service delivery and has helped the hospital experience net increase in revenue as a result of increased operational efficiency and transparency.

Recommendations

This paper commended the deployment of I.T. infrastructure to University of Nigeria Teaching Hospital, Ituku Ozalla and recommended that:

- It should be sustained especially in this COVID-19 era more than ever before. It must be noted that based on the success of this I.T. scheme in UNTH, federal government has deployed the facility to about twenty five (25) federal hospitals across the nation.
- All government hospitals, both federal and state and even community clinics in the country that are yet to benefit from the scheme, should be connected in an aggressive move to improve the services rendered in our hospitals and reduce corruption to a very significant level.
- Government at all levels should also cooperate with Internet data/network service providers in the country to ensure faster and deepened penetration of internet services, to ensure wider and stronger network coverage across every length and breadth of the country. This Internet coverage is especially needed in the hinterlands; remote villages, and rural communities that are yet to enjoy internet coverage should be provided with fast and reliable and affordable Internet data services/availability, if this laudable deployment of ICT infrastructure and services in public hospitals are to benefit the majority of the national population who resides mainly in local/rural areas and villages, where internet availability/services is totally lacking or poor with constant downtime.

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