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Task-Technology Fit of CAD Deployment in Architectural Firms in Nigeria

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Abstract— Architectural design firms deploy design technologies for design, modelling and other services. Autodesk AutoCAD is deployed by 90% of these firms in Nigeria. The paper utilized integrated Task-Technology Fit (TTF) model to measure deployment. Multiple regression analysis of the survey reveals ease-of-locating data as highest predictor of the fit model.

Keywords—Architecture, AutoCAD, Deployment, Regression, Task-Technology Fit.

I. Introduction

The introduction of Computer Aided Design (CAD) to Architectural practice in Nigeria to gradually replace the manual modes of design and drafting began in the early 1980s. Few firms owned one or two computer units with CAD applications installed. Large and economically buoyant firms were the few who could afford the systems at the time. However CAD systems are now ubiquitous in the country. Grassi (2002) and Emmitt (2002) both recognized certain advantages of CAD systems over manual drafting to include: Drawing clarity, precision and consistency in drawing style when multiple designers work on a drawing; elimination of repetition and the monotony in drafting is reduced and maybe even eliminated; increased speed of drawing production is increased in large scale works. Furthermore there are opportunities for ease of alterations and effecting changes; easy coordination and automatic drawing register; rapid access to previous projects and details; and drawing longevity in electronic formats and little storage space needed. The products of the core activities of design and presentation include: sketch design (design development drawings), presentation drawings, production drawings, working drawings, details, design development models, presentation models, schedules, and specifications (Emmitt, 2002; De Amicis et al, 2001).

Dare-Abel (2013) found the most deployed CAD application by architectural firms in Nigeria to be Autodesk AutoCAD with 90% of the firms utilizing the application.

Chopra (2007) described in vivid terms the differences between solid modelling and surface modelling platforms. Solid models as the name implies possess structural mass with a semblance of a clay model. AutoCAD, Form-Z, Inventor and SolidWorks are Software with capabilities for Solid Modelling. This type of model is useful for product fabrication and machine design where precision is vital and where material or component quantities are needed. Calculations can be automatically performed to derive certain parameters as demanded by the operations. Surface Models to cardboard/paper models with the elements lacking mass. This form of modelling is only defined by two-dimensional surfaces combined together and not by elements.

The aim of the paper is to determine the level of fit between Autodesk AutoCAD deployed in Architectural firms and the tasks performed. A modified TTF model was developed to test the following hypotheses.

> Ho – There is no fit between AutoCAD and tasks performed in architectural firms in Nigeria.
>
> Ha - There is a measure of fit between AutoCAD and tasks performed in architectural firms in Nigeria.

Task-Technology Fit is the relationship between task requirements, technology functionality, technology experiences and task knowledge. The basic idea of the TTF model is that the fit between task and technology is the degree of how suitable the software or system usage is for a particular task. Leong (2003) opined that 'Fit' as used in this construct is defined as the matching of the capabilities of the technology to the demands of the tasks.

II. Material and Methodology

A cross-sectional survey was adopted for this study. The sample was derived from the 649 firms entitled to practice in Nigeria by the Architects Registration council of Nigeria (2010). Multi-stage sampling was adopted to enable an easy arrival at the final sample. The listed architectural firms were grouped geographically according to their locations into the six zones. The zones are north-west, north-east, north-central, south-west, south-east and south-south. The city-selection stage involved the choice of the city with the most number of firms. The final stage involved the selection of the calculated number of firms through random sampling by balloting. The six selected cities are Abuja, Kaduna, Maiduguri, Enugu, Lagos and Portharcourt. This ensured a good spread of the firms in order to arrive at results that could be generalized. A sample of 159 architectural firms representing 24.5% of firms in the sample frame was calculated using a sample size calculator. As a result of the field work a total of One hundred and eighteen

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(118) questionnaires out of (159) were returned duly completed. This indicates a response rate of 74.21% (Dare-Abel, 2014).

The data was subjected to factor analysis to obtain the most relevant factors and variables needed for regression analysis. Multiple regression analysis was then conducted using a stepwise method of elimination. The result of the analysis was later used to formulate the model equation to explain the TTF model.

Task Technology Fit (TTF) was observed to possess a strong conceptual link with performance within firms and organizations. Since few researches have been embarked upon along these lines, it is difficult to ascertain the strength of such relationship. Therefore more conceptual and empirical studies are critically needed to substantiate these ideas. This study offers yet another opportunity to test the TTF model to be able to examine the relationships between technology tools and specific tasks within architectural firms in Nigeria as seen in table 1. This however adds to the body of knowledge that will help substantiate the validity of the model.

According to Goodhue (1998) and Baas (2010) noted that several constructs are crucial for consideration in the development of the research instrument; these include the task characteristics constructs: the right data and the right level of detail. A modified TTF model was developed for this study to capture relevant factors in the study context as seen in figure 1.

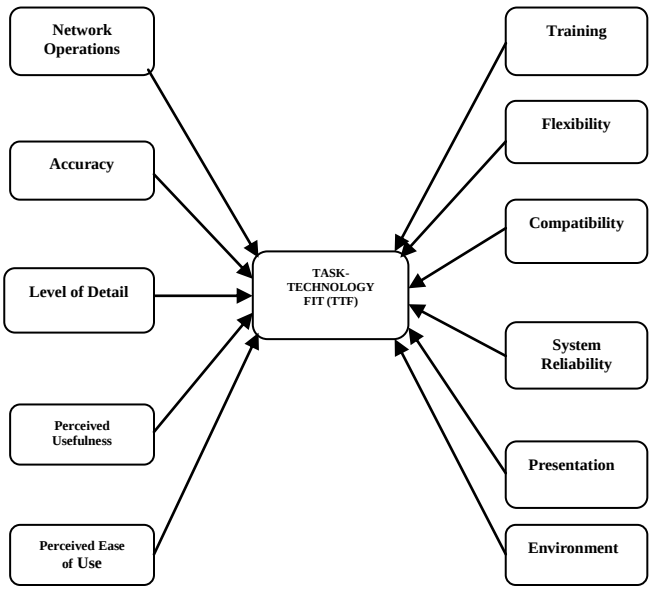

Figure 1: Modified TTF Model for the study showing the various constructs

Source: Dare-Abel (2013)

III. Results and Tables

Three factors were deduced from the factor analysis, comprising several variables useful for the regression analysis. The variables contained in the extracted factors for the AutoCAD dataset are as follows: Factor 1- Challenges with transferring documents from one application to another CLTD; ease of locating data ELD; challenges with multiple applications on same project CLMP; ease of data search for speedy project take-off EINS. Factor 2 -funding for training FNTR; excellent up-time in network operations EXUP and challenges with different data definitions CDDD. Factor 3- detailed system product DSYP; ease of changing system platform ECSP and ease of locating data ELD.

Table 1: Ranking of Relevant Tasks in Architectural Firms

Task Engaged	Mean Score	Standard Deviation	Rank
Sketch Design	3.04	.60	1
Working Drawing	2.90	.71	2
Detailed Drawing	2.85	.55	3
Presentation Drawing	2.85	.68	4
Design Info Search	2.65	.98	5
Digital Modelling	2.63	.76	6
Collaborative Works	2.30	1.17	7

All these were treated as independent variables while Detailed System Product was treated as the dependent variable in the Multiple Regression analysis. The analysis used the stepwise method of exclusion to unveil with precision the variables that have the most effect on the TTF model while excluding those that are not significant.

The results of the analysis show that the coefficients of determination (R square) for the regression Model is 0.489, this reveals that 48.9% of the fit in the detailed design product with the AutoCAD software and the associated systems is explained by ease-of –locating design data (ELD) and other significant variables listed below. Therefore ELD contributes a change of 39% in the dependent variable if it undergoes 100% change, while controlling the effect of other variables in the model. The values of these coefficients are comparable to what Baas (2010) recorded, which range between 13.3% and 43.3% from the three aspects of the study. Staples and Seddon (2004) reported 48% variance explained in ICT performance impact.

This result is significant in making predictions through the regression equation derived from the model which is:

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Equation 1:

$$Y_{DSYP} = 0.390X_{ELD} + 0.284X_{FNTR} - 0.269X_{NBRL} + 0.330X_{DFAT} + 0.293X_{CRSD} + 0.198X_{CDDD} + 0.292_{EINS} - 1.066$$

The predictor variables for this regression model are ease-of-locating data; funding for training; number of branches; difficulty in task accomplishment; clarity of system display; challenges with different data definitions and ease of info/data search for speedy project take-off.

The result of the analysis confirms the acceptance of the alternative hypothesis, therefore the Study accepts that:

Ha - There is a measure of fit between AutoCAD deployed and tasks performed in architectural firms in Nigeria.

IV. Conclusion

The study confirmed that there is fit between technology deployed and tasks in architectural firms in Nigeria. Improvements in presentation, Training, usefulness of software, network operations, system accuracy and ease-of-use will translate to greater level of task-technology fit with regards to the use of autoCAD in Architectural firms in Nigeria.

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