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DEVELOPING A MODEL FOR BUSINESS INTELLIGENCE SYSTEM FOR REAL ESTATE INVESTMENT MANAGEMENT IN BENIN CITY, NIGERIA

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ABSTRACT

This study examined the willingness of real estate investment managers in Benin City to adopt business intelligence systems (BIS) for real estate investment management and the factors influencing the adoption of BIS in the study area. This was with a view to modelling the adoption of BIS by real estate practitioners in the study area. Questionnaires were distributed to 39 practising estate surveyors and valuers in Benin City to harness relevant data. Using multiple regression analysis, the study established willingness of the practising estate surveyors to adopt BIS. The primary predictive factors on adoption of BIS was profitability and outcome, skill and competence related requirements and process efficiency requirements. The study recommends sensitisation and demonstration of how BIS could result in improved profitability and investment outcome as this is the primary driving factor for BIS adoption in the study area.

1.0 Introduction

Organizations recognize the invaluable nature of data as a critical asset, yet many struggle to harness its potential effectively, unsure of where to begin [1]. This challenge is particularly pronounced among real estate investment managers who rely on data to gauge market trends and optimize portfolio performance, balancing returns and risks [2]. Compounded by a contracting real estate market, companies are under pressure to optimize efficiency while meeting growing demands for transparency from investors across all asset classes, including real estate [3]. In response to these trends, swiftness in assembling, analyzing, and disseminating information has emerged as a cornerstone of success in the real estate sector.

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Traditional property management and accounting systems, designed for single-record operations, fall short in meeting these demands, leaving users reliant on cumbersome, error-prone spreadsheets for data aggregation and reporting [4]. To thrive in this environment, investment management firms must embrace comprehensive business intelligence strategies that streamline decision-making processes and eliminate manual inefficiencies.

Implementing a robust business intelligence platform has become imperative for real estate firms seeking to remain competitive. Business intelligence enables the transformation of disparate data streams into actionable insights, aligning with organizational goals and missions [5]. By leveraging predictive analytics, businesses can anticipate future trends and outcomes, enhancing strategic planning and market responsiveness.

Business intelligence (BI) is particularly relevant in real estate for monitoring market trends, analyzing data, and formulating sales strategies. By creating intuitive dashboards and reports, BI tools empower stakeholders to navigate complex data sets efficiently, saving time and facilitating informed decision-making [5]. In essence, investing in a robust BI solution tailored to real estate analysis is pivotal in today's market landscape. The intuitive visualization and interactive capabilities of BI platforms offer significant time savings and enhance decision-making processes for investors, buyers, and sellers alike.

Given the real estate investment potential in Nigeria, consequent to the teeming population, business intelligence solution is relevant to handling the huge information need to realising this potential. The benefits of business intelligence application in the Nigerian real estate investment analysis are undeniable, however these benefits are only realisable when the transition from the conventional practices to adoption of business intelligence solutions is adequately figured out.

Benin City is one of the rapidly growing cities in Nigeria. Being a transit city to many other cities across Nigeria, the improved economic climate has played out in the gradual advancement in its real estate sector. There is therefore need to inquire into the required change in mode of practice, the required additional human and non-human resource beef ups, perceptions, attitudes and dispositions to adoption and projected factors that could drive the adoption of business intelligence solutions in the its real estate investment activities. Existing studies on business intelligence in Nigeria [6, 7] have focused on application to small, medium scale and retail businesses in general without taking cognisance of the peculiarity of application to real estate investment decision. Studies on business intelligence application to real estate have been primarily domiciled in the developed countries [see 8, 9, 10] despite the potential benefits realisable on data management in the Nigerian real estate sector. It is against this background that this study examines the application of business intelligence to property investment management in Benin City, Nigeria.

2.0 Materials and Methods

The relevant population for this study is the Estate surveyors and valuers in Benin City, Nigeria. This category of respondent is responsible for collection of data from clients and managing such for real estate investment advice in Nigeria. The respondents were selected from the list of Estate Surveyors and Valuer registered with the Nigerian institution of estate surveyors and valuers in Benin City. The 2022 directory of the institution in Edo state indicates that there are 56 registered firms in Benin City. The 56 firms, being manageable, thus constitute the sampling frame and sample size for this study. The managers of the estate surveying firms were selected for survey. Where the manager was not available, any other available estate surveyor was selected. Thus, fifty-six estate surveyors from the fifty-six estate surveying and valuation firms in Benin City constitute the sample size for this study.

The relevant information pertinent to achieving the objectives of the study include the willingness of the practicing surveyors to adopt business intelligence in the management of data on property investment decisions, the projected factors influencing the adoption of BI on property investment

management and the relationship between willingness to adopt and the factors influencing the adoption of business intelligence in the management of data for real estate investment decisions.
The data collection tool adopted was the questionnaire. The data collected was analyzed using simple descriptive statistics and multiple regression analysis. The major analytical tools adopted for this study are further discussed hereafter.

2.1 Mean and Relative Importance Index

The relative importance index is used to analyse the respondents' ratings in the mean item score representing the responses from each respondent categories. The use and suitability of mean item score for a study of this nature was supported by earlier studies [11, 12] as it aids in ascertaining the predictive variables' individual and collective contribution to the dependent variable.
To arrive at the mean item score, respondents were asked to rank the concerned variables on a five-point Likert type scale, with weight 1 representing the least weight and 5, the highest weight. The weights assigned to each attribute were multiplied by the frequency of response to the attributes. This is in turn summed together to get the total weight value (TWV) for each variable. The total weight value, when divided by the total frequency of response on each variable gives the mean item score for the variables (Equation 3.1).

$$\text{Mean Item Score (MIS)} = \frac{TWV}{\sum_i^5 Fi} \quad (1)$$

Where

TWV= Total weight value and

F= Total frequency of response

The relative importance index is subsequently arrived at by dividing the mean item scores by the highest scale rateable: 5 (See equation 4.2.)

$$Relative\ Importance\ Index = \frac{Mean\ Item\ Score}{n} \quad (2)$$

Where n= highest scale rateable (5)

The result is then used to rank the variables in descending order based on responses on them.

2.2 Multiple regression

Multiple regression was used to analyze the interaction between the variables which were theoretically considered as influencing business intelligence adoption and between these variables and the dependent variable (willingness to adopt business intelligence).
The regression equation takes the following form:

$$ADOPT = A + B_1COMPAT + B_2COST + B_3CUSTOMER + B_4PROCESSEFFIC + B_5PROFITOUTCOME + B_6SKILLCOMPETENCE \quad (3)$$

Where A = value of ADOPT when the value of all independent variables are zero
Bx = the coefficient assigned to each of the independent variables
The test on the regression coefficients was carried out using the T-statistics or T-value, while the test on the prediction or explanatory ability of the model is carried out using the F-test or F-ratio with the null hypothesis that all the independent variables considered together do not explain significant amount of the variation in the dependent variable. A high probability suggests significant results.

Variables	Definition of Variables	Measurement
ADOPT	Willingness to adopt BIS	Likert scale of 1 to 5; 1-not at all, 2- to a little extent, 3- to an average extent, 4- to a considerable extent and 5- to a very large extent.
COMPAT	Compatibility related factors	Likert scale of 1 to 5; 1-not at all, 2- to a little extent, 3- to an average extent, 4- to a considerable extent and 5- to a very large extent.
COST	Cost related factors	Likert scale of 1 to 5; 1-not at all, 2- to a little extent, 3- to an average extent, 4- to a considerable extent and 5- to a very large extent.
CUSTOMER	Customer satisfaction and participation related factors	Likert scale of 1 to 5; 1-not at all, 2- to a little extent, 3- to an average extent, 4- to a considerable extent and 5- to a very large extent.
PROCESSEFFIC	Process efficiency requirements	Likert scale of 1 to 5; 1-not at all, 2- to a little extent, 3- to an average extent, 4- to a considerable extent and 5- to a very large extent.
PROFITOUTCOME	Profitability and outcome related factors	Likert scale of 1 to 5; 1-not at all, 2- to a little extent, 3- to an average extent, 4- to a considerable extent and 5- to a very large extent.
SKILLCOMPETENCE	Skill and competence related requirements	Likert scale of 1 to 5; 1-not at all, 2- to a little extent, 3- to an average extent, 4- to a considerable extent and 5- to a very large extent.

3.0 Results and Discussion

3.1 Willingness to adopt Business intelligence solution in property investment decision making

This section has the result on the willingness of the respondents to adopt BIS in the management of data for property investment purposes. The responses were based on the Likert type scale of 1 to 5 and the result is as presented in table 2 below.

Table 2: Willingness of Estate Surveyors and Valuers to Adopt BIS

Mean: 3.3333 Standard Deviation: 1.1547		
Rating	**Frequency**	**Percentage**
Not at all	2	5.1
A little extent	8	20.5
Average extent	11	28.2
Considerable extent	11	28.2
Very large extent	7	17.9
Total	39	100.0

The result shows that the mean measuring willingness is 3.3333. This is above 3 which represents average on the rating scale. Majority of the responses were within "average extent" and "considerable extent". This result therefore shows that the respondents are willing to adopt BIS.

3.2 Factors Influencing Adoption of BIS by Estate Surveyors and Valuers

The factors influencing BIS adoption were analyzed in this section. Based on the meaning and application of the factors, six major themes were coined out for clarity. The classifications are also in line with extant literature. These include compatibility related factors, cost related factors, customer satisfaction and participation related factors, profitability and outcome related factors, process efficiency requirements and skill and competence related factors. Table 3 shows the responses on the factors classified under each of these identified themes and analysis based on the themes.

Table 3: Factors influencing the adoption of BIS

Factors	Mean (on a scale of 1 to 5)	Standard Deviation
Cost related factors	**2.6239**	**1.04063**
Running costs	2.641	1.0879
Training costs	2.641	0.98641
Setup costs	2.5897	1.18584
Process efficiency requirements	**2.5085**	**0.77511**
Ability to enhance quicker operational performance	2.7436	1.01872
Flexibility of the process	2.641	0.8732
Amount of time resources consumed	2.5641	0.88243
Ability to boost control over business	2.4615	0.68234
Tendency: to provide timely information	2.3784	0.68115
Ability to try out the technology adequately before major decisions are made	2.2308	0.90209
Customer satisfaction and participation related factors	**2.4786**	**0.77533**
Suitability of BI for clients' needs	2.6923	1.07981

Extent of required end user participation	2.641	0.93153
Pressure from customers to integrate BI	2.1026	0.64051
Compatibility related factors	**2.4051**	**0.78336**
Ability to integrate BI with other systems	2.7436	0.96567
Compatibility with existing organisation's IT infrastructure.	2.3846	1.04164
compatibility with work practices	2.3333	0.86855
compatibility with organisational culture	2.3333	0.80568
compatibility with business values	2.2308	0.77668
Profitability and outcome related factors	**2.3949**	**0.8651**
Ability to improve job performance	2.5897	1.09347
Ability to provide access to reliable information	2.5385	1.14354
Ability to provide competitive advantage	2.5128	1.0481
Pressure from the industry to measure up to state of the earth practice	2.1795	1.0481
Tendency to improve profitability	2.1538	0.93298
Skill and competence related requirements	**2.3675**	**0.65692**
Need for additional skill and training	2.6154	0.87706
Extent of complexity involved in the process	2.4359	0.82062
Ease of learning the process	2.0513	0.82554

The result presented in the table shows that the most influencing factors on BIS adoption is Cost related factors. This is followed by process efficiency requirements, Customer satisfaction and participation related factors, Profitability and outcome related factors, and skills and competence in rank order. Overall, Ability to enhance quicker operational performance, Ability to integrate BI with other systems and Suitability of BI for clients' needs with mean values of 2.7436, 2.7436, and 2.6923 are the most influencing factors while Pressure from customers to integrate BI and Ease of learning the process with mean values of 2.1026 and 2.0513 respectively were adjudged the least influencing factors.

3.3 Modelling the Adoption of BIS for Real Estate Investment Data Management

This section presents in details, the regression analysis done in order to develop a model for BIS adoption in Benin City. This is done by examining the impact of the identified factors influencing respondents' willingness to adopt BIS in managing data related to real estate investment on their willingness to adopt BIS. Shows in table 4 below.

Table 4 Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.958[a]	0.917	0.902	0.36218

Table 4 indicates that the R^2 statistic is 0.917. This shows that 91.7% of the sample variation in willingness to adopt BIS is attributed to the independent variables and this is significant at the 0.05 significant levels (Table 5). This means that the identified factors significantly affect the willingness of the respondents to adopt BIS in the study area, hence the null hypothesis that all the independent

variables considered together do not explain significant amount of the variation in willingness to adopt BIS is rejected.

Table 5: Analysis of Variance

Model	Sum of Squares	Degree of freedom	Mean Square	F	Significance test
Regression	46.469	6	7.745	59.041	0.000
Residual	4.198	32	0.131		
Total	50.667	38			

Table 6 provides information on the factors that made significant contributions to willingness to adopt BIS (WILADOPT) in the study area. It also provides information on the level of significance on difference in individual contribution of these variables; and the contribution of each variable (relative to others) to the adoption of BIS in the study area.

Table 6: Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	Test Statistic	Significance test
	Beta	Standard Error	Beta		
(Constant)	4.095	0.383		10.689	0.000
COMPAT	0.323	0.421	0.219	0.767	0.448
COST	-0.820	0.248	-0.739	-3.309	0.002
CUSTOMER	0.731	0.489	0.491	1.496	0.144
PROCESSEFFIC	-2.316	0.325	-1.555	-7.117	0.000
PROFITOUTCOME	3.403	0.360	2.549	9.465	0.000
SKILLCOMPETENCE	-3.311	0.606	-1.884	-5.462	0.000

From the table, it can be seen that Profitability and outcome related factors has the highest absolute coefficient (3.403) and therefore contributes most to adoption of BIS in the study area. This is followed by Skill and competence related requirements (-3.311), Process efficiency requirements (-2.316), Cost related factors (-0.820), Customer satisfaction and participation related factors (0.731) and Compatibility related factors (0.323). Also, three of the factors have positive relationships with willingness to adopt BIS. These include profitability and outcome related factors, Customer satisfaction and participation related factors and Compatibility related factors. Three of the factors also have negative relationship with willingness to adopt BIS: Skill and competence related factors, Process efficiency requirements and cost related factors. It is also apparent from the table that all of the factors, except Compatibility related factors and Customer satisfaction and participation related factors made significant contributions to willingness to adopt BIS at 95% confidence level.
The multiple regression constant and coefficients provided by the unstandardized beta coefficients in Table 6 give the linear multiple regression equation as

ADOPT = 4.095 + 0.323 COMPAT - 0.820 COST + 0.731 CUSTOMER - 2.316 PROCESSEFFIC + 3.403 PROFITOUTCOME -3.311 SKILLCOMPETENCE (4)

This result implies that the adoption of BIS in the study area is primarily dependent on profitability and outcomes, skill and competence required and process requirements.

Conclusion

The study indicated willingness to adopt BIS in the study area. This implies that the adoption of BIS in the study area is not a question of preference, it is a question of availability of enabling

environment/conditions for the adoption of BIS. It is also discovered from the model that profitability, outcome and availability of skills and competences are the primary predictive factors of BIS adoption. Thus, ability of BIS to enhance profitability and achievement of investment objectives will enhance adoption of BIS. Also, the model shows that the surveyors are averse to employment of special skills, extra costs and stringent processes. This is evident in the negative coefficients on factor related to skills, costs and process requirements. Efforts should therefore be tailored towards simplifying the BIS process and reducing costs.

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