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THE ROLE OF INTERNAL RELATIONSHIP CAPITAL IN MOTIVATING BIM INNOVATION IN SME FIRMS.

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Abstract- The Architecture, Engineering and Construction (AEC) industry is facing a paradigm shift in the adoption of Building Information Modelling (BIM). However, the shift to its adoption and implementation in the emerging markets has brought distortion in both the business processes and environment for Small and Medium Enterprises (SME architectural) in the industry. This is not unrelated to the lack of clear orientation in Relationship Capital Development of the firms. This paper identifies the different strategies concerning the development of the Internal Relationship capital; development. This is achieved by identifying how BIM adopters differ from non-adopters in the ways their Internal Relationship capital development is considered. The study involves a two-step analysis; empirical enquiry to identify the various indicators of the Internal Relationship capital development and the analysis of its impact on BIM adoption. The empirical enquiry comprised of research framework and fieldwork data collection. The framework was used to collect data from the fieldwork. It involved a questionnaire survey with a sample of SME architectural firms in Nigeria. The survey involved administering questionnaires by hand to 351 firms within nine cities in Nigeria during September 2015. It yielded 228 completed questionnaires by the end of December 2015. Using regression analysis, the result indicates that, there are three critical indicators that determine the role of the Internal Relationship in BIM innovation, these are; efficient communication flow, participative culture and less uncertainty avoidance in their internal relation.
Keywords– Building Information Modelling (BIM), BIM Innovation, Internal Relationship Capital, Business Value, Small Medium Enterprise (SME), Architectural Firms, Nigeria.

1. INTRODUCTION

An internal relationship refers to the development and maintenance of the relationship between individuals within an SME architectural firm, including the production line workers, managers, supervisors, administrative staff, and facilities and maintenance support. BIM adoption and implementation requires these internal relationships in order for the firm to effectively deliver a project (Arayici et al, 2011a). Although this type of relationship may be informal in BIM adoption (Yamaguchi, 2013), it is a valuable resource for successful innovation (Arribas et al., 2013). Nahapiet & Ghoshal (1998) described this relationship as the sum of the actual and potential resources embedded within the firm, which is derived and made available through the network of relationships of the firm's social unit. Holzer (2015) emphasised this in the BIM adoption process suggesting that this potential resource is formed through the interaction between the top management, the IT manager and the employees. Elsetouhi et al (2015) further described internal RC as a result of the interaction, communication and collaboration among individual employees within a firm, and can be measured by their knowledge sharing and cultural experiences. Reche et al. (2008) emphasised that, through the internal setting of a firm, RC provides a conducive environment for employee flexibility in an uncertain environment. Oh et al. (2006) suggested that such a conducive environment can enable a social unit in a firm to be significantly responsive through innovation and recurrent patterns of dynamic relationships between its individuals. Hence, the internal relationship can be a measure of the innovation capability and network resource of a firm.

Among the approaches provided in the literature, that explore the ways in which internal relationships motivate innovations, such as BIM processes, is the implementation of rewards and punishment schemes as stimuli for successful knowledge sharing (Egbu & Botterill, 2001). Motivating employees to share the knowledge they have involves good people management, as trust is itself an incentive. The establishment of a psychological contract between employer and employee, for example, is a constructive approach to developing a knowledge-sharing culture (Scarbrough et al, 1999). Moreover, Subramaniam & Youndt (2005) demonstrated that this kind of relationship represents the informal interactions and information exchanges among employees that develops a smooth and desirable work atmosphere. Therefore, it is a result of the interaction and collaboration among employees within an organisation who share their knowledge and experiences. Nonaka et al (2008) emphasised that internal relationships provide an excellent atmosphere for increased employee flexibility in an uncertain environment. Groups can be more responsive, largely because of the recurrent pattern of dynamic relationships among people within the group. In this study, four indicators were identified and discussed as predictors for the

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internal relationship that could influence BBVC in SME architectural firms, and these are; communication flow, trust, participative culture, and uncertainty avoidance.

Since the main objectives of the BIM process in firms are to improve and ensure efficient communication and collaboration between stakeholders in the project (Holzer, 2015), the relevance of communication flow and its effect on the BBVC cannot be over-emphasised. Moreover, Jo & Shim (2005) suggested that effective employee communication has been shown to increase job satisfaction and employee performance; hence, it potentially results in organisational success and innovation. Furthermore, as most social interactions require some degree of trust, it is a mechanism that helps to deal with the unknown in complex situations, especially those where foreseeing the outcome is not possible due to numerous uncertainties (Grabner-Kräuter & Kaluscha, 2008). Eisenegger & Imhof (2008) described trust as the most significant operational resource in a social unit, highlighting that it strengthens existing relationships between individuals and at the same time acts as a magnet for future relations.

Clegg et al (2002) argued that SME architectural firms develop their motivation and capability to innovate easily when they establish positive expectations about an idea from individuals in their firm and this occurs when they have created a basis of mutual trust. Thus, the employees of a firm are more involved in innovation processes when they think their ideas are considered. This is particularly true as innovation infers risks, and it is implausible for firms to engage in innovation when trust does not exist between the individuals in the firm. Valenzuela & Contreras (2014) suggested that, in order to adjust to the dynamism of the technology marketplace, SME architectural firms seem to be flexible and timely in their decision making on innovation. However, this requires collaborative relationships between their employees and other partners to acquire the knowledge needed (Nooteboom, 2006). Hence, Valenzuela & Contreras (2014) further suggested that technological innovation in SME architectural firms is essentially described by their accrued knowledge and skills within which learning takes place. They argued that this is based, to some extent, on the trust built between the individuals in that context and their participating agents; hence, trust indirectly influences innovation through learning. Mollaoglu et al (2015) emphasised that building trust among employees is crucial to the success of any improved learning from the BIM process. However, they argue that there are some types of trust, such as the technical trust, that have a direct influence on innovation. Consequently, one can argue that the concept of trust is more dynamic than static, as it is not a product of a particular decision but rather a set of approaches regulated by attitude, behaviour, and even decision-making. In that sense, trust is an element of the business environment (Valenzuela & Contreras, 2014).

The concept of participative organisational culture has also been identified as significant for the BIM implementation process in that it involves and values collaboration and the exchange of input between the different stakeholders within and outside an SME architectural firm (Arayici et al, 2011a). Thus, teamwork is valued, and the emphasis is placed on the collective rather than the individual, meaning that the firm overall and its employees specifically share goals (Succar, 2009). A participative organisational culture values innovation and seeks input from employees and other stakeholder groups to ensure a thorough analysis of its decisions and policy (Caywood, 1997). Individuals within the firm hierarchy are often integrated or multifunctional, and emphasise open communication across different levels in the BIM process. Caywood (1997) also suggested that a participative organisational culture values information, seeks input from internal relationships, and functions as an open system with respect to its employees, their opinions, and their concerns. This allows for the efficient flow of information allowing employees and those at lower levels of the firm to have an input in management decision-making. When this input is sought and encouraged, a firm can reap a successful innovation process (Caywood, 1997). Accordingly, SME architectural firms with participative organisational cultures would make decisions in a decentralised manner across varying levels of the firm and enable implementation by those who hold responsibility for a particular task (Caywood (1997). As innovative ideas can come from any level of the firm, from the employee to top management, this would also mean ensuring increased teamwork and that value is placed on employees at all levels of a firm.

In addition, uncertainty avoidance is considered an indicator of an internal relationship, and based on the notion that some risks need to be faced when introducing and implementing new technologies or approaches, including, for example the BIM process (Bin Zakaria et al, 2013). Hofstede (2011) identified uncertainty avoidance as a cultural dimension of relationships that describes the degree to which employees prefer conservativeness in an established method and process over trying a new one; he argued that this is in order to reduce social anxiety. For example, in firms with high uncertainty avoidance, employees tend to prefer clear requirements and instructions, to follow organisational rules, to take fewer risks, and to demonstrate greater loyalty to the employer (Caywood, 1997). Such a context contradicts the notion that SME architectural firms usually develop their initial motivation and capability to adopt BIM through employees' championship of trial and risk (Succar, 2009). Mollaoglu et al (2015) suggests that high levels of uncertainty avoidance have an adverse impact on innovation. According to Caywood (1997), when SME architectural firms exhibit low uncertainty avoidance within their hierarchy, employees can feel more tolerant of ambiguous situations, develop less resistance to change, and show greater interest in taking risks, and this ultimately improves internal innovations within the internal relationship of the firm. The following hypotheses are thus provided;

H41: The motivation and network resources within the internal relationships of SME architectural firms have a significant correlation with BBVC.

H40: The motivation and network resources within the internal relationships of SME architectural firms have no significant correlation with BBVC.

Sub-hypotheses;
H6a: Firms that derive their motivation and network resource through the internal relationship characteristic of effective communication flow are likely to succeed in BBVC.
H6b: Firms that derive their motivation and network resource through the internal relationship characteristic of confidence and trust are likely to succeed in BBVC.
H6c: Firms that derive their motivation and network resource through the internal relationship characteristic of participative culture are likely to succeed in BBVC.
H6d: Firms that derive their motivation and network resource through the internal relationship characteristic of less uncertainty avoidance are likely to succeed in BBVC.

2. RESEARCH FRAMEWORK

This section discusses the dependent variable of the study, which is BBVC. It starts by defining BIM from the business perspective, and the emergence of the term 'business value' in BIM. Subsequently, the study defines the term BBVC through the literature of IT business value and built its case from that field.

Vass (2015) suggested that most studies on measuring business value in the field focus on evaluating the value of IT. Others concentrate on determining suitable metrics or key performance indicators to measure and evaluate the effects of implementing IT, and in particular to measure any increased productivity from IT. This is also true in the case of current construction management and BIM research (Aranda-Mena et al, 2009; Barlish & Sullivan, 2012; Construction, 2014; Vass, 2014). For example, Curley (2004) explicitly states that, in order to measure the business value of IT in a firm, a maturity and capability metric is essential. This is also reiterated by Succar (2009) and Aranda-Mena et al (2009) who argued that generating business value through BIM is highly dependent on the individual capabilities of firms Similarly, McGraw-Hill (2009) suggested that numerous successful firms invest to make sure clients are aware of their BIM capabilities in order to create business value. All the above assertions point to the level of maturity and capability as essential in generating IT business value. (Curley, 2004; Kohli & Grover, 2008; Racheva et al, 2009). Measurement of BIM success or maturity models in firms has well been established in the literature; it was early started by the National BIM Standard Capability Maturity Model (NBIMS-CMM), developed in the U.S. by the National Institute of Building Sciences (NIBS, 2007). NBIMS-CMM consists of eleven critical BIM measures, including business process, delivery method, data richness and information accuracy. It focuses only on information management and has been therefore criticised for not reflecting the diverse facets of BIM. Critics have also questioned its usefulness and usability due to its structural limitations (Succar, 2010). So profound and powerful these critics were and resulted in the introduction of new models that tried to build on NBIM-CMM and provide more optimised models. However, following the success of the UK BIM Task Group over the past years in defining and implementing BIM Level 2 within Government Departments. The emergence of new models seeks better ways of measuring BIM. Frameworks such as the BIM Maturity Matrix (Succar, 2010), the Virtual Design and Construction (VDC) Scorecard (Kam, 2015) and the BIM Maturity Measure (BIMMM) (Ammar et. al, 2017), have been designed to improve previous models. They have supplemented past measures with diverse areas of measurement that represent much broader dimensions of BIM e.g. policies, technologies and processes. Individually and collectively, coexisting AMs have contributed to the growing body of literature that examines BIM use.

In order to develop the measure for BBVC based on these various models and efforts, it is important to reflect on all the existing maturity models/indices of maturity and capability concerning the BIM process.

Numerous models contribute to the development of viable BIM maturity and capability models. Among them are; Control Objects for Information and Related Technology, CMMI (Capability Maturity Model Integration), CSCMM (Construction Supply Chain Maturity Model), I-CMM (Interactive Capability Maturity Model), Knowledge Retention Maturity Levels, LESAT (Lean Enterprise Self-Assessment Tool), P3M3 (Portfolio, Programme and Project Management Maturity Model), PCMM® (People Capability Maturity Model), $(PM)^2$ (Project Management Process Maturity Model), SPICE (Standardised Process Improvement for Construction Enterprises), Supply Chain Management Process Maturity Model, and BPO (Business Process Orientation Maturity Model). These models as listed in (Succar et al, 2012) were studied by Kori & Kiviniemi (2015) with regard to BIM in Nigeria, and the outcome was that most of these models were broad in approach and could collectively form a basis for a range of BIM capabilities. However, Succar (2009) suggested there is not enough differentiation between the notion of capability and that of maturity. Hence Succar (2009) defines 'BIM maturity' as, "the quality, repeatability and degree of excellence within a BIM capability and developed the BIM Maturity Matrix". Succar described BIM capabilities in three stages:

Object-based modelling;
Model-based collaboration; and
Network-based integration.

Barlish & Sullivan (2012) highlighted that it is the extent of an organisation's performance or ability within a particular stage that is measured to determine their BIM maturity. This is gauged according to the five maturity levels shown in **Error! Reference source not found.**The BIM maturity level at Stage 1, for example, indicated an organisation performing testing or pilot projects to determine the benefits of BIM (Barlish & Sullivan, 2012); this is the first stage (object-based modelling) and within that phase they are at an 'ad-hoc' or 'defined' maturity level, working for more optimisation through increasing testing. Furthermore, the organisation's level of BIM maturity can be accessed via general objectives within a level similar to **Error! Reference source not found.** Figure12: The BIM Maturity Map by Bew & Richards (2008) in BIM Overlay to the RIBA Outline Plan of Work (Sinclair, 2012), or matrix of competencies, is similar to Building SMART Alliance's BIM Capability Maturity Model. Organisations' varying levels of maturity should be taken into consideration when comparing organisations' BIM business cases.

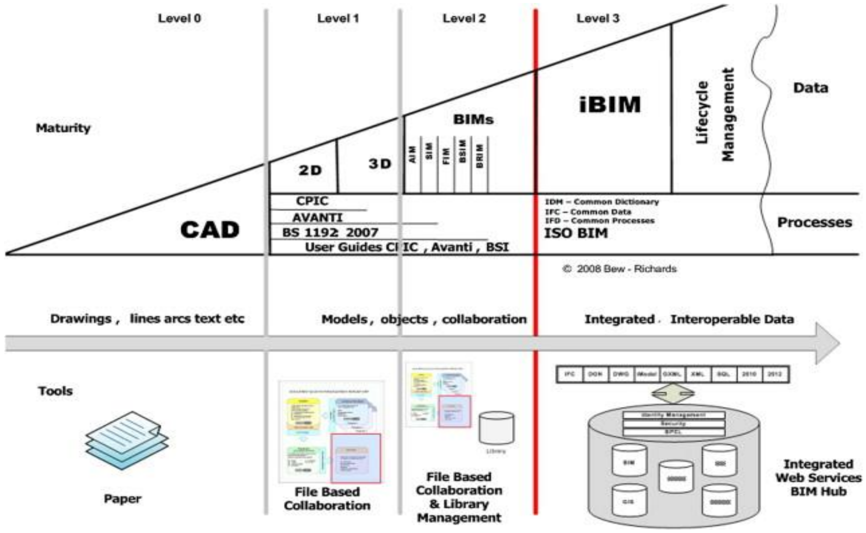

Figure 1: BIM Maturity Map (Bew & Richards, 2008)

Consequently, in accordance with the BIM Maturity map by Bew & Richards (2008) having identified the BIM fields, Succar (2009) further developed five stages which delineate capability milestones. Succar (2009) describes BIM capability as the basic ability to perform a task, deliver a service, or generate a product. BIM capability stages (or BIM stages) define the major milestones for achievement by teams and organisations as they adopt BIM technologies and concepts. BIM stages identify a fixed starting point (the status before BIM implementation), three fixed BIM stages, and a variable ending point, which allows for unforeseen future advancements in technology. The following is a list and description of each of the five stages developed in accordance with Succar & Kassem (2015) BIM Maturity Matrix, which is subsequently used as the baseline in developing the measure of BBVC for this study.

Pre-BIM status: Disjointed Project Delivery : The construction industry is characterised by adversarial relationships where contractual arrangements encourage risk-avoidance and risk-shedding. Much dependence is placed on 2D documentation to describe a 3D reality. Even when some 3D visualisations are generated, these are often disjointed and reliant on two-dimensional documentation and detailing. Quantities, cost estimates and specifications are neither derived from the visualisation model nor linked to documentation. Similarly, collaborative practices between stakeholders are not prioritised and workflow is linear and asynchronous. Under pre-BIM conditions, the industry suffers from low investment in technology and a lack of interoperability.

BIM Stage 1 Object-Based Modelling : Collaborative practices at Stage 1 are similar to the pre-BIM status and there are no significant model-based interchanges between different disciplines. Data exchanges between project stakeholders are uni-directional and communications continue to be asynchronous and disjointed. As only minor process changes occur at Stage 1, pre-BIM contractual relations, risk allocations and organisational behaviour persist. However, the semantic nature of object-based models and their 'hunger' for early and detailed resolutions of design and construction challenges encourage the 'fast-tracking of project lifecycle phases - when a project is still executed in a phased manner yet design and construction activities are overlapped to save time.

BIM Stage 2: Model-Based Collaboration : Although communication between BIM players continue to be asynchronous, pre-BIM demarcation lines separating roles, disciplines and lifecycle phases start to fade. Some contractual amendments become necessary as model-based interchanges augment and start replacing document-based workflows. Stage 2 also alters the granularity of modelling performed at each lifecycle phase as higher-detail construction models move forward and replace (partially or fully) lower-detail design models.

BIM Stage 3: Network-Based Integration : At this capability stage, semantically-rich integrated models are created, shared and maintained collaboratively across project lifecycle phases. This integration can be achieved through 'model server' technologies (using proprietary, open or non-proprietary formats), single-integrated/distributed-federated databases, Cloud Computing or SaaS (Software as a Service). BIM Stage 3 models become interdisciplinary nD models allowing complex analyses at early stages of virtual design and construction. At this stage, model deliverables extend beyond semantic object properties to include business intelligence, lean construction principles, green policies and whole lifecycle costing. Collaborative work now 'spirals iteratively' around an extensive, unified and shareable data model. From a process perspective, a synchronous interchange of the model and document-based data cause project lifecycle phases to overlap extensively forming a phase-less process.

Integrated Project Delivery: Interdependent, Real-Time Models : This is the most suitable stage representing a long-term vision of BIM as an amalgamation of domain technologies, processes and policies. The term is generic enough and potentially more readily understandable by industry than 'Fully Integrated and Automated Technology', Integrated Design Solutions, or 'nD Modelling, as three prominent examples. The selection of Integrated Project Delivery (IPD) as the goal of BIM implementation is not to the exclusion of other visions appearing under different names. On the contrary, the path from Pre-BIM (a fixed starting point), passing through three well-defined stages towards a loosely defined IPD is an attempt to include all pertinent BIM visions irrespective of their originating sources.

Similarly, Aranda-Mena et al (2009) developed a model based on the Val IT approach (ITGI, 2006) identified three layers of capability:

Technical capability: the specific technological capabilities delivered by the programme.

Operational capability: the operational capabilities that are supported by the technological capabilities.

Business capability: the overall business capabilities enabled by the operational capabilities.

The discussion above provided a baseline for shaping an appropriate model that could fit the context of this study. However, because the study deals with SME architectural firms in a Nigerian context, there may be some layers and elements that might need to be re-evaluated and contextualised. Hence, the following discussion will focus on the contextualisation of the model.

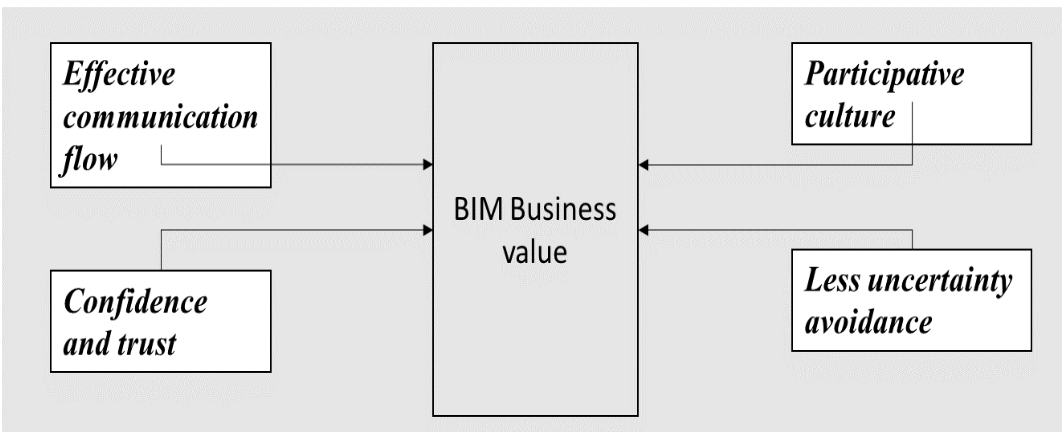

Figure 2: The Hypothetical Model for the Internal Relationship Capital Development for BBVC

3. METHODOLOGY

The study involves two-step analysis; empirical enquiry to identify the various indicators of the IT manager's human capital development and the analysis of its impact on BIM adoption. The empirical enquiry comprised of research framework and fieldwork data collection. The framework comprises of two main variables, these are; The independent variables which involved the IT manager's indicators and the dependent variables which is the measure of BIM Business Value, the framework was used to collect data from the fieldwork. It involved a questionnaire survey with a sample of SME architectural firms in Nigeria. The survey involved administering questionnaires by hand to 351 firms within nine cities in Nigeria during September 2015. It yielded 228 completed questionnaires by the end of December 2015. The survey data enable the assessment of the framework using multiple regression analysis. The regression analysis was done based on two-step analysis; first through investigating the correlation between the main variables of the IT manager component and the BIM Business value creation which is a combination of the four indicators, secondly, the effects of each of the four indicators on the BIM business Value creation. The outcome provides with the Relative Weighting Value (RWV) of each of the four indicators on the BIM Business Value Creation in the SME firms.

4. ANALYSIS

This section discusses the data analysis and results of the study. In other to investigate the relationship in the first step of the analysis, a multiple linear regression and correlation analysis was conducted to assess whether the independent variables predict the dependent variable (criterion). The multiple linear regression assesses the relationship between a set of dichotomous, or ordinal, or interval/ratio predictor variables on an interval/ratio criterion variable (Solutions, 2013) . Hence, the following regression equation (main effects model) was used for each component as a regression model:

$y = b0 + b1x1 + b2x2 + \ldots\ldots. + bnxn + e$

Where, y = estimated dependent variable (BBVC)

e = constant (which includes the error term), b = regression coefficients and x = each independent variable (the individual indicators (predictors) of the component) and n = number of indicators under a component.

A standard multiple linear regression, called 'the Enter' method, was used for the SPSS analysis. In this method, the user enters all independent variables (the four indicators of the IT manager's role) simultaneously into the model. Variables were evaluated by what they add to the prediction of the dependent variable, which is different from the predictability afforded by the other predictors in the model (Nach, 2009) .

In order to test the component level hypotheses in terms of whether there is a significant linear relationship between the individual components in the theoretical model and the dependent variables, the F-test was used. It involved testing whether the set of the independent variables (indicators) collectively predicts the dependent variable for that particular component. The 'R-squared' multiple correlation coefficients of determination were also reported and used to determine how much variance in the dependent variable can be accounted for by the set of the independent variables. The t-test was used to determine the significance of each of the indicators and beta coefficients were used to determine the magnitude of prediction for each indicator variable. For significant predictors, every one-unit increase in the predictor, meant the dependent variable will increase or decrease the number of unstandardized beta coefficients (Statistics Solutions, 2013).

The analysis below presents the relationship between motivation and capability of an IT manager in SME architectural firms and the BBVC. Table 1 lists the variables of the IT manager components.

Table 1: Variables of the Internal Relationship component

Independent Variables			Dependent Variables
Component Level	The Motivation and Network Resource of SME Architectural Firms Through Internal Relationship		BIM Business Value Creation (BBVC)
Indicators Level	1	Internal relationship of efficient communication flow	
	2	Internal relationship of confidence and trust,	
	3	Internal relationship of participative culture	
	4	Internal relationship of less uncertainty avoidance	

5. THE REGRESSION ANALYSIS

A multiple regression analysis was conducted to investigate whether the motivation and network resource, through the internal relationships of SME architectural firms and concerning innovation have a significant correlation with BBVC. This involved analysing the effect of four indicators of the internal relationship in predicting BBVC. Preliminary analysis shows that all assumptions are valid, and the potential indicator variables are accepted to carry out a multiple regression analysis.

Table 2: Model summary for the internal relationship component

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.725a	.525	.517	.98978

a. Predictors: (Constant), Internal relationship of less uncertainty avoidance, Internal relationship of effective communication flow, Internal relationship of participative culture, Internal relationship of confidence and trust.

Table 17 shows the multiple linear regression model summary and overall fit statistics. The table shows that the adjusted R^2 of the model is 0.517 with the $R^2 = 0.525$, which means that the linear regression explains 52.5% of the variance in the data.

Table 3: Anova test for the internal relationship component

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	241.797	4	60.449	61.704	.000b
	Residual	218.466	223	.980		
	Total	460.263	227			

a. Dependent Variable: BIM adoption level

b. Predictors: (Constant), Internal relationship of less uncertainty avoidance, Internal relationship of effective communication flow, Internal relationship of participative culture, Internal relationship of confidence and trust

Table 18 shows the linear regression F-test which has the null hypothesis, H40 that there is no linear relationship between the dependent variable and independent variable at the component level (in other words $R^2=0$). The F-test shows F value of 61.704 with a highly significant P-value; thus the study can assume that the null hypothesis H40 is rejected. Hence, H41 is accepted, which means there is a significant linear relationship between the motivation and network through the internal relationships of SME architectural firms toward innovation and that this has a significant correlation with BBVC at the components level. However, to determine the direct effect, it is essential to conduct further analysis at the indicator level. Hence, the result of the analysis on the level of the indicator is presented in Table 19.

Table 4: Coefficient showing the linear regression estimates of all the indicators of the internal relationship components on BBVC

Model		Unstandardised Coefficients		Standardised Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.659	.177		3.729	.000
	Internal relationship of effectient communication flow	.235	.078	.248	3.000	.003
	Internal relationship of confidence and trust,	.049	.089	.050	.553	.581
	Internal relationship of participative culture	.307	.089	.296	3.467	.001
	Internal relationship of less uncertainty avoidance	.196	.075	.205	2.601	.010

a. Dependent Variable: BBVC

Table 19 shows the multiple linear regression estimates of all the indicators, thus testing the four Sub-Hypotheses, H4a-H4d, including the intercept and the significance levels on the effect of each IC indicator on the success level of BIM adoption. The unstandardized coefficients' Beta (B) value indicates the extent of the effects for each of the independent variable on the dependent variable BBVC. The table shows there is the significant positive effect on BBVC when firms have internal relationships demonstrating an efficient communication flow, a participative culture and with less uncertainty avoidance; however, an indicator of confidence and trust in the internal relationship was found to be an insignificant predictor of the success level of BIM adoption.

6. CONCLUSION

In conclusion, the findings for this section indicate that the development of motivation and networks resulting from RC have a significant impact on BBVC in SME architectural firms. Thus, the better SME architectural firms manage and nurture their RC network resource, the more success those firms can experience in terms of BBVC. This network resource is formed through specific critical aspects of the interaction between the firm's internal and external relationships, environment, and image and reputations. For example, within the internal hierarchy, the effective communication flow, encouragement of a participative culture in the innovation process, and less uncertainty avoidance is critical to the development of the network resource. Another critical aspect in the development of network resources for the BIM adoption process is the aspect of firm interoperability in efficiently operating within the BIM environment. These include technical, semantic, cultural and legal interoperability. Although government and regulatory systems have been proven to play a crucial role in the environmental influence of the BIM adoption process, because there is no clear intervention policy on BIM in Nigeria, only the client system and the competitive environment are critical to BBVC. Additionally, image and reputation, particularly through the outcome quality of BIM and employees' perceptions of their competitive advantage, are found to be critical in BIM Business Value Creation.

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