

EFFICIENCY OF INVENTORY MANAGEMENT TECHNIQUES AND PERFORMANCE OF CONSTRUCTION INDUSTRY FIRMS IN SOUTH- SOUTH, NIGERIA

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ABSTRACT

Purpose: The study aims at providing insight into the extent to which some factors influence the effectiveness of inventory management, as well as the level to which the inventory management affect the performance of firms operating in the construction industry in south-south, Nigeria.

Design/methodology/approach: Data for the study were collected from 204 small and 46 medium construction industry firms selected using stratified purposive sampling techniques. The relationships and hypothesis proposed in the conceptual framework were tested using structural equation modeling (SEM).

Findings: The finding of the study shows that the identified factors have positive relationship with the efficiency of inventory management techniques. Another finding from the study is that a positive relationship exists between efficient inventory management techniques and construction industry firms' performance in terms of time, cost, quality and profitability, while an indirect positive relationship also exists between the identified influencing factors and the construction industry firms' performance.

Research limitation/implications: The study purposively selected only small and medium construction firms in south- south, Nigeria. This is not exhaustive enough; therefore, the results may not be generalized for the entire construction firms in Nigeria.

Originality/value: The study established the significance of efficient inventory management and its contribution to the overall sustainability and survival of construction firms in the built environment.

Keywords: Construction industry firms; efficiency; firm performance; influencing factors; inventory management.

1. INTRODUCTION

Nigeria is one of the developing countries seriously plagued with increased population growth most noticeable in urban centres (Ajayi, Ajayi, Akinsiku &

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Osunsanmi, 2016) together with poor quality and quantity of infrastructure Obiadi, Irouke, Ezezue and Nzewi (2017).

Consequent on the volumes of basic infrastructure requirements to address the infrastructural needs of these countries, Ofori (2018) noted the pressing need to substantially increase the capacity, capabilities and performance of the construction industries in the developing countries where the majority of the world's population live. Characteristically, infrastructural projects are categorised into tasks and sub-tasks, which need renewable (machines, tools, work force, information and others) or non-renewable (raw material, space, time, fuel, energy, and others) resources depending on the nature on the project (Pinha & Ahluwalia, 2019). One of the ways of substantially improving the performance of the industry is by improving the management of these construction resources. Consequent upon the resource-driven nature of construction projects, construction managers have tried to develop plans of action for directing and controlling resources of workers, machines and materials in coordinated and timely manner in order to deliver a project within the frame of cost, time and quality (Nagaraju, Reddy, & Chaudhuri, 2012). Ugochukwu, Ogbuagu and Okechukwu (2014) observed that despite the significant importance of the building/construction sector to the economy of Nigeria and its impressive efforts, the Nigeria's construction sector is yet to realize its full potentials. Abah and Adamu (2017) also observed that the construction industry in Nigerian is famous for high inventory, absence of formal relationship, poor interaction with supplier and high cost and time overrun.

In corroboration, Othman, Napiiah and Potty (2014) noted that construction industry stakeholders are discovering that their process for managing tools / machines /equipment, materials, labor, methods, costs and consumables is broken and hence the field of construction in developing countries has largely failed to make progress in the last decade (Ofori, 2018). Some of these basic construction resources used in production in the form of goods or materials is termed inventory (Sabure, 2020). Inventory management is a portion of current resources management, which is concerned with maintaining optimum investment in inventory and applying effective control system so as to minimize the total inventory cost. It can be referred to as the process by which a firm is supplied with the goods and services that is needed to realize its goals of buying, storage and movement of materials for effective production (Subramani, Nair, David, Ghose & Kumar, 2017). Inventory management covers raw materials, processed materials, components for assembly, consumable (fuels), general stores, maintenance materials and spares, work in progress and finished products (Sabure, 2020). The level to which firms usually hold inventory of these items depends on the nature of production, which may be construction, manufacturing, fabrication, hiring and servicing, among others in the construction industry. Building materials therefore constitute the major aspect of inventory management. Building materials range over different types of elements and also come in various sizes and shapes. While some materials like cement, iron rods, roofing sheets, floor tiles and wall tiles are produced by large manufacturing companies, others like timber, block, and so on are produced by medium and small sized manufacturers.

The importance of management of these materials in construction, stems from the view that the cost of material is a major proportion of the total project costs. Studies have established that the material contents for building usually range between 50% and 70% of total cost depending on the nature of the project (Arijeloye & Akinradewo, 2016). Another reason why materials management is very important and source of concern in developing countries is their supply, as a large proportion of the construction

materials used in most developing countries are imported as finished products and those manufactured locally have high foreign content resulting in high cost of construction (Ugochukwu, Ogbuagu & Okechukwu, 2014). Therefore, inventory management is important to organization because it helps in proper planning of the materials needed so as to ascertain the gap between the desired and the actual level of materials, allocation of resources, purchasing, sales and employment of staff and everything concerned to human resources management all of which reduce the costs incurred by the firms in the production departments for improved performance of the organization (Inegbedion, Eze, Asaleye & Lawal, 2019, Sabure, 2020).

This paper is of the view that the inventory control of other items also contributes to firm performance, as construction industry utilize materials in different forms. Hence it aims at providing insight into the extent to which some factors influence the effectiveness of inventory management, as well as the level to which the inventory management affect the performance of firms operating in the construction industry.

2. REVIEW OF RELATED LITERATURE

This section covered the overview of the inventory management techniques and the empirical review of the influence of some factors on the efficiency of inventory control techniques as well as the relationship between inventory management and firm performance.

2.1. Inventory Management Techniques Used by Construction Industry Firms

The study of supply chain in the construction industry showed that it involves a chain of construction business with business-to-business relationships as well as network of diverse organization and relationships, or a network of facilities and activities that provide customer and economic value to the functions of design development, contract management, service and material procurement, material manufacture and delivery, and facilities management (Oludare, Okunola & Oluseye, 2018). In order to overcome the complexity of the construction supply chain process which usually causes resources like equipment, raw materials, processed materials, components for assembly, consumable (fuels), general stores, maintenance materials and spare parts, work in progress and finished products and other services not to be available on time, in right amounts and in the desired quality and price, several inventory control techniques are used by different organisations. Some of the techniques adopted according to the firm's convenience as identified from several studies are as follows:

- Always Better Control (ABC) Analysis
- Vital, Essential and Desirable (VED) Classification
- Scarce, Difficult Easy to obtain (SDE) Classification
- High, Medium and Low (HML) Classification
- Economic Order Quantity(EOQ) Analysis
- Fast moving, slow moving and Non-moving (FSN) Classification
- Seasonal, Off- Seasonal (SOS) Analysis
- XYZ Analysis
- GOLF Analysis

Minimum-Maximum Technique.

Just-in-Time Technique

Materials Requirement Planning

The detail explanations of these techniques are available in the previous studies by Deshpande (2008), Brindha (2014), Biswas, Karmaker, Islam, Hossain, and Ahmed (2017) and, Pagare, Yadav, Mahale, Pawar, Patil and Bhadane (2017) and Pushpakumara (2018).

2.2. Factors Affecting Efficiency of Inventory Control Techniques

It has been established that some factors have certain influence on the effectiveness of inventory control technique used by different firms, companies or organisations. These are highlighted in this section. Adafin, Ayodele, and Daramola (2011) identified eight factors as follows; Bill of quantities, schedule of materials, construction programme, specification, accounting system, security system, traits of store officer and nature/type of stock control method. Nganga (2013) identified that the factors effecting inventory control are, delays in procurement of goods, frequent stock-outs and uncertain change of prices, inadequate and untimely dispatch of funds, unavailability of stationeries/stores records, lack of specific time or date for both posting stores records, lack of adequate qualified and well trained staff. Chan, Tasmin, Aziati, Rasi, Ismail, and Yaw (2017) identified four factors which have significant influence on the inventory management in manufacturing small medium enterprises namely; planning, documentation/store records, knowledge of employee/staff skill and funding.

Adafin, Ayodele, and Daramola (2011) utilized structured questionnaire to examine the methods of stock control utilized by construction firms on construction sites in South Western Nigeria, with a view to assessing the factors affecting material stock control practice used, and also determine the impact of the factors on building project performance. The respondents were randomly selected construction professionals and technicians. The data analysed descriptively showed that the stock control method utilized by most construction firms is the Action Level method, while the factors identified had significant impact on building project performance in respect of cost, time and quality. The study then recommended that material stock control should be practiced on all sites and by all categories of building construction firms in strict compliance with Action Level Method in connection with adequate use of project bill of quantities, schedule of materials, construction programme, specification, proper stock accounting and security systems. It was also suggested that competent and experienced personnel with basic material managerial skills be used as site store officer to enhance material stock control practice. Though this study is based on south western Nigeria, it did not investigate the impact of firm performance. The study did not also look at some other important factors and inventory management techniques.

Nganga (2013) assessed the factors influencing effectiveness of inventory control in ministry of state for provincial administration and internal security in Nairobi, Kenya. The study used Structured and unstructured questionnaires administered to stratify randomly sampled, three hundred and fourteen (314) staff involved in inventory control or any other related activities in five (5) agencies/parastatals of government. The study found that the factors effecting inventory control are, delays in procurement of goods, frequent stock-outs and uncertain change of prices, inadequate and untimely dispatch of funds, unavailability of stationeries/stores records, lack of specific time or date for both

posting stores records, lack of adequate qualified and well trained staff. It was recommended that there should be a reviewed and redesigned of the current inventory control practices and procedure, avoid too much red tape and rigid rules and policies, engage qualified and adequate personnel in stock control with adequate timely dispatch of funds.

Ondari and Muturi (2016) evaluated the factors affecting the efficiency of inventory management in firms in Kisii, Kenya. The study employed a self-administered questionnaire to collect information from a stratified random sample of 56 respondents selected from a population of 112 employees who work with four firms in Kisii Town. The data analyzed descriptively, established that bureaucratic procurement procedures, documentation, stock records, managerial skill and funding had a positive impact on the efficiency of inventory management among firms in Kisii town. It was recommended that firms in Kisii town should enhance their bureaucratic procurement procedures through elimination of overlapping or conflicting jobs or duties.

Chan, Tasmin, Aziati, Rasi, Ismail, and Yaw (2017) identified the problem of inventory management faced by the manufacturing small medium enterprise and also determine the factors that influence the effectiveness of inventory management in Batu Pahat, Johor, Malaysia. The study randomly selected 80 from manufacturing small medium enterprise in the study area. The study found that the problems of inventory management confronting manufacturing organization were underproduction, overproduction, stock out situation, delays in the delivery of raw materials and discrepancy of records. The significantly influencing factors are, documentation/store records, planning, and knowledge of employees/staff skill, with funds having slightly significant influence on the inventory management in manufacturing small medium enterprises. The study inferred that the finding is a demonstrated guideline which can help employers to overcome the problems of effectiveness of inventory management in Batu Pahat, Johor, Malaysia. They neither looked at the inventory nor the effect on the performance of the firms.

Pushpakumara (2018) identified types of inventory control system and the factors affecting effective inventory management system in government sector organizations in Sri Lanka. The study used descriptive research design with a sample of 65 of inventory section employees in 35 of government sector organizations in Dambulla Secretary Division. Primary data was collected through distributed questionnaires among selecting employees. Hypotheses were tested with one-way ANOVA and correlation coefficient analyses. It was concluded that inventory record system, storage system, wastage system, procurement system, security system and investment in inventory affect effective inventory management, while staff characteristics and method of inventory do not significantly affect effective inventory management system in government sector organizations in Sri Lanka, thereby recommending that inventory should be physically checked, properly classified, coded, recorded and kept in the storeroom. There should be proper recycling system, effective communication, while written document should be used to get approval for release of inventory from the storeroom.

Other factors identified in literature were Poor staff training, Poor control, Poor quality of stock used, Poor management and support, Poor communication, Poor time management, Corruption by other staff, Poor planning by Stores, Large quantities of stocks ordered, Complexity of the control system, warehouse operations and transportation costs, suppliers reliability, economic downturns and extent of local competition (Barwa, 2015; Okwaro, Iravo and Berut, 2017; Amachree, Apkan, Ubani, Okorocha and Eberendu, 2017).

2.3. Inventory Management and Firm Performance

Arijeloye and Akinradewo (2016) assessed the current material management practices on building projects, the problems associated with materials management and measures for managing materials in building projects in Ondo state. The study utilized questionnaire administered to professionals in both consulting and contracting firms, while data collected were analyzed descriptively. It was found that purchasing of materials, material planning method and transportation of materials are the most common practices of materials Management. The severe problems militating against materials management were lack of proper work planning and scheduling, inadequate cash flow and delayed payments, burglary, theft and vandalism. It was recommended that there should be improved supervision on site, proper handling of materials. More awareness should be given on construction sites on the knowledge of materials management on building projects.

Agu, Obi-Anike and Nnate (2016) investigated the extent to which inventory control affect the productivity of selected manufacturing firms in Nigeria, to determine the nature of the relationship between demand management and customer satisfaction of selected manufacturing firms and to determine the effect of Just – in – time on the growth of selected manufacturing firms. The study utilised the view of 270 respondents collected with questionnaire and interview as primary data instruments. The hypotheses were tested using Pearson product moment correlation and simple linear regression tests. The findings indicate that inventory control significantly affects productivity of selected manufacturing firms, with a positive relationship between demand management and customer satisfaction, while Just –in – time has a significant effect on growth of the selected manufacturing firms. The study concluded that inventory management is essential in the operation of any business. The study recommended that Organizations should train their personnel in the area of inventory control management for efficient smooth running of the inventory management activities or program.

Subramani, Nair, David, Ghouse and Kumar (2017) carried out a Study of Inventory Management System In Construction Industry in salem, India. The study utilised a questionnaire-based survey to elicit the attitude of owners, consultants, and contractors towards factors considered in inventory management system which affect the performance of construction projects. The study found that Quality materials inventory control is of a greater interest for contractors in order to improve cost, time, and quality performance. It was recommended that inventory management should ensure that contractors maintain the stock list and purchase list, calculate materials usage and store materials in safety

Atnafu and Balda (2018) empirically examine the impact of inventory management practice on firms' competitiveness and organizational performance. Data were collected from 188 micro and small enterprises (MSEs) operating in the manufacturing sub-sector in Ethiopia and the relationships and hypothesis proposed in the conceptual framework were tested using structural equation modeling (SEM). The study found that higher levels of inventory management practice can lead to an enhanced competitive advantage and improved organizational performance. It was also found that competitive advantage can have a direct, positive impact on organizational performance. It was then recommended that policy makers, and any concerned stakeholder should provide the necessary training and resource to promote the inventory management practice of MSEs for increased competitiveness and organizational performance.

Inegbedion, Eze, Asaleye and Lawal (2019) examined the influence of classical inventory management techniques on the efficiency of a door sales company in Ilorin, Nigeria. The study applied classical inventory management techniques were applied to an organisation's inventory system. Relevant data were collected on six types of doors; panel, flush, sliding, folding and as well as manual and electronic garage doors. The company had no scientific inventory management strategy but the EOQ, inventory cycle time and reorder level were computed for the six doors using the average values of the data obtained for 2011-2017. The found that the company can minimise its total inventory cost by consciously adopting an identified inventory management policy. The study though did not concern construction directly, it suggested that an improved inventory management technique can influence the cost performance of an organisation in the construction industry.

3. THEORETICAL AND CONCEPTUAL FRAMEWORKS FOR THE STUDY

3.1. Theoretical supports of the study

Constraint and Multi-echelon inventory theories were adopted for this study.

3.1.1. *Theory of Constraint*

The theory of constraints which was introduced by Eliyahu M. Goldratt in 1984, posited that a chain is not strong when it has a weak link, this is a management concept that postulates that all businesses are limited in achieving their maximum success by one or more hindrances. It is used to identify those business bottlenecks that would have encumbered production and outputs, and by ultimately controlling them performance is improved (Atnafu and Balda, 2018).

Therefore, for firms to achieve effective inventory management, the constraints which constitute weak links to ensuring overall firm performance need to be identified controlled or removed. Using the theory of constraints, a firm can focus its efforts and attention on the business obstacles and optimise processes so that it sees improved performance or output.

3.1.2. *Multi-echelon inventory theory*

Multi-echelon inventory theory is directly linked to supply chain management which in recent years has become an important way to enhance the company's competitive strength and therefore very important for the growth of companies. Multi-echelon inventory management as an integrated approach, considers completely the factors related to inventory optimization: cost, variability, service and complexity. It sizes correctly the stock across the entire supply chain while taking into account the complex interdependencies between stages as well as variables that cause ineffective inventory (Noucaiba & Abdelaziz, 2018). This is related to this study because supply chain management covers all the activities involved in delivering a product from raw material through to the customer including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management,

distribution across all channels, delivery to the customer and the information systems necessary to monitor all of these activities.

3.2. Conceptual framework

The conceptual framework of this study is used to illustrate the expectation of the research and includes the relationship among variables which indicates variables of causes and effects.

Inventory control management comprises planning and control of inventory. Inventory planning involves determining when to order items, how much to order, forecasting demand and stock replenishment, inventory information, while inventory control consists managing the inventories that are in store, knowing that products are in stock, quantities, cost and location (Sabure, 2020). The theoretical review has shown that some factors influence the effectiveness of inventory control management, which eventually leads to increased firm performance. This relationship is represented in the theoretical framework presented in Figure 1.

Twelve inventory management variables were identified, while the factors affecting the technique were grouped into firm characteristics, inventory control strategies, external factors, staff characteristics and organizational factors. The firm performance comprises cost, time, quality and profitability. An efficient inventory management techniques arising from the positive influence of the identified factors provides proper planning of the materials needed so as to ascertain the gap between the desired and the actual level of materials, allocation of resources, purchasing, sales and employment of staff and everything concerned to human resources management all of which contribute to improved performance of the firm.

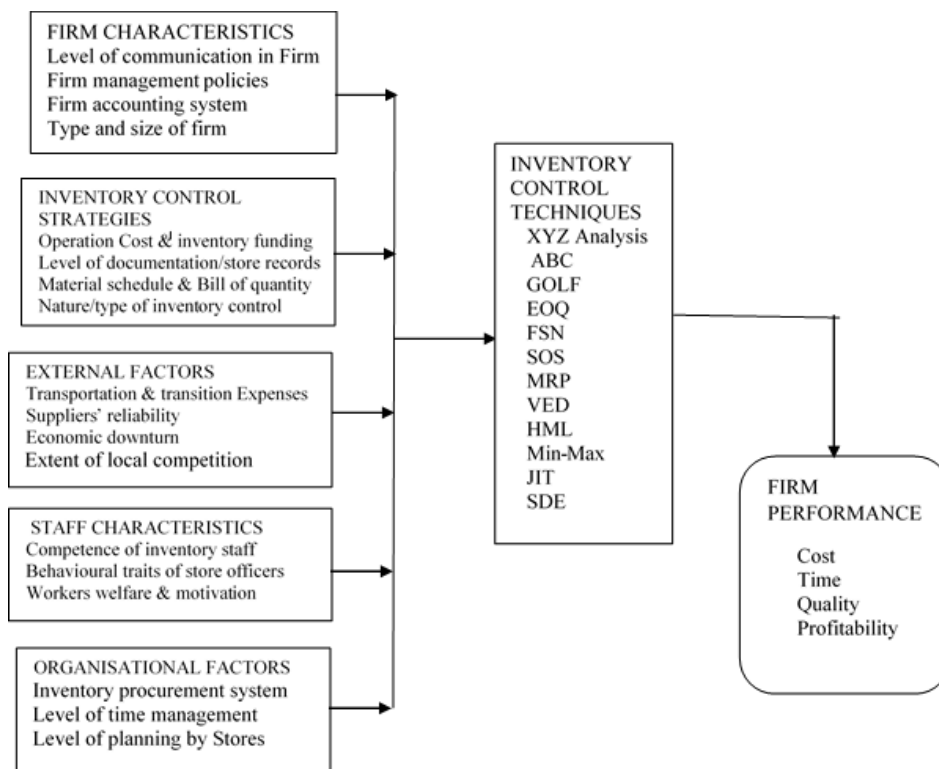


Figure 1: Conceptual framework for the study

3.3. Hypotheses of the study

Two hypotheses were postulated in this study based on the theories and relationships established in literature. The first hypothesis states that the identified internal and external factors do not have effect on the efficiency of inventory management techniques of construction industry firms in south-south, Nigeria. The second hypothesis States that the effectiveness of inventory management techniques do not affect the performance of construction industry firms in the study area.

4. RESEARCH METHODOLOGY

The study adopted quantitative survey approach which enables quantification, description and evaluation of the factors affecting the efficiency of common inventory techniques, as well as to measure the effect of the inventory management techniques on performance of small and medium size firms operating in the construction industry in south-south, Nigeria. A pilot survey was conducted to identify 304 small firms and 55 medium sized firms operating in the construction industry in four purposively selected towns in the study area and adopted as the study population. A sample size of 204 Small and 46 medium construction industry firms were selected using stratified purposive sampling techniques as respondent for this study. The use of small and medium sized construction industry firms as respondents is because, it was discovered that the two categories are considered key to economic growth, poverty alleviation and employment generation. They constitute the indigenous Nigerian firms, with low experienced and poor performance, who are unable to compete with their foreign counterparts that dominate the industry and execute major engineering projects (Ali, Awad, & Abdulsalam, 2019).

The study utilised structured questionnaire as the research instrument administered and filled by the firms' representatives, preferably managers. Questions on effective level of each of the inventory management techniques, factors influencing them and the firms' performance were formulated from extensive literature review. All questions were rated by using Likert scale ranging from 1(low) to 5 (very high) points. Data obtained through questionnaire, were analysed using SPSS25 and AMOS24 to obtain the output analysis of descriptive and inferential statistics. To test the hypothesis and examine the relationship between the variables, Structural Equation Model was adopted.

5. DATA ANALYSIS, RESULTS AND DISCUSSION OF FINDINGS

A total of 153 questionnaires were administered, only 138 usable questionnaires were. The result and discussion are presented in this section.

5.1. Characteristics of Respondents used for the Study

For an understanding of the characteristics of the firm that were represented by respondents, the location, size, type of operation, years of experience and managerial status of representative were evaluated and the result presented in Figures 2 to 6. Figure 2 shows

that the firms were almost evenly selected from the four cities (Asaba, Calabar, Port Harcourt and Uyo). Figure 3 shows that majority of the firms were small size firms while others were medium size firms. Figure 4 indicated that the firms operate in the area of design development, production management, material manufacture and supply, facility maintenance and specialized services and plant and equipment hire. These cover reasonable areas of operation of firms in the construction industry that require inventory management. Figure 5 shows that over 90% of the firms have operated for more than eleven years which gives reasonable level of experience. Figure 6 shows that majority of the managers who represented the firms were of middle and high level management. Hence, the results generally imply that the information from the selected firms and representatives can be reasonably relied on.

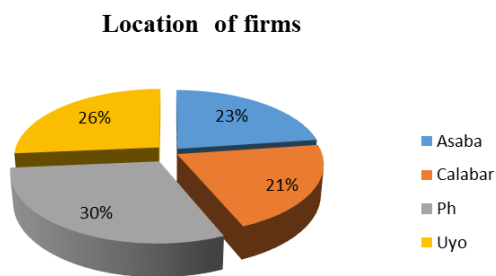


Figure 2: Location of firms

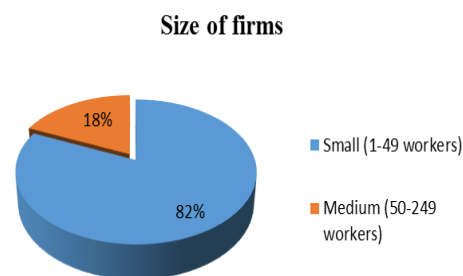


Figure 3: Size of firms

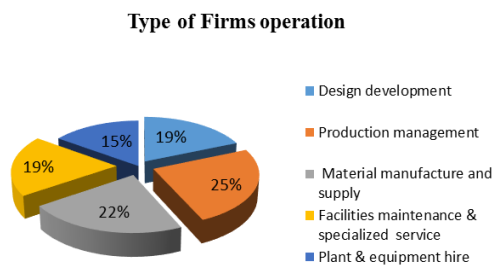


Figure 4: Type of firms



Figure 5: Years of experience of firms

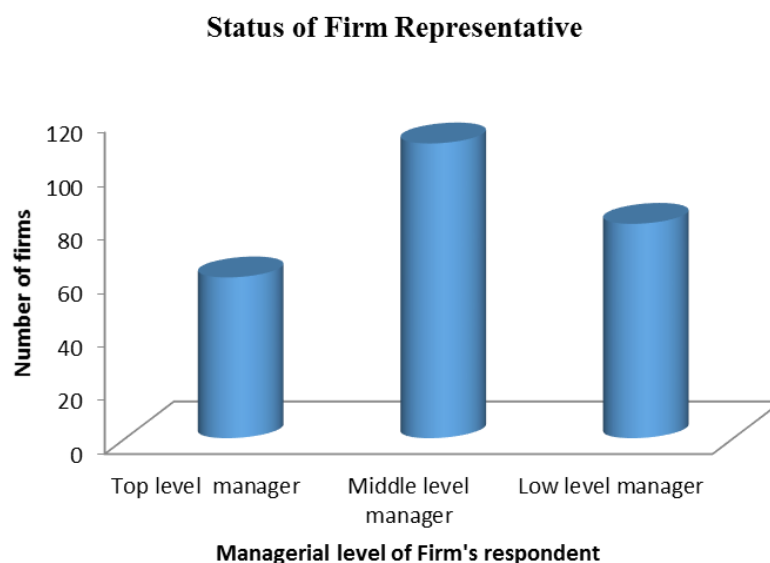


Figure 6: Status of firm representative

5.2. Exploratory Factor Analysis (EFA)

In order to determine if the identified factors fitted the constructs as described theoretically in the literature, exploratory factor analysis (EFA) was conducted. The result presented in Table 1 shows that all items had significant loadings on their respective factors with Eigen values above 1(one) and all the constructs exhibited relatively high factor loadings ranging between 0.832 and 0.982. The values of cumulative variance explained ranged from 24.098 to 88.675. The KMO (Kaiser–Meyer–Olkin) measure in Table 2 was 0.864 which is above the recommended threshold value of 0.50, indicating that there are sufficient items for each factor, while the reliability measure of Cronbach’s alpha was 0.822, which is considered acceptable. The P-value of 0.000, is significant (less than .05), indicating that the correlation matrix is significantly different from an identity matrix, in which correlations between variables are all zero. The result provided evidence to support the theoretical conceptualization of the seven latent variables or constructs.

Table 1: Result of Rotated Component Matrix

FACTORS	CODE	COMPONENTS						
		1	2	3	4	5	6	7
XYZ Analysis	ICT1	.897						
Always Better Control (ABC)	ICT2	.913						
GOLF Analysis	ICT3	.901						
Economic Order Quantity(EOQ)	ICT4	.914						
Seasonal, Off- Seasonal (SOS)	ICT6	.928						
Materials Requirement Planning	ICT7	.955						
Vital, Essential and Desirable (VED)	ICT8	.906						
High, Medium and Low (HML)	ICT10	.832						
Minimum-Maximum	ICT11	.855						
Quality Performance	FPI1		.982					
Time Performance	FPI2		.976					
Cost Performance	FPI3		.949					
Profitability	FP14		.978					
Level of communication in Firm	ICF8			.924				
Firm management/investment policies	ICF13			.962				
Firm accounting system	ICF22			.933				
Type and size of firm	ICF23			.955				
Operation Cost & inventory funding	ICF15				.930			
Level of documentation/store records	ICF17				.939			
Materials schedule & Bill of quantity	ICF20				.948			
Nature/type of inventory control method	ICF24				.936			
Transportation and transition Expenses	ICF25					.848		
Suppliers reliability	ICF26					.953		
Economic downturn	ICF27					.944		
Extent of local competition	ICF28					.937		
Competence of inventory staff	ICF1						.917	
Behavioural traits of store officers	ICF10						.953	
Workers welfare & Motivation	ICF19						.951	
Inventory procurement system	ICF6							.949
Level of time management	ICF9							.951
Level of planning by Stores	ICF16							.933
Eigen value		7.470	3.805	3.638	3.588	3.475	2.760	2.753
Percentage Variance		24.098	12.273	11.735	11.574	11.210	8.904	8.881
Cumulative variance		24.098	36.371	48.106	59.679	70.889	79.794	88.675

Table 2: Result of KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.864
	Approx. Chi-Square	10302.543
Bartlett's Test of Sphericity	Df	465
	Sig.	0.000
Cronbach's alpha		0.822

5.3. Evaluation of the goodness of fit of Models

In order ascertain if the data set satisfied the theory and provide a good fit to the model the results from the structural equation models were obtained and compared with the baseline criteria as adopted from Byrne (2010) and Gaskin (2012) for model goodness of fit. The result is presented in Table 3.

Table 3: Model goodness of fit result

Model	Factors \ Criteria	χ^2	Df	χ^2/Df	CFI	NFI	TLI	RMSEA	PCLOSE
				<3.0	≥ 0.95	≥ 0.90	≥ 0.95	≤ 0.05	>.05
1	7 factors (31 indicators)	918.351	428	2.146	0.954	0.917	0.954	0.068	0.000
2	7 factors (30 indicators)	860.644	399	2.157	0.956	0.920	0.951	0.068	0.000
3	7 factors (29 indicators)	718.859	371	1.938	0.965	0.931	0.962	0.061	0.003
4	7 factors (28 indicators)	550.514	344	1.600	0.978	0.944	0.976	0.049	0.569

Where χ^2 = Chi Square; DF = Degree of Freedom; CFI = comparative fit index; NFI= Normed fit index; RMSEA = root mean squared error of approximation; TLI = Tucker-Lewis Index. PCLOSE= Closeness of fit

Table 3 shows that the first model which is the hypothesized model consists of seven factors with 31 indicators, chi square for the model was 918.351 with 428 degrees of freedom at a probability level of $p < 0.05$. Comparative Fit Index (CFI, 0.954) which is above the threshold of acceptance of > 0.95 is a measure of the relative amount of variance and covariance in sample data that is jointly explained by the hypothesized model while that of the Normed fit index (NFI) is $0.917 > 0.90$. The Tucker-Lewis Index (TLI) yields a value of .954 which is within an acceptable range of 0-1.00, implying a good fit. However, the Root mean square error of approximation (RMSEA) which measures how well the model would fit the population covariance matrix if unknown optimally chosen parameter values are available (Byrne, 2010), has a value of $0.068 > 0.05$, while the closeness of fit (PCLOSE) is $0.000 < 0.05$ criteria. These fell short of the criteria implies that the model did not fit the data.

The second model obtained by dropping ICF25 of external factors, consists of 7 factors with 30 indicators; it provides a model fit of ($\chi^2 = 718.859$, Df= 399, CFI= 0.956, NFI= 0.920, TLI= 0.951, RMSEA= 0.068, PCLOSE=0.000), while the third model obtained by dropping ICT10 of the inventory control techniques, consists of 7 factors with 29 indicators, provides a goodness of fit of ($\chi^2 = 860.644$, Df= 371, CFI= 0.965, NFI= 0.931, TLI= 0.962, RMSEA= 0.061, PCLOSE=0.003), with all the models having $\chi^2/\text{Df} < 3.0$. It can thus be seen that the second and third models though show a substantial improvement in the model fit, yet fail to satisfy the RMSEA and PCLOSE criteria in Table 3, hence the models did not fit the data.

The last and acceptable model obtained by dropping ICT11 of the inventory control

techniques, consist of 7 factors with 28 indicators having goodness of fit of ($\chi^2 = 550.514$, Df= 344, CFI= 0.978, NFI= 0.944, TLI= 0.976, RMSEA= 0.049, PCLOSE=0.569) with the models having $\chi^2/\text{Df} = 1.600 < 3.0$. These values satisfied all the criteria, therefore the fourth model represents the final best-fitting and most parsimonious model representing the data. The path diagram of the final model is shown in Figure 7.

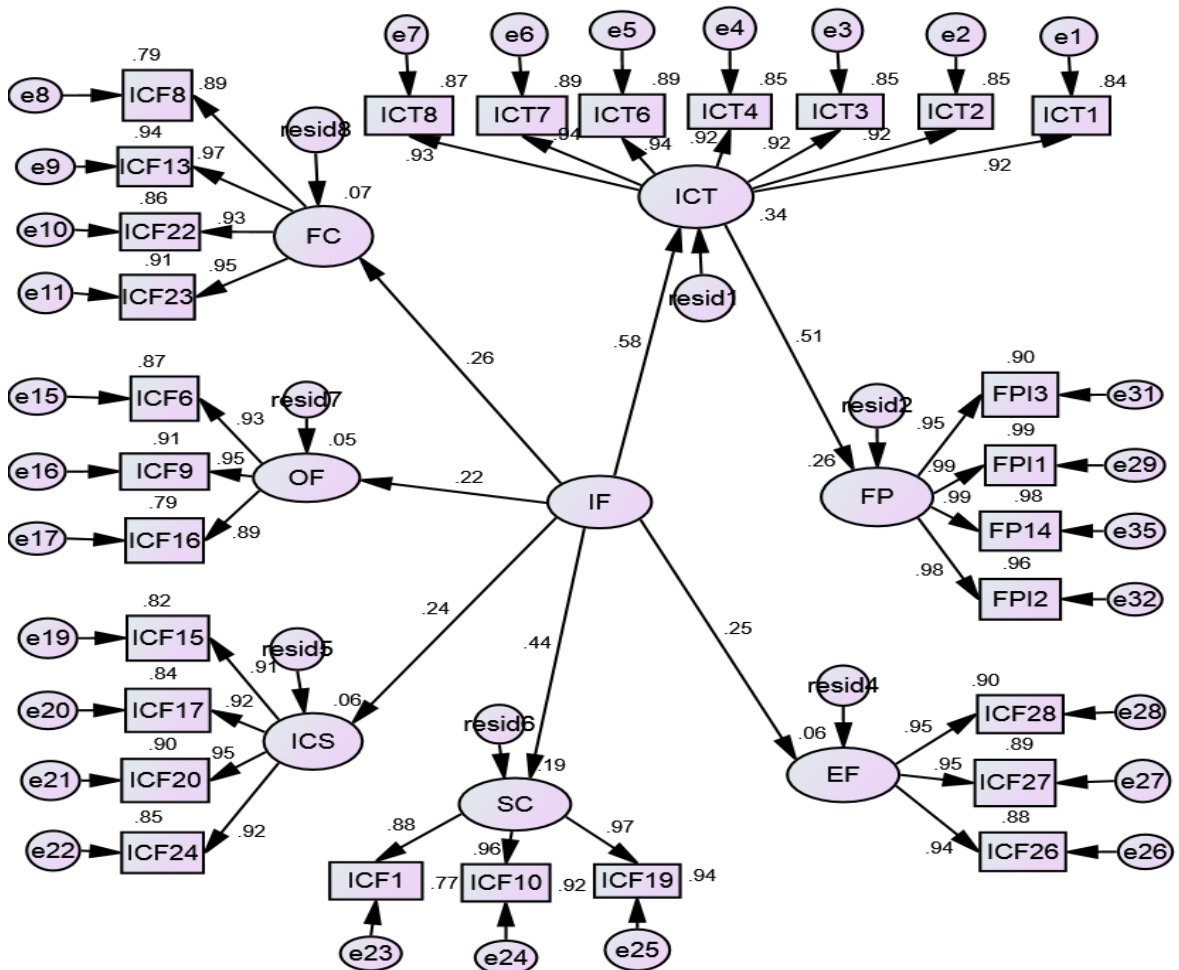


Figure 7: Path Diagram of Model 4 – Final model

5.4. Regression Estimates of factor loadings for the final model

The results presented in appendices 1 and 2 show the regression loadings of the factors in the final model. The result shows that all the estimated values in Appendix 1 were found to have critical ratio value > 1.96 , thereby implying their statistical significant difference from zero. ICT loads on IF with standardized regression value of 0.392, FC with 0.188, ICC with 0.211, EF with 0.185, PC with 0.353, while OF loads with the lowest value of 0.153. This implies that as IF increases by 1 standard deviation, ICT increases by 0.392, FC by 0.188, ICC by 0.211, EF by 0.185, PC by 0.353, while OF increases by 0.153. The probability of getting a critical ratio as large as the values in Appendix 1 is less than 0.001. For example, the regression weight for IF in the prediction of ICT is significantly different

from zero at 0.001 level (two-tailed). Therefore, the regression weight estimate is 4.873 standard errors above zero. The result also indicates that FP loads on ICT with standardized regression value of 0.420 which is greater than 1.96.

5.5. Proposed relationship and hypothesis testing

The result in Table 4 is used to ascertain if the proposed structural equation model analysis indicated supports the postulated hypotheses. The decision criteria is that if p-value is less than 0.05, the hypothesis is rejected and if otherwise the hypothesis is accepted.

Table 4: Result of Proposed Structural equation model and hypothesis testing

Hypothesis	Relationship	Total Effect	Direct Effect	Indirect Effect	Decision
Hypothesis 1	IF → ICT	0.581	0.581	-	Reject
	p-Value	0.000	0.000	-	
Hypothesis 2	ICT → FP	0.512	0.512	-	Reject
	p-Value	0.000	0.000	-	
	IF → FP	-	-	0.298	

Table 4 shows that the standardized coefficient of the relationship between influencing factors and inventory management techniques is 0.581 with a p-value of $0.000 < 0.05$ significant level. This implies rejecting hypothesis 1, which indicates that the selected factors have direct positive effect on the effectiveness of the inventory management techniques. Hence, firms' characteristics, inventory control strategies, external factors, staff characteristics and organizational factors may directly enhance the efficiency of inventory management techniques if the negative aspects of the factor are adequately taken care. This finding is consistent with some previous studies by Ondari and Muturi (2016) which established that bureaucratic procurement procedures, documentation, stock records, managerial skill and funding had a positive impact on the efficiency of inventory management among firms in Kisii, Kenya, and Pushpakumara (2018) which identified staff characteristics, inventory record system, storage system, wastage handling system, inventory procurement system, among others as factors affecting effective inventory management system in government sector organizations in Sri Lanka.

Table 4 also shows that the standardized coefficient of the relationship between the inventory management techniques and performance of construction industry firms is 0.512 with a p-value of $0.000 < 0.05$ significant level. This implies rejecting hypothesis 2, which indicates that the effectiveness of the inventory management techniques has direct positive effect on the performance of construction industry firms in the study area. The effective application various inventory management practices, such as XYZ Analysis, Always Better Control, GOLF Analysis, Economic Order Quantity, Seasonal, Off- Seasonal, Materials Requirement Planning and Vital, Essential and Desirable techniques, may enhance construction firms' performance through enhanced cost, time, quality and profitability delivery of projects and services. This finding is similar to that by Subramani, Nair, David, Ghouse and Kumar (2017) which found that quality materials inventory control is of a greater interest for contractors in order to improve cost, time, and quality performance of construction projects in Salem, India, as well as Atnafu and Balda (2018) which found that higher levels of inventory management practice have direct positive relationship on firms' competitiveness and organizational performance in Ethiopia.

The result also with a standardized coefficient of 0.298 suggested some level of indirect relationship between the significant influencing factors and Firms' performance. This indicates that the factors also have indirect positive relationship with the performance of firms operating in the construction industry in the study area

6. CONCLUSION AND RECOMMENDATIONS

The finding of the study on the relationship between some influencing factors and efficiency of inventory management techniques is that the factors have positive relationship with the efficiency of inventory management techniques. This means that the better the influence of the factors are controlled the more efficient is the inventory management techniques. The factors were classified into firm characteristics, inventory control strategies, external factors, staff characteristics and organizational factors, while the important inventory management techniques are XYZ Analysis, Always Better Control (ABC), GOLF Analysis, Economic Order Quantity (EOQ), Seasonal, Off- Seasonal (SOS), Materials Requirement Planning and, Vital, Essential and Desirable (VED). The implication of this finding is that if construction industry firms do not understand and control the identified factors, efficiency of inventory management techniques may be difficult to achieve.

Another finding from the study is that a positive relationship exists between efficient inventory management techniques and construction industry firms' performance in terms of time, cost, quality and profitability. The finding is an indication that improvement in the efficiency of inventory management techniques will lead to improvement in the performance of construction industry firms in the study area. The implication on this is that if managers of construction industry firms under play the efficiency of the management of their inventory then sustainability, competitiveness and survival of the firms will be jeopardized. It was also found that an indirect positive relationship also exists between the identified influencing factors and the construction industry firms' performance.

It is therefore recommended that managers of construction industry firms should understand, emphasize and control the identified factors for enhanced efficiency of inventory management techniques and overall performance of the firms. It is also recommended that managers of construction industry should not under play the efficiency of the management of their inventory, so that they can remain sustainable, competitive and survive in the construction industry.

It is worthy of note that this study is limited to the twelve inventory management techniques, twenty-eight influencing factors and four firm performance indicators selected from literature and the views of managers who represented the various construction industry firms operating in south-south, Nigeria. Since the study was also limited to the views of 250 managers who returned their questionnaire, the result could be improved by further studies on other stakeholders, other factors and other geopolitical zones not covered in this study. In spite of these limitations the result could provide reasonable insight into the factors construction firm managers can control to ensure the efficiency of inventory management techniques for enhanced construction firms performance in Nigeria, as well as guide for further studies.

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