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Improving the Performance of Building Construction Firms through Addressing the Gap of Building Production Management: A New Production Model Approach

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Abstract: Gap of building production management (BPM) is a serious issue that influences project success and building construction firms' (BCFs) performance. Hence, the call for BCFs performance improvement using a new production model approach is a necessity. The aim of this study is to investigate the role of the new production model concept as a method for enhancing the performance of BCFs through addressing the gap of BPM in Nigeria. To attain this aim, a research procedure was designed to achieve two objectives which include: (i) exploring the nature of Nigerian construction industry, gap of BPM and new production model concept; (ii) investigating the awareness and application of the new production model concept as a method for enhancing the performance of BCFs in the study area. To accomplish the aforementioned aim, a research method comprised of a literature review and questionnaire surveys was designed to address the objectives. The study identified unproductive/ineffective BPM, lack of buildability and maintainability analysis, professionalism mismatch, and unauthorized practices as the gap of BPM. This study revealed that the gap of BPM is the main reason behind building failures/collapses, bad debts, low productivity, low level of clients satisfaction, high labour turnovers, and barriers to economic fortune. The study also revealed poor cash flow, lack of experience in the construction field, unprofessionalism and a high number of unskilled employees in a company, lack of co-operation from subcontractors and suppliers and poor labour relations, as the top five causes of BPM gap. BCFs in Nigeria have adopted several approaches to arrest these issues, but the challenges still occur. Thus, the new production model concept that has not been well adopted by construction firms in Nigeria, and which emphasizes on-site production, and aims at enhancing production management is a key to tackling these issues. Based on the survey findings, the study recommended that the issue of the gap of BPM must be correctly identified and clearly understood so as to enable BCFs to bridge the production management gap which will influence their performance positively.

Keywords: building construction firms, building production management, new production model, performance.

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1. Introduction

The world is changing constantly as well as the construction industry. There is a constant change in the construction industry alongside with new technologies and business methods (Odediran et al., 2013), and the business environment within which construction firms operate also changes rapidly (Tagesse, 2017). Globally, the ever-changing development in the construction industry such as technology and production management advancement has not changed the minds of people from entering into the building sector business. This sector is mainly concerned with the building of houses, civil engineering works, etc. The building construction sector depends on insight practice, past experience, and its production system supervision (Antunes and Gonzalez, 2015).

Building production management (BPM) is defined as the management of construction resources such as materials, finance, labour, equipment and building production information, etc. during the physical realization of a building project, or simply, the overall management of building construction/production on site. Effective and efficient BPM is essential for achieving ultimate construction projects goals and objectives; it also promotes the survival of building construction firms (BCFs) in a modest business environment like construction. Construction firms that fail to adapt and respond to the difficulty of the innovative environment are likely to undergo survival problems (Tagesse, 2017). To achieve satisfying results such as aesthetic satisfaction, value for money, completion within budget, completion on time,

health and safety, and functional satisfaction, a sound and good management of construction project is required (Iheme and Chiagorom, 2018). According to Kabirifar and Mojtahedi (2019) a successful BPM plays a significant role in a construction firm's success, and organisations that manage its resources effectively will achieve high-performance efficiency. In the Nigerian construction industry, the possibility of tracing ineffective BPM in the system may not be far-fetched. In spite of the construction management system that exists in most Nigerian construction companies, it is characterized by poor documentation and ineffectiveness (Olutuase, 2014). This could be the negligence of core professionals in charge of managing building production and shallow knowledge about notable professionals in the industry. Okolie, Ugochukwu and Ezeokoli (2017) pointed out that, in Nigeria, the difference between the various professionals in the construction sector is known by few people.

In Nigeria, lawlessness, corruption, ignorance, use of inexperienced professionals, gluttony among construction stakeholders, unskilled labour, and the propensity of some professionals in the construction sector to plunder into well-paid specialist fields without the fundamental skills have become well-known issues in the industry (Ede, 2010). This reveals the possibility of professionalism mismatch, unauthorized practices, and unproductive BPM in the industry. The ineffective BPM has a negative implication on construction companies as well as on the economy. The gap of BPM can only result in project delays, designs and details that are difficult to construct economically, budget overruns, poor specifications, poor workmanship, termination of projects before completion or project abandonment, rework, and building failure/collapse. Obviously, these occurrences do not promote development, investment, and economy of a nation, rather a waste of resources such as money, materials, time, etc. The study by Osuizugbo (2018) revealed that the fundamental challenges confronting the construction sector of Nigeria include: lack of effective National Building Code; non-regulatory arm of the building production; unprofessional and unqualified personnel (quacks) manage building production; lack of respect and negligence in the use of some key professionals in the building industry; buildability and maintainability analysis are not often carried out on production drawings and design work by nonprofessionals; and untrained persons are being used for construction of buildings. Therefore, this issue of the gap of BPM needs to be adequately understood and managed, because, it is the reason for most building failures and collapses, disputes, non-profitability, and failure of most construction firms in the construction business. The key gap of BPM includes (i) Unproductive/ineffective BPM, (ii) Lack of buildability and maintainability analysis, (iii) Professionalism mismatch, and (iv) Unauthorized practices.

Unproductive/ineffective BPM is defined as inefficient operating technology/methods in use or deficiencies in management and construction workers that result in unnecessary work due to poor/faulty specifications and designs. Lack of buildability and maintainability analysis is a total absence of building production information examination to determine its suitability, production-friendly and defects-free from the design stage before the commencement of work on-site. Professionalism mismatch is the gap between the fundamental skills a professional possesses and the skills required to execute a particular task, regardless of the agreement reached to work under any condition. Unauthorized practices are illegal practices by unlicensed firms and individuals in the Nigerian construction industry (National Bureau of Statistics, 2015). In spite of the application of various techniques, tools, and theories, the construction sector still suffers from incompetence in relations to time and cost overruns and poor quality globally (Kabirifar and Mojtahedi, 2019).

Past studies have mostly focused on factors affecting construction performance (Soewin and Chinda, 2018; Dorcas et al., 2019; Nyangwara and Datche, 2015; Ayodele et al., 2011; Enshassi et al., 2009). Very few focused on addressing problems relating to BPM. Little is known about the whole package of the New Production Model concept for BPM in the construction industry. Even though this paper applies particularly to the construction industry of Nigeria, the same technique or approach can be used to other countries that are experiencing BPM problems.

The new production model concept is primarily designed to be prescriptive, disclose how action contributes to the set goals of production, and the likely actions are; design of the building production system, control of the building production system so as to achieve the planned purpose of the project, and improvement of the building production system (Koskela, 1999). It has been used successfully in the Toyota production system and Chinese construction firms (Gao, 2013). In direction to learning from advance countries, this study, therefore, aims at investigating the role of the new production model concept as a method for enhancing the performance of BCFs through addressing the gap of BPM in Nigeria. It is expected that the findings assist a construction firm to better understand the gap of BPM that affects construction performance, and effectively plan for performance improvement using the new production model approach.

2. Literature Review

This section of the paper provides the relevant review of existing literature on the gap of BPM in the Nigerian construction industry and the new production model for improving the performance of building construction companies.

2.1. An Overview of the Nigerian Construction Industry

One of the main supports of Nigeria's economy is the construction industry (Olowa et al., 2018). Basically, this is because, nearly all other sectors of the economy rely solely on its services and products in one way or the other in order to perform their various operations or functions (Dantata, 2007). The industry is complex, dynamic, large, and has been an instrumental driver of Nigeria's infrastructure and economic development. According to the Development Bureau (2018), the construction industry has been an enabler of social development for many generations. Historically, the industry is connected with the process of urbanisation and industrialisation, and it has been found that there is an association between construction investment and economic growth (Lopes et al., 2011). The significance of this sector is usually measured by considering its influence on the amount of employment it creates and its impact on the gross domestic product (GDP) (Dantata, 2007). And according to Soewin and Chinda (2018), the

impacts of the industry on the economy's GDP is more than any other industries.

Organized construction practices began in the 1930s in Nigeria, controlled by the Nigerian Army Engineers and Public Works Department. In the 1940s construction contracting began with few foreign companies coming into operation in Nigeria (Ruya et al., 2017). Presently, the construction sector consists of a group of varied and separated companies, and within companies, and a great variety of operations/activities exist (Oladinrin et al., 2012). Several criteria are used to categorise construction firms in Nigeria, which include; large, medium and small based on size and type of contracts; engineering and building based on area of specialization; indigenous and foreign contractors based on the company's proprietors' nationality; and regional, local, multinational and national based on scope of operation (Ilori and Omopariola, 2018). According to Tunji-Olayeni et al., (2016) the Nigerian construction industry is one of the largest and most energetic in Africa, making up of 22% foreign companies and 78% indigenous companies which are mainly small and medium-sized. Many construction companies exist in Nigeria, but very few operate on large scale including; Costain West Africa Plc., Julius Berger Nigeria Plc, Reynolds Construction Company Nigeria Limited, (RCC), Dantata and Sawoe Construction Company Nigeria Limited (DandS), China Civil Engineering Construction Corporation (CCECC), Setraco Nigeria Limited, and PW Nigeria Limited. Clients, engineers, architects, builders, quantity surveyors, management consultants, construction contractors, subcontractors, construction workers, and building users are the main participants of the construction industry (Isa et al., 2013). The superb buildings around the cities, the bridges, road networks, and air terminals, are the products of the construction industry (Adeagbo, 2014).

However, for several decades, the Nigerian construction industry has been accused of poor performance. The industry faces problems and challenges of all kind, and there exists a perception that the industry is backward in relations to technological improvement and development of operating and effective processes. Similar to other production industry, the construction industry is confronted with challenges that affect its performance and products (Dorcas et al., 2019). The poor performance and challenges in the industry are as a result of ineffective management of building project by construction firms. As stated by Mafimidiwo and Iyagba (2015) organizations, firms or companies that perform construction activities are referred to as contractors, they offer their services and skills, and accept the challenge of executing the works in exchange for financial reward. The success of any construction project depends on the contractor's performance, because, it is the contractor who translates designs into physical realization and therefore, contractors' performance improvement leads to client satisfaction as well as contractors' reputation enhancement (Aliyu et al., 2015). Building construction firms should be capable of enhancing their performances continuously (Tagesse, 2017), and to be effective in managing building production, the construction industry and BCFs have to develop an approach that responds to the system of the industry in which they function.

2.2. The Gap of Building Production Management

The gap of BPM is a serious issue that influences the project success and BCFs' performance. The gap of BPM is the gap between the required procedures and management techniques for effective management of building production by the construction firms, and the available procedures and management techniques practised. Few professionals in the construction industry understand the significance of bridging the gap of BPM and the need for it to be addressed adequately for the betterment of the citizenry. Furthermore, in Nigeria, the gap of BPM is the main reason behind project delays, design and details that are difficult to construct economically, budget overruns, poor specifications, poor workmanship, termination of projects before completion or project abandonments, reworks, disputes, non-profitability, building failures/collapses, and construction firms being thrown out of the construction business. It is also a barrier to innovation and the industry's growth. Closing the gap of BPM has a connection with economic and social development, BCFs improvement, productivity improvement, and project success. The key gap of BPM in the Nigerian construction industry includes; unproductive/ineffective BPM, lack of buildability and maintainability analysis, professionalism mismatch, and unauthorized practice.

2.2.1. Unproductive/ineffective building production management

Unproductive/Ineffective BPM is defined as inefficient operating technology/methods in use, or poor/faulty specifications and designs or deficiencies in management and construction workers that leads to unnecessary work. Unproductive/ineffective BPM is a major barrier to creativity, innovation, and industry's growth. Management has been considered as one of the most significant factors affecting the performance of works in the construction industry (Tagesse, 2017), and production management techniques can be responsible for many building failures in construction projects (Henrich and Koskela, 2006). This gap of BPM usually gives birth to unproductive time. Unproductive time such as travelling, waiting, working slowly, doing reworks, and ineffective work are the major causes of productivity loss on construction projects (Aliyu et al., 2015). As stated by Kabirifar and Mojtahedi (2019), manageable factors such as inadequacy, ineffective control, poor planning, poor allocation, poor design, resources and information, improper implementation and execution, poor dispensation, insufficient quality, and non-manageable factors such as environmental issues and failures in external methods are the most significant factors that caused construction project's inefficiency.

2.2.2. Lack of buildability and maintainability analysis

Lack of Buildability and Maintainability Analysis is a total absence of building production information examination to determine its suitability, production-friendly and defects-free from the design stage before the commencement of work on-site. According to Lam and Wong (2009) in design quality assessment, buildability and maintainability analysis of building designs have not been taken seriously as a significant factor during the design process. Examination of building production information (e. g. architectural and structural designs, etc.) by qualified professionals is necessary before construction commences on site so as to enable ease of construction. Most functional professionals often operate independently, making design decisions without considering their effects on the other professionals and the building, and this has resulted to the creation of walls between professionals (Aniekwu et al., 2015). According to Lam and Wong (2009), a good design should consider challenges the construction team faced as

well as the constraints and site characteristics during the building production phase. Design of a building that is lacking harmonized production information and ease of construction often leads to costs overruns, delays, unproductive time due to reworks, disputes among stakeholders, and project abandonment.

2.2.3. Professionalism mismatch

Professionalism Mismatch is the gap between the fundamental skills a professional possesses and the skills required to execute a particular task, regardless of the agreement reached to work under any condition. Professionals in the construction industry are expected to possess the pertinent knowledge, skills, techniques and tools to achieve the project objectives (Essays UK, 2018). More often in the industry, a particular profession probably because is the first person to be approached by the client hijacks other professions roles without engaging their inputs in the execution of building projects. This act is not helping the project owners and the industry; rather it discourages creativities and innovations in the system. There are seven notable professionals in the construction industry, namely; architects, engineers, builders, quantity surveyors, town planners, land and estate surveyors, and valuers, where each has a specific role to play in building project delivery. Engineers and architects carry out calculations and examination to come up with a good design for a building project, whereas the implementation or execution of such designs is the duty of the builders (Anyanwu, 2013). According to Odediran et al., (2013), construction business consists of several trades and professions, all working together to attain the goal of buildability, maintainability and constructability of any building project.

2.2.4. Unauthorized practice

Unauthorized Practices are illegal practices carried by unlicensed firms and individuals in the Nigerian construction industry (National Bureau of Statistics, 2015). Evidence has shown that people see construction or building works as a fast way of getting rich, thus, traders, lawyers, microbiologists, and political scientists ventures into engineering and building professions undisturbed in the Nigerian construction industry (Osuizugbo, 2018). The unauthorized practice gap in BPM is seriously affecting the performance of the Nigerian construction industry, in terms of creativities, innovations, and the industry's growth. More importantly, the incessant building collapses is connected to this gap. Notable professionals in the built environment enacted laws that make it a criminal offence to practice in their various professions without the required authorization. Unfortunately, these laws have not been enforced for once (National Bureau of Statistics, 2015). If quacks are not identified earlier during the execution of a particular task, the project will be affected negatively. As stated by Osuizugbo (2018), what makes one a professional builder or an engineer is not about knowing how to read structural or architectural drawings or having funds to venture into property development and real estate, but about having the academic discipline and the necessary skills to marry the profession. National Bureau of Statistics (2015) opined that to improve the quality of construction industry's product, the illegal operators in the sector must be weeded out; the construction system must be quack-proof and protected from such threat.

2.3. The New Production Model Concept

The new production model concept emphasizes on-site production and aims at enhancing production management. As stated by Antunes and Gonzalez (2015), production management in building construction had received little attention. The new production model concept is primarily designed to be prescriptive and disclose how action contributes to the set goals of production. These actions include; design of the building production system, control of the building production system so as to achieve the planned purpose of the production, and enhancement of the building production system (Koskela, 1999). Koskela (1999) outlined three classes of production goals as; (i) the goal of receiving the planned products produced in general; (ii) goals related to the features of the production itself, like cost minimization and level of utilization (internal goals); and (iii) goals related to the needs of the client, like flexibility and quality (external goals). The new production model concept consists of three views, namely; transformation view, flow view, and value generation view, which if utilized or applied simultaneously will improve the performance of BCFs and its production. The association of the transformation, flow and value generation views with a set of principles constitute the transformation-flow-value (TFV) theory of production (Antunes and Gonzalez, 2015). The TFV theory of production's key contribution is spreading its consideration to designing, modelling, controlling and improving production from the three views (Bertelsen and Koskela, 2002). According to Bertelsen and Koskela (2002), the main cycle of managerial attention in production management is value management – task management – flow management – value management.

2.3.1. Transformation view

As stated by Gao (2013) the concept of transformation view is mainly applied in the construction industry, where management efforts are placed on task management. The profession of project management is based on the transformation concept (Koskela, 1999), and in this concept, building production is seen as a transformation of inputs to outputs (Bertelsen and Koskela, 2002). Gao (2013) points out that the value of the output can be raised by using more skilled labour and standard materials. In the transformation view, the basic thrust is to define the task (work) to be done in a project and to get it done efficiently (Koskela, 1999). The principles of transformation model are: (a) production can be reduced to smaller and more manageable sub-processes, then into tasks, in which inputs such as materials, labour, funds, etc. are obtainable and allocate these tasks to work units or operatives; (b) cost can be reduced by minimizing the cost of each sub-process; (c) the output value of a process is linked with the costs of its input (Gao, 2013).

2.3.2. Flow view

The flow view concept of production flow comprises of four stages; processing (transformation), moving, waiting, and inspection, and the production management which tends to minimize the part of non-transformation phases of the production flow, particularly by reducing variability (Bertelsen and Koskela, 2002). As stated by Koskela (1999) stages like inspection, waiting, and moving signifies waste in production and that the basic thrust of flow view is to eliminate waste from flow processes, which will eventually promote the practices such as reduction of reworks, short distances between work units, etc. The principles of flow view are: (a) reducing the share of non-

value-adding activities (waste), (b) reducing the lead time (Lead time = queue time before processing+ processing time + waiting time + moving time) and reduce variability (process-time variability and flow variability), and (c) fundamental principles based on their usefulness in practice include; simplicity, increase flexibility and increase transparency (Gao, 2013). The causes of non-value-adding activities as listed by Gao (2013) include; (i) the production system's structure; (ii) the approach in which production is controlled; and (iii) the characteristic nature of production in the different time frame of the process (i.e. design, control and improvement of production).

2.3.3. Value generation view

The main concern in production management is the value generation. To achieve a value-based approach in BPM, various value generation models such as client-driven, client orientation, and value-based management must be adopted by the construction firms (Gao, 2013). According to Bertelsen and Koskela (2002), value generation concept views production as a way of fulfilling the client needs, and production management translates these needs correctly into a design solution that produces projects that conform to the specified design. The principles of value generation concept of production as listed by Gao (2013) are as follows; (i) ensure that all the client requirements have been captured; (ii) make sure that client requirements are obtainable in all stages of production, and that they are not lost in the design production plan and the project itself; (iii) make sure that client requirements have a bearing on all deliverables for all roles of the client; (iv) guarantee the skill and competence of the production system to construct project as required; and (v) guarantee by measurements that value is generated for the client.

2.4. Illustration Analysis of TFV Model of Production

The association of the transformation, flow and value generation views, with a set of principles, constitute the TFV theory of production (Antunes and Gonzalez, 2015). The TFV theory of production's key contribution is spreading its consideration in designing, modelling, controlling, and enhancing production from the three views (Bertelsen and Koskela, 2002). Each of the production concepts pays attention to definite parts of the production and has its own approaches and practices, but the three models are complementary (Gao, 2013). According to Bertelsen and Koskela (2002), in production management, the needs of management from the three ideas should be combined and balanced, and the first move towards the integration is to conceptualize production concurrently from these three views. Fig 1 shows the sequence of managerial attention to TFV model of production.

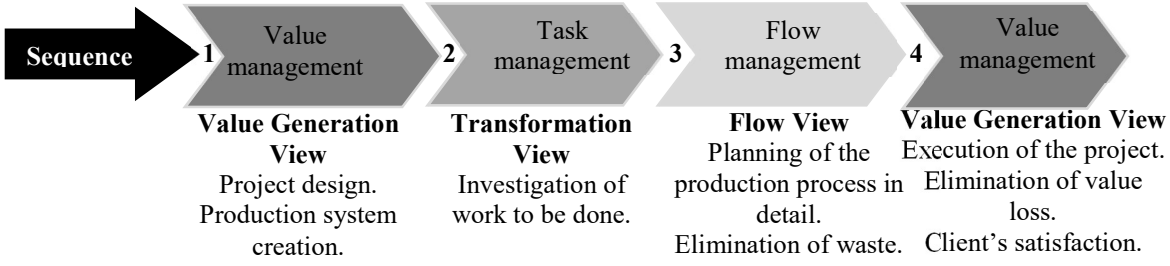

Fig 1. Production management sequence of TFV Model (Bertelsen and Koskela, 2002).

From Fig 1; assuming that a client's needs are clear and flawless, the first phase is to design the building project and establish a system of production. Value management is the starting point; that is identifying, studying, and evaluating the client's needs. Secondly, the attention moves from value management to task management for the investigation of work to be done efficiently. Thereafter, assign skill workers to perform the required tasks. The third phase is the flow management, which aims at construction of the project as required by the client. It begins by planning the building production process in detail and at the same time eliminating waste or non-value adding activities. Finally, in the fourth phase, value generation view, the plan is executed perfectly as planned (avoiding value loss) for the satisfaction of the client. In Fig 1, a close inspection of the TFV model of production shows that each view of production is linked to the traditional project success criteria such as time, cost, and quality. According to Gao (2013), cost reduction is achieved by reducing the cost of sub-process which transformation view supports; time or project duration can also be maintained or lessen through elimination of the non-value adding activities in the flow view; and in the value generation concept, quality is attained when the client's needs and requirements are met in a standard method.

2.5. The Relationship between Gap of Building Production Management, New Production Model Concept and Performance Improvement

The gap of BPM is a critical issue that affects the Nigerian construction industry and BCFs in particular. The gap of BPM includes the following; unproductive/ineffective BPM, lack of buildability and maintainability analysis, professionalism mismatch, and unauthorized practices. The new production model concept has three sub-concepts which are; transformation view, flow view, and value generation view that if applied concurrently in building production, would address the issue of the gap of BPM. In the construction industry, the BPM begins with investigating the work to be done and ensuring efficient production of such work. If the task is duly established, then the planning of the production in details commences. During the planning process, it is utmost necessary to eliminate waste from the production information, as well as during the implementation stage. Furthermore, knowing the client's needs is the key value, thus, care should be taken in order to eliminate non-value adding activities (i.e. avoid value loss) so as to achieve client's requirements and satisfaction. Finally, adopting a production management sequence of TFV model will enable BCFs to enhance their performance and gain confidence in the building users and owners.

2.6. Challenges and Benefits of Closing Gap of Building Production Management

The gap of BPM poses the utmost threat to the future of the Nigerian construction industry. It has mounted barriers to the growth of the industry. If the gap of BPM is not closed, challenges such as project delays, design and details that are difficult to construct economically, budget overruns, poor specifications, poor workmanship, termination of projects before completion or project abandonment, reworks, disputes, non-profitability, building failures/collapses, and construction firms being thrown out of construction business, will continue to dent the image of the industry. However, closing the gap of BPM will benefit building owners, users, and construction firms in achieving project success, client's satisfaction, innovations and value generation, etc. In addition, it will impact positively in the Nigerian construction industry, and the incessant building collapses in the country will be significantly reduced if not permanently eliminated.

3. Methodology

Fig 2 displays the research flow of this paper which starts with an intensive literature review of relevant materials related to the Nigerian construction industry and the gap of BPM. Then the new production model concepts were identified through a review of literature, which was used in addressing the gap of BPM. The questionnaire survey was developed using the identified BPM gaps and the new production model concept. Relationship between the gap of BPM, the new production model concept, and performance improvement was established. Finally, the challenges and benefits of closing the gap of BPM were highlighted.

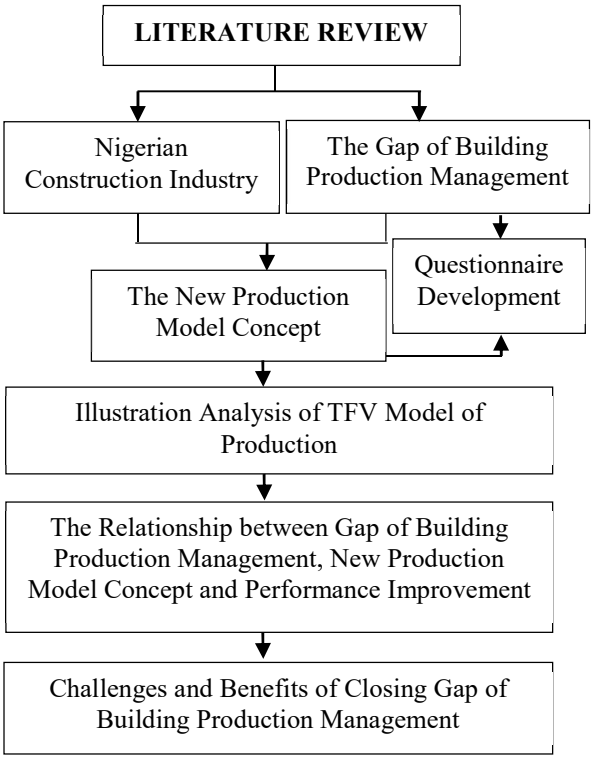

Fig 2. Research flow of the study.

The research approaches adopted in this study are literature reviews and cross-sectional surveys. According to Nakanoa and Muniz (2018), the literature review provides the theoretical foundation that supports the research argument, sets the limits of discussions, and defines and elucidates the major concepts used in the empirical sections. Literature review shows the importance and originality of the envisage research problem. A thorough and substantive literature review is the foundation for any good research project (Nakanoa and Muniz, 2018). Cross-sectional surveys are surveys that are performed at a particular period. These surveys provide a picture of what is happening in a group at a particular period. Moreover, these surveys usually take an exploratory or descriptive form that simply sets out to explain attitudes or behaviours (Mathers et al., 2007). Particularly, questionnaire surveys are a good way of collecting relevant information from a wide range of population, hence the use of questionnaires in this study.

To accomplish the aforementioned aim, a research method comprised of a literature review and questionnaire survey was designed to address the following objectives: (a) a literature review was utilized to explore the nature of Nigerian construction industry, the gap of BPM, and new production model concept, a questionnaire survey was conducted for both; (b) to investigate the awareness and application of the new production model concept as an approach for improving the performance of BCFs through closing gap of BPM; and (c) to investigate the awareness, causes and effects of gap of BPM, followed by actions adopted to overcome the gap of BPM by BCFs. The findings from the data analysis used in this study were obtained from three states in the Western part of Nigeria, namely Ogun state, Lagos state, and Oyo state. These three Western states of Nigeria were considered because they are economically important cities in Nigeria. These states have a high volume of construction works, a large concentration of engineering and BCFs, and the record-high number of building collapse in Nigeria.

The questionnaire survey comprised of four sections. Section one was designed to collect characteristics of the respondents; the second section was also designed to collect characteristics of the responding firms; the third section addresses the awareness, causes, and effects of the gap of BPM, also the actions adopted to overcome this problem in BCFs and respondents are to attest to these in the following order on the Likert scale: 1 = very irrelevant; 2 = irrelevant; 3 = fairly relevant; 4 = relevant; 5 = very relevant. Finally, the fourth section addresses the awareness and application of the new production model concept as an approach for bridging the BPM gap in BCFs. To show the accuracy and completeness of the survey instrument, a pilot study was conducted before administering it to the respondents. Cronbach's alpha test was used to measure the reliability of the multiple Likert scale questions. The Cronbach's alpha (α) value obtained was 0.811, which indicated a high level of internal consistency for the scale. The sample was selected using a snowball sampling technique, a non-probability sampling method. According to Alvi (2016), the method is useful in approaching population that seems not readily available. A total of 76 questionnaires were administered to BCFs in the study area, while 57 was adequately completed and returned representing a 75% response rate. Descriptive statistics were used to analyze the characteristics of the respondents, responding firms, the awareness of the gap of BPM, and the new production model concept. Whereas mean item score, relative importance index (RII), and ranking were used to analyze the frequency of the causes

and effects of the gap of BPM, and the actions adopted to overcome this problem in BCFs.

3.1. Data Analysis Procedures

The study employed the following procedures for data analysis:

3.1.1. Computation of the relative importance index (RII):

This method of analysis was adopted so as to rank variables used in the study according to their relevance. Hence, the Relative Importance Index that is used for measuring and determining the relative importance of variables considered in this work was utilized. To calculate, the mean for each variable was computed by summing up the scores by the various respondents. The Relative Importance Index was computed using Eq. (1).
Relative Importance Index (RII) is computed as:

$$\frac{\sum fx}{\sum f} \cdot \frac{1}{k} = \frac{\bar{x}}{k} = \text{equation} \quad (1)$$

Where: Mean = $\bar{x} = \frac{\sum fx}{\sum f}$

x = Points on the Likert's scale (1, 2, 3, 4, 5)
f = Frequency of participants' choice of each point on the scale x
Where k = Highest point on the Likert's scale (in this case, k is 5)

3.1.2. Ranking of the items based on their RII:

The item with the highest RII value is ranked first (1) and so on.
The followings are the interpretation of RII values:
Item is "low rating" if RII is less than 0.60
Item is "high rating" if $0.60 \leq RII < 0.80$
Item is "very high rating" if $RII \geq 0.80$

4. Data Presentation, Results and Analysis

The analysis of data collected for the study is presented as follows. The summary of the demographic characteristics of the survey participants is shown in Table 1.

Table 1: Respondents' Background information

Respondents' Background Information	f	%
Sex		
Male	42	73.7
Female	15	26.3
Age Bracket		
21 – 30 years	17	29.82
31 – 40 years	21	36.84
41 – 50 years	10	17.54
51 years and above	9	15.80
26 and above	4	7.0
Designation		
Project Manager	24	42.10
Estimating Manager	6	10.52
Managing Director	10	17.54
Commercial Manager	4	7.02
Design Manager	4	7.02
Other	9	15.80
Professional Background		
Architect	7	12.30
Quantity Surveyor	12	21.05
Builder	17	29.80
Civil Engineer	13	22.80
Mechanical and Electrical Engineer	1	1.75
Other	7	12.30
Academic Qualification Achieved		
HND	18	31.57
B.Sc./B. Tech.	25	43.85
PGD	5	8.80
Masters	6	10.52
PhD	2	3.51
Other	1	1.75
Years of Experience in Construction		
Less than 5	9	15.8
5 – 10	22	38.6
11 – 15	9	15.8
16 – 20	9	15.8
21 – 25	4	7.0
26 and above	4	7.0

f = Frequency

The percentage distribution of the participants based on gender in Table 1 shows that majority of the respondents are males with 73.7%, while the remaining 26.3% of the population are females. This confirms that the construction industry has more males than females. 70% of the total respondents are above 30years old, which means that the majority of the participants are mature to participate in this study. Project manager constitutes the highest population (42.1%) of the respondents. Builders constitute the highest population of about 30% of the respondents, followed by civil engineers of about 23%, indicating their involvement in construction activities in the study areas. B.Sc. /B. Tech. holders constitute the highest of about 44% of the respondents, followed by HND holders of about 32%. More than 84% of the survey participants have their working experience in construction above 10years at the time of collecting these data.

Table 2 shows that NIQS has the highest percentage of about 43% among the graduate membership, and among the corporate membership, NIOB has the highest percentage of about 37%. Five (5) out of 57 respondents were males (1 from NIA, 3 from NSE and 1 from NIOB) Based on the respondents' professional membership status, they were qualified for the survey.

Table 2: Professional membership status of respondents.

	Graduate		Corporate		Fellow	
Professional Qualification/Me-membership Status	**F**	**%**	**F**	**%**	**F**	**%**
Nigerian Institute of Architects (NIA)	1	7.14	5	13.16	1	20.0
Nigerian Society of Engineers (NSE)	2	14.28	9	23.68	3	60.0
Nigerian Institute of Building (NIOB)	2	14.28	14	36.84	1	20.0
Nigerian Institute of Quantity Surveyors (NIQS)	6	42.86	6	15.79	-	-
Others	3	21.43	4	10.53	-	-
Total	14	100	38	100	5	100

F = Frequency of respondents' choice of membership status.

Table 3 shows that the majority of the responding firms are main contractors (73.7%), while the remaining 26.3% execute their duties on-site in subcontractor's capacity. About 44% of the respondents are limited liability companies and about 95% of the responding firms have been practising for more than 10 years in the construction industry. Most of the construction firms operate a fully indigenous firm (61.4%) and about 58% of the responding firms have workers ranging from 1 to 49, the remaining 42% have workers ranging from 50 and above. The percentage distribution of the annual turnover of the responding firms shows that 43.9% have 10 to 50 million Naira as annual turnover, while 8.8% of the responding firms have annual turnover 500 million Naira and above. Furthermore, 73.7% of responding firms are building and civil engineering contractors, whereas building contractors alone constitute 26.3% of the entire population. These results revealed that most contractors do not specialize in a single type of construction. Table 3 also shows that 94.7% of the responding firms are involved in the practice of both new and maintenance work activities. According to Ugochukwu and Onyekwena (2014), firms in Nigeria vary in size from the self-employed craftsmen who engage mainly in repairs and maintenance of buildings to the very large multi-national or foreign-based construction company that execute both maintenance and new construction works.

Table 3: Characteristics of responding firms

Responding Organisation	**f**	**%**
Class of Contractor (Firm)		
Main contractor	42	73.7
Sub-contractor	15	26.3
Ownership of Contracting Organisation		
Sole proprietorship	9	15.8
Partnership	20	35.1
Limited liability company	25	43.9
Public limited company	3	5.2
Years of Existence of Organisation		
Less than 5	3	5.3
5 – 10	19	33.3
11 – 15	13	22.8
16 – 20	7	12.3
21 – 25	3	5.2
26 – 30	5	8.8
31 and above	7	12.3
Organisation Ownership and Management		
Fully indigenous	35	61.4
Fully expatriate	9	15.8
Partly expatriate/indigenous	13	22.8
Company's Workforce (site/head office)		
1 – 49 workers	33	57.9
50 workers and above	24	42.1
Annual Turnover (last year)		
Less than 10 million Naira	18	31.6
10 – 50 million Naira	25	43.8
51 – 100 million Naira	5	8.8
101 – 500 million Naira	4	7.0
Above 500 million Naira	5	8.8
Organisation Operation/Activity		
Building	15	26.3
Building and civil engineering	42	73.7
Type of Construction Activity		
New work	1	1.8
Maintenance work	2	3.5
Both new and maintenance work	54	94.7

Table 4 shows that individuals were ranked first in terms of obtaining construction projects with a mean score of 4.14, thus, meaning individuals are the major source of

projects for construction firms in the study areas. Corporate bodies/organizations with a mean score of 3.51 were ranked second, while government/public agencies are the least frequent source of a construction project for construction firms.

Table 4: Ranks of the level of frequency of obtaining projects from clients

S/No	Clients	Weighting (x)/Response Frequency (f)					Σf	$\overline{X}$	Rank
		1	2	3	4	5			
1	Corporate bodies	4	6	17	17	13	57	3.51	2
2	Individual	0	3	9	22	23	57	4.14	1
3	Government/public agencies	7	14	21	7	8	57	2.91	3

1 = never; 2 = rarely; 3 = sometimes; 4 = often; 5 = very often

Table 5 indicates that all the responding construction firms are fully aware of the gap of BPM in the construction industry. As stated by Kabirifar and Mojtahedi (2019), manageable factors such as inadequacy, ineffective control, poor planning, poor allocation, poor design, resources and information, improper implementation and execution, poor dispensation, insufficient quality, and non- manageable factors such as environmental issues and failure in external methods, are the most significant factors that caused construction project's inefficiency. Evidence has shown that people see construction or building works as a fast way of getting rich, hence, traders, lawyers, microbiologists or political scientists ventures into engineering and building professions undisturbed in the Nigerian construction industry (Osuizugbo, 2018). The unauthorized practice gap in BPM is seriously affecting the performance of the Nigerian construction industry, in terms of creativities, innovations, and the industry's growth. It is not debatable that stakeholders in the Nigerian construction sector are aware of these gaps in BPM. However, this finding has revealed and supported that players in the construction industry are fully aware of the gap in BPM.

Table 5: Percentage of awareness of gap of building production management

Awareness	Frequency	Percentage (%)
Yes	57	100
No	0	0

The level of relevance of causes of the gap of BPM factors is "very high" for two out of the twelve factors (RII ≥ 0.80), it is "high" for the remaining ten factors (Table 6). However, in Table 6, poor cash flow was ranked first by the level of relevance, with RII = 0.820. This indicates that without the flow of money many things can go wrong. Lack of experience in the construction field, with RII = 0.814 was ranked second, and unprofessionalism and the high number of unskilled employees in a company ranked the third position, with RII = 0.796. This was in support of the Enshassi et al., (2009) and Ayodele et al., (2011) studies, which reveals unavailability of resources (e.g. poor cash flow), quackery, and professional indiscipline as factors causing gaps in the BPM. These problems in the construction sector have to stop so as to attain project completion goals. Otherwise, issues will continue to confront the sector.

The level of relevance of effects on the gap of BPM factors is "very high" for one out of the ten factors (RII ≥ 0.80), it is "high" for the remaining nine factors (Table 7). However, in Table 7, building failures/collapses were ranked first by the level of relevance, with RII = 0.810. This indicates that the incessant building failures/collapses in the country are the most concern of the construction firms. Bad debt, with RII = 0.782 was ranked second, and low productivity was ranked the third position, with RII = 0.772. The study of Dalibi (2016) is in support of these findings, by revealing structural defects, rework, poor finishing and collapse of building as the major resultant effects of gaps in practising BPM in Nigeria. Osuizugbo (2019) noted that the rate of project failure, manifesting as client dissatisfaction, uncompleted or abandonment projects, cost overshoots, and structural collapses in both private projects and public facilities are indeed high. This means that, if these gaps are not managed adequately, clients will continue to suffer losses in building construction investment.

The level of relevance of actions adopted to overcome the gap of BPM factors is "very high" for seven out of the ten factors (RII ≥ 0.80), it is "high" for the remaining three factors (Table 8). However, in Table 8, do away with quacks in construction project realization (patronize only licensed practitioners in the industry) was ranked first by the level of relevance, with RII = 0.874. This shows that the industry allows anybody (quacks) to practice building construction and is the reason behind building failures/collapses in the country. Insists on quality delivery, with RII = 0.838 was ranked second, and adopt modern construction methodology that enhances more profit was ranked the third position, with RII = 0.828.

Table 6: Relevance of causes of the gap of building production management

S/No	Causes of Gap of Building Production Management	Weighting (x)/Response Frequency (f)					Σf	$\overline{X}$	RII	Rank
		1	2	3	4	5				
1	Too much focus on low prices at tender stage	6	5	2	22	22	57	3.86	0.772	6
2	Lack of access to funding from commercial banks	5	8	5	23	16	57	3.65	0.730	10
3	Lack of adequate knowledge about roles of professionals in the industry	3	8	6	24	16	57	3.74	0.748	9
4	Unprofessionalism and high number of unskilled employees in a company	3	3	3	31	17	57	3.98	0.796	3
5	Poor cash flow	2	2	7	23	23	57	4.10	0.820	1
6	Lack of management skills	3	8	2	25	19	57	3.86	0.772	6
7	Lack of access and reliable information about contract	3	8	6	22	18	57	3.77	0.754	8
8	Poor labour relations	5	2	7	23	20	57	3.89	0.778	5
9	Lack of experience in the construction field	2	6	8	11	30	57	4.07	0.814	2
10	Higher start-up cost	4	10	9	13	21	57	3.65	0.730	10
11	Poor contractor's attitude towards competitiveness	6	5	13	18	15	57	3.54	0.708	12
12	Lack of co-operation from subcontractors and suppliers	4	2	9	21	21	57	3.93	0.786	4

1 = very irrelevant; 2 = irrelevant; 3 = fairly relevant; 4 = relevant; 5 = very relevant

Table 7: Relevance of effects of the gap of building production management

S/No	Effects of Gap of Building Production Management	Weighting (x)/Response Frequency (f)					Σf	$\overline{X}$	RII	Rank
		1	2	3	4	5				
1	Low productivity	10	2	7	19	19	57	3.61	0.772	3
2	Low demand for services of BCFs	6	4	7	28	12	57	3.63	0.726	8
3	High labour turnover	5	8	3	23	18	57	3.72	0.744	5
4	Projects abandonment	7	4	11	16	19	57	3.63	0.726	8
5	High level of defects in construction	8	3	6	25	15	57	3.63	0.726	8
6	Bad debt	4	5	3	25	20	57	3.91	0.782	2
7	Building failures/collapse	3	5	6	15	28	57	4.05	0.810	1
8	Low level of client satisfaction	7	1	5	28	16	57	3.79	0.758	4
9	Unethical or corrupt practices tend to distort construction process and thereby hamper economic fortune.	10	3	2	20	22	57	3.72	0.744	5
10	Delayed payment by clients	6	5	8	19	19	57	3.70	0.740	7

1 = very irrelevant; 2 = irrelevant; 3 = fairly relevant; 4 = relevant; 5 = very relevant

Table 8: Relevance of actions adopted to overcome the gap of building production management by building construction firms

S/No	Actions Adopted to Overcome Gap of Building Production Management by Firms	Weighting (x)/Response Frequency (f) 1	2	3	4	5	Σf	$\overline{X}$	RII	Rank
1	Adequate use of professional advisors and consultants in the construction industry	5	4	3	18	27	57	4.02	0.804	6
2	Adopt modern construction methodology that enhances more profit	2	1	8	22	24	57	4.14	0.828	3
3	Partner with bigger experienced firms	2	8	7	19	21	57	3.86	0.772	10
4	Comply building control and regulations	4	2	5	25	21	57	4.00	0.800	7
5	Meet all specifications	3	5	2	20	27	57	4.10	0.820	5
6	Insists on Due Process	3	5	6	21	22	57	3.95	0.790	9
7	Engaged right professionals at every stage of construction and skillful workers	3	4	4	18	28	57	4.12	0.824	4
8	Insists on quality delivery	1	6	4	16	30	57	4.19	0.838	2
9	Prior to the commencement of construction work ensure that buildability and maintainability analysis is done on the production information	5	3	4	21	24	57	3.98	0.796	8
10	Do away with quacks in construction project realization (patronize only licensed practitioners in the industry)	1	2	5	16	33	57	4.37	0.874	1

1 = very irrelevant; 2 = irrelevant; 3 = fairly relevant; 4 = relevant; 5 = very relevant

Table 9: The awareness and application of the new production model concept

New Production Model	F	%
Awareness of TFV Model of Production		
Yes	29	50.9
No	28	49.1
Handling/Management of the Model		
Separately	10	17.5
Concurrently	23	40.4
Neutral	24	42.1
TFV main cycle of managerial attention = value management → task management → flow management → value management.		
Yes	33	57.9
Don't know	24	42.1

Table 9 shows a summary of the awareness and application of the new production model concept of surveyed participants. About 51% of the responding firms say they are aware of the TFV model of production, while the remaining 49% are not aware of the concept. When asked how the TFV model is being handled or managed, about 40% of the respondents said concurrently, about 42% said they are not sure of how is being managed, whereas, about 17% said separately. Thirdly, about 58% of the responding firms said the TFV main cycle of managerial attention is **value management → task management → flow management → value management,** while the remaining 42% said they don't know about it. In general, Table 9 indicates that the level of awareness and application of the new production model concept of the responding firms is on the average in the study areas. As stated by Antunes and Gonzalez (2015), production management in building construction had received little attention. Furthermore, in Nigeria, the study of the new production model concept is scarce. This has resulted in a low level of awareness of the concept and its application in BPM.

5. Limitations and Implication of the Study

The major limitation of this study is that it focused on the gap of BPM, new production model concept, and performance improvement. The implication of the findings can lead to the following: building failures/collapses, bad debt, low productivity, low level of client satisfaction, unethical or corrupt practices which tend to distort

construction process and thereby hamper economic fortune, and high labour turnovers. In order to reduce the aforementioned implications, the following must be strictly adhered to: do away with quacks in construction project realization (patronize only licensed practitioners in the industry); insists on quality delivery; adopt modern construction methodology that enhances more profit (for instance TFV concepts); engaged right professionals at every stage of construction and skillful workers; and meet all specifications.

6. Conclusions and Recommendations

The gap of BPM is one of the utmost problems or challenges confronted by the Nigerian construction industry. The difficulty of the problem disturbs the economy and also contributes to delay in having sustainable development like other countries. This research has revealed that the industry and the BCFs, in particular, suffer from BPM gap which is the main reason behind building failures/collapses, bad debt, low productivity, low level of client satisfaction, high labour turnovers, and barriers to economic fortune. Poor cash flow, lack of experience in the construction field, unprofessionalism and a high number of unskilled employees in a company, lack of co-operation from subcontractors and suppliers, and poor labour relations were the top five causes of BPM gap, revealed by the study. In spite of the various strategies adopted by construction firms to bridge the BPM gap in a construction project, the challenge still occurs because these strategies lack the innovative and advance approaches that are included in the TFV model of the production concept. This concept emphasizes on-site production and aims at enhancing production management to solve the problem of the gap in BPM. The concept consists of three views, transformation, flow, and value generation views, which if utilized or applied simultaneously will improve the performance of BCFs and its production.

Having reviewed the literature and keeping in mind the results of the survey questionnaires, it is, therefore, recommended that the issue of the gap of BPM must be correctly identified and clearly understood so as to enable BCFs to bridge the production management gap which will influence their performance positively. Also, the provision of the benefits of the TFV model of production concept to the senior management in BCFs towards bridging the lack of buildability and maintainability analysis gap will ease construction, thereby constructing efficiently and economically.

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