IMPACT OF INNOVATION ON PERFORMANCE OF SPECIALIST CONSTRUCTION CONTRACTORS IN KADUNA STATE

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MTECH/SET/2019/9769

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ABSTRACT

Findings from previous studies have revealed that specialist construction practices in Nigeria have been influenced by a lack of innovation as well as the use of outdated and inappropriate innovation, which has hampered successful public project delivery. Innovation has been found out to be critical to gaining a competitive advantage and ensuring a firm's survival in business. This study therefore assessed the impact of innovation on the performance of specialist construction contractors (SCC) in Kaduna State. The study adopted a quantitative research approach. Data was collected with the use of a questionnaire survey. The population for the study comprises 28 specialist construction firms registered with the Federation of Construction Industry (FOCI) operating within Kaduna metropolis and one specialist was selected from each firm amounting to 28 respondents. Analysis of the data was undertaken with the use of frequency counts, percentages, and Meant Item Score (MIS). The study revealed that intensified market competition and survival were the most significant drivers of innovation among specialist construction contractors in Kaduna state, with an MIS of 4.73 and 4.55, respectively. On average, all the drivers of innovation among specialist construction contractors are important (average MIS = 4.39). The most significant barriers to innovation among specialist construction contractors are the high cost of innovation (4.53) and a lack of understanding of the benefits of innovation (4.50). All the identified innovation among specialist construction contractors is moderate (average MIS = 3.87). Improvement of services (MIS = 4.69); and improvement of product quality (MIS = 4.62) are the most important benefits of innovation among specialist construction contractors. On average, all the identified benefits of innovation among specialist construction contractors are important (average MIS = 4.31). The spearman's rank correlation revealed that there exists a significant strong relationship between the adoption of innovation and the performance of a specialist construction contractor. It was concluded that innovation, when adopted, has a positive impact on the performance of specialist construction contractors in Kaduna state. It was therefore recommended that Specialist contractors should make every effort to attend workshops, seminars, and other training programmes that will enlighten them on new ideas, cutting-edge technologies, and how to apply them.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURE

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The construction sector contributes significantly to the social and economic development of nations all over the globe (Abdullateef and Seong, 2017). The industry contributes to societal development by providing jobs to a significant number of individuals. It offers fundamental infrastructure for the society's efficient operation (Ogunbayo *et al.,* 2018). Furthermore, in contrast to other sectors, the construction industry is perceived as having poor productivity and quality. One of the major causes of this predicament is the industry's slow acceptance of new technologies (Winch, 2003). Innovation may be defined as the process of turning an idea into a marketable product or service, or as the result of enhancing an existing product or service (Benmansour and Hogg, 2012). It may also be defined as a new or old concept, method, or process that is used in a unique manner to the creation of products or services, thus adding value to a system, process, or product (Ozorhon *et al.*, 2010).

Improving all aspects of building operations is critical since it contributes significantly to the Gross Domestic Product (GDP) of most developed and developing nations. The industry has the potential to grow in terms of size, market share, and profitability, and innovation is the key to achieving these goals. Damanpour and Schneider (2010) observed that innovation is critical for gaining a competitive edge and ensuring a firm's existence in the business. According to Blayse and Manley (2010), the more innovative the construction sector is, the more likely it is to contribute to economic development. Furthermore, experts in engineering and construction companies in the sector must innovate in order to win, increase efficiency, and enhance project quality. To manage innovation, it is imperative to comprehend the sector as a whole and how innovation

affects the Nigerian construction industry, as well as how a new concept would bring value to the industry's companies. From the planning phase through the construction phase and until successful delivery, innovation is required to handle changes in the scope of public projects (Amusan *et al.,* 2018).

Specialist contractor' is a very broad term that describes a contractor appointed to carry out activities in the development of a built asset that involve specialist construction knowledge and skills. The term specialist contractor is used to describe a firm which constructs specific elements of buildings. Traditionally such firms act as trade sub-contractors to a general contractor. Historically design details were settled on site in discussions between the sub-contractors and the architect (Sexton and Barrett, 2005). The decision-making process and the productive result of decision-making efforts are influenced by leadership style. Because of the complexity of projects, effective delivery requires a mix of technical and specialized expertise (Ameh & Odusami, 2014). The findings of Afolabi *et al.* (2018), Fadun and Saka (2018), and Hamma - Adama *et al.* (2018) all point to the fact that Specialist construction practices in Nigeria have been influenced by a lack of innovation, as well as the use of outdated and inappropriate innovation, which has hampered successful public project delivery. This research evaluates the Impact/effect of innovation on the performance of specialized construction contractors in Kaduna State.

1.2 Statement of the Research Problem

The construction industry is frequently accused of implementing fewer innovations than other industries (Bankvall *et al.,* 2010), even after knowing that innovation has a significant impact on increasing the productivity of construction firms and their resources (Davis *et al.,* 2016; Dedahanov *et al.,* 2017).Numerous studies have demonstrated the significant positive relationship between innovation and productivity (Panuwatwanich *et*

al., 2008; Sexton and Barrett, 2005), Most Specialist construction contractors are struggling to adapt and react to the complexities of the modern innovation-driven business climate, and are facing survival issues (Akande *et al.,* 2018; Ojelabi *et al.,* 2018).

Despite the fact that innovation is accessible to enhance project performance, researchers have discovered that most Specialist contractors are slow in or outrightly resist using it (Akande *et al.*, 2018; Ozumba and Shakantu, 2018). Because of this aversion to adopting new technologies, Specialist Construction contractors automated assessment and monitoring of project performance has remained insufficient (Amusan *et al.,* 2018). Therefore, a better understanding of why Specialist Construction Contractors are slow to adopt new innovation to improve decision-making processes and project success rates is required (Ojelabi, *et al.,* 2018; Hamma-Adama *et al.,* 2018). The particular issue is that the obstacles to Specialist Construction Contractors adopting innovation to reduce the incidence of failed and abandoned construction projects are still poorly understood (Muhammad *et al.*, 2018; Onungwa and Uduma-Olugu, 2017).

1.3 Research Questions

In order to address the problem identified, the study will address the following problem:

i. What are the drivers to innovation among specialist construction contractors in Kaduna State?
ii. What are the barriers to innovation among specialist construction contractors in the Kaduna State?
iii. What are the benefits of innovation among specialist construction contractors in the study area?
iv. What is the impact of innovation on the performance of specialist construction contractors?

1.4 Aim and Objectives of the Study

1.4.1 Aim

The aim of this study is to assess the impact of innovation on the performance of specialist construction contractors (SCC) in Kaduna State.

1.4.2 Objectives of the Study

i. Examine the drivers to innovation among specialist construction contractors in Kaduna State.
ii. Assess the barriers to innovation among specialist construction contractors in Kaduna State.
iii. Appraise the benefits of innovation among specialist construction contractors in Kaduna State.
iv. Determine the impact of innovation on the performance of specialist construction contractors.

1.5 Justification for the Study

The contribution of the construction sector to the growth of the economy cannot be overstated. Specialist construction firm's performance in the sector has significant implications on the economy. Specialist construction firms has often been criticized for delivering products and services which fall short in quality and fail to meet client expectation of price certainty and assured delivery (Lu *et al.*, 2013).

This has prompted many calls for performance improvement (Egan, 2011; Fairclough, 2010; Latham, 2014). Innovation has been identified as an important means for improved performance in a rapidly changing business environment (García and Calantone, 2012). In the construction professional services environment, successfully creating and managing knowledge provides an important means of creating value although this value

creation has been called into question by clients (Lu *et al.,* 2013). The need for improvement is also being driven by the quest for more flexibility that enables Specialist construction firms to respond to conflicting expectations and demands from clients (Koch and Bendixen, 2010). Innovation provides a means for Specialist construction firms to differentiate their services in order to stay ahead of competition. Profit maximization has also been identified as an important driving force behind efforts at innovation by Specialist construction firms.

Previous studies have reported the adoption, benefit and barriers of innovation in many developed nations of the world (Kousar *et al.*, 2017; Alaa *et al.*, 2018; James *et al.*, 2019; Abdulmuizz and Loqman, 2020) with impressive outcomes, despite some challenges.

Alaa *et al.,* 2018 in their study investigate the effect innovation barriers has on the innovation orientation in the Syrian construction firms in the period of the war years. The effect of 8 different barriers were investigated: Technical, Financial, Process, Psychological, Management, Culture, Environmental and Governmental barriers. The results from total sample community confirmed only 9 hypotheses out of 16, confirming the full significant effect of the Technical, Financial, Process and Psychological Barriers had on both innovation orientations (Creation and Adoption), Whereas, environmental Barrier significant effect only on the Creation innovation orientation.

James *et al.* (2019). Found major drivers of innovation from the survey were clients' requirements, developments in ICT and design trends while the main barriers to innovation as perceived by the respondents from the study were lack of understanding of the benefits of innovation, perception that the industry is doing well without innovation and cost of innovation. If the industry must improve its growth potentials then, innovation is not negotiable.

Abdulmuizz and Luqman (2020), identified the major drivers of innovation from the study are client innovative demand, productivity increase, design trend, subsides for innovative application and materials and improve effectiveness while the main barriers to innovation are lack of understanding of the benefits of innovation, cost of innovation and perception that the industry is doing well without innovation. Innovation has been found to be driven by the actions of clients and challenges thrown up by emergent crises on construction projects. The main barriers to innovation from the study are lack of understanding of the benefit of innovation, cost of innovation and perception that the industry is doing well without innovation.

In order to fill the gap identified, this study assesses impact of innovation on the performance of specialist construction contractors in Kaduna State with a view to exploring the influence importance of innovation on their performance. The outcome of this research will clearly make the strategies for innovation system approved by the specialist construction contractors to be known. It will also enable the stakeholders involved make adequate provisions for the adoption of innovation at each stage of a construction projects. These would in the long run solve the problem of increased wastages, rework, time overruns, cost overruns, and adversarial relationships between project stakeholders which have been attributed to the fragmented nature of the Nigerian construction industry.

1.6 Scope of the Study

The study investigated the impact of innovation on the performance of specialist construction contractors in Kaduna state. The study was quantitatively conducted. Kaduna was selected as study area because a significant number of specialist contractors and ongoing construction. Also, Kaduna is one of the fast-growing cities in Nigeria. The

study focuses on the importance, drivers and barriers of innovation amongst Specialist construction contractors in Kaduna State. For the purpose of the study, specialist construction contractors practicing in Kaduna State.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Concept of Innovation

Dictionaries and scholars have various insights and often conflicting definitions of innovation. Reviewing the literature on innovation management and construction innovation from mainly business and construction engineering management disciplines, it was observed that there is no single definition of the term 'innovation'. Kamal *et al.* (2016), emphasise this statement: "the term innovation is notoriously ambiguous and lacks either a single definition or measure". The heterogeneity in content and absence of a single and complete definition of innovation which causes problems and confusion is also highlighted by a few other researchers (Ozorhon *et al.,* 2010). However, there were few attempts to define a consistent definition of innovation for multi-disciplinary purposes. Huang *et al.* (2016), by studying 60 definitions of innovation from various disciplinary literatures (economy, innovation and entrepreneurship, business and management, marketing, technology and science engineering, organisational studies) from 1934 to 2007, concluded that the diversity of innovation definition creates confusion and uncertainty amongst researchers and practitioners.

The content analysis of the definitions demonstrates that 'newness' dominates most of the definitions. The word "new" appears 76 times, meaning it is repeated more than once in the same definition. "Product", "organization" and "idea" are the most repeated terms in the definitions after "new". In a very similar approach to Panuwatwanich and Stewart, (2012), by focusing on the types of innovation rather than the disciplines, studied six different types of innovation; new products, new services, new methods of production, opening new markets, new sources of supply, and new ways of organising from 8 different

industry groups. Their aim was to explore a perception of innovation that could contribute to a meaningful definition. The argument was that the term "new" is used naïvely in definitions of innovation between scholars without addressing what is new, how new it is and to whom it is perceived as being new. In the 'what is new?' argument, the problem is generated where the measurement of innovation is heavily focused on R&D and the number of patents. Two reasons are discussed by (Panuwatwanich and Stewart, 2012). Firstly, not all the patents are commercialised. Secondly, more focus is on engineers and scientists and other members of the organisation are left out.

The degree of newness in 'how new?' that constitutes innovation may differ in degree - radical or incremental. With regard to'new to whom?' newness can be argued relative to the company or to the market, with each case requiring a different framework. In the economic unit, it is more likely that innovation will be defined in a radical scale. As a result of their study, they concluded that "the success of an innovation is determined more by the extent of its adoption than by who originates it or how technologically advanced it is. What makes it innovative is its newness". Contrary to Panuwatwanich and Stewart, (2012), research, Stewart (2011) highlights the importance of the individuals' role in the process of bringing new ideas as raw material to the innovation-as-action or innovation-as-object. He criticises the ignorance of the human element in the definition of innovation. "Innovative action alone or the presence of some new thing does not make the outcome an innovation" (Stewart, 2011). In fact, the thoughts of the human mind that turn to action (in a praxeological sense - personal goals and fears, etc.) and the judgment of people is needed in the acceptance of an idea which later on will become an object or action known as innovation.

Stewart (2011) coined a term called ‘contra-novation’ in opposition to in-novation. Contra-novation is the action against novelty and a “state wherein innovation-as-action comes to rest in nothing due to the effect of forces external to the innovator” (Stewart, 2011). Earlier, the importance of the individual’s role as a success factor in innovation was also pointed out in a number of researches (Gambatese and Hallowell, 2011). Among the diversity of the definitions of innovation, a theme of “successful exploitation” could be observed. The definition “a successful exploitation of new ideas” is largely adopted by many academic researchers and policy makers. It is vague in terms of what is adopted and what constitutes a success.

Stewart (2011) argues that the term ‘exploitation’ is an action of bringing the ‘raw materials’ to the ‘new objects’ - if the action has not led to profit for the organisation, then no innovation has occurred, no matter how many ‘new objects’ might subsequently exist. Stewart and Fenn (2006) suggest the definition of innovation as “a profitable exploitation of new ideas”, explaining that “Profit or gain is the goal and reason for acting and the only meaningful indicator of its accomplishment”. Nonetheless, researchers such as Akintoye *et al.* (2012) believe that “the development of a single definition of innovation is a fruitless and pointless exercise. The more meaningful challenge is to adopt a particular view of innovation appropriate for a specific context.”

Gambatese and Hallowell (2011), establish that different types of innovation have different impacts on the innovation process and its output. They point out that inconsistency in labelling innovations may contribute to the slow progression of knowledge of the innovation process whereas the consistency helps practitioners to identify the characteristics of the new products and compare it to the real new products. Ozorhon, (2012) acknowledges three general typology discussions in innovation studies;

types according to the ‘functionality or domain of application’, ‘degree of newness’ and ‘attributes of innovation’. The Oslo Manual classified innovation as being either technical or organisational (Murphy *et al.,* 2011). Organisational innovation is also referred to as process innovation, whilst technical innovations are sometimes referred to as product innovations. Murphy *et al.* (2011) disputed that the interaction between product and process innovation is required to be considered in depth. In other research, they showed that product innovations often lead to process innovations (Murphy *et al.,* 2011). However, process innovations are required to produce a product innovation.

Furthermore, it is often the resulting process innovation that sustains the initial product innovation. Early economists approached the subject of product innovations, “carefully and imaginatively” (Qi *et al.,* 2010), and in some cases, ignored the area entirely. Schumpeter (1947), emphasised the importance of product innovations for economic growth. He argued that product innovations had fundamental implications for understanding the nature of capitalism as well as the nature of competitive forces. Utterback (1974) confirmed this by observing that product innovations are not just about increased output but are creative responses to competitive and technological challenges (Murphy *et al.,* 2011). Although typologising in innovation studies helps to manage the diversity and reduce the complexity, there is no universal agreement on which is the most suitable of the typologies to operationalise in innovation research (Calvert *et al.*, 2002).

2.2 Innovation in the Construction Industry

In reviewing the literature, a wide range and variety of definitions of innovation were observed. Murphy *et al.* (2011) criticise the lack of attempts that have been put forward in construction innovation definitions. They stated that definitions are ‘less prolific’, ‘scant’ and ‘insubstantial’. The definitions that emerge from the construction innovation literature. As can be seen, the early construction innovation definitions are mostly

technology and product (material) oriented. The concept of 'first use' was echoed in early definitions, however the shift of concept to 'exploitation', 'application' and 'generation' of an idea is evident in the latest definitions. 'Newness' and 'new ideas' are the key themes in the nature of definitions.

Sexton and Lu, (2012) criticise the application of 'newness' characteristics in the definitions of innovation, which need to be distinguished between new to the world or new to the given situation. One could argue a most striking missing element in the definitions is the human factor in the process of generating new ideas to become the subsequent action of innovation. Another criticism in the construction innovation definition is that they are "value neutral" - the definitions do not clearly state that innovation should be beneficial and add value to the organisation or the actors (stakeholders) (Barrett *et al.,* 2008). On the contrary, Capaldo *et al.* (1997). Argue that innovation does not necessarily lead mechanically to improved performance, but that conversely "the decision to innovate may even strongly jeopardise the firm".

Barrett *et al.* (2008) states that "the risk of such jeopardy leads to the 'innovator's dilemma' Christensen (1997), under which conditions firms should stick to what they already do and in which situation they should initiate innovation activity". In contrast, Aouad *et al.* (2010) advocated that the characteristics of the construction industry, including its fragmentation and project-based nature, causes the pattern of innovation vary from those of other industries. They articulate that "industry innovation remains hidden when co-developed at the project level". Similarly, Sexton *et al.* (2008) stress the characteristics of the construction industry as multi stakeholder, there is a need for maximisation of joint-value and benefits for all the stakeholders involved in the construction process, not just for example.

2.3 Classification of Innovation in the Construction Industry

Similar to the discussion of classification of innovation in general terms, there is also an ongoing discussion on the classification of the construction innovation. The first classification of construction innovation is noted in Bowley's (1960), book; those that change the product and those that affect processes. There are a number of researchers who have studied types of innovation in the construction industry (Nam and Tatum, 1988; Groak, 1992; Slaughter, 1998; Slaughter, 2000, Murphy et al., 2011; Lim and Ofori, 2007; Stewart and Fenn, 2006).

Nam and Tatum (1988, 1989) studied construction innovation as product innovation and criticised the focus of researchers only on technological progress in the Architecture Engineering and Construction (AE&C) industry. They quoted Rosenberg (1982): "to ignore product innovation and qualitative improvements in products is to ignore what may very well have been the most important long-term contribution of technical progress to human welfare. To exclude product innovation is to play Hamlet without the prince". Nam and Tatum (1989) in studying construction innovation analysed innovation as a complex product which is constructed from raw material, including farmed products (e.g. cotton), natural materials (e.g. sand and stone) and chemical and forest products. On the other hand, what they meant by construction innovation was heavy immobile structures and facilities such as homes.

Meanwhile, Slaughter (1998) provided a set of models of construction innovation. Which is believed to reflect the nature of the construction industry and the activities of specific construction companies. The proposed models are incremental innovations (e.g. full-body safety harness), modular innovations (e.g. post-tensioned concrete), architectural innovations (e.g. self-compacting concrete), system innovations (e.g. pre-fabricated bathroom pods) and radical innovations (e.g. introduction of structural steel). Slaughter's

model is in the mode of product innovation. It argues that much of the research concerning innovation within construction is based on examples of the manufacturing of products for the industry. Consequently, it remains a failure to assess innovation within the context of construction as a mode of production. Even though the products produced are for construction, the process of innovation is tied to the principles and production methods of manufacturing.

In the model, the interaction of innovation within the context of the construction environment is neglected. Stewart and Fenn (2006) argued that construction innovations occur in three domains: product, process and organisation. Process innovation is oriented towards production methods and organisational innovation towards approaches to managing the firm and implementation of corporate strategic orientations. Lim and Ofori (2007) proposed a classification of innovation in terms of source and types of resource required for the innovation strategy to provide a competitive advantage to guide the contractors to take strategic decisions for their construction businesses. “Type 1 innovations that consumers are willing to pay for, Type 2 innovations that reduce contractors’ construction costs, and Type 3 innovations that encompass intangible benefits such as improved reputation and high credibility, which provide contractors with sustainable competitive advantage”. There were also attempts in modelling and generic understanding of the innovation process in construction projects.

2.4 The specialist contractors

The term specialist contractor is used to describe a firm which constructs specific elements of buildings. Traditionally such firms acted as trade sub-contractors to a general contractor. Historically design details were settled on site in discussions between the sub-contractors and the architect (Sexton and Barrett, 2005). In recent times there has been little or no contact of this kind. For the traditional trades this remains the case and general

contractors provide the construction interface with designers. For example, this is normally the case in respect of brickwork, insitu concrete, formwork, carpentry, plastering, glazing, painting and other traditional craft work. In practice the responsibilities of specialists (especially industrial rather than craft based specialists) are often wider and frequently include at least some design decisions. These may be merely at the level of craftsmanship (Leonidou *et al.*, 2017).

This is selecting the material to be used in a specific position from amongst a batch delivered to site in accordance with design decisions made by others and usually also includes selecting appropriate established construction details. However mundane these decisions, the choices made by the craftsman directly influence the performance of the finished building. This takes the operative and therefore the firm which employs him into the realm of design decisions. Specialist contractors increasingly bear more than simple craftsmanship design responsibilities. Figure 2.1 illustrates the range of possible responsibilities from fitness for purpose to craftsmanship. Although the figure shows a simple, general sequence, in practice decisions are complexly inter-related so that in many projects the sequence illustrated may be reversed (Leonidou *et al.*, 2017).

Also the range of responsibilities in Figure 2.1 clearly encompasses decisions about design, manufacture and construction. These provide yet a further dimension to the possible responsibilities carried by specialists. However, bearing these factors in mind, the stages illustrated in Figure 2.1 provide a good basis for describing the variety of contemporary practice. A specialist responsible for fitness for purpose must establish the needs which his work must satisfy in terms of the client's interests. Whereas responsibility for element design implies that others have determined the client's interests and expressed them in performance terms (Khosrowshahi *et al.*, 2014). Thus, taking a lift specialist as an example, in the first case a client's interests may be that no-one using his new building

should wait for more than 15 seconds for a lift and that all normal deliveries can be conveyed by lift.

The specialist will need to study the proposed pattern of use of the building and turn this into a detailed statement of the loads to be carried. In the second case, responsibility for element design, the specialist can rely on someone else providing him with the detailed performance specification. His responsibility is then limited to producing a design which satisfies these specific requirements. Responsibility for detail design implies that others have determined the overall form and style of the element. In this case the specialist's responsibility is to select materials, components and construction and fixing details which work properly within the given element design. Shop drawings take design one stage further to provide the information.

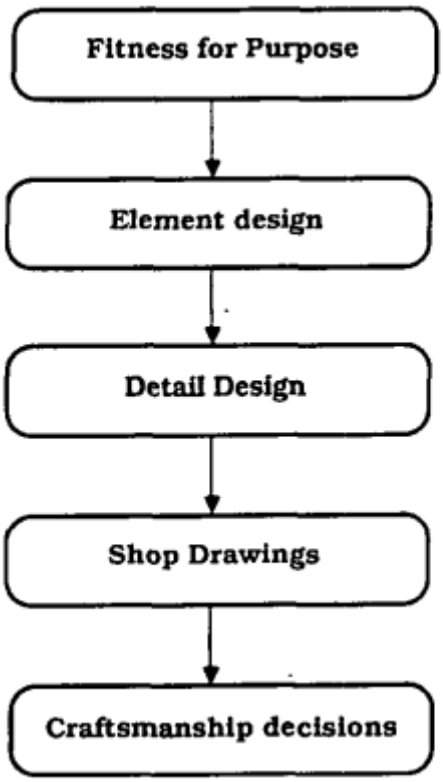

Figure 2.1: Range of specialists' design responsibilities. Note that specialists may enter the process at any of the stages shown
Source (Khosrowshahi *et al.*, 2014)

Required to manufacture all the required components. Fairly obviously, when the selected answer used standard components there is no need for a project-specifics shop drawings stage. Whether standard or individually designed components are used, specialists may produce shop drawings for others to manufacture or may undertake manufacturing themselves. In both cases shop drawings involve specialists in many detail design decisions.

The final stage of design responsibility is exemplified by the day-to-day site-based decisions which all operatives must make. These are much more significant with established craft-work which uses general materials than with work which comprises site assembly of factory made components (Leonidou *et al.,* 2017). However, even in the second case operatives select one component rather than another, deal with tolerances in the position and alignment of components and adjustments within fixings. All these decisions affect the precise form of the end product. They are commonly referred to as workmanship. An important development is that the change from craftsmanship to the assembly of components reduces operatives' discretion and their apparent control over their own work. This inevitably makes basic site work less satisfying and more difficult to manage. It is also at this level that the orderly progression of specialists' responsibilities illustrated in Figure 2.1 is often interrupted by the use of labour-only contractors.

While this makes no contractual difference to specialists' responsibilities, in practice labour-only sub-contracting reduces their concern for operatives' training, welfare, safety, employment prospects and general well-being. As we shall see this in turn affects the end product. The exact combination of design, manufacturing and construction responsibilities chosen for particular building elements depends on technical and commercial considerations specific to individual projects. The overall effect is that many

firms have a vague or mistaken understanding of the roles of others with whom they must work. This inevitably leads to confusion and inefficiency (Benmansour and Hogg, 2012).

There is therefore a strong case for research aimed at identifying the different roles which specialist contractors may be required to undertake. There is some justification for anticipating that there are very few essentially different such roles. One basis for this optimism is the similarity between the traditional collaboration on site by architects and craftsmen in settling design details and the modern collaboration between architects and specialist designers. This later process takes place at the drawing board and in the research laboratories and test rigs of industrially based specialists designing, manufacturing and installing sophisticated components. So although the technology has changed and the relationships have become much more formalized, the essential nature of joint design is common.

2.5 Innovation in Specialist Construction

In the current global economic environment, it is vital for the specialist construction companies to keep pace with the rapid changes of the technology and economic model that the world is heading towards. However, literatures in innovation indicate that specialist construction contractors, generally speaking, has often been criticized for resisting change and for failing to adopt innovative approaches to improve performance (Yoo *et al.,* 2010). According to the National Endowment for Science, Technology and the Arts (NESTA) (2007), the construction industry as a whole is among the six "low innovation" sector along with oil production, retail banking, legal aid services, education and the rehabilitation of offenders sectors. In addition, the Third UK Community Innovation Survey conducted in 2004 revealed that construction was the worst performing industry in innovation in comparison with 11 other industries (Abbott, 2006).

A survey conducted by the Australian Bureau of Statistics on innovation in Australian industries indicates that specialist construction contractors had one of the lowest proportions of innovating businesses comparable to mining businesses and had fallen behind other industries such as manufacturing, electricity, gas and water supply and communications (Thorpe *et al.*, 2009). Nevertheless, the indicative low innovation level among specialist construction contractors by past researchers, according to Panuwatwanich *et al.,* (2008), is considered not conclusive and demands for more in-depth studies. This is contributed by diverge views of scholars in defining and identifying innovation, which are distinct and in some cases irrelevant across different industries. For example, in dynamic industries such as pharmaceuticals, electronics, biotechnology and IT, product innovation is essential which demands organizations for continuous product development in order to succeed in the intense competition and fast product evolution environment. These types of industries are considered as research intensive industries that adopt indicators such as Research and Development (R and D) expenditures and capital investments, publications and patents as the common measures for innovation (Gracia-Morales, 2008).

On the contrary, construction industry is regarded as a highly fragmented, loosely coupled, complex and non-research intensive industry and innovation is established within a project implementation that require involvement of varying combinations of large and small organizations from across the supply chain spectrum (Wood head, 1998). This includes a broad representation of key players in the industry particularly among manufacturers and service providers in the process of transforming materials, knowledge and processes into buildings and infrastructures.

Adopting the traditional measures of innovation in a dynamic industry such as manufacturing will not reflect the actual representation of the construction industry. This

is because innovation in construction usually does not involve Rand D investments and introduction of new products and processes in the form of publications and patents. Hence, if such measure were used by specialist construction contractors in the construction industry, the outcome might result in low level of innovation. This view is supported by Aouad *et al.,* (2010), who argue that innovations in construction industry are project based and not able to be indicated as formal Rand D expenditure and innovations are neither patented nor trademarked.

Hence, employing the appropriate measures for assessing innovation will provide real depiction of innovation amongst specialist contractors in the construction industry. In addition, while manufacturing innovations for example, involve resources within the organization itself for both product and process innovation, construction innovations require involvement of different parties from various organizations engaged directly in the construction projects. For these reasons, much of the innovation in construction remains "hidden", as it is co-developed at the project level and not at the organizational level. Project teams disband upon completion of projects whilst innovation typically remains within the project per se. Hence, in the construction industry, evaluating innovation at project level will provide a more objective measurement as compared to the innovation at organizational level.

The organizational context of construction innovations as Slaughter (1998) pointed out differs significantly from a great portion of manufacturing innovations. This is supported by Blayse and Manley (2004) who state that construction is partly manufacturing (materials, components, and equipment) and partly services (engineering, design, surveying, consulting, and management). Similarly, Peansupap and Walker (2005) categorizes innovation in construction industry into three; (1) Innovation in materials,

equipment and methods (2) Management innovation and (3) Information Technology (IT) innovation.

The first category refers to technical innovation, which can be either technical product or technical process innovation. Technical product innovation includes concrete materials, construction techniques, Industrialized Building System (IBS), robotics construction equipment etc. This type of innovation can be either adopted by organizations or created within a particular construction project. For example, a technical project setback in construction installation has triggered a construction organization to develop an innovative construction method.

A project delay may generate an innovative and efficient technique devised from existing resources. Management innovation on the other hand is reflected by techniques and principles that are adopted to facilitate the process of management and administration of construction organization and construction projects. Value engineering, Total Quality Management (TQM) and Lifecycle Costing are some of the examples of management innovation. Finally, Information Technology (IT) innovation is characterized by the adoption of hardware and software that are used to facilitate for a more effective and efficient construction project implementation such as the Building Information Modeling (BIM), online project procurement system, project management application, Radio Frequency Identification (RFID), material testing, etc.

Evidence from past research indicate that construction innovation is process and organization based and often characterized by the widespread adoption of new practices as a result of advances in technological and business processes. This is supported by the case study conducted by Gil *et al.*, (2012) on Heathrow airport's T5 project, which stress that innovation hinges on technology adoption decisions. Panuwatwanich *et al.* (2008) adopted innovation diffusion outcomes namely innovative design products, innovative

design practices and advanced technology utilization as the measurement for innovation in the architectural and engineering design sector. The innovative design product is measured by elements like recognitions and awards received, flexibility for change, and minimum environmental impact. The innovative design practices elements include value management, value engineering, life cycle costing and sustainable design.

Examples of the elements for the advanced technology utilization dimensions are design drafting and development, integration of design information and remote collaboration. In addition, Qi *et al.*, (2010) highlight the increasing concerns on environmental degradation which has triggered the need for innovative construction environmental practices. It is suggested that construction sustainable design is included as one of the innovative products of specialist contractors in the construction industry. Proactive environment strategies and practice adoption by project managers in mitigating the environmental impact by the specialist contractor's activities is considered as one of the innovative efforts. Other studies listed several innovative initiatives such as the application of environmental friendly equipment and technologies and the investment on the environmental protection measures in construction practice (Buysse and Verbeke, 2003). In this field of study, scholars usually define such effort interchangeably between green construction and sustainable development practices. Both terms in the context of construction industry are described as the responsibility to minimize the impact of industry's activities on environment and society. Sustainable or green related innovations include retrofitting solar, passive principles to older buildings, employing environmental awareness, surface-water management, employment of lighter and more environmentally friendly materials, and use of advanced building products.

2.6 Drivers of Innovation Amongst Specialist Construction Contractors in the Construction Industry

The literature on general and construction innovation reveals that many forces may drive firms to be innovate. In general, competitive advantage refers to the ability of an organization/firm to perform at a higher level than others in the same industry/market, which can be achieved through innovation (Magretta, 2012). To gain advantage over their competitors, Specialist Construction contractors need to be innovate. Four drivers of innovation amongst Specialist Construction Contractors identified by Goffin and Mitchell (2005) are technological advances, changing customers and needs, intensified market competition, and changing business environments. In recent years, changes towards sustainability have been recognized as a key driver of innovation and meanwhile sustainable innovation has become a prominent agenda (Dewick and Miozzo, 2004; Jepsen *et al.,* 2014).

Drivers of innovation can be either internal or external (Crossan and Apaydin, 2010). For example, an internal driver can be corporate image (Chang, 2011), whereas an external driver can be market trends and opportunities. Generally, innovation should be value-added and value-based (Gerybadze *et al.,* 2010). However, it is not always the case. This is because innovation in low-tech firms and industries may be cost-driven as opposed to value-driven (Hirsch-Kreinsen and Jacobson, 2008). In construction, innovation can be stimulated by the new requirements of clients, needs to develop standards, compliances with new regulations, and innovative ideas of research and development (Rand D) staff (Gann and Salter, 2000). Survival, stability and development are identified by Sexton and Barrett (2005) as innovation drivers in construction firms, especially in small construction firms. Cost reduction, competitive advantage, improved quality, and increased productivity can motivate innovation in construction (Gambatese and Hallowell, 2011).

According to the CIOB, there are seven drivers of construction innovation: cost efficiency, sustainability, client demands, time constraints, technology, global competition, and end users (CIOB, 2007). A group of construction innovation drivers presented by Bossink (2004) consist of government incentive, technological promotion, integration of design and construction, and so on. Other drivers of innovation amongst Specialist Construction Contractors identified by construction researchers include: best practice (Yitmen, 2007), customer/user satisfaction (Ozaki, 2003; Wandahl *et al.,* 2011), government initiative (Qi *et al.,* 2010), public policy (Seaden and Manseau, 2001), and recession aftermath (Aouad *et al.,* 2010).

Specialist Construction Contractors may strategize innovation in different manners. In general, internal R and D and external knowledge acquisition can be considered as two innovation strategies (Cassiman and Veugelers, 2006). Fostering innovation-supportive culture is another general strategy for innovation (Jassawalla and Sashittal, 2002). In construction, the innovation strategies identified by Egbu (2004) include top management support, strategic vision, innovation culture, long-term focus, knowledge sharing and transfer, and education and training.

According to Manley and McFallan (2006), introducing new technologies, enhancing technical capabilities, and hiring new graduates are three strategies that are significantly different among clients, contractors, consultants and LME suppliers. In addition, construction researchers have identified some other innovation strategies: action learning (Davey *et al.,* 2004), appropriate response to innovation opportunities and risks (Loosemore, 2014), continuous improvement of performance (Hartman, 2006), employee engagement in innovation-related activities (Toole *et al.,* 2013), extension of business fields (Gann and Salter, 2000), linking project and business processes (Gann and Salter, 2000), incentive mechanism (Hartmann, 2006; Leiringer, 2006), proactive attitude

towards changes (Hardie and Newell, 2011), quick response to dynamics , strategic decision making (Seaden,, 2003), and strategic management of resources (Sexton and Barrett, 2005).

Specifically, the factors that drive innovation amongst Specialist Construction Contractors are many, Bossink (2015) classified them into four distinct categories namely: environmental concerns, technological knowhow, knowledge sharing and boundary spanning. These four distinct categories were further subdivided by (Owolabi *et al.,* 2019) into the following drivers of innovation among Specialist Construction Contractors in the Nigerian construction industry: Clients with innovative demands, developments in ICT, design trends, productivity increase, reduction in cost, improved effectiveness, environmental sustainability, government regulation, subsides for innovative application and materials, competitive advantage, improved quality, environmental sustainability, stimulation of research, programmes promoting, product evaluating institution, market trends and opportunities, empowerment of innovation champions, creation of knowledge network, changing business environment, technology advances, recession aftermath, government incentives, programmes promoting access to technology, empowerment of innovation leaders, governmental guarantee for innovative firm and innovation stimulating regulation.

2.7 The Forms of innovation amongst Specialist Construction Contractors

In innovation theory and practice we could find numerous forms of innovation. Two most commonly used forms

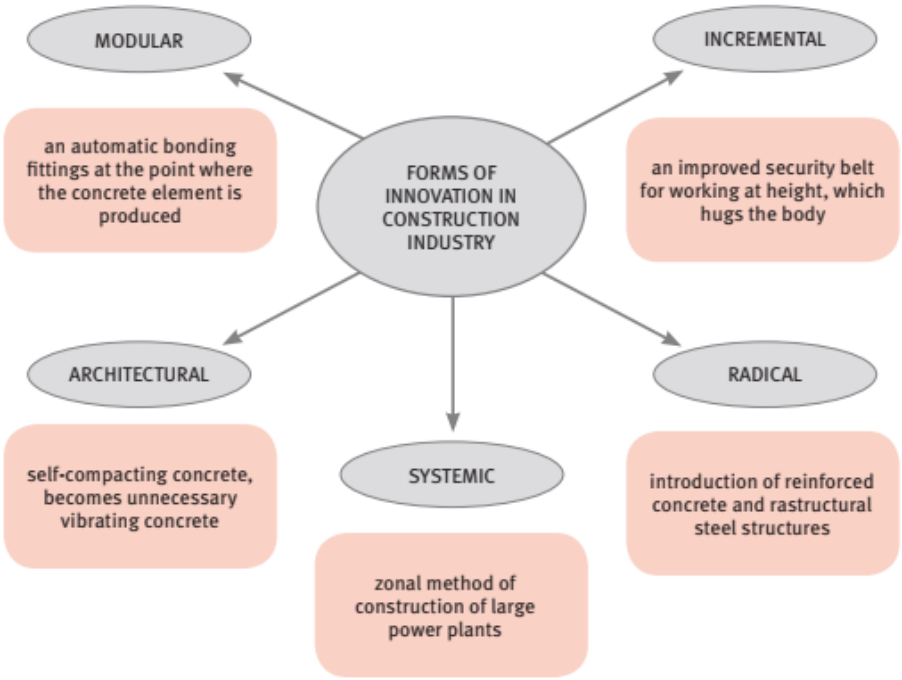

Figure 2.2: The forms of innovation amongst Specialist Construction Contractors in construction industry
Source: Suman *et al.*, (2013).

Innovation as a product, which involves the introduction of new or significantly improved product or service (e.g. improved software), and innovation as a process, which involves the implementation of a new or significantly improved production process, distribution method, raw materials etc. Of course, both forms of innovation are not mutually exclusive, but mutually connect. According to Blayse and Manley (2004) and Suman *et al.*, (2013), innovation in the construction industry can take different forms. It can be: incremental (small, based on the existing experience and knowledge), radical (a breakthrough in science and technology), modular (the change of scheme inside the object element itself), architectural (changes in connection with other components and systems) and systemic (multiple, integrated innovations) (see Figure 2.1).

Suman *et al.*, (2013), describe the forms of innovation in construction industry a little differently than Slaughter and Blayse and Manley. They describe form as: incremental innovation that are constantly occurring as a result of operation of the two principles: learning by doing and learning by using; radical innovation, which include a combination of product, process; and organizational innovation and new technological systems and technological change in the economic paradigm based on a combination of radical and incremental innovations. Practice has shown that it is necessary to integrate the described forms of innovation in the construction industry and it is important to pay special attention to the proper choice of time which defines resources required for the implementation of innovations.

Furthermore, it is necessary to pay attention to the degree to which innovation requires the use of implicit and explicit coordination between project team members (developers, designers, contractors, subcontractors, etc.) Using innovation may require special resources that can be found only in companies with specialized expertise. For this reason, it is necessary to integrate innovation into a specific project focused on the selection of the source and type of professional resources. Attention should be paid to the control activities, including control at the organizational level, as well as type of regulated activities and specific skills of supervisors.

2.8 Barriers to Innovation Amongst Specialist Construction Contractors in the Nigeria Construction Industry

The building sector differs from many other businesses in the sense that it creates unique products (Gann and salter 2000). It is a complicated combination of both actors and processes, where relationships only that last during a limited time (Bygballe and Ingemansson, 2014). It has also been argued that if the project does not provide conditions for innovation, other objectives will be prioritized such as cost and schedule (Tatum,

1989). According to Bygballe and Ingemansson (2014) the greatest difficulty regarding innovation among Specialist Construction Contractors in the construction industry was to interconnect the "project and company levels of the single organization". It was established that endorsing new solutions, that have proven to be successful in one project, across the organization as a whole, is not strength in the construction industry (Bygballe and Ingemansson, 2014). Hence, there is much room for improving the diffusion of innovative solutions in this business. The construction industry is also known for being traditional which is argued to be one reason for having difficulties implementing innovations and not being innovative enough (Bygballe and Ingemansson, 2014). A survey, where twenty senior managers from the Norwegian and Swedish construction industry were interviewed, resulted in the conclusion that Swedish construction firms actually consider the co-workers to be the essential source for innovation. The runner up driving force for innovation was found to be the customers (Bygballe and Ingemansson, 2014).

According to Bygballe and Ingemansson (2014), suppliers were shown to be less considered when it comes to innovation, even though they are an incredibly necessary part of the industry. This was being explained by the fact that there are few incentives for suppliers to be innovative as it comes with great risk when using materials viewed as unreliable as they have not been tested long enough to be approved or accepted by the industry. It was reported that customers within the supplier industry greatly prefer using traditional, tested and durable materials instead of experimenting with new innovative products that have not been sufficiently tested (Bygballe and Ingemansson, 2014). The most reliable outcome of an innovation is measured through a full-scale prototype test but it is often expensive and time consuming to perform (Slaughter, 1998).

The risk of using innovative material is an aspect that not many seem willing to take, as predictability is more prioritized than using something new (Bygballe and Ingemansson, 2014). This is one difficulty the construction. According to Benmansour and Hogg (2012), certain factors have been identified from literature as hindrances to innovation among Specialist Construction Contractors in the construction industry, they are highlighted as follows: lack of understanding of benefit of innovation, perception that the industry is doing well without innovation, cost of innovation, belief that innovation is risky, short term thinking, lack of resource/capacity, government regulation, lack of skillful brainstorm facilitation, lack of focus, lack of support, lots of idea, no delivery to market, cultural issues, politics, constantly shifting priority, lack of shared vision, lack of collaboration, lack of spare-time to develop new ideas, lack of urgency, stagnating mind, no clear process, not adopting emerging technology, unwillingness to acknowledge and learn from past, risk aversion, lack of leadership, type of organization structure and no creative thinking.

2.9 Benefits of Innovation Among Specialist Construction Contractors

A lot of research have been done on the benefits of innovation adoption. The identified benefits were noted to be strategic in adopting innovation because they exert a decisive influence on an organization's likelihood of future success of Specialist Construction Contractors (Siano *et al.,* 2009). According to Siano et al., (2009), the benefits of innovation adoption include an increase in the competitive edge of the market and a reduction in the staff strength needed for the execution of a project. The most significant impact of innovation adoption is improving the company's image, advancing the services and product rendered by the firm, improving and enhancing client satisfaction and improving the current processes adopted by the firm, as shown in Table 2.1 by (Ozorhon *et al.,* 2010).

Blayse and Manley (2004) furthered the research on benefits of innovation by Ozorhon *et al.* (2010) and suggested that the more Specialist Construction firms become creative and innovative, the higher their chances and opportunities of winning more projects and also advancing the financial results of these projects. Ozorhon *et al.* (2010) too continued the research by saying that, the other benefits that firms get from innovation adoption includes increase in organizational effectiveness, penetration of market and growth, introduction of new services and processes, increase in technical capability, growth in revenue due to new services, short-term and long-term profitability, advancement of organizational structure, and enhancement of human skills and resources. Ozorhon *et al.* (2010) add that, the most important outcome or impact of innovation is to be a better company image. Ozorhon *et al.* (2010) also proposed that reputation is the most valuable asset for a construction organization or firm and is effective in sustaining long term competitive advantage.

Table 2.1: Benefits of Innovation Adoption

No.	Benefits
1	Improvement of services
2	Improvement of product quality
3	Increase in technical capability
4	New services
5	New processes
6	Revenue growth due to new products and services
7	Improvement of organizational structure
8	Intellectual property (patent, trademarks, design)
9	Improvement of human resources
10	Short- and long-term profitability
11	Market penetration and growth
12	New product
13	Increase in organizational effectiveness
14	Improvement of process
15	Improvement of client satisfaction
16	Better company image

Source: (Ozorhon et al., 2010)

2.10 The Relationship Between Innovation and Project Performance

Many scholars have endorsed the importance of innovation in determining the performance of Specialist Construction Contractors (Panuwatwanich *et al.,* 2008; Gracia-Morales, 2008; Chang, 2011). These studies were done across different economic sectors around the globe and relate innovation to Specialist Construction firm's performance that further recognized the importance of innovation for an economy's success. For instance, Gracia-Morales (2008) claim that construction firms with greater innovation will achieve a better response from the environment, obtaining more easily the capabilities needed to increase project performance and consolidate a sustainable competitive advantage". Garcia-Morales (2008) suggest that Specialist construction firms "that concentrate on speed of innovation gain a greater market share which produces high income and high profitability". Garcia-Morales (2008) denotes innovation brings efficiency and effectiveness – the two main criteria influencing success for long term survival. On the

study on American and European pharmaceutical firms, Garcia-Morales (2008) examines the effect of innovation on performance.

The study depicts that innovation introduces new knowledge that is not made available to competitors at least for a certain period of time. The knowledge comes in the form of capabilities, resources and technologies and they are kept within the firm that adopts the innovation which intricate competitors to imitate. Reiterates that construction firms that adopt an innovation first are able to create "isolation mechanisms" as knowledge of the innovation is not available to competitors. This allows the organization to maintain its competitive advantage, protect profit margins and obtain greater project performance. In the construction industry environment, Panuwatwanich *et al.* (2008) explores the impact of innovation towards business performance in AED firms in Australia. The study concludes that innovation has a positive influence on performance. It is highlighted that in an industry where design is one of the critical elements, continually successful at developing and implementing innovation resulted in a positive perception of the organization by both clients and competitors.

These numerous studies in the innovation research field support the significance of innovation on enhancing performance as it offers better response to changing environment, gain greater market share, introduces new knowledge and established isolation mechanism for innovative organization. This highlights the fact that organizations that focus on improving innovation have greater chance in achieving greater performance. Nevertheless, despite the many research in this field that provide evidences that the innovation-performance relationship is positive in nature, there are also evidences on the negative impact of innovation on performance. Such phenomenon is supported by Panuwatwanich *et al.* (2008) who explain that the nature of innovation requires risky and expensive activities leading to increase exposure to market risk, increased costs,

employee dissatisfaction or unwarranted changes that consequently provide negative impact on the overall project performance.

In a different study conducted by Wright *et al.* (2005), they indicate that innovation has a positive effect only on performance only in a hostile environment but not in a benign environment for small businesses. A hostile environment is characterized by intense rivalry among firms and weak or diminishing competitive opportunities. Firms operating in highly competitive (hostile) markets are likely to be more successful innovators by increasing the number of new product introductions through incremental innovation in order to meet customer needs hence contributing to the positive impact on performance.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

Design in research is the overall plan for connecting the conceptual research problems to the pertinent empirical research. It articulates what data is required, what methods are going to be used to collect and analyse the data (Yin, 2018). It also constitutes the measurement of analysis and collection of data. Clearly research problem determines the type of research design (Turner *et al.* 2017). This study adopted a survey design approach using quantitative data. Survey design was suitable for this study because the factors considered are those identified from the literature to which their applicability in construction project is to be verified in this study. Data was collected through structured questionnaire administered to Specialist construction contractors within Kaduna State, the North West of Nigeria. Kaduna was selected because it is one of the epicentres of construction activities in Nigeria.

The method used in carrying out this research is classified into two parts. The first part involved carrying out a review of past literature i.e. journals, a seminar paper, conference papers, textbooks, materials from the internet. The literature review helped in identifying contributions of various authors on the topic in question providing a basis for further investigation.

The second method involved a survey design approach using a well-structured questionnaire which was based on the information from the literature review.

3.2 Research Population

A research population is generally a large collection of individuals or objects that is the main focus of a scientific query (Sherif, 2018). Saunders *et al.,* (2015) defines population

in research as the whole number of people or inhabitants in a country or region from which a sample can be drawn. The unit of analysis may be a person, group, organization, country, object, or any other entity that you wish to draw scientific inferences about (Sherif, 2018). The targeted population for this research are specialist construction contractors within Kaduna State, North West Nigeria. The population of this research constitutes active specialist construction projects sites in Kaduna, Nigeria gotten from Federation of Construction Industry in Nigeria (FOCI directory) directory which states that there are 28 registered firms in Kaduna.

3.3 Sample Frame

This is the process of defining the population, a selection of a representative of the population. This is an accessible section of the target population (usually a list with information) from where a sample can be drawn (McCusker & Gunaydin, 2015).

A sample is a limited number of observations from a population. Usually the sample is drawn because it is impossible to cover all observations in a population on grounds of time or expense (Sherif, 2018).

The sample frame were active specialist construction sites of the 28 registered firms that are located and operating within Kaduna.

3.4 Sample Size

A sample is a smaller percentage of a populace chosen for remark and investigation; the small sample size had been calculated using a simplified procedure proportion as demonstrated simply by Glenn (2013). Since the population size for the study is small (28), a census of the whole number of Specialist construction firms in Kaduna registered with FOCI was therefore carried out. For the purpose of this research, the sample size is 28 respondents (specialist construction contractors).

3.5 Method of Data Collection

Research data can either be primary or secondary in nature. Primary data are raw data, gotten through the use of questionnaire, interview or observation, or the combination of any of these research tools. It is extracted directly from the various sources such as the respondent and the area(s) under study. They exist in published materials and are merely collected for the purpose of research. This study was employed the use of primary data which was collected through the use of interviews and well-structured questionnaire administered to selected specialist construction contractors in the selected firms registered with FOCI directory in Kaduna.

3.6 Data Collection Instrument

For the purpose of this research, a well-structured questionnaire was used to gather information from the selected specialist construction contractors in construction firms registered with FOCI directory in Abuja. A primary data source is an original data source, that is, one in which the data are collected firsthand by the researcher for a specific research purpose or project. A multi-choice type questionnaire was designed for this research. The questionnaire contained tables and check-boxes for easy selection of options by respondents. The questionnaires was structured in a manner that allowed respondents to select from the answer choices provided. The questionnaire was reflecting the major areas of the study interest, thereby, providing information relevant to the study objectives and answering the research questions.

The questionnaire was divided into five (5) main parts. Part A - is related to demographic information of the respondents and their companies. Part B - drivers to innovation among specialist construction contractors. Part C - barriers to innovation among specialist construction contractors. Part D - benefits of innovation among specialist construction

contractors. Part E - relationship between innovation and performance specialist construction contractors.

3.7 Method of Data Analysis

In order to achieve the aim of this research, the descriptive method of analysing data was employed and this ranged from the use of percentile, frequency, Mean Item Score (MIS) and Relative Importance Index (RII). Data processing was done with the aid of Statistical Package for the Social Sciences (SPSS 23) software version.

3.7.1 Percentile

These are ratios multiplied by 100. It helps in rating a number of factors according to the degree of occurrence attached to them. The higher the percentage ratings, the higher the importance or significance attached to factors. The essence of percentile is to allocate a value between 0 and 100 to a factor (where 100 is the highest possible value) using factor size and the total size.

The formula is $$P = \frac{n\,x\,100}{N}$$

Where "P" is the percentage of the factor, "n" is the size of the factor in consideration and "N" is the total size or population. This method of analysis was employed in analysing the background information of the respondents.

3.7. 2 Mean Item Score (MIS)

This method of analysis was employed for different aspects of the study. In examining the barriers and drivers innovation among specialist construction contractors, MIS was employed. MIS was used for two purposes, that is, ranking and determination of significance of different factors of the data to be collected. The premise of decision for

the ranking is that the factor with the highest mean item score is ranked 1st and others in such subsequent descending order.

Since a Likert of 5-point scale was employed for the collection of data, the formula for mean item score is written as:

$$\text{MIS} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{n_5 + n_4 + n_3 + n_2 + n_1}$$

Where n is the frequency of each of the rankings, and

n_1 = number of respondents who answered “not applicable” or “strongly disagree”

n_2 = number of respondents who answered “low” or “disagree”

n_3 = number of respondents who answered “moderately applicable” or “indifferent”

n_4 = number of respondents who answered “applicable” or “agree”

n_5 = number of respondents who answered “highly applicable” or “strongly agree”

3.8 Relative Importance Index (RII)

The relative importance index was adopted different aspects of the study. In determining the importance of benefits of innovation among specialist construction contractors. RII was used for two purposes, that is, ranking and determination of significance of different of the data to be collected. The premise of decision for the ranking is that the factor with the highest mean item score is ranked 1st and others in such subsequent descending order.

The Relative Importance Index (RII) according to Muhammad et *al.*(2018) is written as:

$$\text{RII} = \frac{\sum W}{A*N}$$

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight, and N is the total number of respondents.

The analysed data were presented in tables. Table 3.1 shows the procedures adopted in treating each objectives which comprise of sampling tools and method of analysis.

Table 3.1: Procedures for treating the research objectives

S/n	Objectives	Data tools	Methods of data analysis
1	Examine the drivers to innovation among specialist construction contractors in the study area	Questionnaire	Relative Important Index and Ranking Method
2	Assess the barriers to innovation among specialist construction contractors in the study area	Questionnaire	Mean Item Score and Ranking Method
3	Appraise the benefits of innovation among specialist construction contractors in the study area	Questionnaire	Mean Item Score and Ranking Method
4	Determine the impact innovation on performance specialist construction contractors .	Questionnaire	Correlation

Source: Researcher's Construct, 2020

3.8.1 Decision rules for the Likert scales used

Morenikeji (2006), stated that, the outcome of Mean Item Score (MIS) on a Five-Points Likert scale could be decided on the following; 4.50-5.00 for Very High; 3.50-4.49 for High; 2.50-3.49 for Moderate; 1.50-2.49 for Little; 0.1-1.49, and Very Little. This was adapted and converted to RII on a scale 0 to 1.

Table 3.2: Decision Rule for determining the inherent materials procurement risk factors in building projects

SN	Cut-off Point for MIS 5-Points	Cut-off Point for RII 5-Points	Decision
1	4.50-5.00	0.90-1.00	Very High (VH)
2	3.50-4.49	0.70-0.89	High (H)
3	2.50-3.49	0.50-0.69	Moderate (M)
4	1.50-2.49	0.30- 0.49	Little (L)
5	0.1-1.49	0.10-0.0.29	Very Little (VL)

Source: Adapted from Morenikeji, 2006.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Presentation of Respondents' Profile

The data for the study were collected with the use of questionnaire. The questionnaire copies were administered to 28 specialists' contractor's construction professionals in Kaduna State. All the questionnaire copies administered were returned and used for data analysis. This section presents the profile of the respondents considered for data collection. The respondents' profile is presented in Table 4.1.

Table 4.1: Presentation of Respondents' Profile

Respondents' Profile	Frequency	Proportion (%)
Respondents' Profession		
Architect	3	10
Quantity Surveyor	7	24
Civil/Structural Engineer	17	60
Builder	1	6
Total	28	100
Respondents' Highest Educational Qualification		
OND/NCE	1	5
BSc	18	65
MSc/MTech	7	24
PhD	2	6
Total	28	100
Respondents' Years of Experience		
1-5Years	4	16
6-10 Years	14	50
11-15 Years	5	18
16-20 Years	3	9
Above 20 Years	2	7
Total	28	100
Position of respondents		
General Contractors	1	2
Specialist Contractors	27	98
Total	28	100

It was shown from Table 4.1 that out of the 28 specialists contractor considered for the study, 10 were Architects, 12 were Builders, 60 were Civil/Structural Engineers, 24 were Quantity Surveyors, and 6 12 were Builders. This shows that 60% of the respondents, representing the majority, are Civil/Structural Engineers. It was also shown from Table 4.1 that 65% of the respondents, representing the majority, are holders of Bachelor's Degree (BTech/BSc). This is followed by Master's Degree holders which represent 24% of the respondents. Holders of Higher National Diploma (HND), representing the minority of the respondents, constitute 5% of the population of respondents and 5% of the respondents were PHD degree holders. This shows that the respondents have the requisite educational qualification to give reliable response required for the study.

Table 4.1 also indicates that 16% of the respondents have between 1 and 5 years of experience; 50% of the respondents, representing the majority, have between 6 and 10 years of experience; 18% of the respondents, representing the majority, have between 11 and 15 years of experience; 9% of the respondents, representing the majority, have between 11 and 15 years of experience; and 7% of the respondents, representing the minority, Above 20 years of experience. This shows that the respondents are experienced enough to give reliable information needed for the study. It was also revealed that 27 of the respondents were specialist contractors and 2 of the respondent's general contractors This indicates that the respondents have the required professional experience to give useful information needed for the study.

4.2 Result and Discussions on the drivers to innovation among specialist construction

The MIS analysis results of the drivers to innovation among specialist construction contractors are summarised in Table 4.2.

Table 4.2: Drivers to innovation among specialist construction contractors

SN	Drivers to innovation among specialist construct	MIS	Rank	Decision
1	Intensified market competition	4.73	1st	Very Significant
2	Survival	4.55	2nd	Very Significant
3	Changing customers and needs	4.50	3rd	Very Significant
4	New requirements of clients	4.44	4th	Significant
5	Changes towards sustainability	4.42	5th	Significant
6	Technological advances	4.38	6th	Significant
7	Needs to develop standards	4.34	7th	Significant
8	Compliances with new regulations	4.30	8th	Significant
9	Changing business environments	4.28	9th	Significant
10	Stability and development	4.00	10th	Significant
	Average MIS	***4.39***		*Significant*

Table 4.3 shows that the drivers to innovation amongst Specialist Construction Contractors in Kaduna State are: Intensified market competition (MIS = 4.73); Survival (MIS = 4.55); and Changing customers and needs (MIS = 4.50). Other drivers to innovation among specialist construction contractors are also important. These range from New requirements of clients (MIS = 4.44) to Stability and development (4.00). Averagely, all the drivers to innovation among specialist construction contractors are important (average MIS = 4.39).

The study of Goffin and Mitchell (2005) corroborate the finding of this study by identifying four drivers of innovation amongst Specialist Construction Contractors which are technological advances, changing customers and needs, intensified market competition, and changing business environments.

4.3 Result and Discussion on Barriers to Innovation Among Specialist Construction Contractors in Kaduna State:

The result of the analysis on the barriers to innovation among specialist construction contractors in Kaduna State is presented in Table 4.3.

Table 4.3: Barriers to Innovation Among Specialist Construction Contractors In Kaduna State

SN	Barriers to Innovation Among Specialist Construction Contractors In Kaduna State	MIS	Rank	Decision
1	High cost of innovation	4.53	1st	Very Significant
2	Lack of understanding of benefit of innovation	4.50	2nd	Very Significant
3	Lack of resource/capacity	4.00	3rd	Significant
4	lack of focus, lack of support	3.97	4th	Significant
5	Belief that innovation is risky	3.90	5th	Significant
6	Perception that the industry is doing well without innovation	3.84	6th	Significant
7	Lack of spare-time to develop new ideas	3.50	7th	Significant
8	Cultural issues	3.47	8th	Significant
9	Politics	3.44	9th	Moderate
10	Constantly shifting priority	3.38	10th	Moderate
11	Lack of shared vision	3.38	10th	Moderate
12	Lack of Collaboration.	3.37	12th	Moderate
13	Cultural issues	3.32	13th	Moderate
14	Lack of awareness	3.31	14th	Moderate
15	Lots of idea, no delivery to market,	3.09	15th	Moderate
16	Government regulation	3.00	16th	Moderate
17	Lack of urgency	2.90	17th	Moderate
18	Unwillingness to acknowledge and learn from past	2.81	18th	Moderate
19	Type of organization structure and no creative thinking	2.70	19th	Moderate
20	Risk aversion	2.50	20th	Moderate
	Average MIS	***3.44***		Moderate

Table 4.3 revealed the result of MIS for the twenty (20) identified barriers to innovation among specialist construction contractors by this study. It was shown that the most significant barriers barriers to innovation among specialist construction contractors are: High cost of innovation; Lack of understanding of benefit of innovation; Lack of

resource/capacity, lack of focus, lack of support, Belief that innovation is risky, Perception that the industry is doing well without innovation, Lack of spare-time to develop new ideas and Cultural issues with MIS values of 4.53, 4.50, 4.00, 3.97, 3.90, 3.84, 3.50 and 3.47 respectively. On the average, all the identified innovation among specialist construction contractors are Moderate (average MIS = 3.87).

Findings from the study of Benmansour and Hogg (2012) is in support of the finding of this study by establishing the hindrances to innovation among Specialist Construction Contractors in the construction industry. These are lack of understanding of benefit of innovation, perception that the industry is doing well without innovation, and cost of innovation.

4.4 Result and Discussions on the benefits of innovation among specialist construction contractors in Kaduna State

The result of the MIS analysis undertaken to rate the benefits of innovation among specialist construction contractors in Kaduna State is summarised in Table 4.4.

Table 4.4: Benefits of Innovation among Specialist Construction Contractors in Kaduna State

SN	Benefits of innovation among specialist construction contractors in Kaduna State	MIS	Rank	Decision
1	Improvement of services	4.69	1st	Very important
2	Improvement of product quality	4.62	2nd	Very important
3	Increase in technical capability	4.55	3rd	Important
4	Increase in organizational effectiveness	4.54	4th	Important
5	Improvement of process	4.49	5th	Important
6	Improvement of client satisfaction	4.49	5th	Important
7	Better company image	4.32	7th	Important

8	Revenue growth due to new products and services	4.32	7th	Important
9	Improvement of organizational structure	4.28	9th	Important
10	Improvement of human resources	4.25	10th	Important
11	New services	4.22	11th	Important
12	New processes	4.20	12th	Important
13	Market penetration and growth	4.17	13th	Important
14	New product	4.15	14th	Important
15	Intellectual property (patent, trademarks, design)	4.00	15th	Important
16	Short- and long-term profitability	3.80	16th	Important
	Average MIS	***4.31***		***Important***

It was revealed from Table 4.4 that of the sixteen (16), benefits of innovation among specialist construction contractors in Kaduna State, Improvement of services (MIS = 4.69); Improvement of product quality (MIS = 4.62); Increase in technical capability (MIS = 4.55) and Increase in organizational effectiveness (MIS = 4.54) are the most important benefits of innovation among specialist construction contractors. On the average, all the identified benefits of innovation among specialist construction contractors are Important (average MIS = 4.31).

In line with this finding, Muhammad *et al.* (2018) suggests the benefits of innovation adoption include an increase in the competitive edge of the market and a reduction in the staff strength needed for the execution of a project. Also in support of the finding of this study Blayse and Manley (2004) furthered the research on benefits of innovation by Ozorhon *et al.* (2010) which suggests that the more Specialist Construction firms become creative and innovative, the higher their chances and opportunities of winning more projects and also advancing the financial results of these projects.

4.5 Impact of Innovation on Performance Specialist Construction Contractors

Further analysis carried out using Spearman's Rank Correlation revealed that there exists a significant relationship between adoption of innovation and performance of specialist construction contractor.

Table 4.5: Results of Spearman's Rank Correlation Analysis

Analysis No.	Variables		Observations		Inferences		
	X_1	X_2	R	(%)	P_{value}	Strength of Relationship	Remark
1	Adoption of new innovation in your day to day activities	performance of specialist construction contractor.	89.6		0.036	Strong	Significant

Source:

The result of the correlation analysis is in line with the findings from literature Panuwatwanich e*t al*. (2008) which explores the impact of innovation towards business performance in AED firms in Australia. The study concludes that innovation has a positive influence on performance. These numerous studies (Panuwatwanich *et al.*, 2008; Gracia-Morales, 2008; Chang, 2011) in the innovation research field support the significance of innovation on enhancing performance as it offers better response to changing environment, gain greater market share and introduces new knowledge.

4.7 Summary of Findings

The findings of the study is as follows:

i. Intensified market competition and Survival are most significant drivers to innovation among specialist construction contractors in Kaduna state with the

MIS of 4.73 and 4.55 respectively. On the average, all the drivers to innovation among specialist construction contractors are important (average MIS = 4.39).

ii. The most significant barriers to innovation among specialist construction contractors are: High cost of innovation (4.53); and Lack of understanding of benefit of innovation (4.50): Averagely, all the identified innovation among specialist construction contractors are Moderate (average MIS = 3.87).

iii. Improvement of services (MIS = 4.69); and Improvement of product quality (MIS = 4.62) are the most important benefits of innovation among specialist construction contractors. On the average, all the identified benefits of innovation among specialist construction contractors are Important (average MIS = 4.31).

iv. Spearman's Rank Correlation revealed that there exists a significant relationship between adoption of innovation and performance of specialist construction contractor.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Despite the fact that innovation is accessible to enhance project performance, researchers have discovered that most Specialist contractors are slow in or outrightly resist using it. The study therefore assessed the impact of innovation on the performance of specialist construction contractors (SCC) in Kaduna State. Data was thus collected with use of questionnaire survey from Specialist construction contractors in Kaduna State. Analysis of data was undertaken with the use of frequency counts, percentage, Meant Item Score (MIS) and spearman rank correlation.

In view of the findings from the results of the data analyses carried out, it was shown that Intensified market competition and Survival most significant drivers to innovation among specialist construction contractors in Kaduna state respectively. On the average, all the drivers to innovation among specialist construction contractors are important. The most significant barriers to innovation among specialist construction contractors are: High cost of innovation and Lack of understanding of benefit of innovation. Averagely, all the identified innovation among specialist construction contractors is Moderate. Improvement of services and Improvement of product quality are the most important benefits of innovation among specialist construction contractors. On the average, all the identified benefits of innovation among specialist construction contractors are Important. It can therefore be concluded that innovation when adopted as positive impact on the performance of specialist construction contractors in Kaduna state.

5.2 Recommendations

Based on the findings and conclusion of the study, the following recommendations were made:

i. Specialist contractors should endeavour to attend workshops, seminars and other training programs that will enlighten them on new ideas, modern technologies and how to apply them.

ii. Government legislation should be introduced, which would enhance the adoption of innovation by specialist construction contractors thereby improving their overall performance.

5.3 Contribution to Knowledge

The outcome of this study makes the following significant contributions to the body of knowledge:

i. The study has been able to identify the drivers to innovation among specialist construction contractors so as to allow government and construction stakeholders to know/identify the driving forces behind innovation

ii. The outcome of the study has also made known the fact that in spite of the averagely high level of awareness of need for innovation among specialist construction contractors in particular and in the construction industry in the general, there are several barriers confronting the adoption and implementation of innovation.

5.4 Areas for Further Studies

The following areas have been suggested for further research in view of the gap identified from this study and previous studies:

i. Assessment of level of awareness of innovation in construction industry as a whole.

ii. An Investigation into the Barriers to Innovation and their Relevance within the Construction Sector.

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RESEARCH QUESTIONNAIRE COVER LETTER

Department of Quantity Surveying,
School of Environmental Technology,
Federal University of Technology,
P.M.B. 65, Minna, Niger State.
Date: ……

Dear Participant,

RESEARCH QUESTIONNAIRE: Impact of Innovation on Performance of Specialist Construction Contractors in Kaduna State.

My name is **Ayuba Bobai Kuyet,** a Master's degree student of Quantity Surveying**,** Department of Quantity Surveying, School of Environmental Technology, Federal University of Technology Minna, Niger State. I am researching ***"Impact of Innovation on Performance of Specialist Construction Contractors in Kaduna State ".***

Your participation in filling the attached questionnaire will be crucial to the success of this research. Please note that all information provided will be used for academic purposes only, and no personal identifying information is required. Therefore, you do not need to include your name or telephone number in your response.

If you have questions or observations at any time about the survey or procedures, please make use of the contact information below:

Thank you very much for your support.

Name:	Ayuba Bobai Kuyet	DR. Abel Tsado
Position:	Researcher	Supervisor
Contact information:	09079347747	07036113705

IMPACT OF INNOVATION ON PERFORMANCE OF SPECIALIST CONSTRUCTION CONTRACTORS IN KADUNA STATE.

Section A: Demographic information on respondents

Please provide information about the respondent as requested by selecting one of the options provided. Thank you.

A Gender of respondent	1	Female	
	2	Male	
B Educational qualifications of respondent	1	OND/NCE	
	2	HND/BSc	
	3	MSc	
	4	PhD	
C Respondent's profession	1	Architect	
	2	Quantity surveyors	
	3	Builders	
	4	Engineers	
D Position of respondent	1	General contractors	
	2	Specialist contractors	
E Respondent's years of experience	1	1-5 years	
	2	6 -10 years	
	3	11-15 years	
	4	16 - 20 years	
	5	>20 years	

1. Kindly rate the impact of adoption of innovation on your performance as a specialist construction contractors (SCC) (A) very Significant (B) Significant (C) Moderate (D), Minor (E) Insignificant

SECTION B: Drivers to innovation among specialist construction contractors

2. Kindly use this five-point scale to rate the drivers to innovation among specialist construction contractors: KEY: SE= Severe (5), SI= Significant (4), M = Moderate (3), MI= Minor (2) and IS = Insignificant (1)

	Drivers to innovation among specialist construction contractors	**5 SE**	**4 SI**	**3 M**	**2 M**	**1 IS**
1.	Technological advances					
2.	Changing customers and needs					
3.	Intensified market competition					
4.	Changing business environments					
5.	Survival					
6.	Changes towards sustainability					
7.	New requirements of clients					
8.	Needs to develop standards					
9.	Compliances with new regulations					
10.	Stability and development					

SECTION C: Barriers to innovation among specialist construction contractors

3. Kindly use this five-point scale to rate the barriers to innovation among specialist construction contractors: KEY: SE= Severe (5), SI= Significant (4), M = Moderate (3), MI= Minor (2) and IS = Insignificant (1)

	Barriers to innovation among specialist construction contractors	**5 SE**	**4 SI**	**3 M**	**2 M**	**1 IS**
1.	*Lack of understanding of benefit of innovation*					
2.	Perception that the industry is doing well without innovation					
3.	High cost of innovation					
4.	Belief that innovation is risky					
5.	Short term thinking					
6.	Lack of resource/capacity					

	Barriers to innovation among specialist construction contractors	5 SE	4 SI	3 M	2 M	1 IS
7.	Government regulation					
8.	Lack of skillful brainstorm facilitation,					
9.	lack of focus, lack of support					
10	Lots of idea, no delivery to market,					
11.	Cultural issues					
12.	Politics					
13.	Constantly shifting priority					
14	Lack of shared vision					
15	Lack of Collaboration.					
16	Lack of spare-time to develop new ideas					
17	Lack of urgency					
18	Unwillingness to acknowledge and learn from past,					
19	Type of organization structure and no creative thinking					
20	Risk aversion					

SECTION D: Benefits of innovation among specialist construction contractors

5. Kindly use this five-point scale to identify the benefits of innovation among specialist construction contractors: 5 (VI) = Very Important ; 4 (I) = Important; 3 (FI) = Fairly Important; 2 (LI) = Less Important; 1 (LIS) =Least Important .

	Benefits of innovation among specialist construction contractors	5 VI	4 I	3 FI	2 LI	1 LIS
1.	Improvement of services					
2.	Improvement of product quality					
3.	Increase in technical capability					
4.	New services					
5.	New processes					
6.	Revenue growth due to new products and services					
7.	Improvement of organizational structure					
8.	Intellectual property (patent, trademarks, design)					

	Benefits of innovation among specialist construction contractors	5 VI	4 I	3 FI	2 LI	1 LIS
9.	Improvement of human resources					
10.	Short- and long-term profitability					
11.	Market penetration and growth					
12.	New product					
13	Increase in organizational effectiveness					
14	Improvement of process					
15	Improvement of client satisfaction					
16	Better company image					

THANK YOU.