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RESEARCH ARTICLE

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# The influence of industrial attitudes and behaviours in adopting sustainable construction practices

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## Abstract

Considering the rapid environmental changes, the transitions to sustainable practices in the construction industry is vital now. Though the developed construction industries have already made efforts to switching to more sustainable and environment friendly practices, the developing countries are still lacking it. This research was organised to understand the role of project management practises and integrated methods in the sustainable development in the developing countries, for looking on how such practices can help these construction sectors become sustainable. The moderation effect of industrial attitudes and behaviours on sustainable construction was also conducted to understand the intermediary impacts. A survey based on the snowball sample of 208 construction professionals in Ghana was conducted to determine the impact of project management practises and integrated methods on sustainable construction. Research model was tested by employing bivariate correlation and multiple hierarchical regression analysis techniques, to establish the interrelationships among the project management practices, integrated approaches, industrial attitudes and behaviours, and sustainable construction and to explain these constructs in terms of their common underlying dimensions. The findings highlight that the project management practices and integrated approaches are significantly impacting on the sustainable construction practices in terms of BIM, Digital Twin, LEED, and BREEAM. Whereas the industrial attitudes and behaviours were found to be affecting the project management practises and integrated approaches through moderating role on sustainable construction. The study was concluded by suggesting the importance of sustainable construction practices and shaping industrial attitudes and behaviours towards such practices in the developing construction industries.

**KEYWORDS**
industrial attitudes and behaviours, integrated approaches, moderation effect, project management practices, sustainable construction

## 1 | INTRODUCTION

Construction is one of Ghana's most important sectors, and it brings both opportunities and problems (Choudhry and Iqbal, 2013). Construction project management practises and processes have recently seen a great evolution in the industry (Wang et al., 2013). According to Silvius et al. (2017), construction professionals strive to realise sustainable construction in construction projects, and project and construction teams are uniquely positioned to contribute significantly to sustainable construction using effective management practises and approaches. Sustainable development is defined as development that satisfies current demands without compromising future generations' capacity to meet their own (WCED, 1987). The Triple-Bottom Line (TBL) of sustainability is the integration of three dimensions: economic, environmental and social sustainability (Elkington & Rowlands, 1999).

A project, according to the Guide to the Project Management Body of Knowledge, is a temporary endeavour undertaken to produce a unique product, service or outcome (PMI, 2013). Project management, according to the Project Management Institute (PMI) (2013), is "the application of knowledge, skills, tools and methods to project activities in order to satisfy the project requirement." This is accomplished when the three elements of sustainability are given equal weight (Marcelino-Sádaba et al., 2015). Given this context, the goal of this research is to find ways to incorporate project management techniques and integrated approaches into Ghana's construction projects to achieve sustainable construction.

Ogunde et al. (2017) stated that construction practice encompasses the complete system that specifies procedure and standards for all phases of the building process, defining roles and interactions among building industry experts, often known as Project Managers (PM). In fact, it tackles the central ethical quandary offered by sustainable development, namely the responsibility of the world's current population to future generations. It encompasses all the energy and water used during the project's life cycles (Kibert, 2007).

Today, the interest towards sustainable construction practices have started getting boost from both the industry and research (Darko et al., 2019; Maqbool & Amaechi, 2022). However, in the case of developing countries, such as Ghana, the implementation of such sustainable construction approaches is not yet up to the mark as compared to developed countries (Ayarkwa et al., 2017). Ametepey et al. (2015), highlighted construction as a fundamental sector of the Ghanaian economy, and its attention towards sustainability concerns spans literally the entire industry. Unfortunately, due to diverse of challenges, Ghana's construction industry has yet to completely establish itself in assuring Sustainable Construction.

Ghana's construction industry makes a significant contribution to the country's GDP. Ghana's construction industry increased its contribution to GDP from 8.5% to 14.8% between 2010 and 2015 (Ghana Statistical Service, 2017). The Ghanaian government, in collaboration with non-governmental organisations and academics, is fiercely promoting sustainability awareness in the construction sector as a means of boosting environmental protection (Atongo, 2014). As a key contributor to Ghana's GDP, the construction sector is expanding rapidly (Ackah et al., 2014). The problem is a lack of motivation, bravery, and strategy to apply sustainable construction techniques, not a lack of knowledge about the benefits of sustainable construction (Ahmed et al., 2014). According to Atongo (2014), all stakeholders in the construction industry should be aware of the destructive nature of traditional construction practices in comparison to the benefits of sustainable construction. The sustainable construction practices are not fully integrated with the project management practices in construction of Ghana, as the case of other developing countries. Sustainable construction practises can be incorporated into every level or component of the construction process (Kissi et al., 2018; Maqbool & Jowett, 2022). The research aims to determine the impact of Project Management Practices and Integrated Approaches in bringing sustainable construction to the Ghanaian construction industry. In order to meet the aim of this research following objectives have been drawn to conduct in this research.

1. To investigate the role of Project Management Practices in bringing sustainable construction to the Ghanaian construction industry.
2. To determine the impact of Integrated Approaches on Sustainable Construction in the Ghana's construction industry.
3. To identify the effects of Industrial Attitudes and behaviours on the adoption of Sustainable Construction in Ghana's construction sector.

A quantitative research approach would be adopted. Hence, the attained variables would be designed into a close-ended questionnaire. Respondents would mainly be from academia and operating construction professionals in Ghana. The sample frame would be a survey of the targeted respondents who are in good standing, who have been active in the construction industry for at least 5 years and are practising within Ghana.

This research will also delve into literature to explain what Management Practices and Integrated Approaches are about. It will further explore some Management Practices and Integrated Approaches to investigate what is needs to be done to ensure sustainable construction. It would also investigate how the Ghanaian construction industry can embrace these practices and approaches for effective realisation of sustainable construction. Atombo et al. (2015) highlighted the integration of the environmental, economic and social needs of projects as an effective way of attaining sustainable construction in the Ghanaian construction industry. The study by Djokoto et al. (2014) looked at sustainable construction from the consultants' perspective. Their study identified a lack of demand and a lack of promotional strategy as key barriers to achieving sustainable construction. They are calls for the Ghanaian construction industry to promote sustainable construction. Therefore, there is the need for the industry to develop a robust framework for achieving sustainable construction objectives.

## 2 | LITERATURE REVIEW

### 2.1 | Sustainable construction

Sustainability is frequently defined in terms of three dimensions: environmental, economic, and social, collectively known as the Triple-P (People, Planet, Profit). All three aspects must be evaluated concurrently to effectively contribute to sustainable development, as they are interconnected and progress in one must not jeopardise progress in another (Larsson & Larsson, 2020). However, many researchers concentrate on only one dimension, which creates an imbalance in sustainable development. Sustainable construction is concerned with the entire building cycle, from the extraction of raw materials through the management and recycling of the waste generated (Maqbool & Wood, 2022; Shi et al., 2012). According to Köhler et al. (2012), the lack of project management standards to address sustainability in terms of competency makes it difficult to apply sustainability in projects. It has also been speculated that the integration of economic, environmental and social factors would affect the project management profession.

Some researchers examine sustainable construction from a managerial standpoint (Bossink, 2002; Du Plessis, 2007; Lam et al., 2009; Maqbool & Amaechi, 2022; Rwelamila et al., 2000). According to Wu and Low (2010), project management in sustainable construction should concentrate on techniques such as stakeholder management and organisational structure. To accomplish sustainable construction, all stakeholders involved in the process must play a role (Shi et al., 2012).

#### 2.1.1 | Environmental impact

According to Forsberg and Saukkoriipi (2007), the quantity of waste supplied is around 30%–35% of a project's cost of production. The quantity of construction materials lost on the work site is rather substantial, accounting for 9% of the acquired materials by weight. Pollution includes all forms of traffic pollution, noise, dust, and so on. Dust is classified into five categories based on dispersion. Hard particles of the fifth class are the most dangerous. The mathematical simulation of pollutants is one of the most important methods of assessing and forecasting air quality (Medineckiene et al., 2010). According to Seow and Mohamad (2007), illegal waste disposal endangers human health and the environment. The term "energy efficiency" keeps an important position in the environmental aspects, as an approach to enhance energy efficiency in buildings projects (Low et al., 2009; Maqbool, 2018). Whereas the water efficiency deals with the selection of efficient water usage in the construction operations. In addition, the sustainable construction practices and operation in design to material selection and construction activities emphasise on the environmental protection. The other important sustainable benefits include the innovative practices and the usage of modern technologies for improving the environmental sustainability (Maqbool, Namaghi, et al., 2022).

#### 2.1.2 | Economic impact

Buildings are well known for consuming significant amounts of water, wood, energy and natural resources in the economy. According to Gachoki et al. (2022), the use of sustainable construction methodologies has resulted in an 8%–9% reduction in operating expenses, a 7.5% increase in building value, and a 6.6% improvement in return on investment. Energy consumption is reduced, and systems are improved as a result of education on sustainable construction and the use of sustainable methods (Maqbool, Deng, & Ashfaq, 2020). Water use on construction sites must also be reconsidered with waterless technologies, low-flow faucets, and self-closing faucets (Reffat, 2004).

#### 2.1.3 | Social impact

People who are concerned with the healthy living in their liveable buildings can be benefitted through sustainable practices. It involves responding to people's requirements at any step of the construction process (from commissioning to demolition), offering high customer satisfaction and working closely with customers, suppliers, employees, and local communities (Hussin et al., 2013). To achieve the social sustainability requirements in architectural designs, the following elements must be met: social interaction; social security; adaptability; hierarchy; architectural identity; and participatory design (Davoodi et al., 2014). In their study, Tunji-Olayeni et al. (2020) stated that social sustainability addresses people's social expectations. It includes institutions, processes, systems, and relationships that ensure that present and future generations' social needs are not jeopardised. People come from a variety of cultural and socioeconomic backgrounds, and their needs must be met fairly and equitably while ensuring social integration and cohesion.

### 2.2 | Project management practices

Project management, according to PMI (2008), is the application of knowledge, skills, tools and methods to project activities to achieve project requirements. The following project life cycle phases are included in the project activities: conceptualization, planning, execution, termination, and monitoring and controlling. According to Irefin (2013), project management integrates through these phases with the sole purpose of producing stakeholder and customer satisfaction. A project manager has significant influence over 34%–47% of the success of a building project (Frank, 2002). According to Hwang and Ng (2013), a project manager must have the necessary abilities and expertise to handle the project professionally and successfully. Successful construction companies are now focusing on ensuring that project managers learn the essential abilities needed to succeed in their roles. The construction industry's growing understanding of the link between project success and construction project management capabilities.

Many governments are becoming more cognizant of their obligation to ensure long-term development. Governments mandate that corporations carrying out projects produce strategies, action plans

and performance metrics that will contribute to the host country's long-term growth. In the face of uncertainty, the most vital components are practical experience and collecting feedback, that is, checking the outcomes for the analysis of judgements and evaluations (Hubbard, 2014). So, in order to have a better management of sustainable construction projects, initial planning, accurate estimation, correct data decrease the level of uncertainty (Sadler-Smith, 2016). As a result, Wang (2021) suggests new analytical approaches for analysing the environment to execute a sustainable construction project, which will aid in moving project focus from results to decision-making based on project management standards.

#### 2.2.1 | Stakeholder management

According to Li et al. (2018), stakeholders are individuals or organisations that may influence or are influenced in a positive or negative way throughout the project cycle. Stakeholder groups are more evident in sustainable projects (Maqbool, Deng, & Rashid, 2020; Maqbool, Rashid, & Ashfaq, 2022; Olander, 2007). Stakeholder management seeks to reconcile stakeholders' economic interests with social and environmental goals (Marcelino-Sádaba et al., 2015). According to Armenia et al. (2019), a project management approach that attempts to preserve perspective inclusiveness should involve a collaborative, transparent, varied and comprehensive discussion and shaping process among various stakeholders. Despite the importance of stakeholder management in construction projects, there are still countless project failures because of poor stakeholder management (Mok et al., 2015). Hence, more efforts are required for effective stakeholder management in order to reduce such project failures.

#### 2.2.2 | Quality management

Chen (2019) defines construction quality management as the coordination of the construction organisation's quality control during construction and installation, as well as project completion acceptance. Construction project management involves rallying the enthusiasm of all team members towards the quality of construction and collaborating to complete their individual tasks. According to Zeng et al. (2015), quality management aims for radical innovation and reinforces control and stability by demanding standardisation or formalisation, which would obstruct the unconventional change in the process management system from the current situation to a completely new one that is conducive to sustainable construction development.

#### 2.2.3 | Communication management

A communication plan is defined in conventional project management as "a suitable method and plan for project communication based on the stakeholder's information needs and requirements" (PMI, 2013). Techniques utilise the sharing of knowledge among the people or groups working on the project. Proper communication management also enhances cooperative and collaborative processes (Bond-Barnard et al., 2018; Maqbool et al., 2018). According to de Oliveira and Rabechini Jr. (2019), the communication gap among customers, designers and subcontractors is a key obstacle to sustainable construction.

#### 2.2.4 | Human resource management

The ability to control people within an organisation is known as human resource management (HRM). Human resource management in construction is overwhelmingly concerned with ensuring that a project has enough human resources, with the appropriate skillsets and expertise, to finish it effectively. Construction project teams are known to be made up of many skilled professionals (k-workers) from various backgrounds who collaborate to accomplish the required project performance goals. There is no doubt, a better human resources management is the key element in achieving the success in any kind of sustainable construction projects (Gunasekera & Chong, 2018).

### 2.3 | Integrated approaches

According to Yudelson (2008), green buildings are built on the principles of sustainable construction, which address the ecological, social and economic issues of a building in the context of its community. These buildings are designed and built to use less energy and resources than traditional buildings and to have a lower environmental impact. Green building is frequently mentioned in connection with sustainable construction. Traditional project management techniques reduce total performance by attempting to optimise each activity, whereas integrated approaches attempt to optimise at the project level (Forbes & Ahmed, 2010).

Thus, integrated techniques vary considerably from traditional project management methodologies. Using sustainability assessment tools (BREEAM, LEED) and their specific weighting methods and criteria, this work examines how sustainable construction evaluation tools handle this problem and how these weights impact energy efficiency decision-making tasks (Ferreira et al., 2014). Moreover, in order to measure sustainability level in the buildings such sustainability techniques are also needed (Birgisdottir & Hansen, 2011). They employ a broad set of criteria, which may lead to the pursuit of more sustainable solutions (Cole, 1999). These three sustainability goals are typically conflicting (Birgisdottir & Hansen, 2011).

#### 2.3.1 | Lean construction

Lean production methods were pioneered in the Japanese automobile sector (Cullen et al., 2005), where they were widely adopted. Beginning with efforts to reduce machine setup time and influenced by total quality management, a simple set of objectives for the design of the production system was established, which is to produce a car to

the specifications of a specific customer, deliver it instantly, and maintain no inventories or intermediate stores (Lim, 2008). Lean construction evolved from the application of lean production techniques, according to Cullen et al. (2005). It has ushered in a new era of manufacturing design, supply and assembly. The cornerstone of a new type of project management is provided by Lean theory, methodologies and principles.

Collaboration between sustainable and lean construction may result in improved cost savings, waste reduction, and environmental effects (Koranda et al., 2012; Maqbool, Saiba, & Ashfaq, 2022). The combination of sustainable and lean construction will improve the quality of life (Abd Jamil & Fathi, 2016), as there are enormously significant positive correlations between lean and eco-sustainability (Scherrer-Rathje et al., 2009). Lean's progress has resulted in the establishment of a new paradigm, which will invariably include an aspect of environmental sustainability. According to Pandithawatta et al., 2019, the major aim of lean construction is to give outstanding value to the client while maximising revenues through cost reduction. So, the lean construction practices helping to solve the social and environmental problems and bring value to the social and environmental sustainability (Bae & Kim, 2008).

### 2.3.2 | The building research establishment environmental assessment method

The BREEAM, was originated from the United Kingdom, which has got a popularity other sustainability rating system. It stood number 1 sustainability rating systems from 2013 to 2017 in the world (Serrano-Baena et al., 2020). With the introduction of BREEAM, the area of measuring the sustainability of buildings has also caught up. BREEAM's key sustainable features include resources, environmental effects, and, finally, health (Jensen et al., 2018). According to Sewell and Fraser (2019), BREEAM is widely recognised as a successful approach to environmental evaluation. If the sustainability is well understood and the BREEAM is applied in the early design stages, it can be one of the important indicators of sustainable development in the construction building projects.

### 2.3.3 | Leadership in energy and environmental design

According to Bowers et al. (2020), LEED is a third-party building certification scheme founded in 1993 by Robert K. Watson and spearheaded by the United States Green Building Council (USGBC). LEED is now the most widely used building certification system, with applications all around the world (Jeong et al., 2016; Zhao et al., 2015). The LEED grading system guides the project towards sustainability in many ways, including design, building, operation, and maintenance. One of the benefits is that it gives long-term solutions to individual tasks. One of the LEED system's assets is its ability to provide sustainable solutions for unique projects (Mehranrad & Mahini, 2018). LEED is not only intended for improved communication, yet improved communication will be required owing to all the precise planning. A LEED project will require more intensive prior preparation for all stakeholders to be successful. This extreme inspection may or may not have been the original purpose of the LEED system, but it has had that effect (Robichaud & Anantatmula, 2011).

### 2.3.4 | Digital twin and building information modelling

The important discussions regarding the sustainability rating through BIM and IoT is presented by Tagliabue et al. (2021). Smart contracts and construction management are two areas where digital twin technology is gaining momentum (Chang et al., 2018; Li et al., 2019). The creation of digital twins is the outcome of iterative optimization of the information model and project physical model (Opoku et al., 2021). The terminology "BIM" is typically related to a multitude of disciplines (ISO, 2016). According to research, BIM may aid in various aspects of sustainable construction (Wong & Kuan, 2014). Because of its 3-dimensional capacity, BIM has eliminated the need for a traditional approach due to the time and effort required to effectively include architectural features into the energy simulation model (Ryu & Park, 2016). These initiatives inspired Santos et al. (2019), who utilised BIM to define a project's physical and functional attributes and generate a digital model (i.e., a BIM model).

## 2.4 | Theoretical development

Though Project management has been already used is previous studies (Armenia et al., 2019; Bryde, 2003), however, in its conjunction with the developed theoretical basis to provide solutions for the sustainable construction is not addressed by many studies. Crawford et al. (2006) argued in their study framework focusing on project management research that stakeholder management, quality management, relationship management and human resource management are all critical for project success. The method involves many levels of study and shows how project management practises impact project performance. Figure 1 highlights the theoretical framework to be tested in this research.

### 2.4.1 | Moderation effect of industrial attitudes and behaviours

According to Ajzen (1991), attitudes and behaviours are people's reactions to a certain occurrence. This reflects the evaluative judgement of construction stakeholders on sustainable construction (Anzagira et al., 2019). According to Chan et al. (2017), the attitudes and behaviours of industrial practitioners have a major negative influence on the promotion of sustainable construction. There is frequently a misalignment and inconsistency between industrial participants' sustainability concerns

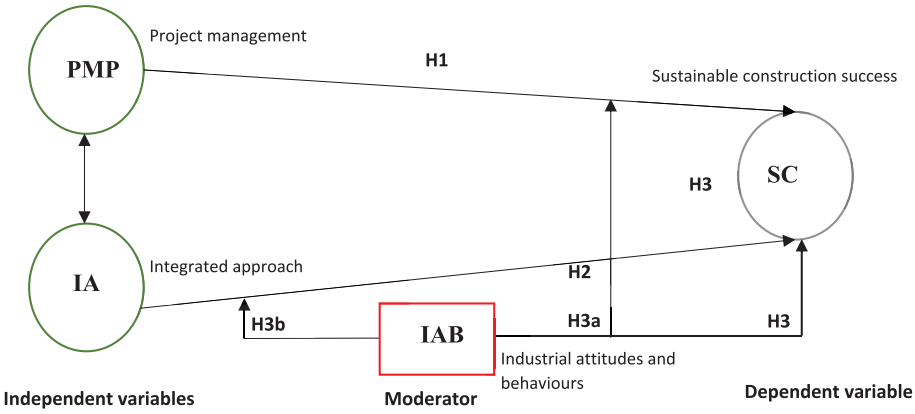


**FIGURE 1** Theoretical framework [Colour figure can be viewed at wileyonlinelibrary.com]

and their proactive behaviours and attitudes towards sustainable construction (Park & Tucker, 2017). Many construction employees in developing countries are unaware of the concept of sustainable construction and, as a result, are naturally resistant to change (Shafii et al., 2006). Hwang et al. (2018) stated in their research that limited knowledge of sustainable construction, the reluctance of workers to change their conventional practises, and a lack of demand from clients are key barriers to sustainable construction.

*Resistance to new approaches*

The construction industry's reluctance to adopt sustainable methods and innovation is an attitudinal barrier to sustainable construction (Alam et al., 2019). This is due to a lack of professional interest in adopting new sustainable practises over traditional technologies (Gupta et al., 2017). Pinkse and Dommisse (2009) postulated that in developing countries, people are not always interested in embracing innovative sustainable practises in their construction projects because of their cultural beliefs. Therefore, cultural resistance to sustainability approaches is considered a significant behavioural barrier to sustainable construction. According to Dwaikat and Ali (2016), delivering sustainable construction projects necessitates organisational leadership and management commitment. Because sustainable projects are more complex than traditional ones (Ahmed and El-Seyegh, 2022), management practises must be updated to address these complications. According to Aghimien et al. (2019), construction team members are accustomed to traditional construction practises and thus hesitant to abandon their traditional construction methods, making the adoption of new sustainable approaches a difficult task.

*Lack of knowledge and awareness to new approaches*

Lack of awareness and lack of proper training for professionals are significant obstacles that hinder the adoption of sustainable techniques in construction projects (Hong et al., 2018). Most developing countries are unaware of the numerous benefits that sustainable construction may offer, making it difficult for their employees to adopt sustainability principles (Simpeh & Smallwood, 2015). Limited knowledge of sustainable construction approaches has also been identified as a key impediment to the adoption of sustainable construction approaches in construction projects due to incorrect information about sustainability technology (Iqbal et al., 2021). According to the United Nations Environmental Programme (UNEP, 2010), understanding of sustainable construction approaches among many professionals is limited, making it difficult for such professionals to incorporate sustainability initiatives into their projects. Sustainable construction necessitates advanced sustainable practises with limited application (Aghimien et al., 2019). There is insufficient information about the application and performance of these sustainable practises due to a lack of rigorous studies on them (Ahmed & El-Sayegh, 2022).

*High cost of adoption*

According to Gillingham and Sweeney (2012), a lack of financial resources is a key obstacle to taking the initiative for the adoption of sustainable construction in construction projects. Sustainable construction necessitates a significant initial investment as well as enough resources (Darko et al., 2018). Ampratwum et al. (2021) stated that one of the challenges inhibiting the implementation of sustainable practises in the construction industry has been identified as a lack of capital to spend on sustainable construction. The high cost of adopting sustainable construction practises might be a challenge for professionals in developing countries (Gou et al., 2013). The cost-related challenges to sustainable construction are a lack of incentives, initial capital costs, and capital expenditure (Abidin & Azizi, 2021). Agyekum et al. (2020) postulated that the cost of sustainable construction practises is higher than that of traditional methods, which impedes the adoption of sustainable construction approaches in Ghana's construction sector.

## 3 | RESEARCH METHODOLOGY

This chapter details the methodology that will be used in the research. This chapter will concentrate on the study design, how the population will be selected, the sample frame and size, data collection and analysis, and so on. It appears necessary to clarify the difference between research methodologies and research methodology at this point. All the procedures and techniques used to do research may be categorised as research methods (Kothari, 2004). On the other hand, research methodology refers to the complete approach to the design

process, from theoretical underpinnings through data collection and analysis (Collis & Hussey, 2014).

### 3.1 | Research philosophy

According to Bryman (2016), the research philosophy is based on the researchers assumptions on the study. Whereas the research is based on the positivist knowledge which is further depends on the proven realities (Bryman, 2016; Osei-Hwedie, 2010). The survey instrument would be created using core variables from the literature, and statistical tools for data analysis would be used.

### 3.2 | Research design

The research design is designed to determine, among other things, how to acquire further data, analyse and interpret it, and propose solutions to the problem (Sekaran & Bougie, 2016). Two basic methods to describe the data collection and analysis are the quantitative and qualitative approaches (Pathirage et al., 2005). The choice of such approach is dependent on the study's objectives and the nature of the data available for the particular research (Baiden, 2006). The goal of quantitative research is to create and apply mathematical models, ideas, and hypotheses about natural occurrences (Sarantakos, 2005). Quantitative research uses questionnaires, surveys and experiments to collect data, which is then reviewed and tabulated in numbers, allowing the data to be categorised by statistical analysis (Hittleman & Simon, 1997). Because of the limitations, this study took a quantitative approach. It is the ideal method for research when the researcher already has some knowledge about the population, which is the case in this study. A survey questionnaire has been found to be a less expensive and time-consuming method of gathering information on population changes (Ayyash et al., 2011).

### 3.3 | Unit of analysis and data sources

Primary data and secondary data are the two forms of data. Primary data is newly gathered data that is primarily intended to answer the research question or achieve the study objectives (Saunders et al., 2009). Secondary data, on the other hand, is that which has already been acquired by someone else and has been subjected to the statistical process (Kothari, 2004). The primary and secondary both the methods have been utilised for this research. The primary data was collected by the questionnaire survey from the professionals working in the construction industry. The professional from the Ghanian construction industry, having experience and knowledge of project management practises and integrated approaches for the sustainable construction. Whereas the secondary data was based on the research contents collected from different published articles, journals, reports, books and magazines, and so forth. So, the unit of analysis were the project management practises and integrated approaches for the sustainable construction in the Ghanian construction industry.

### 3.4 | Population and sample frame

According to Walliman (2011), a population is the total number of a specific type of person, unit or instance relevant to a researcher's subject. The importance of selecting a target population cannot be overstated (Ritchie et al., 2013). A sample is a part of a population drawn to represent the whole (Naoum, 2012). The term "sample" refers to a portion of a larger group (population) selected to represent the remainder (Naoum, 2012). The data was collected from both the construction employees and researchers on the topics related to construction project management. A snowball sampling technique was used to collect the data from construction employees and researchers. The snowball sampling technique is well known for acquiring the data form most concerned people conveniently (Israel, 1992). The data was collected based on the respondents' overall knowledge and experience of the sustainable construction rather than asking about their experience of any of their single projects. This way we tried to avoid any kind of biased responses from the respondents.

### 3.5 | Questionnaire development

A total of four factors were the part of this research, which includes, two independent factors, namely Project Management Practices and Integrated Approaches, one moderating factor of Industrial Attitudes and Behaviours, and one dependent factor of Sustainable Construction. The survey questions were asked on the five-point Likert scale ranging from strongly disagree to strongly agree. The net score of all the factor items represented the mean of the particular factor of the research.

### 3.6 | Data collection instrument

A questionnaire is made up of a series of questions that are written or typed in a certain order on a form or set of forms (Kothari, 2004). This type of data collection is very common, especially for large inquiries. Commercial individuals, researchers, private and public organisations, and even governments are embracing it. This survey includes both closed-ended and open-ended questions. An online survey questionnaire was developed to collect data to measure the research variables. A total of 208 questionnaire responses from the respondents in the process of sharing it by the emails and reminder email later. A total of 250 questionnaires were sent out for the data collection, for which purpose we got 208 valid responses. The respondents views were taken through the use of five point Likert scale on the research related questions. The Likert scale is simple to use and reduces uncertainty and inaccuracy. Whereas the usage of five point Likert scale over the seven point Likert scale and nine point Likert scale was due to its benefits towards quality responses and reducing respondents frustration (Hayes, 1992).

Most of the questions were delivered and retrieved over the internet. This ensures that the appropriate recipients are reached. The

**TABLE 1** Sources of questions

| Variables | No of items | Source for questions adopted from literature |
|---|---|---|
| Project management practices | 22 | Demirkesen and Ozorhon, (2017) |
| Integrated approaches | 20 | Forbes and Ahmed (2010), Hwang and Ng (2013) and Ferreira et al. (2014) |
| Industrial attitudes and behaviours | 9 | Chan et al. (2017), Park and Tucker (2017). |
| Sustainable construction | 15 | Anantatmula (2011), Hussin et al. (2013), Reddy (2016) and Gachoki et al. (2022). |

questions were adopted from the already developed scales; however, some adjustments to the wording were made wherever it was required. Five variables were included in the study, namely project management practices, integrated approaches, industrial attitudes and behaviours, organisational innovation performance (OIP), and sustainable construction.

### 3.7 | Measurement and operationalization variables

The questions were adopted from the already developed scales by previous researchers; however, some adjustments to the wording were made wherever it was needed. Five variables were included in the study, namely project management practices, integrated approaches, industrial attitudes and behaviours, organisational innovation performance (OIP), and sustainable construction.

The operationalization of variables is presented in Table 1.

### 3.8 | Ethical consideration

All research raises ethical issues, so this study was not different, and for that matter, the researcher observed all necessary protocols to overcome ethical challenges. As indicated by Cresswell et al. (2013), researchers must protect participants in their studies, build trust with them, promote the study veracity, define and defend against offences and impropriety that could reflect their institution or establishment, and adapt to problems. Therefore, a letter of introduction was attached by the researcher to seek permission from the respondents before the study was conducted.

## 4 | ANALYSIS OF RESULTS

### 4.1 | Data processing and analysis

Data analysis refers to the methods used to get answers by evaluating the collected data (Strydom et al., 2007). Data analysis necessitates several closely connected procedures, such as the creation of categories, the application of these categories to raw data via coding, tabulation, and finally the drawing of statistical inferences. The suitable kind of analysis for this study was determined by the degree of measurement used in the data collection instruments (nominal, ordinal, interval and ratio) and the number of cases to be analysed (Walliman, 2011).

The data was analysed by using the Statistical Package for Social Scientists version 20.0 (SPSS 20.0), and performed initial reliability and validity checks before completing the research specific tests of Correlations and Multiple Hierarchical Regression analysis.

### 4.2 | Demographic results

A total of 208 (83.2%) valid responses were received out of 250 sent out questionnaires. More details of demographics regarding respondents are shown in Table 2.

### 4.3 | Reliability and validity

Cronbach's alpha value above 0.70 is considered acceptable (Hair et al., 2010), and the study satisfies the minimum requirement of Cronbach's alpha in the case of all variables in the study (See Table 3).

A correlation analysis was performed to check the significant association between the variables of the study. A summary of Cronbach alpha, standard deviations and correlation analysis is reported in Table 3.

The convergent and discriminant validity of the data was determined by; Cronbach's α N 0.70 for all constructs, composite reliability (CR) for all constructs N 0.70, and average variance extracted of each construct N 0.50 (Hair et al., 2012). Table 3 highlighted all the satisfied criteria. So, it can be said with the confidence that whole data is normal and error free to proceed for further analysis. The CR of the five constructions is substantially above the recommended level, and the measurement items' internal reliability is acceptable (See Table 3). The discriminant validity was measured by comparing the square root of the AVE of constructs with the correlations between the constructs (Hair et al., 2012), which also reflects the satisfactory conditions of the data, as highlighted in Table 3.

### 4.4 | Moderated regression effect of industrial attitudes and behaviours

Correlation analysis was performed to check the significant association between variables of the study (See Table 3). To verify a high degree of significant correlation between the variables, multicollinearity diagnostics were conducted. Based on VIF (.10) thresholds per Hair et al. (2010), no multicollinearity was found. To conduct regression analysis, the conditions of homoscedasticity, linearity, multicollinearity and normality were investigated and were satisfied, in accordance with guidelines of Hair et al. (2010). For testing moderation, we performed hierarchical regression analysis in three steps to determine the

moderation effect of industrial attitudes and behaviours on the relationship between project management practices and integrated approaches (IVs) and sustainable construction (DV). At step 1, following the regression analysis procedure, project management practices and integrated approaches were entered in model 1. At step 2, project management practices and integrated approaches and industrial attitudes and behaviours were entered in regression model 2. To test for moderation, multiple hierarchical regression analysis was performed, and results are shown in Table 4. The variables yielded no significant moderation effect of industrial attitudes and behaviours on sustainable construction in model 3 at $p$-value < .05. However, at a $p$-value of <.10 industrial attitudes and behaviours shows significant moderation on the relationship between project management practices and integrated approaches on sustainable construction.

**TABLE 2** Demographic results from survey

| Demographic | Item | Frequency | Percentage |
|---|---|---|---|
| Age | 16–25 | 45 | 21.6 |
| | 26–35 | 78 | 37.5 |
| | 36–45 | 50 | 24.0 |
| | 46–55 | 29 | 13.9 |
| | 55+ | 6 | 2.9 |
| Occupation | Architect | 21 | 10.1 |
| | Consultant | 26 | 12.5 |
| | Contractor | 16 | 7.7 |
| | Other | 31 | 14.9 |
| | Professional engineer | 11 | 5.3 |
| | Project manager | 22 | 10.6 |
| | Quantity surveyor | 30 | 14.4 |
| | Student/Researcher | 51 | 24.5 |
| Education | Bachelor's | 97 | 46.6 |
| | Diploma/Certification | 30 | 14.4 |
| | Master's | 55 | 26.4 |
| | Others | 8 | 3.8 |
| | PhD | 18 | 8.7 |
| Experience | 1–5 | 88 | 42.3 |
| | 11–15 | 44 | 21.2 |
| | 16–25 | 20 | 9.6 |
| | 26+ | 8 | 3.8 |
| | 6–10 | 48 | 23.1 |

Since the moderated regression (Table 4) shows significant results at $p = .1$, the hypothesis that industrial attitudes and behaviours moderate project management practices and integrated approaches in Ghana is accepted. It can be concluded that the Ghanaian construction industry exhibits negative attitudes or behaviours towards the adoption of project management practices and integrated approaches. However, the moderation effect industrial attitudes and behaviours in the Ghanaian construction industry is a slow and minimal.

The regression equations' information was used to illustrate the relationship between project management practises, integrated methods and sustainable building at low and high levels of industrial attitude and behaviour (IAB). Low integrated approaches and project management practises are associated with being −1 SD below their means. High-integrated approaches and project management practices, on the other hand, refer to +1 SD above their means (see Figures 2, 3 and 4).

Figure 2 highlights the moderation effect of industrial attitudes and behaviour (IAB) on the relationship between project management practices and sustainable construction.

Figure 3 highlights the moderation effect of industrial attitudes and behaviour (IAB) on the relationship between integrated approaches and sustainable construction.

**TABLE 4** Regression analysis results

| Model testing | Sustainable construction | | |
|---|---|---|---|
| **Attribute** | **$\beta$-value** | **$t$-value** | **$R^2$** |
| **Model 1** | | | .240 |
| Project management practices (PMP) | .280*** | 4.331 | |
| Integrated approaches (IA) | .319*** | 4.936 | |
| **Model 2** | | | .250 |
| Project management practices (PMP) | .241*** | 3.503 | |
| Integrated approaches (IA) | .294*** | 4.436 | |
| Industrial attitudes and behaviours (IAB) | .113* | 1.648 | |
| **Model 3** | | | .254 |
| Project management (PMP) | .107* | 1.020 | |
| Integrated approaches (IA) | .309* | 1.581 | |
| Industrial attitudes and behaviours (IAB) | −.477* | −1.785 | |
| (PMP × IAB) | .655* | 1.755 | |
| (IA × IAB) | .236* | 1.240 | |

*$p$ < .10. ***$p$ < .01.

**TABLE 3** Correlation and Cronbach alpha results

| Variables | Cronbach alpha | CR | AVE | PM | IA | IAB | SC |
|---|---|---|---|---|---|---|---|
| Project management practices | .901 | .932 | .50 | 1 | | | |
| Integrated approaches (IA) | .900 | .940 | .45 | .336[a] | 1 | | |
| Industrial attitudes and behaviours (IAB) | .829 | 0.823 | .53 | .423[a] | .341[a] | 1 | |
| Sustainable construction (SC) | .848 | .853 | .37 | .387[a] | .413[a] | .581[a] | 1 |

[a]Correlation is significant at the 0.01 level (2-tailed).

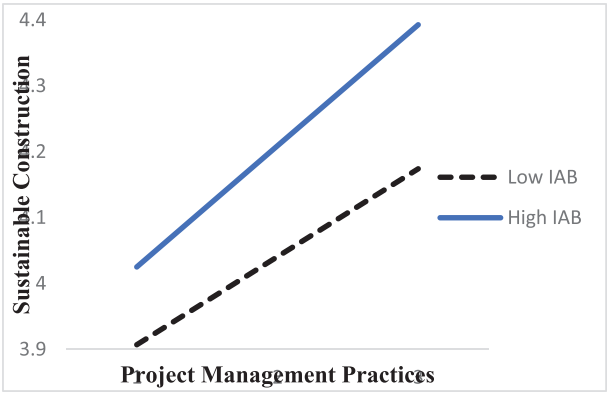


**FIGURE 2** The moderation effect in between project management practices and sustainable construction. [Colour figure can be viewed at wileyonlinelibrary.com]

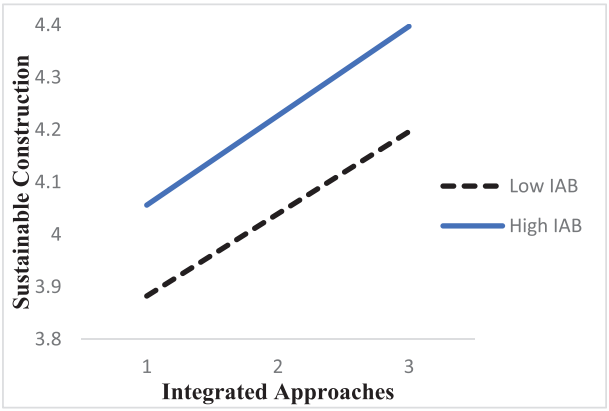


**FIGURE 3** The moderation effect in between integrated approaches and sustainable construction. [Colour figure can be viewed at wileyonlinelibrary.com]

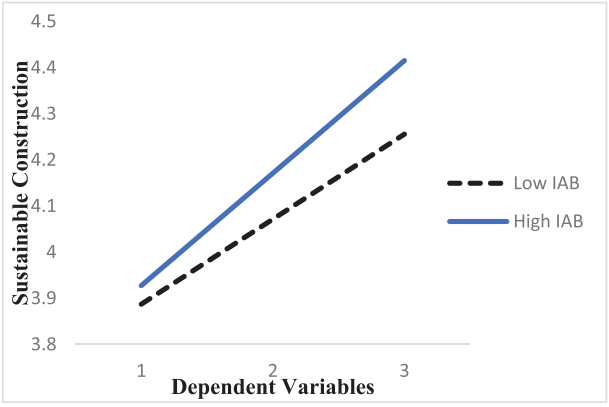


**FIGURE 4** The moderation effect in between the combine relationship between the two dependent variables (project management practices and integrated approaches) and sustainable construction. [Colour figure can be viewed at wileyonlinelibrary.com]

Figure 4 highlights the moderation effect of industrial attitudes and behaviour (IAB) on the combine relationship between the two dependent variables (project management practices and integrated approaches) and sustainable construction.

## 5 | DISCUSSIONS

### 5.1 | Critical findings

This study is aimed at exploring the impact of Project Management Practices and Integrated Approaches towards bringing sustainable construction in Ghana's construction industry. Industrial Attitude Behaviours (IAB) is further taken as the major moderating factor for the indirect relations. The major findings are discussed in detail here.

#### 5.1.1 | Project management practices and sustainable construction

According to Tabassi et al. (2016), good project management practises move projects towards sustainable construction. It was observed that the direct impact of the elements of Project Management Practices (i.e., Stakeholder Management [SMP] and Quality Management [QMP]) on the sustainable construction is significant with its values as 0.25 and 0.29 respectively. Stakeholder management and quality management aspects of project management directly lead towards sustainable construction. Project Management Practices to an extent contributes to sustainable construction.

#### 5.1.2 | Integrated approaches and sustainable construction

It was observed that the Integrated Approaches are showing the positive and significant direct effect towards sustainable construction with the values of 0.06 and 0.44. Integrated Approaches, however, have a significant influence on sustainable construction. This supports Tafazzoli et al.'s (2020) hypothesis that integrated approaches significantly contribute to sustainable construction bottom-lines. According to Cole (1999), integrated approaches investigates the sustainability of construction projects in other to arrive at more sustainable solutions. Thus, it can be drawn from the findings that the usage of such integrated approaches and technologies is vital for the Ghanaian construction industry in order to bring the sustainable aspect of the construction industry.

#### 5.1.3 | Moderation effect of industrial attitudes and behaviours on sustainable construction

Furthermore, this research expands on previous studies on sustainable construction attitudes and behaviours. The moderation influence of Industrial Attitudes and Behaviours (IAB) on Sustainable Construction was significant. Although project management practices and integrated approaches are known to have an impact on the implementation through industrial attitudes and behaviours (Anzagira et al., 2019), few researchers have investigated the effects of different worker attitudes and behaviours on various aspects of sustainable construction. Our findings confirm industrial

attitudes and behaviours as a key barrier to improving construction sustainability in the conventional mix of project management practices and integrated techniques. The impacts of project management practices and integrated techniques paired with industrial attitudes and behaviours, was also significant as anticipated. Industrial attitudes and Behaviours do hinder sustainable construction. This finding implies that the influence of industrial attitudes and behaviours on sustainable construction is considerably more complicated than previously predicted (Agyekum et al., 2020; Alam et al., 2019; Iqbal et al., 2021).

Furthermore, past studies examined several aspects of sustainable construction from several viewpoints. The importance of public-private partnerships (PPP) (Cheng et al., 2020), sustainability competences (Abou-Warda, 2014), and policies are among these crucial areas (Mohammed et al., 2022). However, there is a scarcity of literature on sustainable construction and OIP. According to extant research, measuring systems for project management and integrated techniques are not universal. The Project Management Practices (PMP) measuring framework is divided into four dimensions when MCI is applied to the Ghanaian construction industry: SMP, CMP, QMP and HMP. The measuring framework for Integrated Approaches was similarly separated into two parts: ST and INT. New and advantageous efforts in the construction sector have been thoroughly validated and they add to the literature on project management theory, particularly the dimensions of SMP and QMP given in this study. Similarly, this study establishes the measurement structure of SC from four perspectives: project management practices, integrated approaches, organisation innovation performance, and industrial attitudes and behaviours, considering the differences between project management practices and integrated approaches. They all have strong reliability and validity and can pass the empirical test. As a result, the proposed measuring scales can be used as a guide for researchers conducting similar research.

## 5.2 | Implications

### 5.2.1 | Theoretical implications

This study's research is centred on a model that was built in the context of different project management practises and techniques, which are tailored together with improved sustainable construction performance. Through a solid theoretical framework of project management practises, integrated methods, industrial attitudes and behaviours, and sustainable construction, this study contributes to theory. This study proposed and evaluated a research model to help Ghanaian professionals define, plan, create, and evaluate project management practises and integrated methods that influence sustainable building across sectors. Despite the plethora of literature on project management practises and project sustainable building, Ghanaian professionals still lack practical support and implications. This study's practical implications are aimed at engineering managers, project managers and project directors in the construction industry. The research can enable practitioners to learn project management practises and integrate approaches to enhance sustainable construction. According to Robichaud and Anantatmula (2011), project management practises should be integrated with technology techniques to guarantee products satisfy sustainable construction objectives.

### 5.2.2 | Practical implication

The influence of project management practises and integrated approaches on sustainable construction was investigated in this study. The findings suggest that the Ghanaian construction sector should strengthen stakeholder and quality management practises as well as employ integrated techniques to achieve sustainable construction performance. Professional courses must also be taken by construction industry experts to improve their implementation of integrated technologies and practises.

Furthermore, the findings imply that the Ghanaian construction sector has a favourable attitude and behaviour towards sustainable construction. Thus, bringing the training for the project management practices, the usage of the sustainable and innovative technologies, and proper understanding of the technological and managerial innovations will enhance the sustainable aspect of construction industry.

## 5.3 | Limitations

Only survey data from Ghanaian construction sector workers was used in this study. As a result, it represents their perspectives and experiences. The study's greatest contribution to the literature, however, is that it offers industry-specific indicators for measuring sustainable construction. The proposed model could be simply applied to other investigations, and the results could be compared. This approach could be used to create an altogether new model for measuring sustainable construction performance. Finally, this research was limited to stakeholder management, quality management, communication management, and human resource management practises in project management. However, the paradigm is shifting towards a more holistic approach that includes risk management, procurement, environmental management, integration management, and management performance, all of which should be addressed in future studies.

# 6 | CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to determine the impact of project management practises and integrated approaches in bringing sustainable construction to the Ghanaian construction industry. This study concluded by looking on the factors impacting the sustainable construction by testing a theoretical framework which was based on the quantitative questionnaire survey data of 208 valid industrial responses collected through snowball sampling process. The

correlation and hierarchical regression model testing techniques were employed to test the relations and affirm the findings. It was observed that the direct impacts of project management practises such as stakeholder management, quality management and integrated approaches are positive and significant towards the sustainable construction, which depict the knowledge of such practices by the professionals working in the Ghanian construction industry. However, in order to further enhance the sustainable construction, the professionals need to focus on their stakeholder management, quality management, and integrated approaches. For greater generalizability of the study findings, further research should be conducted in other developing countries, exploring additional dimensions related to project management practices. Some of the important recommendations were also formulated to suggest for sustainable aspects of the construction industry as following;

The industry is expected to focus on these areas due to the positive impact of stakeholder management and quality management of project management practises on sustainable construction. Green construction, Building Information Modelling, Lean construction and sustainability performance certifications such as LEEDS and BREEAM may be used as integration tools in construction.

Based on the negative impact of industrial attitudes and behaviours on sustainable construction, these areas should not be ignored. The industry should pay attention to creating sustainable construction awareness, training on the use of sustainable technologies and integrating approaches and policies to encourage sustainable construction.

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