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Modelling the drivers to sustainable project management in the construction industry: A Structure Equation Modelling Approach

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ABSTRACT

Research on the implementation of sustainable project management (SPM) in the building industry is still in its early stages, with only a few noteworthy studies completed. Particularly interesting is how developing countries are responding to development difficulties and strategically using SPM. SPM is one way in which the building industry influences sustainable development. Therefore, this study seeks to identify, categorize and evaluate the influence of the drivers of SPM in Ghana's public sector construction projects. By the usage of a questionnaire survey, the opinions of construction firms on the drivers of SPM were assessed. 641 applicable answers were used for the exploratory factor analysis and four groups named project management-related factors, social sustainability-related factors, financial sustainability-related factors and environmental sustainability-related factors were revealed to significantly influence SPM. The building sector is growing and as a result of its devastating impacts on society, economy and environment, the development of sustainable facilities is imperative.

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1. Introduction

In the words of Fei et al. (2021) and Wells (2026), the construction business is considered as a vital element of the economy of any nation, playing a strategic role in society well-being. In the past decade, this industry has developed rapidly because of the speedy growth of the global economy as well as the hastening of urbanization (Ahmed et al., 2023; Schiller & Roscher, 2023). With respect to this, Ametepey et al. (2022) and Fitriani and Ajayi (2023) observed that the industry's impact on society with regards to the three themes of sustainability is very substantial. That is the sector uses around 40% of total energy consumption, and responsible for between 45% and 65% of the disposed waste in landfills, 40% of global carbon emissions and consumes nearly half of the world's natural resources (Chen et al., 2022; Fei et al., 2021). Again, Al-Numan (2024) and Tafesse et al. (2022) postulated that large resource consumption, low profit, degradation, pollution, large construction waste and lack of technology are some of the problems that the industry has been battling with.

In addition, the problems of quality, duration, cost, safety, etc. have been failed to be addressed by using traditional project management procedures and methods (Akram & Habib, 2024; Fobiri et al., 2022) and therefore, promoted the notion of Sustainable Project Management (SPM) (Friedrich, 2023; Fathalizadeh et al., 2022). Henceforth, to ensure economic improvement while concurrently protecting biodiversity and ecology, construction firms must adopt SPM and meet the sustainability agenda (Antwi Afari et al., 2025; Chawla et al., 2018). However, some scholars have done some work on SPM in recent years, and construction enterprise has seen an increase in its strategic significance on sustainability (Mad Kaidi et al., 2025; Prasetyo et al., 2024). Among these, Stanitsas and Kirytopoulos (2022) explored and categorized the important indicators that expedite the shift in the direction of sustainable construction projects management. Siew (2023) developed a framework to aid in sustainability integration into the practices of construction firms.

Similarly, Stanitsas et al. (2021) investigated the incorporation of the indicators of sustainability into practices of project management in the construction sector. In a 2021 published research by Silvius, he assessed the impact of SPM on the tasks and responsibilities of the project management office. Other scholars (Elhamahmy et al., 2025; Fathalizadeh et al., 2022; Misnan et al., 2024; Zahid, 2021) have examined the barriers to SPM. However, all these studies have to do with the development of frameworks for sustainability integration into project management and the barriers to SPM implementation and not on the identification, categorization and evaluation of the drivers to SPM implementation. Furthermore, it is

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important to note that SPM implementation in African countries has been slower than in European and other wealthy countries (Ahmed et al., 2023; Akindele et al., 2023). As stated by Ayodele et al. (2020) and Putra and Santoso (2020), different countries and regions have exclusive traditions and cultures, distinct climatic conditions, varied kinds and ages of buildings, or comprehensive priorities with respect to the environment, economic, and society, may influence how they approach SPM. These concerns show that SPM is not a standard practice everywhere, so it is important to know how to promote it in different nations and areas. In view of the aforementioned, this present investigation seeks to identify and characterize the many drivers of SPM implementation in the building sector, with an emphasis on the Ghanaian public sector. The potential applications of the findings of this present investigation make it noteworthy. First and foremost, to gain a better understanding of the drivers connected to the implementation of SPM in the building sector by identifying, categorizing and evaluating the most significant ones. Besides, this study will aid industry professionals and top management as it provides a thorough list of critical elements that can help them improve the implementation of SPM. Furthermore, the insights on drivers can aid policymakers, industry stakeholders, and advocates in developing appropriate frameworks to encourage SPM implementation. Once more, as published academic reports on the drivers of SPM acceptance and implementation are uncommon, this study adds to the current SPM literature. Similarly, by the usage of the results of this investigation, advocates and international organizations wishing to adopt and implement SPM in Ghana or other African countries, may gain prior practical understanding of SPM drivers. Finally, this research contributes to the overall sustainable development of the building sector.

The paper's structure is as follows: the first section includes a literature analysis of existing research on the drivers to SPM implementation in the building sector. The methods and data collecting are detailed in the following section. The conclusion portion follows the discussion section.

2. Literature review

2.1 Sustainable Project Management (SPM)

The procedures needed for efficient supervision of a facility's planning, design, and construction are included in project management. In order to minimize environmental effects while maximizing beneficial effects on the economy and society, SPM combines sustainable development techniques, sustainable management practices, and sustainable building materials (Friedrich, 2023; Fathalizadeh et al., 2022; Oke et al., 2019). According to Wang (2021), SPM is essential for businesses looking for stability and investment appeal since it incorporates sustainable development principles into project management. Inadequate knowledge of the possible advantages, a lack of collaboration between practitioners, academic institutions, and environmental organizations, and a lack of a methodical approach to achieving sustainability goals are significant obstacles that could prevent integrating sustainability in construction project management (Fathalizadeh et al., 2021). SPM techniques guarantee reaching sustainability goals in order to overcome such obstacles. The integration of sustainability into construction project management procedures and results, however, has been a topic of discussion among academics. In order to guarantee that systems are in place to address sustainability risks, recent research advocates integrating sustainability into all aspects of construction projects (Soares et al., 2024). For construction professionals in charge of project delivery, the significance of implementing sustainable practices in project activities becomes increasingly apparent. Furthermore, SPM has become widely acknowledged throughout the scientific community, serving as a foundation for a change in perspective from conventional methods to more environmentally friendly ones. According to Soares et al. (2024), SPM offers projects a wide range of operational and strategic advantages, such as enhanced access to finance markets, increased customer loyalty, a stronger supplier chain, brand awareness, more employee morale, and lower business risks. Projects are better able to adjust to a changing environment when sustainability concepts are incorporated into project management (Peng et al., 2025; Tite et al., 2021). Participants in building projects have disclosed their sustainability responsibility activities and complied with environmental protection criteria as a result of these advantages (Soares et al., 2024; Tite et al., 2021). In order to effectively cascade sustainability policies and choices, they use project management techniques to guarantee the coherence of programs across departments and organizational levels. In order to better achieve sustainable development goals, proactive stakeholder participation in various project lifecycle stages is made possible by strengthening the link between sustainability and project management (Soares et al., 2024; Tite et al., 2021).

2.2 Identification of drivers

In relation to the accessible literature, many academics have researched the drivers of green construction, sustainable construction, green building, sustainable building, green building project management, and so on, with minimal work on SPM. The evidence quality is generally high, with several research using rigorous procedures. The consistency of findings across multiple methodological approaches contributes to the validity of identified drivers. Table 1 shows the 26 drivers that were identified, along with the required references. Consequently, the selection of prospective drivers was mostly based on elements that had garnered significant attention in earlier studies on similar themes in various nations and circumstances. This supports the claims made by Dalirazar and Sabzi (2023) and Zahid (2021), that it is preferable to use well-known elements for investigations since they allow respondents to react more easily.

Table 1
Drivers to Sustainable Project Management

Code	Drivers	Reference
D1	Reduced lifecycle costs	Ismail et al. (2023); Zulu et al. (2023); Assylbekov et al. (2021); Sajjad et al. (2021); Dosumu and Aigbavboa (2021); Marsh et al. (2021); El Khatib et al. (2020); Tunji-Olayeni et al. (2020); Oke et al. (2019); Tokbolat et al. (2019); Durdyev et al. (2018)
D2	Enhancing reputation and image of company	Ismail et al. (2023); Zulu et al. (2023); Opoku et al. (2022); Assylbekov et al. (2021); Marsh et al. (2021); El Khatib et al. (2020); Tunji-Olayeni et al. (2020); Oke et al. (2019); Tokbolat et al. (2019); Ohiomah et al. (2019); Durdyev et al. (2018)
D3	Provision of regulations, code and policies	Zulu et al. (2023); Opoku et al. (2022); Assylbekov et al. (2021); Sajjad et al. (2021); Marsh et al. (2021); Oke et al. (2019); Ohiomah et al. (2019); Durdyev et al. (2018); Munyasya and Chileshe (2018)
D4	Improved indoor environmental quality	Ismail et al. (2023); Zulu et al. (2023); Assylbekov et al. (2021); Dosumu and Aigbavboa (2021); Marsh et al. (2021); Tokbolat et al. (2019); Ohiomah et al. (2019); Durdyev et al. (2018)
D5	Natural resources preservation	Ismail et al. (2023); Zulu et al. (2023); Assylbekov et al. (2021); Marsh et al. (2021); El Khatib et al. (2020); Oke et al. (2019); Tokbolat et al. (2019); Durdyev et al. (2018)
D6	Increased financial and marketing value	Ismail et al. (2023); Zulu et al. (2023); Assylbekov et al. (2021); Dosumu and Aigbavboa (2021); El Khatib et al. (2020); Tokbolat et al. (2019); Durdyev et al. (2018)
D7	Increased education, training and research	Zulu et al. (2023); Opoku et al. (2022); Assylbekov et al. (2021); Sajjad et al. (2021); Marsh et al. (2021); Oke et al. (2019); Ohiomah et al. (2019)
D8	Client or public demand	Zulu et al. (2023); Opoku et al. (2022); Sajjad et al. (2021); Marsh et al. (2021); Tunji-Olayeni et al. (2020); Oke et al. (2019); Ohiomah et al. (2019)
D9	Provision of sustainable financing schemes	Zulu et al. (2023); Sajjad et al. (2021); Marsh et al. (2021); Oke et al. (2019); Ohiomah et al. (2019); Munyasya and Chileshe (2018)
D10	Efficient use of energy	Ismail et al. (2023); Zulu et al. (2023); Assylbekov et al. (2021); El Khatib et al. (2020); Tokbolat et al. (2019); Durdyev et al. (2018)
D11	Attracting and retaining quality and experienced workforce	Assylbekov et al. (2021); El Khatib et al. (2020); Oke et al. (2019); Ohiomah et al. (2019); Durdyev et al. (2018)
D12	Governmental support	Opoku et al. (2022); Assylbekov et al. (2021); Sajjad et al. (2021); Marsh et al. (2021); Ohiomah et al. (2019)
D13	Improvement in the economy	Ismail et al. (2023); Assylbekov et al. (2021); El Khatib et al. (2020); Tokbolat et al. (2019); Durdyev et al. (2018)
D14	Efficient use of water	Zulu et al. (2023); Assylbekov et al. (2021); Tokbolat et al. (2019); Durdyev et al. (2018)
D15	Reduction of waste	Zulu et al. (2023); Assylbekov et al. (2021); Marsh et al. (2021); Tokbolat et al. (2019)
D16	Awareness creation	Assylbekov et al. (2021); Marsh et al. (2021); Oke et al. (2019); Ohiomah et al. (2019)
D17	Provision of local suppliers/market	Zulu et al. (2023); Dosumu and Aigbavboa (2021); Marsh et al. (2021); Durdyev et al. (2018)
D18	Provision of database, information and model projects	Zulu et al. (2023); Assylbekov et al. (2021); Oke et al. (2019); Durdyev et al. (2018)
D19	Consideration of sustainability in bids or recruitment assessment	Dosumu and Aigbavboa (2021); Durdyev et al. (2018); Munyasya and Chileshe (2018)
D20	High investment returns	Zulu et al. (2023); Assylbekov et al. (2021); Marsh et al. (2021)
D21	Commitment to social responsibility	Assylbekov et al. (2021); El Khatib et al. (2020); Tunji-Olayeni et al. (2020)
D22	Provision of rating systems and labeling programs	Dosumu and Aigbavboa (2021); Marsh et al. (2021); Ohiomah et al. (2019)
D23	Efficient processes and practices	Assylbekov et al. (2021); El Khatib et al. (2020); Oke et al. (2019)
D24	Stakeholders' satisfaction	Ismail et al. (2023); Dosumu and Aigbavboa (2021); Ohiomah et al. (2019)
D25	Integration of sustainability in project management framework	Ohiomah et al. (2019); Munyasya and Chileshe (2018)
D26	Attract premium clients	Assylbekov et al. (2021); El Khatib et al. (2020)

3. Research methods

This present investigation used a quantitative approach to attain its goal. The measurement items collected from literature were put through a piloting approach to ensure that they were appropriate for the intended purpose. Interviews were conducted with 15 industry players (Engineers, Project Managers, Quantity Surveyors, Construction Managers, and Architects) with SPM experience. These professionals assessed the applicability of the measuring items and had the option to change any of them. Similar piloting approaches were utilized in other sustainability-related projects (Ayarkwa et al., 2022; Agyekum et al., 2022; Omopariola et al., 2024; Zulu et al., 2023). After the feedback, the measuring items were strategically placed in closed-ended surveys. The structured questionnaire was divided into two parts, with a cover letter outlining the investigation purpose and contact information. The first section focused on the respondent profile, while the second examined the drivers to SPM. The items in the second section were scored on a five-point Likert scale ranging from "Strongly Disagree" = 1 to "Strongly Agree" = 5. The five-point Likert scale was chosen in this study because it reduces respondents' irritation while enhancing response rate and quality (Russo et al., 2021; Tanujaya et al.,2022). Similarly, it is frequently employed in studies on construction management and sustainability due to its capacity to deliver unambiguous and easy-to-interpret results (Adabre et al., 2022; Almakayeel et al., 2023; Omopariola et al., 2024; Tanujaya et al., 2022; Zulu et al., 2023).

The survey included all construction firms in Ghana. Ghana was preferred as the investigation context because of its rapid economic growth, which has resulted in numerous construction projects and the establishment of one of Sub-Sahara Africa's largest construction markets (Frimpong et al., 2020; Owoo & Lambon-Quayefio, 2020), providing a wealth of data for the project. However, the research's target demographic was all construction enterprises listed as of March 18, 2024 with the Public Procurement Authority (PPA). PPA database was chosen as the target population because it was concerned with the use of SPM in the planning, design, management, and construction of public-sector facilities, and according to section 22(3) of the PPA Act, 2003 (Act 663), as amended by Act 914, only PPA-registered firms are allowed to conduct business with public-sector organizations.For the sample size, Yamane (1967) formula was utilized. As a result, with a population of 5,978 construction firms from the PPA database and a probability threshold of 0.05, the minimal sample size for the investigation is 375 respondents. Yet the typical rate of reply in such research is 30% (Adabre et al., 2022; Fitriani & Ajayi, 2023; Omopariola et al., 2024; Zulu et al., 2023), thus 1250 construction firms were contacted to ensure a suitable sample size. The study sample was again drawn from the sampling frame using a probability-sampling technique. That is, the study used systematic random sampling because the list from the PPA database was in alphabetical order. However, with a sample ratio of 1:5 as well as a random opening number of 55, the cases were chosen systematically from the sampling frame. In all, 641 applicable answers were acknowledged, giving a rate of reply of 51.28%. Due to the recent prominence of the topic and the fact that it was distributed via email, WhatsApp, and in-person with sporadic reminders, this response rate is relatively high when compared to previous research.

4. Presentation of findings

IBM SPSS v31.0.2.0 was used to analyse the data for appropriateness and exploratory factor analysis (EFA) before the usage of structural equation modelling (SEM). SEM uses a confirmatory approach to assess a structural hypothetical model based on a phenomenon in addition to testing hypotheses among measurement items and constructs (Ghaleb & Yaslioglu, 2024). To put it another way, SEM assesses the direct and indirect associations between one or more independent factors and one or more dependent variables. Within a single structural equation model, SEM can simultaneously perform path analysis and confirmatory factor analysis (Ghaleb & Yaslioglu, 2024). Covariance-based SEM (CB-SEM) and variance-based PLS-SEM are the two methods used in SEM. PLS-SEM can handle nonnormal data, small sample numbers, and aids in resolving the problem of variable errors, in contrast to CB-SEM (Amusa & Hossana, 2024). Furthermore, it is used to simplify the complex decision-making process (Akter et al., 2017; Sukhov et al., 2023). PLS-SEM has recently gained popularity in construction engineering and management studies due to these benefits over CB-SEM. In a similar vein, the current work used PLS-SEM to validate the hypothetical models using SmartPLS 4.1.1.8 software. The model of the research included reflective as well as formative variables. That is, the measurement model was reflective while the structural model was formative (Almakayeel et al., 2023; Qureshi et al., 2023).

4.1 Respondents' characteristics

The respondents were quantity surveyors, architects, project managers, civil/structural engineers, electrical engineers, construction managers, contract managers, mechanical engineers, site engineers and general managers from construction firms with varied backgrounds and experience. The survey revealed that project managers were the most respondents with 21.68% and site engineers with least respondents with 2.81%. Over 66% of the respondents had a postgraduate degree, indicating that they were generally well-educated. With respect to public sector projects, there are only two groups of companies, with the majority of the respondents being construction companies at 55.54%. Lastly, 51.33% of respondents had more than 20 years of expertise in the building sector, while only 7.33% had less than five years (refer Table 2).

Table 2
Respondents' characteristics

	Characteristics	Frequency	Percentage
Highest academic qualification	HND or lower	46	7.18
	First degree	167	26.05
	Post graduate	428	66.77
Type of organization	Contractor	356	55.54
	Consultant	285	44.46
Role in organization	Architect	61	9.83
	Civil/structural engineer	77	12.01
	Quantity surveyor	55	8.58
	Electrical engineer	42	6.55
	Mechanical engineer	43	6.71
	Project manager	139	21.68
	Construction manager	62	9.67
	Contract manager	57	8.89
	Site engineer	19	2.81
	General manager	59	9.05
	Managing director	27	4.21
Experience in years	Less than 5	47	7.33
	5 – 10	102	15.91
	11 – 20	163	25.43
	Above 20	329	51.33

4.2 EFA for drivers to SPM Implementation

The EFA technique evaluated the dealings of several interrelated variables. The EFA is accustomed to organize a lot of variables in a more manageable and understandable format. First of all, the appropriateness of data for assessment was determined through the correlation matrix examination, and the results revealed several of the coefficients having values of 0.3 or higher (Field, 2024; Rossoni et al., 2016). Again, the Kaiser-Meyer-Olkin (KMO) method was used to assess the adequacy of the sampling and was found to be 0.936. This value surpasses the satisfactory value of 0.5 and shows that the sample is marvelously suitable (Schreiber, 2021). For Bartlett's test of sphericity, the approximate Chi-Square was 14271.818 at a significant level of 0.000, indicating the procedure is suitable for the data as clarified by Field (2024) and Rossoni et al. (2016).

Based on Table 3, after extraction, the variables' average communality was 0.733. Therefore, the extracted communalities justify the application of factor analysis to the items (Field, 2024; Rossoni et al., 2016). In addition, none of the items had extracted eigenvalues below the threshold of 0.5, hence all measurements were eligible for further analysis (Field, 2024; Rossoni et al., 2016). The results of the EFA yielded a four-factor component solution that explained 73.403% of the variance, which exceeds the suggested minimum of 50% (Field, 2024; Rossoni et al., 2016). The first component explained 43.271% of the variance, the second component 13.070%, the third component 9.641%, and the final component 7.421%. The rotated component matrix, which is displayed in Table 4 reveals the four distinct components, with each variable primarily belonging to a particular component. The four components, project management related factors, social sustainability related factors, financial sustainability related factors, and environmental sustainability related factors, were named in accordance with the definitions offered by Ershadi and Goodarzi (2021).

Table 3
Communalities of 26 items related to drivers of SPM implementation.

	Extraction
D1 Reduced lifecycle costs	0.725
D2 Enhancing reputation and image of company	0.764
D3 Provision of regulations, code and policies	0.749
D4 Improved indoor environmental quality	0.774
D5 Natural resources preservation	0.801
D6 Increased financial and marketing value	0.840
D7 Increased education, training and research	0.689
D8 Client or public demand	0.725
D9 Provision of sustainable financing schemes	0.735
D10 Efficient use of energy	0..749
D11 Attracting and retaining quality and experienced workforce	0.736
D12 Governmental support	0.791
D13 Improvement in the economy	0.745
D14 Efficient use of water	0.720
D15 Reduction of waste	0.723
D16 Awareness creation	0.693
D17 Provision of local suppliers/market	0.576
D18 Provision of database, information and model projects	0.786
D19 Consideration of sustainability in bids or recruitment assessment	0.799
D20 High investment returns	0.698
D21 Commitment to social responsibility	0.596
D22 Provision of rating systems and labeling programs	0.792
D23 Efficient processes and practices	0.698
D24 Stakeholders' satisfaction	0.732
D25 Integration of sustainability in project management framework	0.754
D26 Attract premium clients	0.693

Extraction Method: Principal Component Analysis.

Table 4
Rotated Component Matrix[a]

	Component			
	1	2	3	4
D18	0.845			
D2	0.838			
D19	0.824			
D22	0.823			
D25	0.821			
D23	0.801			
D3	0.785			
D6		0.900		
D20		0.900		
D12		0.861		
D13		0.840		
D1		0.832		
D9		0.821		
D11			0.836	
D16			0.796	
D8			0.756	
D21			0.726	
D7			0.633	
D24			0.620	
D17			0.613	
D26			0.606	
D5				0.871
D4				0.823
D14				0.805
D15				0.799
D10				0.793

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 5 iterations.

4.3 Assessment of measurement model

The measurement model was evaluated on the basis of the quality criteria proposed by Hair et al. (2019) and Sarstedt et al. (2022) for PLS-SEM. That is, the indicator loadings should not be less than 0.7. The items were more than the threshold (0.745 – 0.915) as shown in Table 5. For the construct reliability and validity, Cronbach's alpha, Composite Reliability (CR) (rho_a, rho_c) and Average Variance Extracted (AVE) were used. The outcomes as shown in Table 5, exceeded the thresholds with Cronbach's alpha coefficient values starting from 0.917 to 0.948, CR (rho_a) from 0.917 to 0.948, CR (rho_c) from 0.936 to 0.957, and AVE from 0.646 to 0.761. Discriminant validity refers to how much a construct differs from other constructs in terms of experimental values. According to the findings of discriminant validity, the model is distinctive and successfully represents the phenomenon in a way that other models do not. This was done by assessing heterotrait-monotrait ratio (HTMT) and cross loadings. Tables 6 show the outcomes of the HTMT values, which were less than 0.85 (Henseler et al., 2015). Also, Table 7 shows the items' loading on their variable is far more than that on the other variables. The Variance Inflation Factor (VIF) of the measurement items was analyzed to detect multicollinearity. In the

words of Hair et al. (2019) and Ringle et al. (2012), if VIF is less than 5, multicollinearity is absent. Consequently, as Table 5 shows, the measurement items' VIF falls between 1.837 to 4.210. These findings demonstrate the validity and dependability of the measurement models for modelling the structural path.

Table 5
Construct reliability and validity and variance inflation factor (VIF) results of measurement Model.

Constructs	Items	Outer loading	Cronbach's alpha	rho_a	rho_c	AVE	VIF
PM	D 18	0.883	0.948	0.948	0.957	0.761	3.686
	D 2	0.869					3.399
	D 19	0.895					3.753
	D 22	0.890					3.628
	D 25	0.872					3.261
	D 23	0.830					2.630
	D 3	0.868					3.155
FS	D 6	0.915	0.934	0.935	0.948	0.753	3.423
	D 20	0.832					4.210
	D 12	0.889					3.485
	D 13	0.861					2.988
	D 1	0.850					2.736
	D 9	0.856					2.830
SS	D 11	0.804	0.921	0.923	0.936	0.646	2.714
	D 16	0.798					2.358
	D 8	0.840					2.840
	D 21	0.745					1.873
	D 7	0.830					2.749
	D 24	0.837					2.586
	D 17	0.754					1.953
	D 26	0.868					2.561
ES	D 5	0.884	0.917	0.917	0.938	0.750	3.021
	D 4	0.883					2.958
	D 14	0.851					2.447
	D 15	0.849					2.452
	D 10	0.864					2.595

Table 6
Heterotrait-monotrait ratio (HTMT) results

	ES	FS	PM	SS
ES				
FS	0.337			
PM	0.460	0.363		
SS	0.558	0.404	0.692	

Table 7
Cross loadings results

	ES	FS	PM	SS
D 5	0.884	0.261	0.303	0.389
D 4	0.883	0.274	0.420	0.461
D14	0.851	0.251	0.360	0.432
D15	0.849	0.301	0.378	0.431
D 10	0.864	0.263	0.399	0.514
D 6	0.304	0.915	0.290	0.331
D 20	0.272	0.832	0.256	0.283
D 12	0.261	0.889	0.315	0.363
D 13	0.240	0.861	0.272	0.328
D 1	0.248	0.850	0.298	0.309
D 9	0.297	0.856	0.344	0.337
D 18	0.390	0.288	0.883	0.540
D 2	0.331	0.297	0.869	0.531
D 19	0.431	0.299	0.895	0.605
D 22	0.373	0.301	0.890	0.621
D 25	0.391	0.301	0.872	0.535
D 23	0.294	0.259	0.830	0.528
D 3	0.406	0.338	0.868	0.606
D 11	0.326	0.239	0.380	0.804
D 16	0.369	0.275	0.368	0.795
D 8	0.372	0.303	0.554	0.840
D 21	0.371	0.272	0.350	0.745
D 7	0.492	0.340	0.621	0.830
D 24	0.533	0.335	0.669	0.837
D 17	0.343	0.303	0.558	0.754
D 26	0.490	0.342	0.658	0.821

4.1 Assessment of structural model

All the path coefficients were statistically significant at the 0.05 level, according to the bootstrapping results at Table 8. Fig. 1 shows the structural equation model that illustrates how each driver affects the implementation of SPM.

Table 8
Results of the structural model analysis

Construct	Beta	STDEV	t-values	p-values
Environmental Sustainability (ES)	0.229	0.014	16.330	0.000
Financial Sustainability (FS)	0.242	0.014	16.731	0.000
Project Management (PM)	0.403	0.016	25.255	0.000
Social Sustainability (SS)	0.401	0.017	23.075	0.000

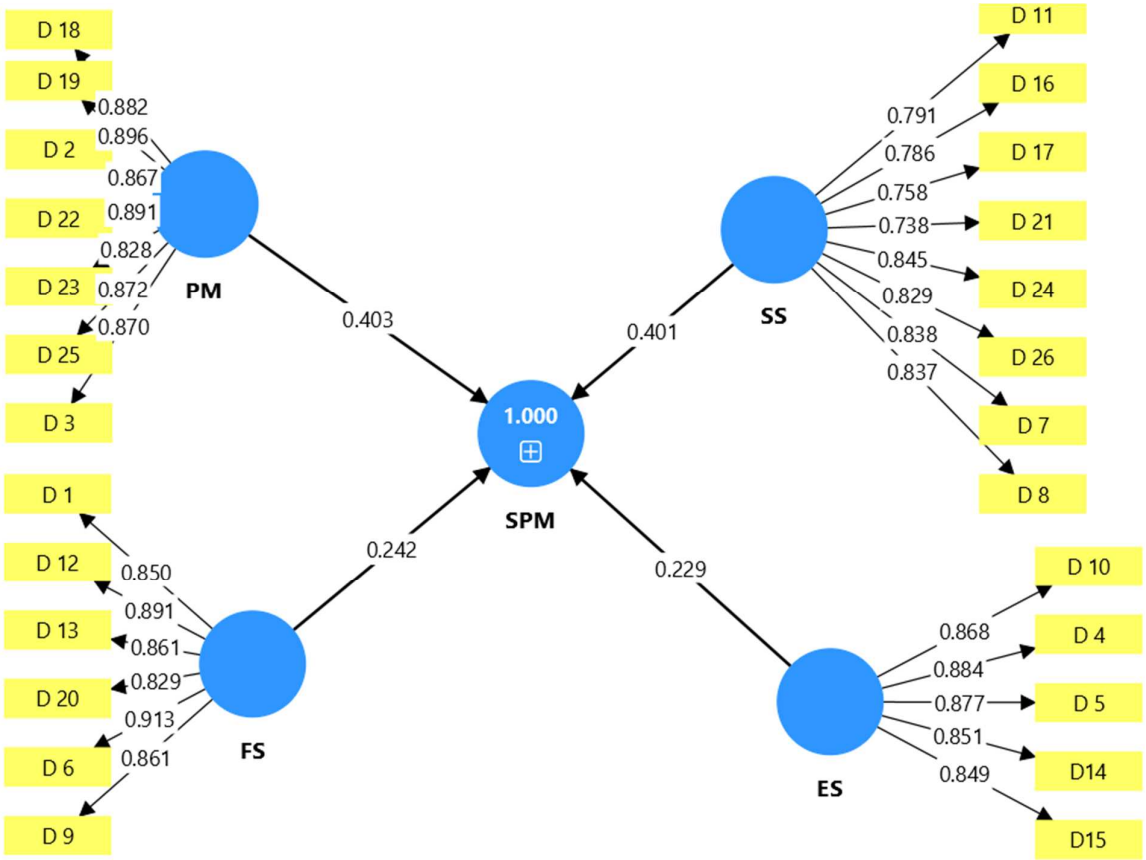

Fig. 1. Outcomes of structural model

5. Discussion

Building projects must be sustainable in order to withstand the intense competition and lessen their detrimental effects on the environment (Chawla et al., 2018). In recent decades, sustainability has drawn attention from a range of disciplines and approaches. The buildings and construction industry accounts for over 39% of worldwide CO2 emissions and 36% of global energy consumption, making this a serious problem (Crawford, 2022). Despite these facts, the incorporation of sustainability into construction project management practices has been incredibly slow, with unsatisfactory outcomes, particularly in developing nations. Therefore, the drivers that will help to propel the mainstream implementation of SPM have to be made known. This study modelled the drivers to the implementation of SPM in the Ghanaian building industry.

The first step in the study was to identify elements from the literature that were said to have an impact on green or sustainable construction. To determine the items' underlying factor structure, factor analysis was performed on the detected items. Four underlying categories for the variables driving the adoption of SPM in Ghana's construction sector were identified by the factor analysis: (1) project management-related factors; (2) financial-related factors; (3) social-related factors; and (4) environmental-related issues. All four structures have a considerable favorable impact on the application of SPM, according to the PLS-SEM results. In keeping with the findings of other studies (Darko et al., 2018; Opoku et al., 2022; Ozorhon &

Oral, 2017), the results also imply that project management-related factors were the driving forces behind the adoption of SPM in Ghana's construction sector (path coefficient of 0.403). This study's conclusion might be due to the fact that SPM adoption is still relatively new in Ghana and that many experts are just now beginning to understand it.

Evidence from past research (Binshakir et al., 2023 Dolla & Laishram, 2020; Phung et al., 2023) strongly supports the view that project management-related drivers, especially provision of database, information and model projects; enhancing reputation and image of company; and consideration of sustainability in bids or recruitment assessment are central in achieving sustainable outcomes on construction projects. Because financial-related drivers could provide sound reasons for the implementation of SPM, they should serve as a motivation. The investigations steered by Orieno et al. (2024) and Vahedi et al. (2025) indicated that the integration of sustainability in project management helped companies to improve their profit and increase financial and marketing value as well as their returns on investment. These advantages are a major factor in the implementation of SPM as, for instance, a positive public image makes it easier for the business to draw in high-end clients. Moreover, social sustainability-related drivers are increasingly recognized as essential for achieving SPM, yet they remain less developed and operationalized when compared to that of the environmental and economic dimensions (Gurmu et al., 2022; Shahzaib et al., 2024). Recent literature points out the importance of attracting and retaining quality and experienced workforce; awareness creation; client or public demand; and commitment to social responsibility as key drivers that influence sustainable outcomes in the building sector (Ajibike et al., 2023; Gbiengu et al., 2025; Moshood et al., 2025). Baba and Brunet (2024) and Mertens et al. (2023) concluded that managing social sustainability-related drivers actively on projects helps to gain legitimacy, reduce risk, and achieve socially sustainable outcomes. Environmental sustainability-related drivers have been defined by Sharma et al. (2025) as focusing on the reduction of the undesirable effects like emissions, pollution, waste, habitat loss, and resource use across the project life cycle. The authors also stated that they are central to the implementation of SPM and shape how organizations plan, execute, and evaluate projects to minimize ecological harm and promote long-term resilience. The results of this research confirm those assertions and that of Bamgbade et al. (2019) and Rotimi et al. (2025), who recognized natural resources preservation; improved indoor environmental quality; and efficient use of water as important drivers to environmental sustainability.

6. Research contributions

In theory, this study advances our understanding of sustainability, SPM, green development, sustainable urban development, eco-city, green city, and sustainable cities, all of which are in line with the Sustainable Development Goals of the United Nations. SPM are examined in the context of a novel approach to urban development that needs to be tackled comprehensively by involving all facets of project management, environmental, social, and economic development through the involvement of the different stakeholders in sustainable urban development. By concentrating on the factors that promote SPM deployment in Ghana and other comparable contexts, this study contributes to theories addressing SPM. By establishing the path for ongoing discussion on SPM to create sustainable cities, the study's conclusions further serve academia and spark a debate in sustainable development. Additionally, it will provide actual evidence to inspire others to carry out additional research.

Additionally, this study significantly influenced policymakers and industry behavior in the areas of sustainability and SPM in the construction sector. It encourages governments to adopt SPM globally in order to fulfill the UN SDGs on sustainable cities by 2030. The implementation of policies should be focused on encouraging citizens to adopt sustainable behaviors and completely switching from traditional project management to SPM. To avoid resistance, SPM should involve the construction community. It is evident that the success anticipated in sustainable cities worldwide may also be achieved when these factors are integrated into the emerging SPM idea in developing nations, like Ghana.

Methodologically, this study moves away from just ranking the drivers as seen in most published papers to a more rigorous approach. Again, by examining the drivers of SPM from a Ghanaian standpoint, this investigation bridges the gap in published scientific works caused by the insufficient study on this subject in Africa.

The substantial impact of the various constructs on SPM gives construction firms who want to adopt and implement SPM ample justification to present their ideas. According to this research, construction firms who adopt and implement SPM are probably going to have a sustained competitive edge over others. This study also shows that sustainability integration has turned out to be an important component of project management. Hence, SPM is an essential part of project life-cycle stages and should be taken into account by construction firms.

The findings also have implicit relevance for public procurement policy and regulatory bodies. Given that the sample frame consists of PPA-registered firms, the results suggest that procurement authorities and policymakers could encourage or incentivize sustainability-oriented management practices and organizational capacity building.

7. Conclusion, limitations and future work

It has been shown that the implementation of SPM in the building industry is a crucial step in the direction of global sustainable development. The implementation of SPM in the construction sector is influenced by a number of factors. Their quantitative impact on SPM implementation, however, is little understood. The current study sought to identify, classify, and assess the quantitative impacts of different kinds of factors on SPM within the framework of the Ghanaian construction sector. A questionnaire survey was used to gather data from 641 businesses. The data was analyzed using EFA and PLS-SEM, and the findings indicated that four driver groups significantly improved SPM implementation. This study had some limitations, but the notable one has to do with the methodological approach in terms of context, as the investigation was restricted to the building sector and Ghanaian geographical location, hence there may be limitations to the generalizability of the outcomes. Therefore, future scholars could conduct a comparative study on developing countries and other developed countries with other sectors. Again, the ongoing ambiguity of decision-making may be eliminated by using a multi-criteria approach.

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