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Review

Insights and challenges of sustainable project management implementations in construction sectors: Systematic literature analysis

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Abstract: The construction industry is a significant contributor towards global environmental degradation and resource depletion, with developing economies facing unique challenges in adopting sustainable construction practices. This systematic review aims to investigate the gap in sustainable construction implementation among global counterparts. The study utilizes the P5 (People, Planet, Prosperity, Process, Products) Standard as a framework for evaluating sustainable construction project management based on environmental, social, and economic targets. A Systematic Literature Review from a pool of 994 Sustainable Construction Project Management (SCPM) papers is conducted utilizing the PRISMA methodology. Through rigorous Identification, Screening, and Eligibility Verification, an analysis is synthesized from 44 relevant literature discussing SCPM Implementations worldwide. The results highlight significant challenges in three main categories: environmental, social, and economic impacts. Social impacts are found as the most extensively researched, while environmental and economic impacts are less studied. Further analysis reveals that social impacts are a major concern in sustainable construction, with numerous studies addressing labor practices and societal well-being. However, there is a notable gap in research on human rights within the construction industry. Environmental impacts, such as resource utilization, energy consumption, and pollution, are less frequently addressed, indicating a need for more focused studies in these areas. Economic impacts, including local economic impact and business agility, are further substantially underrepresented in the literature, suggesting that economic viability is a critical yet underexplored aspect of sustainable construction. The findings underscore the need for further research in these areas to address the implementation challenges of sustainable project management effectively. This research contributes towards the overall research of global sustainable construction through the utilization of the P5 Standards as a new lens of determining sustainability performance for construction projects worldwide.

Keywords: sustainability; P5 ontology; challenges; factor analysis; construction management; green project management

1. Introduction

The construction industry stands out as one of the key industrial segments encountering significant scrutiny in terms of sustainability. Substantial environmental footprints and contributions to pressing global challenges such as resource depletion, waste generation, and greenhouse gas emissions are key environmental, social, and economic issues inhibiting a sustainable paradigm in this sector (Kalemkerian et al., 2024). These challenges are magnified within the context of sustainable construction,

a paradigm that seeks to mitigate the environmental impacts associated with building activities by emphasizing the use of eco-friendly materials, energy efficiency, and minimizing waste. Globally, the sustainable construction movement faces multifaceted obstacles, including but not limited to, resistance to change, high perceived costs of green technologies, and a lack of awareness and expertise in sustainable environmental practices in the sector (Opoku et al., 2019). These issues are often systemic and structural throughout entire construction sectors, with resistance to change and implementation resulting from barriers in funding, awareness, commitment, and consistent policies (Coenen et al., 2023).

The obstacles in implementing sustainable construction are particularly acute in developing countries, where the need for rapid urbanization and economic growth is driven by the stakeholder's preference for traditional construction practices and materials to prioritize speed and cost-cutting over sustainability (Eze et al., 2023). In these contexts, sustainable construction is hampered by additional layers of complexity, such as limited access to sustainable materials, inadequate regulatory frameworks, and a scarcity of skilled labor versed in green building practices (Akcay, 2023; Shaker et al., 2022).

Construction professionals in Nigeria and South Africa further supports this argument, highlighting social inhibitors in construction project managers and organizations resistance to change, inadequate knowledge and understanding of sustainability as a concept, and limited access to relevant information and historical data as factors inhibiting sustainable construction implementations (Aghimien et al., 2019).

From the sustainable development scores data as presented from the 2023 UN Summit of the future, the disparity between the five most performing and five most underperforming countries are apparent from the huge score gaps (80 and above for the most sustainable countries and 50 below for the least sustainable countries) and Individual SDG metric performances which are often underdeveloped or undeveloped for the bottom five as shown in **Figure 1**. The middle Five countries ranking from 80 to 76 aggregate between a score of 69 to 71, and are entirely composed of developing countries such as Indonesia, Malaysia, and Mexico. As previously mentioned, South Africa with social inhibitors within their construction sectors ranks 115 with a performance score of 63.44, and Nigeria ranks146 with a score of 54.58.

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From the sustainability development score data and the litany of research describing the state of sustainable construction and development in developing countries, this study aims to answer the question of how the challenges in construction sustainability implementations persist and affect the sustainability index development for developing countries worldwide. This study aims to answer the question by investigating the gap in sustainable construction implementation between developing regions and their global counterparts through conducting a thorough and systematic literature review of existing research on the topic. Through answering this question, this study aims to bolster the knowledge on global sustainable construction implementation by conducting a comparative study in between global practices and competency level utilizing the sustainability criteria of the P5 (People, Planet,

Prosperity, Process, Products) Ontology as a new basis in evaluating based on systematic environmental, Social, and Economic targets of sustainable construction project management.

Figure 1. Sustainable development scores in 2023, global top, middle, and bottom 5 with Indonesia, South Africa, and Nigeria (Sachs et al., 2024).

This study presents the introduction as a gateway in highlighting the present challenges in construction sector sustainability implementations as the key driver for the score gaps of sustainability development between developing countries and their developed counterparts. The study reviews past literature on the topic of sustainable construction implementations, both theoretical conceptualizations and practical applications throughout global construction sectors. The Material and Methods section highlights the PRISMA Literature review as the methodology of study, with the resulting data from the methodology projected as data of developments in sustainability applications throughout the social, environmental, and economic aspects

of the P5 Ontology. The data is transposed and described for each relevant factor criteria of the P5 Ontology within the Result sections and analyzed within the Discussions segment highlighting key findings and implications for the sustainability development of global construction sectors. The last section concludes the research highlighting the overall state and disparities present in sustainability construction research, providing recommendations for a holistic approach for the comprehensive triple bottom line and each subfactors moving forward.

1.1. Sustainable project management

Project management as a body of knowledge has continually evolved to suit the changing priorities of international collaborative development, especially with the advent of globalization. Growing concerns about environmental and social project impacts, driven by stakeholder demands and regulatory compliance in progressive economic developments without the sacrifice of long-term resource scarcity, have led to the implementations of sustainability practices and principles within projects. Sustainable Project Management (SPM) is an evolution of conventional project management that moves beyond traditional individual project-focused fulfillment of time, cost, scope, and quality constraints. Considering long-term impacts, SPM addresses the need to sustain environmental, social, and economic value creation throughout project deliverables, without project financial success goals as the sole focus value prioritized (Project Management Institute, 2021).

Sustainable Project Management is rooted in the Triple Bottom Line (TBL) of Environmental, Social, and Economic impacts. Introduced by John Elkington in 1994, The TBL framework enforces the prioritization of all three dimensions as a fundamental business shift from focusing on short-term profits to long-term corporate responsibility and value creation. Through holistic and integrative accounting of the Planet, People, and Profits, Triple Bottom Line serves as the instrumental basis for the development of sustainable management practices in participating in responsible global economic development (Elkington, 1998). The sustainable project management model further defines and incorporates sustainability goals within the project deliverables; enhancing teams, assessing and planning project sustainability aspects, and prioritizing comprehensive stakeholder management in bolstering sustainable project success (Phung et al., 2023).

1.2. People, planet, prosperity, process, and product ontology (P5 Ontology)

Adapting the TBL framework towards short-term and tactical project activities requires certain considerations and modifications to the generalized and operational use of the basic framework. The P5 Standards of sustainable practices functions as a standardized set of tools for organizational portfolios, programs, and projects aimed at aligning the resulting processes and deliverables towards prioritizing environmental, social, and local economic prosperity, fulfilling the corporate bottom line of responsibility. Developed by the Green Project Management Global institute, P5 Ontology gauges project impacts towards the triple bottom line of sustainability's enhancing positive social, environmental, and economic impacts for the people, planet,

and prosperity, through the products and processes of organization projects (Carboni et al., 2018).

In the P5 Ontology as described in **Figure 2**, project impacts are first classified as product and process sustainability impacts. From a product standpoint, all projects result in tangible or intangible products, which have a product lifecycle required in realizing the projects deliverables/benefits. Within this lifecycle, the sustainability of each project phase is required to be accounted throughout project ideation, conception, and delivery by planning product realization, design and development (by considering quantity and types of materials, chemicals used, energy efficiency and recyclability), and post-production and servicing (Green Project Management, 2018). From the process standpoint, a project consists of a unique set of processes consisting of coordinated and controlled activities with start and end dates, performed to achieve project objectives. Achievement of the project objectives requires the provision of deliverables conforming to specific requirements. A project may be subject to multiple constraints. Every project has a definite start and end and divided into phases. P5 measures project objectives and deliverables, their intended life spans, servicing, and project process for maturity and efficiency perspective against elements based on the triple bottom line (Green project management, 2018).

	PROJECT										
	Product Impacts										
	Process (Project Management) Impacts										
	Social impacts (People)				Environmental Impacts (Planet)				Economic Impacts (Prosperity)		
	1. Labor Practices and Decent Work	2. Society and Customers	3. Human Rights	4. Ethical Behaviour	5. Transport	6. Energy	7. Water	8. Consumption	9. Return on Investment	10. Business Agility	11. Economic Stimulation
a	Employment and Staffing	Community Support	Non-discrimination	Investment and Procurement Practice	Local Procurement	Energy Consumption	Water Quality	Recycling	Benefit Cost Ratio	Flexibility / Optionality in The Project	Local Economic Impact
b	Labor / Management Relations	Public Policy / Compliance	Exploitative Child Labor	Bribery and Corruption	Digital Communication	CO2 Emisions	Water Consumption	Disposal	Direct Financial Benefits	Increase Business Flexibility	Indirect Benefits
c	Project Health and Safety	Customer Health and Safety	Forced or Compulsory Labor	Anti Competitive Behaviour	Travelling and Commuting	Clean Energy Return	Sanitary Water Displacement	Contamination and Pollution	External Rate of Retrun		
d	Training and Education	Product and Service Labeling			Logistics	Renewable Energy		Waste	Internal Rate of Return		
e	Organizational Learning	Market Communication and Advertising							Net Present Value		
f	Diversity and Equal Opportunity	Customer Privacy									
g	Local Competence Development										

Figure 2. The GPM P5™ Standard for sustainability in project management 1.5.1 (green project management, 2018).

Based on the Triple Bottom-line classifications, the sustainability impact has been further classified into three main categories: Environmental Impact, Social Impact, and Economic Impact as described in **Table 1**.

Table 1. Definition of category.

Category	Definition	References
Environment Impact	The effects of business activities and operations has on the health and condition of the surrounding natural environment.	(Carboni et al., 2018; Elkington and Rowlands, 1999)
Social Impact	The effects of business activities and operations on the wellbeing and prosperity of societies and humans.	(Burdge and Vanclay, 1996; Carboni et al., 2018; Elkington and Rowlands, 1999; Kah and Akenroye, 2020)
Economic Impact	The effects of business activities and operations on the long term growth of economic value internally for the organization, and externally towards society.	(Carboni et al., 2018; Elkington and Rowlands, 1999; Goh et al., 2023)

Social Impacts are the effects of business activities and operations on the well-being and prosperity of societies and humans. Social impacts refer to the value and accountability a business has towards the long-term prosperity and development of human society and comprises topics in labor practices, work conditions, customer's rights and value, human rights, and social ethics (Carboni et al., 2018). Social impacts include all social and cultural consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs, and generally cope as members of society (Burdge and Vanclay, 1996). Topics on societal well-being are categorized into 4 key areas based on the P5 Ontology framework; Labor Practices and Decent Work, Society and Customers, Human Rights, and Ethical Behavior (Carboni et al., 2018).

Environmental Impacts of sustainability are defined as the effects of business activities on the health and conditions of the surrounding natural environment, especially its contributions towards the overall health and longevity of the planet and its resources (Elkington and Rowlands, 1999). Impacts towards nature comprises of factors of Resource Utilization and Logistics, Energy Consumption, Pollution and Emissions, and Waste Management towards natural biodiversity and habitat protection. Positive impacts of business activities towards the environment are further reinforced by Environmental Compliance and Reporting regulations. Environmental Impacts are therefore further categorized into 4 areas; Transport, Energy, Water, and Consumption based on the P5 Ontology.

Economic Impacts are the effects of business activities on the long-term growth of monetary value, both internally for the organizations practicing the business activities, and externally as the organization's contributions towards national, regional, and global economy (Goh et al., 2023). The economic impact of sustainability is further divided into 3 key areas; the Return on Investment from business activities, effects, and growth on Business Agility, and impacts on Economic Stimulations. Economic viability is at the heart of developing sustainable construction because it generates profits and creates employment which consequently contributes to the general social welfare (Azapagic, 2003).

2. Material and methods

The study adopts the qualitative data collection and analysis method, centering on discovering facts and challenges in global construction sustainability implementations per the P5 Ontology. These findings were identified through

systematic literature review of research articles and journals discussing social, environmental, and economic sustainability practices in worldwide construction, utilizing the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA). The current study, in conformity with the PRISMA steps/processes sourced for the relevant pieces of literature as follows:

2.1. Identification

Literature identification is conducted through extensive searching within esteemed literature databases of Scopus, IEEE and among others, with the keywords of "Sustainable Project Management," "Challenge," and "Construction.". Scopus and IEEE are selected as primary databases due to the established indexing systems linking accredited journals in the sustainability and construction topics as sources most relevant for the keywords selected in this study.

2.2. Screening

The identified research is further screened with rigorous quality assessment using the inclusion and exclusion criteria. The screening criteria will focus on selected articles published in the 10-year range, precisely from 2014 to 2024, to capture the contemporary and relevant challenges of SCPM in the recent decade. Only articles from accredited journals and published in English are considered. In this stage, the Rayyan.io tool was utilized to facilitate the article screening process. Rayyan.io provides an efficient and structured platform to systematically review articles, aiding in managing and filtering articles from multiple sources. In addition, Rayyan.io also provides tools to assess risk of bias and handle differences in judgement between reviewers, therefore streamlining the article screening process and improving accuracy and consistency in article selection for the literature review. The comprehensive selection criteria are described in the **Table 2**.

Table 2. Paper inclusion criteria.

Criteria	Inclusion	Exclusion
Publication Time	2014–2024	Before 2014
Document Type	Regular Journal	Manuscript, Pre-Print
Language	English	Non-English

After an initial screening process to ensure relevance to the P5 Ontology topic, the number of articles submitted in the initial stage was reduced from 994 to 639 articles that met the inclusion and exclusion criteria. This selection process was thorough to ensure that the articles selected were relevant to contemporary challenges in the field of SCPM. A total of 350 articles did not meet the pre-defined quality standards.

The final screening process further conducted utilizing Rayyan.io resulted in a reduction from 639 to 149 articles that were still relevant and of high quality according to the P5 Ontology criteria. However, through further evaluation, 490 of these articles were excluded as they did not fulfil the strict criteria. This decision was based on an in-depth analysis of the content and methodology of each article.

2.3. Determination

Continuing from the screening phase, a third stage of eligibility determination is conducted manually by the authors to verify and select research literature relevant towards the discussion of sustainable construction project management as the review objective. Determination is performed by singly examining the findings, discussions, and conclusions of every research article that passes the screening stage. In the determination stage, the authors proceeded to define pre-defined success criteria, after which a rigorous manual selection was conducted to ensure the articles used matched the discussions set out in Sustainable Project Management. By engaging the team for discussion and receiving opinions from team members, we ensured each article selected met the set standards and was relevant to our objectives. From the 149 articles screened through manual selection, we concluded 44 articles worthy of use from filtering out 105 articles that did not fit the criteria of the discussion outcomes. This process ensured each article made a significant contribution and fit within the scope of our research.

2.4. Examination

The literature review is concluded by the data collection synthesis and examination of the results. This follows the research questions and is of uttermost importance to the results. A measurement tool to assess systematic reviews (AMSTAR) had been conduct within the quality review. The selected articles are then thoroughly assessed and analyzed extensively and consequently. The summarized examination of titles, abstracts, and full content of every article is further put into a wider comprehensive summary bringing out relevant issues and sub-issues.

The comprehensive methodology for literature selection process is described procedurally in the **Figure 3** below.

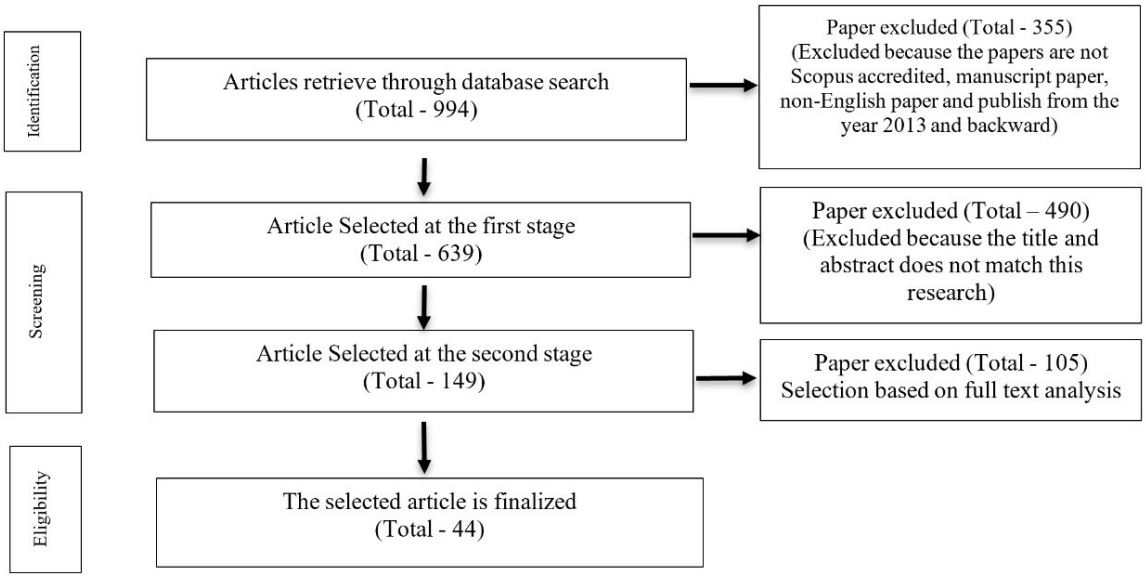

Figure 3. Literature selection process methodology.

3. Results

After a rigorous screening and eligibility quality assessment procedure using the

AMSTAR, inclusion and exclusion criteria, 44 papers are aggregated. Within AMSTAR, the paper had been assessed with the result high quality review. This process within a ten-year time span, from 2014 to 2024, capturing contemporary and relevant challenges in the field of Sustainable Construction Project Management (SCPM).

The examination through team engagement and discussion, deep insights strong consensus was gained and on the most relevant and useful articles for this study. The result of the examination phase results in findings as described in the **Table 3**.

Table 3. Used methodologies in the studies.

Methodology	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Mixed		1				1		1	2	1		6
Qualitative	1	2	1			1		1	3	6	3	18
Quantitative		1	1		2	1	3	2	4	3	3	20
Total	1	4	2	0	2	3	3	4	9	10	6	44

Despite some early fluctuations, research on SCPM is increasing rapidly. In 2022 there we 9 scientific papers analyzing SCPM, a significant surge in discourse in the topic compared to the previous 8 years. This study used scholarly articles from 2014 to 2024, with diverse research methods. The articles were divided into three categories, as shown in **Table 3**, which shows that SCPM research mainly uses quantitative methods, with 20 papers analyzed, while qualitative methods were used in a further 18 papers. Six papers utilized a mixed qualitative and quantitative methodology.

Table 4. The total factors from the category throughout the year.

Category	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Environmental impact	1	1	1				2	1	3	7	5	21
Social impact	1	3	2		2	3	2	3	9	8	4	37
Economic impact			1				1		2	2	3	9
Total	2	4	4	0	2	3	5	4	14	17	12	67

Based on the analysis of the 44 papers, it can be observed from the findings presented in **Table 4** that the social impacts substantially affect the challenges associated with the implementation of SCPM. In terms of result classifications by impacts discussed, from 2014–2024, there are 67 distinct factor categories, with the social impact being the most common at 37. After social impact, there are environmental impact and economic impact categories with 21 and 9 factors respectively. In 2023, there are 17 factors, with the social impacts category having the most at 9 factors. The environmental impact and economic impact categories follow closely behind with 7 and 2 factors respectively, although these impacts could contain overlapping discussions in multi-impact studies. There is also a lack of information in between environmental and economic impact in implementing SCPM. From this data can be concluded that there is a need for thorough research on the challenge of implementing SCPM specifically in environmental and economic impact. Though it should be noted, the data for SCPM research in 2024 is still ongoing and might indicate

a varying result at year end.

According to the results in **Table 5**, Social impacts, comprising variables of Labor Practices and Decent Work, Society and Customers, and Ethical Behavior, contain present literature and studies conducted as early as 2015. There persists a significant surge in research and studies towards social variables which began from 2022, with Labor Practices and Decent Work as the backbone of this increase in research.

According to the results in **Table 5**, Social impacts, comprising variables of Labor Practices and Decent Work, Society and Customers, and Ethical Behavior, contain present literature and studies conducted as early as 2015. Notably absent, Human Rights as a subcategory does not contain any present literature which passes the literature review process and criteria. There persists a significant surge in research and studies towards social variables which began from 2022, with Labor Practices and Decent Work as the backbone of this increase in research.

Based on the results in **Table 6**, Research within the environmental aspect is comparatively limited towards the social aspects, with an average of 2 literature per annum of research until 2022 fitting the review criteria. The subcategories of Transport, Energy, Water, and Consumption all contain literature passing the review process and criteria, being eligible for further analysis. Similar towards the social aspects of construction sustainability, there exists an increasing trend of research and studies geared towards environmental implementations beginning from 2022.

In Comparison towards the 2 other aspects of sustainability, the economic impacts described in **Table 7** are sparsely studied and researched, with inconsistent and often null literature year on year from 2014–2024. The popularity of research within the economic aspect variable has only recently risen in 2023 and 2024, with the topic of Return on Investment as the primary indicator often linked with social and environmental practices in other adjacent literature.

Table 5. Determinant factor in the social impact category.

Factor	Description	Total of Reference	Relevant Factor Criteria	References
Labor Practices and Decent Work	This subcategory covers project governance policies as they pertain to labor practices, the relationship to policy set forth in organizational standards and operations, organizational hiring and staffing procedures, treatment of employees, project resources, and their well-being (Green Project Management, 2018)	30	Labor/Management Relation	(Adel et al., 2023; Ahmed et al., 2023; Ahmed and El-Sayegh, 2022, 2024; Arabpour and Silvius, 2023; Dalirazar and Sabzi, 2022; Górecki et al., 2022; Hedborg and Rosander, 2024; Wu et al., 2019).
			Project Health and Safety	(Arabpour and Silvius, 2023; Caselles and Guevara, 2024; Luchkina, 2023; Naji et al., 2021)
			Training and Education	(Borg et al., 2020; Dalirazar and Sabzi, 2022; Caselles and Guevara, 2024; Elzomor, 2021; Gomes et al., 2022; Higham and Thomson, 2015)
			Organizational Learning	(Adel et al., 2023; Ahmed et al., 2023; Ahmed and El-Sayegh, 2022, 2024; Ayarkwa et al., 2022; Correia and Salgado, 2016; Fathalizadeh et al., 2022; Larsson and Larsson, 2020; Maqbool and Jowett, 2023; Montalbán-Domingo et al., 2019; Moshood et al., 2023; Mustaffa et al., 2023; Nezami et al., 2022; Osypchuk and Iwan, 2023; Shooshtarian et al., 2024)
			Diversity and Equal Opportunity	(Ahmed and El-Sayegh, 2024; Caselles and Guevara, 2024)
			Local Competence Development	(Ahmed et al., 2023a; Ahmed and El-Sayegh, 2022; Amri et al., 2023; Caselles and Guevara, 2024; Fathalizadeh et al., 2021; Gambo et al., 2016; Maddaloni and Sabini, 2022; Oke et al., 2018; Wu et al., 2019)
Society and Customers	This subcategory covers the impacts of a portfolio, program or project on the society in which the project's engagement and product will impact the end users or customers that will make use of it impacted by either the project or product. (Green Project Management, 2018)	12	Community Support	(Adel et al., 2023; Dalirazar and Sabzi, 2022; Díaz Caselles and Guevara, 2024; Tierney and Tennant, 2015)
			Public Policy/Compliance	(Aghimien et al., 2019; Ahmed et al., 2023; Ahmed and El-Sayegh, 2022; Arabpour and Silvius, 2023; Hussain et al., 2024; Maqbool and Jowett, 2023; Naji et al., 2021)
			Customer Health and Safety	(Caselles and Guevara, 2024; Correia and Salgado, 2016)

Table 5. (*Continued*).

Factor	Description	Total of Reference	Relevant Factor Criteria	References
Ethical Behavior	This subcategory covers project process and product impacts as they pertain to ethical behavior and focuses on three areas: Investment and Procurement, Bribery and Corruption and Anti-Competition. Each element in this sub-category extends beyond a behavioral competence to organizational culture in how conscious leadership and higher purpose are cornerstones to successful projects and ultimately stronger business. (Green Project Management, 2018)	8	Investment and Procurement Practices	(Adel et al., 2023; Ahmed et al., 2023; Ahmed and El-Sayegh, 2022; Arabpour and Silvius, 2023; Babinard et al., 2014; Mustaffa et al., 2023; Naji et al., 2021; Solanke and Fapohunda, 2016)
			Bribery and Corruption	(Arabpour and Silvius, 2023; Caselles and Guevara, 2024)

Table 6. Determinant factor in the environmental impact category.

Factor	Description	Total of References	Relevant Factor Criteria	References
Transport	This subcategory covers project process and product impacts as they pertain to transport and focuses on four areas: Local Procurement, Digital Communication, Traveling and Commuting, and Logistics. While each element in this category is categorized under the environmental bottom line, each has significant social and economical impacts that should be accounted for when considering overall impact. (Green Project Management, 2018)	9	Local Procurement	(Babinard et al., 2014; Maddaloni and Sabini, 2022; Naji et al., 2021; Osypchuk and Iwan, 2023; Ruparathna and Hewage, 2015)
			Digital Communication	(Ahmed and El-Sayegh, 2024; Simpeh et al., 2023)
			Logistics	(Ahmed et al., 2023; Ahmed and El-Sayegh, 2022; Naji et al., 2021)
Energy	This subcategory covers project processes and product impacts as they pertain to energy resources and focuses on four primary areas: Energy used, CO2 Emissions, Clean Energy Return and Mixed Energy. (Green Project Management, 2018)	7	Energy Consumption	(Caselles and Guevara, 2024; Correia and Santos Salgado, 2016; Yi et al., 2024)
			CO^2 Emission	(Caselles and Guevara, 2024; Gardezi and Shafiq, 2021; Hussain et al., 2024)
			Clean Energy Return	(Yi et al., 2024)
			Renewable Energy	(Maqbool and Jowett, 2022; Mustaffa et al., 2023)

Table 6. (*Continued*).

Factor	Description	Total of References	Relevant Factor Criteria	References
Water	This subcategory covers project process and product impacts as they pertain to water resources and focuses on three primary areas: Water Quality, Water Consumption and Water Displacement. (Green Project Management, 2018)	1	Water Consumption	(Caselles and Guevara, 2024)
Consumption	This subcategory covers project processes and product impacts as they pertain the consumption and extraction of raw materials, the processing of raw materials into intermediate and final products and the consumption of the final products and focuses on five primary areas: Recycling, Water Disposal, Reusability, Incorporated Energy, and Waste. (Green Project Management, 2018)	8	Contamination and Pollution	(Caselles and Guevara, 2024; Correia and Salgado, 2016; Osypchuk and Iwan, 2023)
			Waste	(Abdulaali et al., 2023; de Gier et al., 2024; Luchkina, 2023; Olubambi et al., 2020.; Shooshtarian et al., 2024)

Table 7. Determinant factor in the economical impact category.

Factor	Description	Total of Reference	Relevant Factor Criteria	References
Return on Investment	P5 views Return on Investment (ROI) from an economic perspective as the direct financial gain to be realized for investing in a portfolio, program or project. This subcategory covers the financial gain and net present value of an individual project. (Green Project Management, 2018)	9	Benefit-Cost Ratio	(Luchkina, 2023)
			Direct Financial Benefit	(Adel et al., 2023; Ahmed et al., 2023; Ahmed and El-Sayegh, 2022, 2024; Caselles and Guevara, 2024; Correia and Salgado, 2016; Naji et al., 2021)
			External Rate of Return	(Luchkina, 2023)
			Internal Rate of Return	(Caselles and Guevara, 2024; Luchkina, 2023)
			Net Present Value	(Hussain et al., 2024)
Business Agility	P5 views business agility as the ability of an organization to easily adapt (from a financial perspective) in response to changes in the portfolio, program or project to meet project outcomes from a sustainability perspective. This sub-category focuses on two elements, flexibility/optionality in the project and increased business flexibility. (Green Project Management, 2018)	1	Increase Business Flexibility	(Ahmed and El-Sayegh, 2024)
Economic Stimulation	P5 views economic prosperity and stimulation as the financial stimulation that occurs as a result of the project. The two measures are Local Economic Impact and Indirect Benefits. The importance of this is to society in general, specifically communities and individual and family prosperity and empowered lifestyle. (Green Project Management, 2018)	1	Local Economic Impact	(Correia and Santos Salgado, 2016)

4. Discussion

4.1. Social impacts

Labor Practices and Decent Work comprises of 7 practical indicators, with 6 indicators containing literature and studies fitting the research criteria. Organizational Learning, Labor/Management Relations, and Local Competence Development are the top 3 indicators with extensive literature and studies conducted. The extensive research into Organizational Learning as a topic indicates the novel nature of sustainable project management in the realm of construction, as most construction sectors worldwide have only started to grasp implementations in organizational policies and practices such as project delivery methods, criteria, and challenges such implementations. This is reinforced by Adel et al. (2023) and Ahmed and El-Sayegh (2024) investigating concepts on integrated and relevant criteria for sustainable construction project delivery methods. Research on this topic heavily emphasizes the need for better collaboration in between project stakeholders through early involvements in goal definitions, collaborative innovation implementation decisions, and open communication in strengthening the social aspect of the project sustainability

Concurrent towards organizational development, labor management relationships are also intensively researched under similar context. Adjustments towards sustainable and holistic delivery methods often involve tighter collaboration and synergy between project departments. In research done by Hedborg and Rosander (2024), collaborative project team relations are investigated in the context of multi-project urban developments in Sweden, emphasizing the mix of self-organization and collaboration required at such scale of development.

Developments in organizational learning and labor management relations thus lead to increased local competence development, as the concept of SCPM is further applied by developing economies, often in close collaboration and for the benefit of local/indigenous construction professionals and partners. A significant amount of research focusing on the social sustainability of SCPM are investigations and research into the competence of project managers in countries such as Iran, UAE, and Nigeria, involving national factors such as local financing, availability of sustainable materials and technology, contracts, regulations, and experience as well as awareness of the workforce and organizations towards sustainable construction (Ahmed and El-Sayegh, 2022).

Focusing on the macro aspects of the social sustainability for CPM, Society and Customers comprises of 6 practical indicators, with 3 indicators containing literature and studies fitting the research criteria. The 3 indicators are Community Support, Public Policy/Compliance, and Customer Health and Safety. Regarding communities, challenges are present in the lack of public support towards sustainable construction from a benefit standpoint. Tierney and Tennant (2015) as example uncovered the lack of sustainable housing buying incentive as the interest of better house energy efficiency doesn't align with the inflated pricing supported by traditional sales strategies. The lack of practical and worthwhile incentives towards sustainable housing results in the resistance for people in switching to green buildings, and furthermore for companies to pull effort in such construction products, creating an

economical lack of demand for sustainable buildings (Dalirazar and Sabzi, 2022) thus also resulting in the lack of incentive for local construction firms and professionals in growing the knowledge and practice of sustainable construction development.

Ethical Behavior comprises of 3 practical indicators, with 2 indicators containing literature and studies fitting the research criteria. The literature focusing on this variable mostly comprise of research in the indicator of Investment and Procurement Practices. Ethical issues in procurement is a standout issue within the construction industry under the lens of sustainability, as construction materials draw intensively on natural resources and their long term sustainability. Research by Babinard et al. (2014) delves into this issue for small island nations such as Kiribati, where the limited availability of construction materials drive procurement practices in risk of damaging local coastal reef environments through exploitative mining.

4.2. Environmental impacts

The Transport variable comprises of 4 practical indicators, with 3 indicators containing existing literature and studies fitting the research criteria. These indicators in order of amount are Local Procurement, Digital Communication, and Logistics. Local Procurement stands out as a sustainability topic due to its correlation with improving stakeholder engagement and project efficiency in the context of material logistics. As it stands, material and supply transport for construction projects perform detrimental impacts in increasing traffic congestion as well as noise and air pollution, increasing risks to public health and safety. However, construction companies seldom adopt new and sustainable procurement practices due to the lack of awareness and incentives for these innovative practices, often prioritizing reduced cost estimates of conventional procurement such the case in Szczecin, Poland (Osypchuk and Iwan, 2023). Even in a relatively developed service economies such as the Canadian construction sector, there persists challenges in funding, awareness, information, commitments, and supporting policies for the local viability of sustainable construction procurement, with local policies primarily functioning as the driving force for the adoption of such practices by construction project managers (Ruparathna and Hewage, 2015).

The Energy variable comprises of 4 practical indicators, with each containing existing literature and studies fitting the research criteria. Energy Consumption, CO^2 Emissions, Clean Energy Return, and Renewable energy are all topics within construction project energy sustainability. Research into the energy aspect of construction project management are at the level of conceptualizing and proposing mathematical and systematic models of energy management methods for increasing consumption efficiency and emissions reduction through clean return and renewability. Notable examples include a mathematical optimization model for construction Net Present Value (NPV) and Green House Gasses (GHG) (Hussain et al., 2024) and a solution method/algorithm for complex trilevel (government-manufacturer-contractor) construction subsidy planning for prefabricated materials (Yi et al., 2024), alongside other assessments towards energy and carbon footprints for the end of life (EOL) phase of construction projects during the pre-project phase (Gardezi and Shafiq, 2021).

Comparatively unique towards other Environmental Variables, Water as a

variable has limited research and studies conducted towards its 3 practical indicators, with Water Consumption briefly mentioned in Caselles and Guevara (2024) as a minor studied topic within the broader literature review in on-site construction sustainability performance. It could be inferred that while there is a substantial case of water usage within construction projects, the sustainability of water within projects are preceded by more opulent topics of procurement, energy, and consumption as the key role of water in construction most often involve the creation and mixing of concrete as a construction material/product.

Consumption comprises of 4 practical indicators, with 2 indicators containing literature and studies fitting the research criteria. Contamination and Pollution as well as Waste are the indicators with extensive research towards their practical implementations. The Waste topic has more extensive research conducted, with practical and implementable studies into limiting construction waste generation in current projects. Notable implementations include utilization barriers for products with recycled content towards the circular economy of the Australian construction sector (Shooshtarian et al., 2024), construction solid waste management through the application green building rating systems in the Iraqi Sector (Abdulaali et al., 2023), and aligning different waste categorization standards in accordance to European Union regulations in supporting proper construction waste management (disposal and recycling).

Although less extensively researched than waste, the topic of contamination and pollution are also at the practical level of implementations according to available research literature. However, these literatures aren't singularly focused on the topic of any specific contaminations and pollutions generated from construction processes, rather on other construction aspects tangible with the topic such as sustainable urban deliveries/transportation of materials (Osypchuk and Iwan, 2023) and as a related aspect for the implementation of an HQE project sustainability framework in the Brazilian sector (Correia and Salgado, 2016). This present gap presents a further opportunity for specific studies into construction contamination and pollution aspects and mitigations, especially with the recent broader implementations of SCPM.

4.3. Economic impacts

Return on Investment comprises of 6 practical indicators, with each indicator containing literature and studies fitting the research criteria. Direct Financial Benefits is a notable indicator with the highest presence of literature within the entirety of economic aspect reviewed within this study. However, there is no significant literature in this category which specifically focuses on the direct financial benefits from the implementation of sustainable construction practices. Most research in this bracket are correlated as benefits towards project profitability resulting from preconstruction planning (Naji et al., 2021),framework implementations (Correia and Salgado, 2016), and project delivery methods (Adel et al., 2023), as well as broader research into developments of sustainable construction and barriers present (A. M. Ahmed et al., 2023). This indicates a literature gap with specific studies into sustainable project return on investment. The other indicators of External and Internal Rate of Return, as well as Net Present Value furthers this argument as they contain very minimal

literature fitting within the review criteria. As a notable example, Hussain et al. (2024) are one of the only research projects within this review which specifically dives into the NPV optimization aspect of sustainable construction projects.

Business Agility, which comprises of 2 practical indicators, has only 1 literature discussing the indicator of Increased Business Flexibility. (Ahmed and El-Sayegh, 2024) outlines business agility as one of the relevant criteria's in selecting sustainable construction project delivery methods. Similarly, Economic Stimulation which comprises of 2 practical indicators, has only 1 literature discussing Local Economic Impact as an indicator with (Correia and Salgado, 2016) linking the benefits of their research into the implementation of the HQE framework into bolstering the local economic development for the Brazil's sustainable construction sector.

The overall literature in the economic category is lackluster comparatively towards the social and environmental aspects of the triple bottom line. Economic impacts often function as tangible results of social and environmental sustainability implementations, rarely including specified research into return on investment, business agility, and economic stimulation aspects of sustainable construction project management in the global economy.

5. Conclusion

The research results present an extensive systematic literature review (SLR) on construction project management sustainability in accordance with the P5 Standard of sustainable business practices. This SLR analyzes the Social, Environmental, and Economic practices implementations in the global construction sector and found 44 literature topics intersecting with 11 variables across the P5 Ontology. Utilizing the P5 Standards, the study uncovered deeper revelations between the social, environmental, and economic aspects of construction sustainability previously hidden in niche subtopics within each aspect as shown in **Tables 5–7**.

The systematic review of 44 relevant studies on SCPM reveals a multifaceted landscape of challenges and opportunities. The analysis of various subtopics within **Tables 5–7** highlights a significant disparity on social impacts, particularly the significant amount of research conducted on the topics of labor practices and decent work conditions, society and customer rights prioritization, and ethical behaviors, underscoring the industry's growing recognition of its social responsibilities. However, the research also exposes critical gaps in understanding the environmental and economic dimensions of SCPM as well as the Human Rights aspect of the social equation. The environmental impacts, including resource utilization, energy consumption, and pollution, are lacking in-depth investigations necessary to develop effective practical strategies for reducing the construction sector's ecological footprint, primarily in the field of material logistics and efficient usage of water and energy resources within construction processes. Similarly, the economic aspects, such as return on investment, business agility, and economic stimulation which are crucial for ensuring the financial viability of sustainable practices, remain underexplored and under integrated towards the effects of developments focusing heavily on social impacts.

These findings imply the presently growing interest in research in sustainable

global construction in recent years has arguably benefited construction projects worldwide. Much of the literature discussed within this review has progressed into the level practical implementations of sustainable practices in a wide range of local economies with varying challenges of their own. However, certain subtopics within the P5 sustainability standard have a complete disparity in this regard, lacking even theoretical foundations of literature in such topics of human rights and smaller subtopics such as sanitary water displacement. Therefore, the limitations of this study hinges on the disparity of knowledge in select areas of the SCPM body of research, as the uneven distribution of theoretical and practical studies in select subtopics contributes to the inconclusiveness of this study in regards to the P5 Ontology Standard

To achieve a holistic approach to sustainability in construction, future research must address these gaps, integrating environmental and economic considerations with the already well-studied social impacts. This comprehensive approach will help in creating robust frameworks and policies that can guide the construction industry towards more sustainable practices globally, particularly in developing regions where the challenges are more pronounced. The findings underscore the importance of interdisciplinary research and collaboration among stakeholders to drive innovation and overcome the barriers to sustainable construction.

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