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The Stakeholder Integration Model for Sustainable Infrastructure Management in Africa

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Abstract

Construction is highly fragmented across multiple stakeholder expectations. But then studies focusing on stakeholder integration (SI) for sustainable infrastructure management (SIM) are still evolving, this paper conducted a systematic literature review on SI for SIM in the past 20 years to identify the current trends and strategies. Through semi-structured interviews of 20 practicing managers of infrastructures in the African public sector, it further explored the identified current trends and strategies using coding of thematic patterns for data analysis. Evidences reveal that publications on SI for SIM fluctuate, and are directly proportional to economic and environmental challenges. It further explored SI for SIM across different countries and disclosed that the Chinese SI for SIM style in Africa is exclusive, exploitative, conflict-prone, and unsustainable. Conclusively, this study recognizes complete SI across all management processes and tools as the impactful strategy for SIM. It then developed stakeholder integration model, identified challenges, hybrid skills, and critical factors for complete SI for SIM in Africa. It further provides direction to both policymakers and researchers on SI in SIM.

Keywords: Stakeholder integration model, sustainable management strategy, sustainable infrastructure management, stakeholder management, management skills

INTRODUCTION

Construction is characterized by lack of effective decision making, communication, laws, inconsistent policies, and inadequate support from established institutions. Stakeholder integration (SI), ought to be the catalyst in driving behavior and performance, but it is not delivering the same [1]. Vilasini et al. [2] acknowledged the "incompleteness" of SI as only a part of the value chain (owner, designer, main contractor) is still considered for integration. SI is a partnership where organizational and project stakeholders such as customers, communities, suppliers of materials and services to contribute to organizational and project management practices to deliver improved performance that meet all stakeholders' expectations [3]. Danso et al. [1] referred to SI as "a fundamental collaboration" of interested parties to inform, appraise, and contribute to practices that will deliver sustainable construction (SC). Although Li et al. [4] recorded growth in theoretical and empirical attention on SI, the understanding of how it relates to sustainability performance in construction is still limited [1].

According to Shi et al.'s [5] conclusions, sustainability is only achievable in construction "through the implementation of sustainable development principles in the industry". This collaborates the United Nations' Sustainable Development Goal 9: "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation". Araujo et al. [6] recognized

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the environment, economy and society as the three cardinals of sustainability principles. Aarseth et al. [7] refer to the interaction with these three sustainability cardinals as managing the relationship between humans and the resources usage in infrastructural development. Hence, sustainable infrastructure management (SIM) is the economic and “collective management processes” that reduce negative impacts of infrastructural activities on the environment [8]. This justifies Li et al.’s [4] development of a measurable assessment of the environmental impacts of construction by applying life cycle assessment methodology to construction processes, although the study is limited to equipment and materials. Similarly, Kwofie et al. [9] endorsed the adoption of life cycle assessment for construction. Luu et al. [10] recommended (i) innovating organizational structure, (ii) effectively managing construction processes (iii) stepping up cost control and (iv) improving equipment management, for the implementation of sustainability. The study validates the adaptation of SIM as a cultural change. Interestingly, Ugwu and Haupt [11] translated the global sustainability objectives to project-level multicriteria decision-making using analytical and computational model as the key performance indicators. This is important as SI through digitalization is essential in today’s SIM. This discovery led Vilasini et al. [2] to propose the model and methodology for automation of construction management processes as part of integrated sustainability appraisal in infrastructure design and construction. Recently, Pan and Zhang [12] also acknowledged that construction management is constantly revolutionizing into digitalization and intelligence to fit and realize automation, optimization and reliability for sustainability. Tools like artificial intelligence (AI), emotional intelligence (EI), internet of things (IoT), building information modeling (BIM), both 3D and 4D productions facilitate SIM through SI [13, 14].

SI is necessary because the Freeman’s stakeholder theory of 1984 diminishes profit maximization as the sole objective of construction project, but promotes equilibrium among stakeholders’ expectation as essential requirement for mid-/long-term success [15]. Unlike stakeholder management or engagement which focuses on informing and consulting, to control stakeholder expectations, SI necessitates a distinction between informing, consulting, and co-deciding [16]. SI focuses on matching the interests and expectations of stakeholders with project goals and objectives. These expectations span across the usage of resources and value chain creation across the entire construction process [6]. Thus, Rumane [17] insists that SIM requires “specialized attention” which address value, resources and expectation of stakeholders. Irrespective of its’ huge economic, social and environmental impacts, construction remains one of the most dangerous and complicated industries [12]. These inherent complexities in construction and sustainability requires specialized management skills and strategies to deliver SIM [18]. According to Simu and Lidelöw [19], strategies in management of sustainability is the focus on how a firm delivers values that meet project objectives and goals. To achieve all these, Matar et al. [20] advocated for application framework that integrates both sustainability and practices at operational level. Hence, this paper added to the body of knowledge by investigating the SI strategies for SIM, it further developed a stakeholder integration model which integrates all existing management processes, tools and strategies, identified challenges, hybrid skills and critical factors for complete SI and holistic cultural change for SIM in Africa. This was achieved through a systematic literature review and analysis of publications from 2002 to 2022 and qualitative data from semi-structured interviews exploring the identified trends and strategies around the global but with a special focus on Africa [21, 22, 23].

LITERATURE REVIEW

Stakeholder Integration in Planning and Design Management

Planning and design are part of the earliest stages in construction delivery and Aarseth et al. [7] refer to planning and design as directions and strategies towards achieving sustainable infrastructure. Emphasizing sustainability at project planning and design is strategic for SIM [24]. Interestingly, project planning and design is not a linear process because it mostly involves iterations, sometimes with unavoidable repetitions and reworks [25]. This is responsible for the causes of design challenges as identified by Sha'ar et al. [26]. Anumba et al. [27] had declared that multi-agent system or SI, which stimulates and demonstrates interaction, communication and negotiation amongst different stakeholders is critical for a collaborative design. This critically demonstrates that sustainable designs are complex, contested, and negotiated by stakeholders. Nonetheless, quality management, enhanced through SI, is crucial in the planning and design of sustainable infrastructure. Therefore, Keenan and Rostami [28] proposed superior managerial control, recording and reduction in defects as immediate improvements in sustainability when implementing any quality management system. However, superior managerial control requires a comprehensive integration system. Shi et al. [5] promote the adoption of last planner systems (LPS) inspired by lean philosophy, which emphasis what "can" be done instead of what "should" be done. What can be done in this case, is a complete SI at the planning and design stage in SIM [29, 30].

Nevertheless, lack of digital integration at the early phase of project planning and design was flagged as a challenge by Le et al. [31]. The scholars recommended collaborative planning and design, plus application of Building Information Modelling (BIM) tools and lean construction for SIM. Interestingly, countries are adopting these practices across the world. In Norway for example, Aarseth et al. [7] revealed that SIM requires policies for "robust" planning and detailed design construction. Robust in their context implies completeness or integrated approach to development [32]. Equally, Bossink [33] disclosed how the Dutch authorities' SIM policy requirements generated innovation through a detailed project design. Also In China, Shen et al. [34] revealed that the project feasibility study and its integrating sustainability role remains the focus of regulators and police makers. Studies by Aarseth et al. [7]; Shen et al. [34] and Bossink [33] highlighted the importance of government as a responsible stakeholder for the promotion of sustainability at planning and design phase. Feasibility study is critical for the sustainability of design during planning. For sustainability and effective management, Yadav et al. [35] insist the design process must be interactive, align with project objectives, adaptive, be less wasteful, and give room for self-modification. Even though most efforts in project planning and design are economic, Solaimani and Sedighi [36] insist that stakeholders must enable more socially and environmentally conscious planning and design in SC. These studies [9, 37, 38] recommend that lifecycle management and value management are critical methods to adopt at project planning and design phase of SC.

Additionally, provision of sustainability indicators is also crucial at planning, design and through construction, operation, maintenance and demolition [39]. Cheng et al. [40] focused on teamwork planning for construction with two emphases. Firstly, to determine the maximum labor a project requires and secondly, to identify the future of expected labor range which is important for effective resources allocation, project budgeting and scheduling. Hartmann et al. [41] observed that it is possible to align the organization, project and technology. This alignment offers an in depth understanding of the underlying project management strategy to guide the operations of a project team by integrating digital functionality across construction management processes. Aligning digital tools closely to the work practices of the construction teams helps implement cumbersome work process [41]. Yadav et al. [35] insist that this will ensure that performance which includes team responsibility and team operation aligns with project objectives. While elaborating on digital tools for collaborative design, Anumba et al. [27] described its potential as the future.

Stakeholder Integration for Construction, Maintenance and Demolition Management

A study to understand and categorize the causes of delays in Moroccan construction industry, identified the client, contractor, consultant/designer, finance, planning and scheduling, communication and contractual relationship, materials, labor and equipment, and external influences [42]. While post project planning and design, identifying key factors to management strategy is critical to SIM [36, 43]. El-Sawalhi and Hammad [44] referred to stakeholders as the major causes of uncertainty in construction execution. Sha'ar et al. [26] identified stakeholders (interface) management as the key success factor in SC. This was demonstrated in Shanghai World Expo 2010 by Shi et al. [5]. Ross et al. [45] reviewed seven sustainability principles; maximize resource reuse, use renewables, recyclables or recycled resources, protect the natural environment, minimize resource consumption, pursue quality in built environment, create a healthy, non-toxic environment and promote socioeconomic uplifting. In Hong Kong, studies [46, 47] reported that prefabricated construction is more sustainable than traditional construction. In the United States of America, Haupt and Whiteman [48] recommended the implementation of total quality management, which encourages constant feedbacks across all stakeholders in construction, and emphasized the development of managers competencies in this regard. Chileshe and Kikwasi [49] acknowledged the significance of competencies in risk assessment and management practices for sustainability in Tanzania construction industry. Focusing on sustainable management capacity, scholars [44, 50–53] highlight the importance of project manager’s skills and competencies development for the success of SIM, with some authors [18, 54] emphatic about digitalization of the construction management skills and competencies.

Additionally, Abbas et al. [55] emphasized the need for integration of BIM to meet the demand of digital approach to SIM. BIM tools have influenced a paradigm shift to stakeholder integration, focusing on both social and technical collaborations [12]. This information systems guarantees provision of information first, where action is most needed [35]. The benefits of BIM in SIM as presented by Hartmann et al. [41], is that BIM as a digital management process and tools facilitate interoperability of data and all phases of construction and engineering, with the advantage of improved communication and collaboration within stakeholders and across all phases of the project. Although Le et al. [56] believe that BIM systems’ moderate supports to operational and tactical issues like process standardization, problem-solving, and information sharing can be advanced in Canadian construction. However, within the past decade, there has been a surge in the automation and digitalization of construction management processes throughout the lifecycle of projects, featuring smart robotics, augmented reality (AR), virtual reality (VR), AI, 4D printing, blockchain and digital twins [12]. Remote, virtual, and visual management is effective in managing and stimulating stakeholder integration [57]. These have positive impact on individual or team management, monitoring, control, and workplace conditions, performance [58, 59] and safety [52, 60, 61].

Interestingly, the lean construction or lean management is built on a need-based evolutionary management system according to Yadav et al. [35]. The main aim of lean construction is to provide a quality product while also ensuring that the product does not cost too much [62]. These costs to the customer could be economic, social and environmental. Gupta and Jain [62] highlighted that lean construction produces an operational and cultural environment that is highly conducive to waste minimization. Identification and elimination of waste is the hallmark of lean philosophy and by extension sustainable infrastructure delivery [53]. Enshassi et al. [63] grouped the barriers to lean construction into six categories: management, educational, financial, governmental, technical and human attitudinal. While poor and low productivity is one of the most significant challenges of SIM according to Hamza et al. [36] study. This study explored the integration of lean in the construction management, revealing the barriers, challenges, organizational culture and framework to lean transformation and implementation. In Bangladesh for example, lean construction promotes waste management and environment protection as reported by Hasan et al. [64]. The study also revealed that although female managers appear to be more competent in this regard, although they are very few in the sector due to cultural barriers. The focus behind the adoption of lean in construction is economic competencies, creation and preservation of social and environmental values [36]. Therefore, integration of lean construction is all about sustainability mentality and culture [65, 66].

Furthermore, encouraging a culture of integration, co-operation and teamwork, were proven by Keenan and Rostami [28] to increase construction performance as time progresses. Interestingly, cultural challenge to implementation of integration for co-operative and sustainable management in Africa was flagged by Dansoh et al. [32]’s confirmation of the influences of traditional authorities and communities on infrastructural development in Ghana. This collaborates Ugwu and Haupt [11] recommendation that integrating local stakeholders must be part of the overall SIM in African countries. Similarly, Tchumtcha [67] described Chinese project management strategy as unsustainable in Africa, because its disregards the integration of community-based stakeholders. The study revealed that contrary to the perception that the Chinese project management style is relationship oriented, informal or "Guanxi" as applicable outside Africa, it is rather strictly formal, contractual and exclusive in Africa. And its secrecy breeds corruption and dissatisfaction amongst stakeholders. This is contrary to established stakeholder management guidelines and regulations widely acceptable even in China as demonstrated during Shanghai World Expo 2010 [5]. In Brazil, Monteiro et al. [68] suggest structural management change which promotes integration and transparency to mitigate corruption in SIM. Lawani and Moore [69] argued that since sustainability deals with diverse individual behaviour of stakeholders, emotional intelligence (EI) is critical in enhancing the performance of SC. EI is a contentious issue in construction industry, due to the acclaimed characteristics of the industry, which include aggressive/authoritative management styles [70] like the Chinese project management style [71]; male-dominance culture [64]; transient workforce; transactional relationships [72, 73]; and fierce competition [74]. These perceptions of the construction industry are believed to emanate from early scientific management systems which were independent, impersonal and just instruments of rationalization with no place for emotions [75]. And they do not meet the collective objectives of the stakeholders and hence are unsustainable for construction.

MATERIALS AND METHODS

We approached this study from a systematic literature review which is a superior literature review method, especially in terms of transparency and replicability [7]. It is also a very familiar research methodology which was recently modelled by Cheng et al. [40]. As shown in Figure 1, publications produced between 2002 and 2022 from 6 renowned journals of architecture, engineering, and construction areas in three comprehensive databases; Google Scholar, SCOPUS, Web of Science were searched, filtered, evaluated and interesting publications were thoroughly investigated. The selection of these three databases was based on their output quantity and influence factors [76]. The key words such as stakeholder integration (SI) for sustainable construction (SC) were adopted as a set of search code. Trial-and-error combination with words like stakeholder management, stakeholder engagement, sustainability or sustainable infra-structure were also used to narrow the search focus. In all, 77 relevant and peer-reviewed papers were selected and thoroughly analyzed. At the end, these 77 papers were selected and rigorously reviewed. Previous studies [1, 71] on SIM were conducted using this same review method.

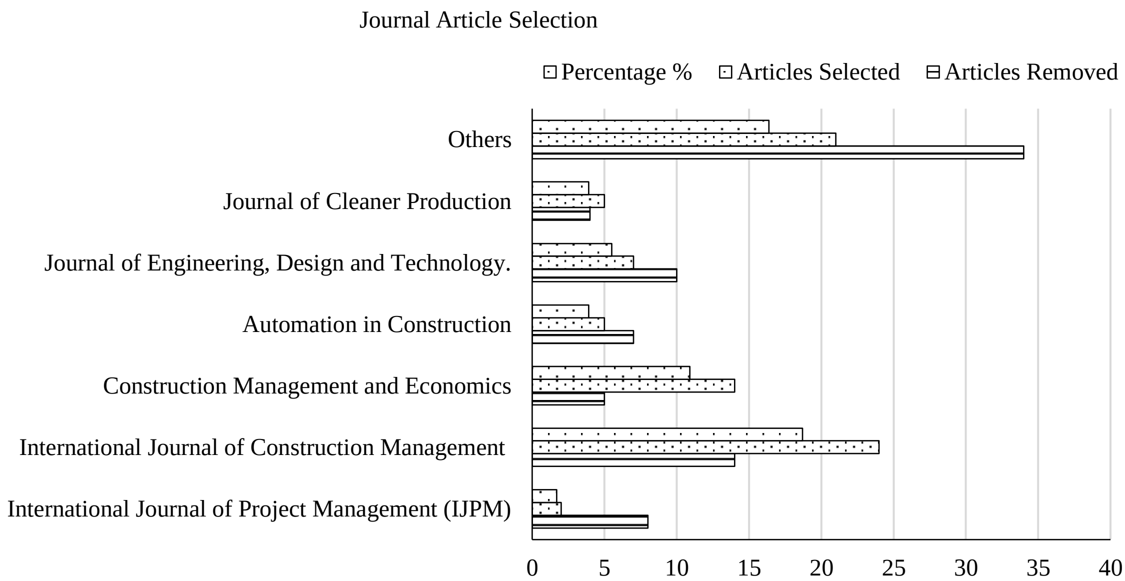

Figure 1. Journal articles retrieval and selection.

Additionally, semi-structured interview of 20 practicing managers of African public infrastructure were conducted virtually to further explored the identified trends and strategies in other to achieve our research objective of developing an effective stakeholder integration model for the African built environment. The interview was designed to explore African SIM as a case study. As Tchumtcha [71] had reported that Chinese SIM approach in Africa is formal, contract focused and not relational or “Guanxi” as presented. We further explored the cultural challenges to SI in African SIM and the influences of African institutions and authorities as identified by Dansoh et al. [32]. A content analysis technique was ascertained as the appropriate approach to establish this study [76]. Elo and Kyngas [77] validated content analysis as a flexible approach to document analysis. Identification of the substantive interest and determination of type of content analysis are the steps recommended by Fellows and Liu [78] for undertaking a content analysis. Quality content analysis tends to analyze the papers’ content, which are then methodically coded and grouped based on topics and conclusions [79]. Content analysis using coding of thematic patterns was used to analyze the data from both the selected journal articles and the interview transcribes of this study.

RESULTS AND DISCUSSION

Globally, the fluctuations in Figure 2 are indicative of the link between SI for SIM, economic and environmental challenges. Which suggest increased publications during and after every major global economic and environment disruptions in the past two decades. Thus, research focus on SI in SIM is directly proportional to economic and environmental challenges. This scholarly focus on these foremost two of the three cardinals of sustainability also received Larsson et al.’s [80] warning that sustainable solutions must have long-term and reliable benefits to all stakeholders and its procurement strategy should influence both the process and out-come. This must strengthen interrelated roles and responsibilities of stakeholders, taking into account principles of safety, stability resilience and harmony of construction and environment [81]. This is similar to Keenan and Rostami’s [28] superior managerial control recommendation. This is crucial because there exists a strong relationship between sustainability and SI according to Aarseth et al. [7]. Which implies that sustainability cannot be attain without SI. Unfortunately, sustainability is not important to African infrastructure developers because their focus is only on cost efficiency Zulu et al. [82]. And Tchumtcha [71] warns that partial SI like Hancock and Tyler [75]’s scientific or formal management system which is currently practiced in African, especially by the Chinese is unsustainable and conflict prone as collaborated by the interviewees in this study (Annex 1).

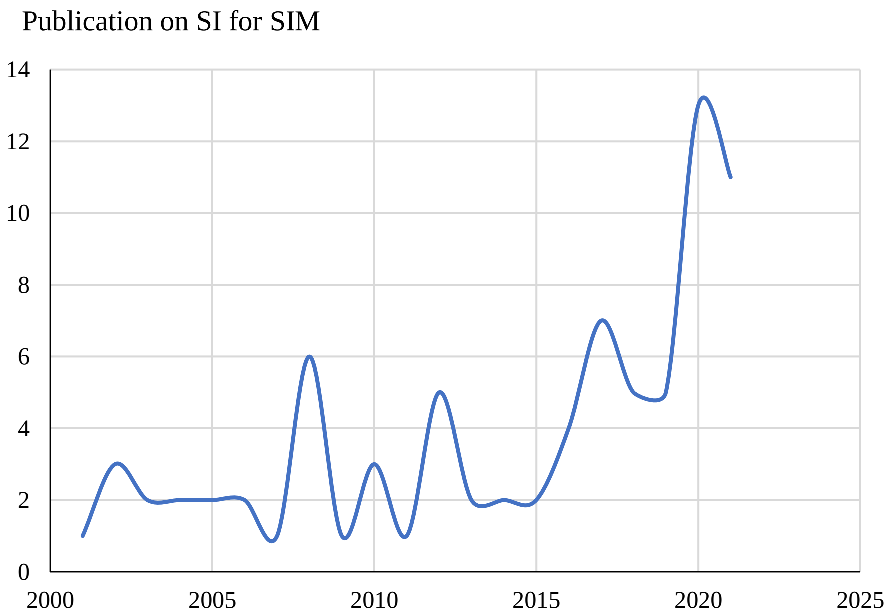

Figure 2. Publication on stakeholder integration (SI) for Sustainable Infrastructure Management (SIM): 2002–2022.

Interestingly, the 20 construction managers interviewed answered “yes” that they have directly been involved in Chinese SIM in Africa with no SI. Remarkably, all the interviewees are of the opinion that there are no SI in African infrastructural projects executed by Chinese contractors, the interviewees identified challenges to SI in infrastructure management in Africa especially in project design and scope, finance and execution, skills and competencies to include “lack of transparency towards all stakeholders”. The interviewees emphasized that the Chinese project management approach in Africa is not inclusive, but concentrated on the core clients. and a “divide and rule mentality”. They also accused the Chinese contractors of ignoring locally experienced and certified experts to “migrate untrained and incarcerated Chinese” as free or cheap labor. All the interviewees are of the opinion that this approach breeds corruption, nepotism, and conflicts. Some expressed concerns that the Chinese approach is about “exploitation of the host environment and communities”, which the interviewees blame on “weak laws and enforcement” as a result of “bribery”. Another interviewee added that the Chinese are aggressive when working with Africans, which leads to “unhealthy relationship and learning” of the projects by the African stakeholders. Others added “lack of standardized or proper managerial style”, “lack of quality control”, “unguaranteed stakeholders” expectations” to the list of challenges SI in African SC.

The implication is that key performance indicators of cost, quality and time may requires SI, safety and wellbeing to be satisfactory, at least in Africa [83, 84, 82], India [85], and Middle East [44] regions. Interestingly, Maiti and Choi [86] had also identified lack of SI as the greatest cause of conflict in construction industry. Which collaborates Hamza et al. [50] conclusions, that “peoples factors” show the highest inconsistency of all project resources as well as the major source of risk. Similarly, Ingle and Mahesh [85] rank customer relations and safety in the top two construction stakeholders’ satisfaction index in India. Implementation of these factors will require complete SI. The interviewees collaborate El-Sawalhi and Hammad’s [44] recommendation that manager’s sustainability skills and competencies, transparent operations and evaluation of the alternative solutions, effective communication – including use of local language, setting common project goals and objectives, and exploring the stakeholders' needs and expectations as factors complete SI. However, Lawani and Moore [69] warned that this must take into consideration both cultural orientation and nature of the activities. To simplify, Liu et al. [86] indicate that culture directly drive the project management principles toward sustainability. They revealed that by influencing mediator factors of strategy, implementation, and reflection, culture is found to present an indirect influence on SC. And while influencing mediator factors of implementation and reflection, strategy is also found to indirectly influence SC.

Nonetheless, the gap in sustainability performance [64, 71, 82] identified through the analysis of SI for SIM studies conducted from 2002 to 2022 established a neglect on human factors of sustainability. To address this gap, this study emphasizes the development of stakeholder integration model and identification of managers’ skills for complete SI in all tools, systems and strategies, across all stages of project management. The stakeholder integration model introduces and addresses the change culture and hybrid skills which Zainon et al. [87] ranked as the top two skills for SI in Malaysian construction industry. This structural change which will be facilitated through the stakeholder integration model will reduce waste and corruption in delivery of SIM [68]. Other skills and factors identified by the interviewees includes “team building”, “time management”, “monitoring and feedback”, “affordability and financial control”, “consistent procurement process”, “anti-corruption”, “inclusive and fair contracting” to address project design, scope, specification and working conditions for everyone. Others are “accountability”, “use of local language”, “stronger laws and enforcement”, “due process”, “early stakeholder engagement”, “safety and wellbeing”, “quality control”, “technical knowhow”, “experience and integrity”, “adherence to UNSDG9”, “effective cost analysis”, “focus on stakeholders needs and expectations”, “competitive process”, “adherence to specialization”, “training and knowledge sharing” “ethics and code of conduct”.

These strategies, skills, and factors were considered and incorporated in the design and development of the SIM demonstrated in Figure 3.

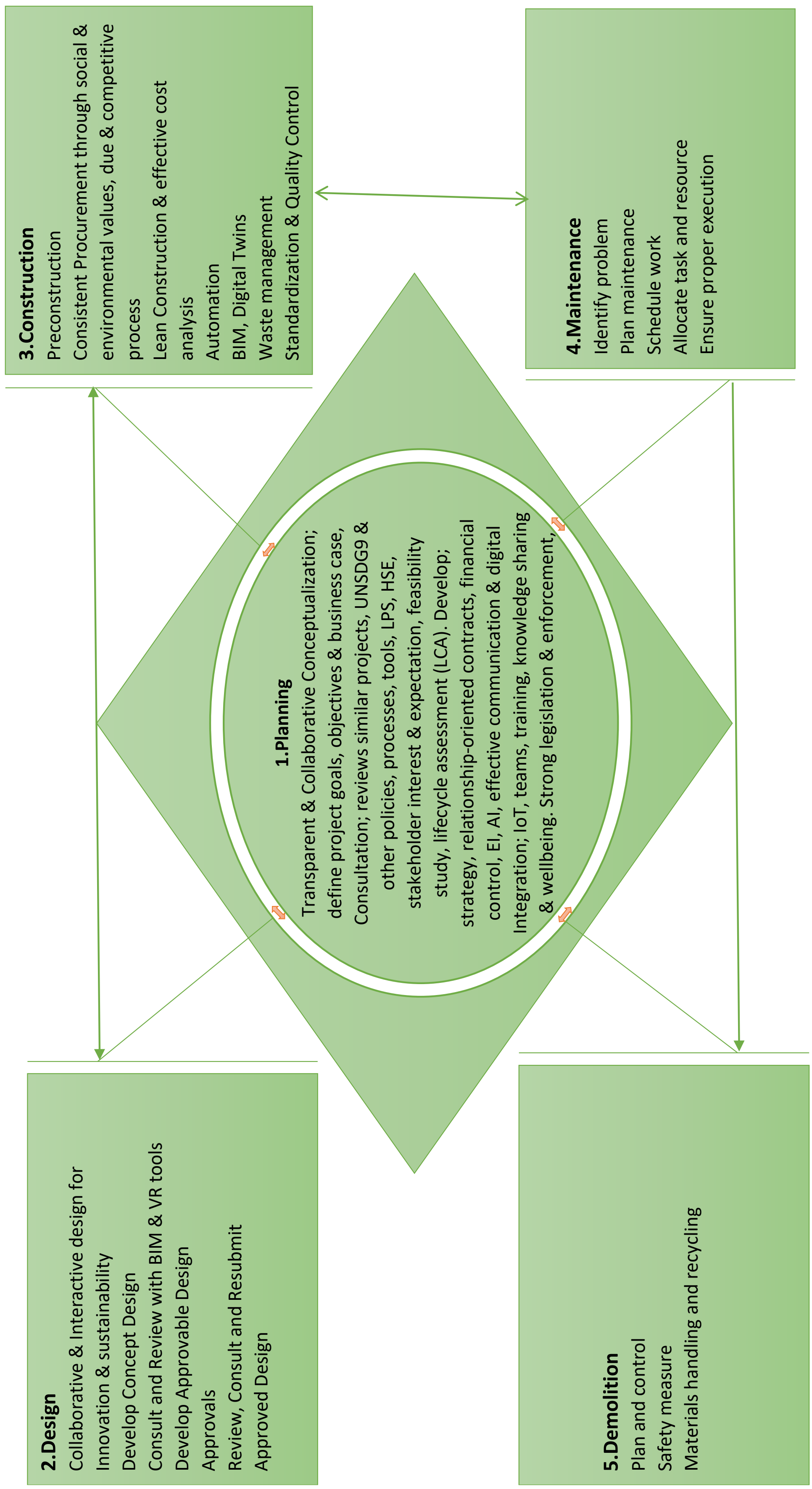

Figure 3. Stakeholder integration model for sustainable infrastructure management in Africa.

Planning should be transparent, collaborative to all stakeholders. Project conceptualization should establish clear goals, objectives and business cases should properly be defined. Consultation should include review of lessons from similar projects, UNSDG9 and other relevant policies, tools, strategies, stakeholders' interest and expectations. Then develop relationship-orientated contracts and operation strategies. Team or labor planning, health, safety, and well-being as well as life cycle assessment (LCA) offers a more robust and feasible project planning and design. Multi-agent system for collaborative designs among the stakeholders enabled by BIM compliant tools should be deployed for interactive design with focus on lean philosophy of economic and environmental efficient designs. Design should be inclusive and align with sustainability aims and objectives of the project, addressing social concerns. Application of lean construction provides a quality and ensures affordability; integrating all stakeholders to digitally generate intelligences for enhanced and robust co-decision makings; emphasis on the use of renewables, recycled resources and protection of natural environment; promotion of health, safety, and well-being of all stakeholders; structural and cultural management change which promotes integration and transparency to mitigate corruption in construction and post construction maintenance. Complete SI to enable holistic identification of problems, development of viable maintenance plan, competent work allocation and schedule which guarantees proper emotion. Demolition should be well planned and controlled with SI concerns and expectation captured for safety and materials management. Emphasis must be on the use of renewables, recycled resources and protection of natural environment. Promoting health and safety of all operatives and stakeholders is important.

CONCLUSIONS

Through this study, we have examined other existing studies on SI for SIM and interviewed 20 experienced managers in Africa. Evidences from the 77 analyzed papers across 6 major construction management journals and 20 others, suggest an imbalanced focus on economic and environmental factors of sustainability in the last 20 years. Notably, a fluctuation in publication output exists between 2002 and 2017 and a massive spike in publication in 2020 with a decline curve in 2021. Clearly, SI discussions for SIM are directly proportional to economic and environmental challenges. Processes like planning, design, manufacturing, construction, maintenance, and demolition require complete SI for sustainability. Evidence from the African construction managers indicate lack of transparency and integration of stakeholders in Africa. Hence, SIM should demonstrate the complete integration of all stakeholders across the construction management tools, systems and processes like planning, design, construction, maintenance, and demolition. SIM should provide the integration of skills, digital and technological competencies, lean philosophy, focus on the needs, expectations and well-being of all stakeholders.

This study not only identifies pattern of publication in SI for SIM in the past 20 years, but also provokes more attention and study in SI with a focus in Africa. It further calls for sustained focus of policy makers and researchers on SI for SIM in Africa. It reintroduced "the people factor", to attain the social construes of sustainability. Consequently, stakeholder integration model was developed. It also identified challenges, hybrid skills and critical factors to complete SI for SIM in Africa. However, further study is required to improve and validate the SIM in the industry, further explore the challenges, hybrid skills and critical factors of complete SI in SIM with perspective of different cultures and geographical regions in the African built environment.

Author Contributions

Conceptualization, U. Onyia; methodology, U. Onyia; validation, U. Onyia; formal analysis, U. Onyia; investigation, U. Onyia; resources, U. Onyia; data curation, U. Onyia; writing—original draft preparation, U. Onyia; writing—review and editing, U. Onyia; visualization, U. Onyia; supervision, U. Onyia; project administration, U. Onyia.

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