

A review of success factors for the adoption of green construction site practices in developing countries

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ABSTRACT

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The advocates of sustainability in the construction process have identified some conditions whose presence are necessary to facilitate the smooth and seamless adoption of green practices on construction sites, to ensure sustainability of the environment. These conditions have been referred to as success factors. This paper presents a detailed review of success factors (SFs) needed for contractors to successfully adopt green practices on construction sites in developing countries. Peer reviewed articles published in reputable journals were reviewed. By systematically reviewing 51 recent literatures related to the subject matter, many success factors for green practices adoption on construction sites were identified. The factors identified include: client related factors, contracting organization related factors, the economic factors of the construction area, environmental factors, site related factors, other stakeholders' factors among many others. It is concluded that various success factors for the adoption of green construction site practices (GCSPs) with each interacting with the others. This paper will improve the understanding of contractors on the various factors that interplay to create an environment supportive for the adoption of green construction practices (GCPs) on construction sites based on the peculiarities of the construction environment in developing countries. It is recommended that clients and contractors should take note of these factors during the conception of the construction projects to ensure a smooth adoption process of green site practices.

Keywords: adoption; developing countries; green construction site practices; success factors

Introduction

The construction industry contributes greatly to economic development and also has significant impact on the natural environment and the socio-economic wellbeing of humans [1]. As a result of construction site activities, various environmental problems have arisen. Some of these problems include greenhouse gas emission, indoor and outdoor environmental pollution and general ecological impacts [2]. In an attempt to solve these problems, there tend to be a shift from conventional (traditional) ways of construction to a more environmentally friendly green practices [1]. This necessitates the adoption of new processes, new technologies, and management styles to reduce environmental impact of construction site activities to the environment.

The adoption of green construction site practices (GCSPs) and the development of green/sustainable buildings



encounters a variety of challenges in developing countries [3]. There is a rapid population growth in most developing countries which comes with increased demands for shelter, water and other natural resources needed for human survival [4]. Despite the fact that buildings and other infrastructural projects are necessary to meet the demands of the rising population in developing countries, construction site activities depletes natural resources by the enormous consumption of energy and other resources and causes significant stress on the natural environment [5]. Ugwu and Haupt [6] reinstated the opinion of Wu, Mao [5] by stating that there is a massive investment in infrastructure such as housing, roads, bridges etc. in developing countries with the aim of bridging the housing and infrastructure deficit and to aid in the stimulation of the economy, but it comes at a great cost to the natural environment. Also Ali and Al Nsairat [7] states that construction activities comes with a myriad of sustainability issues ranging from environmental, social and economic issues, since construction projects are still largely carried out using conventional methods. This is more so because of the poor and inefficient use of resources [8].

Construction projects plays a major role in the attainment of sustainability, thus green construction site practices need to be given due attention. Green Construction Site Practices(GCSPs) are a combination of various onsite practices aimed at reducing the impact of construction on the natural environment and it includes practices such as recycling, resource conservation, waste reduction management, environmental protection, regulatory compliance, pollution control and a host of other issues [9-11]. Putting it differently Kozlowski [12] describes GCSPs as practices aimed at water conservation, reuse of construction materials, use of materials with recycled content and minimization of site disruption. Examples of GCSPs include, energy management, waste management, materials management, dust pollution mitigation, stormwater management, and sustainable site layout planning and development [13]. For these practices to be adopted seamlessly on construction sites, certain conditions need to present, and these enabling conditions are referred to in this study as success factors.

The phrase “success factors” have been made use of severally in many fields, areas and different situations [14]. [14] described success factors as a few/limited/narrow aspects that attention needs to be paid to so as to guarantee success for an organization in achieving its target. If continuous attention is paid to the success factors, high performance outcomes will be guaranteed in the particular activity in which the organization partakes [15], which for the purpose of this research is adoption of GCSPs. Many developing countries particularly those that have green rating tools have developed unambiguous success factors aimed at ensuring successful adoption of green construction site practices. That notwithstanding, some universal success factors are common to these countries [16]. This study laid emphasis on these shared success factors and provides elaborate discussions about them.

Methodology

This study was conducted based on a systematic and comprehensive review of relevant literature from previous researches on success factors for adoption of GCSPs with particular focus on developing countries. Many researches in the field of construction management have used literature review as a methodology for promoting/increasing knowledge on specific topics or areas of interest [17]. The research was based on the review of academic

scholarly literatures obtained through internet searches using Scopus search engine, web of science, IEEEExplore and google scholar. These search engines were used because of the following reasons; they cover a wide spectrum of fields; they contain articles that possess high quality and current information [8].

The online searches were carried out using the following key words and phrases; “success factors”, “adoption of green practices”, “sustainable construction practices”, “low carbon construction”, and “green success factors”. The method of document content analysis was also used. The document content analysis used involved an elaborate and investigative theoretical review of literatures that are related to the success factors for adoption of green construction sites practices in developing countries. Spiller, McIntosh [18] defined document content analysis as a technique used in academic research for determining the presence/availability of certain words, phrases, or concepts within a body or collection of texts and attempts to take stock of the contents in terms of already selected categories (predetermined categories) and in a well thought out and repeatable(replicable) manner.

The predetermined categories in this study include, client knowledge of green buildings, technical and management ability of the contractor, government support, client support and commitment to green buildings, effective communication channels/feedback, internal company management and incentives that facilitate adoption of green/sustainable construction site practices. It is worthy of note that other key words or phrases could be used for this literature search, but the ones chosen was for convenience purposes to have a number of papers that can be adequately managed. 1,300 papers were initially identified but after going through them, 51 were deemed as been best suited for this research based on the following criteria:

- Papers reviewed must be papers that were based on qualitative and/or quantitative methods of research
- The papers must be from peer reviewed journals.

The search was conducted under the “article title, abstract, keywords” section with document type “article or review” and date range was set at “published all years to present”. A flow diagram showing the method adopted in selection of the articles for review is presented in Figure 1 below:

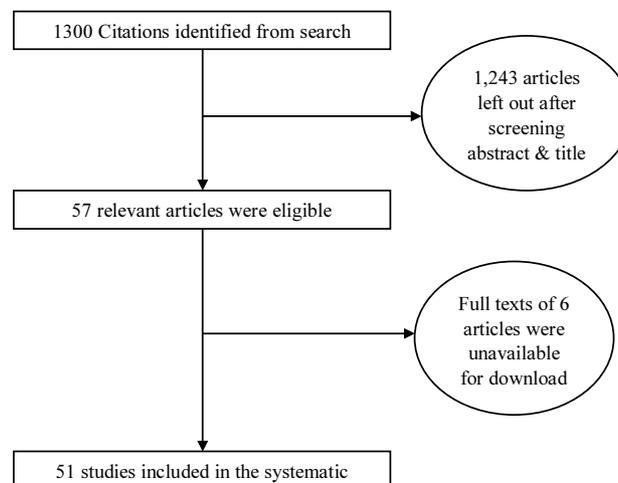


Figure 1. Flow chart showing the selection process of the articles for review.

Review of Success Factors

Definition of Developing Countries

The classification of countries as either developed or developing has no institutional basis [19]. No known convention of the United Nations has any designation of such for countries [20]. One hundred and ninety-three (193) countries which are recognized by the United Nations are categorized thus: 44 countries are categorized as developed; 12 countries in Eastern Europe, Caucasus and Central Asia are classified as transition economies; while 137 countries are said to be developing countries. The latter is subdivided in 54 countries in Africa, 33 countries in Latin America and the Caribbean, 38 countries in Asia and 12 countries in Oceania [19].

For developing countries, the United Nations decides on the countries to be included in the list [20]. The report of the World Bank on this classification is much more linear and less ambiguous. The classification by the World Bank is based on the level of gross national income [21] per capita: Low income countries (LICs), Middle income countries (MICs) subdivided in Lower Middle income countries (LMICs) and Upper Middle income countries (UMICs); and High income countries (HICs). The figures for 2010 are Gross National Income (GNI) per capital of US\$1,005 or less for LICs, GNI per capital higher than US\$1,006 and less than US\$3,975 for LMICs, GNI per capital higher than US\$3,976 but less than US\$12,275 for LMICs, and GNI per capita of US\$12,276 or over for HICs [22].

Success Factors for the Adoption of Green Construction Site Practices

From the various papers reviewed, the identified success factors are discussed next.

Government Support

Government support is a key success factor for adoption of green construction site practices [23]. Government support for a more sustainable environment, such as tax waivers, and financial support from financing markets in the form of low interest loans for developers of green site practices could encourage adoption in developing countries [24]. Government's endorsement and promotion of sustainable means of construction can accelerate its adoption in a country because that can validate the effectiveness of the technology to the public and hence rally support for its adoption [25]. Government support could also be in the form of provision of directions and guidelines, providing help in terms of logistics and training, and making available the required resources to aid contractors who intend to build in a sustainable way.

Client Support and Commitment to Green Construction

The qualities of the client is a crucial factor in determining the success or otherwise of green construction site practices. The seriousness and the zeal of the client or project owner to implement green construction site practices and their willingness to provide the required resources for such to be accomplished determines the success or otherwise of the project [26]. The successful adoption of green construction site practices greatly depends on the

clients performance [27], in the aspect of support for and commitment to adoption of new technologies on site, acceptance and support for green construction methods, and also adequate provision of funds for successful project execution. Clients' interests and the general demand for adoption of green construction is one of the keys to its success. This implies that construction practitioners in developing countries are in a market where the demand for sustainable practices is low [28]. When the client shows little or no interest in sustainable site practices, the contractor will not be motivated to engage in such a practice [29]. Therefore, consumer interest and demand is a significant success factor for green adoption in developing countries.

Troubleshooting

Trouble shooting can also be referred to as problem solving [30]. In the process of carrying out various construction site activities, the members of the construction team could encounter some hitches or challenges be it operational or technical in nature and this may result in the release of pollutants to the environment. An effective trouble shooting mechanism will ensure the problem is addressed before it causes much harm to the natural environment. The environmental impact of construction activities can be greatly reduced if the construction team can provide fast solutions [24]. Therefore, effective and efficient troubleshooting is very important to successfully adopt green site practices in developing countries.

Effective Communication Channels/Feedback Mechanism

In construction projects, stakeholders such as client, contractor, suppliers, the community, and the government have been identified as important for successful execution of projects, particularly so in projects aimed at having minimal environmental impact, which means these stakeholders have strong correlations with success factors [31]. Effective communication among the project team members increases the ease and also the pace with which problems are solved [32]. Communication (constant interaction) between the clients, construction firm and other construction stakeholders on the other hand is essential for success [33]. Feedback is a mechanism for operators to inform the decision makers of the status of planned activities, for instance, from project managers to designers or from builders to project managers. Effective feedback can give decision makers a chance to make timely adjustments to continually improve environmental performance. Green construction often incorporates innovative techniques and management methods, which make effective feedback indispensable for a project organization.

Management of Stakeholders

A stakeholder in a construction project can be a person, group of persons or a corporate organization whose interests are tied to the success of the project and the surrounding environment in which the construction takes place. The stakeholders in any construction projects include; initiators, contractors, institutions designers etc. [34]. For the adoption of green construction site practices to be a success, the construction team or the contractor as the case may be has to identify the stakeholders and manage their differing demands, also their interests needs to be

captured appropriately during the early stages of the project to have a seamless adoption [35]. To perform this function, the construction manager needs to possess good managerial skills which could be acquired through many years of experience, and constant training and retraining to enhance his capabilities.

Competence of Project Team/Stakeholders

The expertise exhibited by the team put together for the purpose of a green construction project determines its success or otherwise [36]. The knowledge and awareness of project team members gained through regular practice, training and retraining would increase their competence in engaging in green practices on sites particularly in developing countries where knowledge of green practices is relatively low [3]. Love, Niedzweicki [37] also opined that when looking at success factors from the perspective of the different construction stakeholders, the competence of the stakeholders is vital. In this case, the stakeholders been referred to includes the various site operatives, client representatives, site workers, green building suppliers and the contractor himself.

Technical and Management Ability of Contractor and Project Manager

In any construction project, it is the duty of the contractor to perform preconstruction activities (such as the selection of construction methods) and construction activities such as, installation of services, casting of concrete, excavation works, selection and use of plant and equipment, and the general management of human and material resources on the construction site [38]. The energy consumed (which includes the initial embodied energy of the building, energy utilized during building materials procurement, transportation (transport of site operatives, transportation of building materials, plant and equipment transportation)) , the quantity of building materials utilized, the amount of waste generated, the quantity of water used and the overall environmental impact of the construction project from the beginning to the end of the construction project largely depends on the technical and managerial capacity of the contractor [39].

This success factor applies to the contractor and his/her team since the technical and managerial aspects of activities on construction sites is headed and controlled by the contractor or contracting organization [40]. Construction teams that lack the requisite skills and know-how on how to implement green practices would be able to execute projects using green principles and techniques [41]. This submission was also affirmed by Gudienė, Banaitis [35] who identified experience, technical and professional capability as characteristics required for project managers to adopt green practices. In developing countries, there is a shortage of skills and inadequate training on sustainable site practices [42]. Staff training on sustainability issues and new construction technology is a prerequisite for successful adoption of green practices [43]. Also, dedication of top and middle management of construction organizations, and commitment to ensure green construction site practices are adhered to is a success factor for green site practices adoption.

Incentive Schemes and Regulations

The adoption of green practices to a large extent is dependent on the availability of incentive instrument [44]. Ozdemir [45] defined incentives as that which changes or modifies one's attitude/behavior to act in a desirable way. Incentives from government is the top success factor for adoption of green site practices [46]. Governments in many parts of the developed and developing countries have initiated incentive schemes to ensure successful adoption of green practices [47]. But in most of these countries, the rate of adoption is still very low [48].

Some studies suggest that when government legislation and regulations are blended with appropriate subsidies to cover for the extra costs that could be incurred as a result of adoption [49], it ultimately results in a successful adoption process particularly in developing countries where awareness of the green construction benefits are very low. It is generally accepted that any form of adoption in the construction industry is largely dependent on government policies and regulations. This is a success factor in developing countries since it is expected that individuals, companies and other stakeholders dither to take actions if necessary, regulations aren't in place. The promotion of adoption of green site practices in the construction industry is to a large extent dependent upon government policies and regulations [50].

Summary of Success Factors

The Success Factors (SFs) for the adoption of green construction site practices identified from previous literature are presented in Table 1 below.

Table 1. The Success Factors (SFs) for the Adoption of Green Construction Site Practices

Success Factors	References
Government support	[24, 25, 51]
Client support and commitment to green construction	[26, 28]
Troubleshooting	[24, 30]
Effective communication channels/feedback mechanism	[30, 31, 33, 52]
Management of stakeholders	Gudienė, Banaitis [35]
Competence of project team/stakeholders	[37, 53, 54]
Technical & management's ability of contractor & project manager	[35, 39, 41, 43]
Incentives schemes and regulations	[44, 46, 50]

Discussion

The successful adoption of green construction site practices in developing countries is made possible by a number of success factors. The success factors identified in this study include government support, client support and commitment to green buildings, troubleshooting, effective communication channels/Feedback mechanism, management of stakeholders, competence of project team/stakeholders, technical and management ability of contractor and project manager, availability of rating tools, incentives schemes and regulations. These factors do not act

independent of each other, they interact to ensure the overall success of adoption of green construction site practices.

Some of the identified factors are relevant for multiple stakeholders while some are stakeholder specific. Each construction stakeholder has a specific role to play for success to be achieved in green construction site practices adoption. For instance, if the government is the client, the government spells out the regulations which has to be adhered to in any construction work while at the same time giving incentives to encourage adherence to its regulations. But with respect to the developer or construction organization, the incentives come from within. The construction organization may decide to provide incentives by way of giving bonuses and promotion to workers who undertake green practices, and this serves as a great incentive. Incentive schemes and regulations as a success factor can also be classified as a form of government support but it was separated in this study for convenience sake since incentives could also be from the construction organization.

Government support in the form of tax holidays for companies that engage in green practices, and the public endorsement of sustainability practices is key to project success. If the government endorses a particular practice or product, it tends to legitimize and promotes such a practice amongst clients and construction organizations which aids in its speedy adoption and increasing its demand. The technical and managerial capacity of the contractor is also very important for success in green practices adoption in construction sites. The identification, selection and coordination of workers with the requisite skills in green practices is necessary for a successful project. This success factor is two folds, it entails the management of members of the construction site team and the effective management of other construction stakeholders such as the client, material suppliers and other vested interests in the project. If there is no effective management of these stakeholders, there is likely to be a frosty relationship which leads to lack of synergy in achieving a unified goal and ultimately frustrates the adoption effort. The contractor also requires some technical skills on adoption of green practices which he can further imbibe in his team members. Such skills could be attained through trainings and regular green practice which translates into them gaining more experience.

Trouble shooting and effective communication/feedback work hand in hand for the success of any construction project. An effective trouble shooting mechanism ensures speedy resolution of issues and problem solving. For troubleshooting to be successful, it is required that there should be an effective communication and feedback mechanism. Internal communication between the project team members and also effective communication between the design team, the construction team and the client is required for successful adoption of green construction site practices. Overall, the client which could either be the government, an individual or a corporate organization needs to show support and commitment to green site practices otherwise all the efforts put in by the construction team would not yield the desired results. There is a need for awareness of the clients on the benefits of green construction to earn their support.

Conclusion

The study has identified various success factors for adoption of green construction site practices. Each of these factors relate with each other to achieve the required success but with different degrees of effect on overall success

of the adoption process. The success factors identified are not only peculiar in developing countries but are more noticeable in them because of a seemingly lack of appropriate structures, low level of awareness and a great demand to meet the housing and other infrastructure needs. Also, so much effort is been placed on infrastructure development without taking cognizance of the accompanying environmental impact. It is therefore concluded that all construction industry stakeholders should get acquainted with these success factors and work towards achieving them if they are to successfully adopt green construction site practices.

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