

# “Study on greening project management practices for sustainable construction: A Review”

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## ABSTRACT

*By raising awareness of environmental problems and growing concerns about climate change, sustainable construction is gradually being carried out around the world. However, the construction of green buildings in some places still faces obstacles as there is a lack of a proper framework for the management of such projects. The findings of this study are as follows: there are significant differences between standard and green construction projects, especially at the level of detail and communication required; there is no weakness in sustainable knowledge in the Singapore construction industry; however, challenges to the implementation of information exist, impact on project performance, and lack of investment in greenhouse management is the biggest obstacle; and finally in order to overcome barriers, a project management framework for the construction of green buildings must be developed, possibly promoting the adoption of sustainable management practices for future green construction projects.*

**Key words:** *sustainable development, sustainable buildings, green buildings, project managers, project managers' role*

## INTRODUCTION

A structure is the design of people that has been in job or in presence from creation. It develops through hundreds of years, from extricating caverns to enormous structures like high rises and as of now to clever structures that can insightfully react to upgrade in its current circumstance (for example robotized entryways, elevators). Building and its construction is a fast process which involves phases and is divided into three main phases: the conception/design phase, construction phase and operation/use phase. The development of green structures is important for feasible

development. As indicated by Kibert (2008), sustainable development tends to the environmental, social and monetary issues of a structure in the setting of its local area. Feasible development is applied all through the whole life pattern of development, from preconstruction to removal of the structure. Such development expected to lessen the effect of the development practice on the climate through its arranging and overseeing of a development project conforming to the agreement record (Trietsch and Baker, 2012).

To accomplish economical turn of events, the development business is a significant area that ought to embrace the manageability idea. Manageable development faces a few difficulties in embracing new cycles and working techniques because of the new advancements that require a few changes all the while and thinking about hazard.<sup>1</sup>

As an end, project managers can assume a fundamental part in incorporating manageability to a structure project during plan and development cycle to convey a fruitful maintainable structure. Their job is critical for feasible structure measure because of the difficulties that they should bargain with. They can encourage the progressions needed for practical structure because of its particular prerequisite. Among their jobs, giving prospects to a superior correspondence and coordination between partners is the main one as a reaction to the intricacy of practical structure projects.

Green structure projects are intrinsically not the same as their con-ventional partners from a specialized point of view. They require the utilization of unique materials and building practices to accomplish sus- tainability. They can likewise require broad documentation and announcing if ecological certificate is a task objective. The extraordinary attributes of green development expect acclimations to conventional venture the executives practices to limit chances and improve the odds of conveying

the undertaking inside worthy expenses. Most of these changes mirror an expanded requirement for cross-discipline coordination on location choice, development methods and building frameworks and subsystems from the get-go in project life cycle (Abbasi and Mukattash,2001).

*To reflect more ordinary practices and focuses in green design, it might be helpful to review the viewpoints and central marks of the rating systems since it is totally expected to give congruity of constructions the rating structures. For evaluating how green the construction is, Rating structures offer steady information concerning extraordinary practices and measures to achieve green targets (Wu and Low, 2010). According to Wu et al. (2010) the three most applied rating structures are "LEED", "BCA Green Mark" and "Green Globes" which are picked for assessment of undertaking the board examination norms.*

## Literature Review

### Defining sustainable construction

To create and perform a healthful constructed surroundings primarily based totally on useful resource performance and ecological layout with an emphasis on seven middle concepts throughout the building's lifestyles cycle: lowering useful resource consumption, reusing resources, using recyclable resources, defensive nature, getting rid of toxics, making use of lifestyles cycle costing, and focusing on quality.

Sustainability is crucial for a number of reasons, which include a higher nice of existence and environmental nice. In order to have thriving and healthful communities, we want to have smooth air, herbal resources, and a non-poisonous environment, and the development enterprise can lead the manner for greener initiatives. Sustainable production is growing every and each day, with greater demand for cleanser and greener spaces. As the results of weather alternate increase, sustainability turns into even greater crucial. While there are challenges, the blessings concerned with sustainable production

can create a pathway to a cleanser future (Mouhoub et al.,2011).

Large production corporations aren't the best ones which can alternate their techniques for the betterment of the environment. Regular human beings operating on their personal non-public initiatives also can attention on using sustainable production techniques. Whether it's the use of the proper equipment, implementing price engineering to decide sustainable fabric options or truly doing all your first-class to be electricity efficient, everyone can assist development sustainability efforts.

### Why sustainable construction ?

From strength utilization to emissions, the production enterprise has a massive effect at the environment. Aside from the capacity for constructing over wild habitats, the development enterprise strength use is high. The heavy equipment utilized in production nonetheless leans closely on fossil fuels, or even inefficient power use can bring about the pointless burning of fossil fuels in addition down the strength deliver line. In fact, the development enterprise money owed for an incredible 36% of global strength utilization, and 40% of CO2 emissions (Pontrandolfo,2000).

The fabrication and transport of substances may have a notable effect on carbon emissions. Mining for uncooked substances can bring about the pollutants of neighborhood water tables. The manufacture of concrete has ended in over 2.8bn tons of CO2, a discern that is simplest going to maintain growing as 4bn tons of concrete is poured each year.

Construction also can bring about risky waste, and the fallacious disposal of such waste can bring about pollutants that influences now no longer simply the environment, however additionally the fitness of human beings dwelling in that area (Pleguezuelo et al.,2003).

According to the Supply Chain Sustainability School, constructing and creation works in countries which are a part of the Organization for Economic

Co-operation and Development (OECD) use

1. 25-40% of general energy.
2. 30% of uncooked materials.

3. 30-40% of world greenhouse fuel line emissions.
4. 30-40% of strong waste generation.

This is why sustainable creation is growing as a solution.

## MANAGEMENT PROCESS AND ITS STAGES

Management of any construction projects can be classified based on system, size, location and availability. But basically for the construction of a sustainable building the basic steps are:

**Goal and Site Analysis-** the first stage of sustainable construction management includes the identification of goal to meet the sustainability and eco friendly development, requirements of construction, and setting of the plan along with selection of appropriate site. Site vicinity should not be habitat for a community of animals and need to not be prone to erosion. Site evaluation for sustainable construction should also include the feasibility and project need assessments, initial web website online choice and plan etc. (Ghomi and Teimouri,2002).

Selection and analysis of construction material selection of construction fabric is the most important part of sustainable construction and is also the most difficult task. The fabric for construction must be certified from legal companies like LEED, BEE, and FRC. The decided on fabric must fulfill the IGBC rating system, or else the fabric must go through an have a look at such as Impact assessment. Materials like earthen pots, AAC, CSEB, Ferro cement (Bockrath,2000)

**Design And Construction:-** Prior to implementation of any project a feasibility study and web website online evaluation is carried out. The feasibility study and site selection evaluation results are considered and plan is made. The construction need to flow to maintain quality, which is achieved under constant supervision and inspection. Quality control, continuous inspection and adjustments in design as per requirement are essential features that must go along to meet the targeted goal and efficiency of work. Workmanship, scheduling and control also

plays major role which must also accept the concept of sustainable construction and strictly observe the necessities of inexperienced constructing ratings. Some design and construction measures like- Rat trap bond, ikra walls, brick jaalis, cross ventilation (Bogenstatter,2000).

**Management of resources-** It is the use of all of the assets herbal and synthetic for control of inexperienced homes. It encourages the use of assets in a way that it's far much less polluting. Also clever utilization of our assets will robotically make certain that homes are sustainable for the existing and

destiny utilization. Choosing neighborhood

materials additionally supports neighborhood economies and decreases the environmental affects of transportation (Robichaud and Anantatmula,).Demolition waste may be used as mixture for making concrete or Bricks/Blocks and fines in Road pavements. Plastic waste is some other waste that is the maximum undesirable land waste all around the World. This fabric is non degradable and stays as such over the time. Plastic / Polythene waste changed Bitumen (Polymerized Bitumen) may be produced and may be used for the development of Roads / bendy Pavements. Such plastic waste or changed Bitumen additionally can be used for making perforated concrete blocks required for making slabs for rain harvesting.

**Energy-** Energy in homes may be labeled into types: electricity for the maintenance/servicing of a constructing at some stage in its beneficial life, and electricity capital that is going into manufacturing of a constructing (embodied electricity) the usage of constructing materials. Study of each the sorts of electricity intake is needed for entire information of constructing electricity needs. Presently the embodied power of constructing substances contributes everywhere from 15% to 20% of the power utilized by a constructing over a 50 12 months period. Homeowners have wonderful impact as to what substances are used and may specify the ones substances with low embodied power, hence lowering the quantity of fossil-gasoline power used at some point of production . Use of low embodied power substances in homes can substantially lessen the power intake in homes and additionally decrease the environmental

affects of constructing construction (IMCSD,2009).

**Project Team and Evaluation-** To be successful, the task supervisor should manage a massive variety of suppliers, subcontractors and crew individuals. Communication is specifically essential for the inexperienced task for you to bring the sustainable practices predicted from the team individuals. Interest among crew individuals is important, Tagaza and Wilson (2004) determined that the preliminary enthusiasm for isolating waste substances among sub-contractors dissipated because the initiatives stepped forward and the recycling skips have been determined to comprise a blend of substances. This is important due to the fact employees may generally tend to forego time-ingesting sustainable practices whilst there are time pressures to finish a undertaking (U.S. Senate Committee,2003).

## METHODS

There are various methodologies adopted in the field of sustainability in project management . in which some of them which are used mostly are-

- Literature review
- Model developing
- Case studies

**1.Literature review-** from this we can use their methodology of data selection, extraction analysis and synthesis. Which are explained below - **Data selection-** it helps us in search of appropriate article of sustainability for project . Even the recommendation given by Bauer and Bakkelbasi that ‘researchers should consult Google scholar.....recentarticle, author or subject area’ . which means we can use google scholar for data selection (Cassidy,2003).

**Data extraction-** Literature consists definitions and concepts in general and sustainable construction of works in particular. So while extracting data we need to keep in mind that what type of articles (means conceptual or empirical. Conceptual solely based on reasoning means concept based on the other hand empirical stands for survey based ) , what type of strategy they used , what are their studies on

particular industries for which we are searching and their key findings that what are the impacts of sustainability on project management (Achman,2013).

**Analysis and Synthesis-** after extracting data from literature now last step is to analyse whole data properly that how it would be beneficial for us to achieving in our goals. Because according to some scholars sustainability of construction works can achieved by making a mixture with blending of management systems, context of construction and sustainable development (Mc Graw Hill,2006). According to some of scholars qualitative method is also suitable because it provides realistic situation of company and also its constraints for this research. So analysis of data based on logic and facts are very important according to Scholar Koch, Neisz and MCarthy. After analysing of data its important to synthesis it to achieve goals (Cassidy,2003).

**2.Model developing-** Model need to be developed according to clients requirements and also to minimize impact of construction on environment. Like sustainable buildings design clear itself as sustainable design envelope and passive cooling strategy and energy efficient strategies(Achman,2013). In passive type cooling strategies air ventilation is controlled which means movement of air in and out in building and maintaining fresh air and maintained temperature according to surroundings likewise designing of building geometries which helps to provide more natural daylight. Model must based on the environmental management systems i.e. based on principals of ISO 14001(Akadiri et al.,2013). Model develops to show usefulness of present theories and practical. It based on conceptual basis which contains environmental aspects of sustainable management and different analysis like stakeholders, management and data etc. the phase of model developing must contained a simplified approach to asses sustainability according to the site situation in terms of environmental aspects which are according to the respective country(Alaghbari et al.,2007).

**3.Case studies-** First of all we need to study all the cases which are considered by scholars in respective industry. To get the different ideas to accomplish the goal, what will be the constraints in achieving our goals and also studying cases will help to improvise the ideas in a better way means it can clear the idea by which we can easily enhance existing idea to complete that particular goal by overcoming

constraints(Assaf,1995). Like green building concept is one of the best example of sustainable development. Green building reduces impact on environment and also energy efficient. Likewise that concept can be used by studying more cases of real life and from literature sources. It can involve single case or multiple cases and along with it multiple analysis. It mostly referred as qualitative but sometime it includes quantitative approach.

## SURVEY RESULTS AND DISCUSSIONS

For the appropriated polls, 31 finished sets were acknowledged. The consequences of the examination were broke down, spellbinding and measurable investigation as a solitary example t-test, ANOVA and Post-Hoc Test. Respondents came from 19 guides (61%) and 12 venture the executives organizations (39%). All respondents had over 2 years experience in green structure ventures and the vast majority of them (19 out of 31 respondents; 61%) were 3 to 4 years of age insight. Additionally, there were 5 respondents (16%) who had over 4 years of involvement with place(BCA,2011). The accompanying areas expound on the consequences of the investigation.

### Basic CHALLENGES

The overview results showed that all respondents experienced certain difficulties during the green structure the board. Table 1 presents a rundown of the main 5 difficulties distinguished dependent on respondent info.

**Table 1: The top 5 challenges facing green building management**

Respondent (%)	Challenges
100	Increase of Project Cost
83.9	Lack of Communication and Interest among Project Team Members
77.4	High Implementation Cost of Green Practices

67.7	Lack of Credible Research on Benefits of Green Buildings
51.6	Lack of Interest from Clients

industry partners (Assaf,1995). In this manner, the green development undertaking will be a tone

in examination development projects are typically costeffective. While there is a BCA's green imprint motivating force

conspire set at a complete worth of \$ 20 million (BCA, 2009a), as indicated by one examination respondents, the asset is running extremely quick and with a strict spending plan, future activities are just potential expects to discover green prerequisites to follow nearby laws. Triumph The issue of significant expenses associated with the development of Respondents detailed that green development activities could bring about an expansion in the all out cost of undertakings as new advancements and frameworks are needed to meet the normal execution of assembled structures. Additionally, specialists in green innovation should be employed to assess and approve plans that will be utilized for green structures. This increments the expense of the task, yet additionally the trouble of correspondence between project colleagues. The basic

data given by the green experts ought to be plainly conveyed to the venture colleagues who might be new to the particular subject matters needed in the development of green designs. This can bring about inappropriate correspondence or end of data stream (BCA,2009a).

Additionally, by taking a gander at a vigorous development project plan, project colleagues may not set aside sufficient effort to comprehend the green necessities, which contrarily influences their inclinations in the green angles. Also, crude propensities can be expensive to execute. At the point when new advancements and projects are presented, project colleagues need preparing and even show a specific degree of execution in recently embraced ideas and practices, interest in the utilization of crude practices can't be repaid. Considering this, it isn't

astounding that an absence of interest from customers gets one of the basic difficulties in overseeing green development projects. This test can be settled by advancing different advantages and impetuses from being green, however as demonstrated in the investigation, respondents feel ignorant about the genuine advantages of green structures, which forestall project proprietors from considering and carrying out green ways to deal with their ventures.

## IMPACT OF THE CHALLENGES

Respondents were additionally approached to rate the degree of the difficulties portrayed above impact the three principle goals of the undertaking, specifically timetable, financial plan, and quality, on a size of 1 to 5 (1-No Impact; 2 - Negative Impact; 3 - Moderate Impact; 4 - Wide Impact; and 5 - Very Great Impact). Table 2 sums up the aftereffects of the investigation. The investigation detailed a mean value 3.320, 4.100, and 3.160 of timetable, financial plan, and quality, individually. As per one example Assessment, monetary arrangement and spending checks fluctuated quantifiably from 3 out of 5. A significance level of 0.05, which was a normal definition, showing that the troubles are authentic immensely impacts the plan and spending objectives of green design projects (BCA,2009a). Additionally, the ANOVA and POST HOC test results set up that the challenges are the most grounded influence on the endeavor spending plan, stood out from their effect on the venture timetable and quality (ANOVA p-esteem = 0.000; POST HOC p - values = 0.010 Budget versus Timetable and 0.000 Budget versus Quality. This can be deciphered as the difficulties talked about in the past area undoubtedly it has numerous ramifications for project costs (CIRIA,2001).

Both of these difficulties incorporate "Expanded Project Expenses" and "High Green Use Costs Practices "are cost-related and are viewed as significant difficulties by the undertaking supervisory group he should win.

Taking into account that the majority of the undertakings attempted in the Singapore development industry are given as far as the least delicate value, issues identified with project costs are generally touchy to all

green structures, all respondents felt was the public authority it ought to give an extraordinary degree of inspiration. Likewise, about 65% of respondents guarantee to train customers later on advantages of being green can be perhaps the most viable answers for related costs difficulties. For in-house clients the advantages that can be gotten from

green structures, significant expenses the premium may have little limitation on client criticism. Likewise, this will be the answer for the distinguished test, "

Customer

Disappointment".

Since the development of green structures is another idea in the Singapore development industry, so as well and it is imperative to impart green objectives and goals for all partners and the task colleagues to effectively accomplish project execution. Absence of correspondence between project individuals as a test in green development project the board, 74.2% of respondents have concurred that customary tool compartment gatherings will attempt to guarantee that significant data about project is advised. In particular, counsel with

green ranchers was prescribed by 45.2% of respondents to defeat correspondence issues between project group members. The critical requirement for green structures is likewise conceivable because of the absence of dependable examination in them benefits. 96.8% of respondents felt that administration financing of innovative work of green build fording plans and their administration can give solid proof of how they are useful to individuals, to society and to the economy

## Conclusions

Sustainable development is not only constructing the building with sustainable materials but sustainably using other aspects like selection of the site which has little or no effect on the environment, using the Life Cycle Assessment (LCA), applying innovative ideas during the construction, Optimizing the use of resources available which would derive maximum benefit.

It States that the Team management plays an important role and the (The paper on “Greening Project to get the best out of all the ,members in the team. These practices invManagement Practice for Sustainable for trainings and communication throughout construction, Use bonus Constructions” by Vital S. project contracting, Designing with the whole team approach, IntegratAmantatmula. team.

In the research paper “Sustainable Construction Management” by B. Sarath Chandra Kumar the author emphasises efficiency and performance of the building can be improved if the the selection of construction management and building materials are integrated in the project to derive maximum benefit. The author states the benefits of Sustainable development such as Cost reduction, Environmental friendly, Pollution control , Better standard of living

.The author greatly emphasizes on the concept of Life Cycle Assessment (LCA) and its approach during the construction period.

The paper on “Green sustainable construction management: schedule performance & improvement” by Bon -Gan HANG states that the

construction scheduled performance was proportional to the construction quality and cost and green building construction project required a more sophisticated and integraal approach to the delivery system compared to The Traditional Construction projects.

Furthermore the paper states the Green Building required 8% more time compared to the Traditional Ones and the cost of construction was 4.3% more than that of Traditional Ones.

The paper on “sustainable project management for green construction: impact, challenge and solution ” by Bon-Gwang Hang deals with the Challenges, Impact of the Green building technology and it gives 5 challenges that the construction of the building have to deal with namely. Absence of Interest & Communication among the members of the project team. High amount of cost of Implementation for Green Practice Increment of Project Cost Lack of Interest from The Clients Lack of Credible Research on the Benefits of The Green Buildings.

These challenges found were interrelated, Ultimately these resulted in Massive cost for the construction green buildings. The absence of Research and development on the benefit of the green building and the green technology are the main reason behind the lack of demands for the green building that go beyond the legislatives requirements(BCA,2009a).Plus green building construction require a communication and collaborative in between the project team member.

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