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Benefits of Project Management to Realizing Sustainable Buildings

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ABSTRACT

Sustainable materials are becoming popular worldwide in terms of ecologically friendly structures that deal with pollution controls, climate change, global temperature increase, and resource conservation issues. Consequently, the researchers believe that simply using sustainable materials to design and create a building is insufficient.

This article discusses several elements of sustainable construction planning including site choice mostly through the proposed project, material classification mostly through the life cycle, analysis time, cost, and commodity controls, reliability and stability, occupant health, manufacturing methodologies and procedures, and design concepts based on advanced ideas. The article argues that by integrating the choice of building components and construction strategic planning practices into the project, the productivity and consequently the reliability of the building could be significantly improved.

The article also discusses the advantages and requirements of sustainable construction, the managerial roles in construction procedure, management processes, and a correlation of conventional construction planning and sustainable project management. The research paper indicates that the objective of constructing an environmentally friendly building is simply fully done when the notion of sustainability is integrated into every phase of the construction approach and that the procedures are not restricted to using recycled practices.

Keywords— Sustainable Materials, Life Cycle, Sustainable Building, Project Management, Sustainable Management

I. INTRODUCTION

Although the principle of sustainable construction initially developed in the mid-nineteenth century, its execution did not begin until the early twentieth century. By summary, sustainable building is defined as that which is created for contemporary demands and satisfies all current occupant requirements in a sustainable manner, i.e. with little or no adverse effect on the ecosystem. Regarding the idea's advantages to the ecosystem, health, efficiency, and costs, for example, industrialized countries such as United State and other European countries are aggressively pushing the notion of sustainable building.

This type of design/construction is sometimes referred to as a sustainable construction or a future-oriented structure. The primary goal of sustainable development is not only to plan for future demands but also to meet existing residential demands while safeguarding the environment and natural resources for coming generations.

This is a difficult task given, as the community grows and accompanying developmental activities increase, individuals, become increasingly reliant on the local environment and its resources for their daily requirements. As a result, environmental materials are depleting daily, i.e. woods are becoming sparser, ice peaks are becoming smaller, the ocean elevation is increased, the air is becoming more polluted, and the natural cycle is being disrupted.

Certain species are becoming endangered, while others have become extinct and exist only in photographs and films. This is never the only cause to choose sustainable building; the primary goal is to fulfill each human being by offering a safe haven and a healthy atmosphere, as well as to allow others to embrace the environment and conserve the planet.

This article focuses on the managerial aspects of any building project, as well as the principle of ecological technologies or as such sustainability, which can help mitigate hazards. This indicates that the strategy would be effective at mitigating the environmental impact of development.

Individuals have been considering sustainable building, sustainable constructions, and sustainable energy, but construction management has received no attention. In a summary, it is everything around managing construction through innovative methods, approaches, tools, instrumentation, procedures, craftsmanship, and quality, both of them contribute to increased efficiency, cost savings, durability, and other aspects of sustainable development.

II. SUSTAINABLE STRUCTURE

In the construction sector, several terminologies are utilized to meet the concept of "sustainable," including smart building, ecological building, sustainable development, sustainable design, environmentally friendly design, and interconnected specification.

In theory, all of the above concepts are utilized to help people comprehend the architecture, construction process, design, and purpose of a building. In conjunction with environmental advances in the 1970s as well as the environmental revolution throughout the 1990s, sustainable buildings could be regarded as a broad and far-reaching cultural development of society's relationship with the ecosystem [1].

Thus, a sustainable construction is viewed as more than a place to live; it is viewed as a contribution to the ecosystem. While there is no uniform model definition for sustainable or green design project, an examination of definitions reveals some common agreements.

2.1. Sustainable Design

A concept design which aims to increase the created ecosystem's quality, while reducing or eliminating adverse impact on ecosystem. Whenever designers plan public facilities with a focus on sustainability, they implement the accompanying five main sustainable building approaches [2]:

1. Sustainable Passive Construction: Passive measures, such as evaluating the sun's position and environment while sitting and keeping mindful of window design and operations, are utilized to optimize illumination and ventilation systems and contribute significantly to the structure's energy efficiency. Thermal energy strategies can be utilized to harvest solar energy in specific conditions.

2. Designing Actively for Sustainability: Designers consult alongside mechanical and electrical specialists to design energy-efficient electrical, piping, HVAC, as well as other infrastructure.

3. Technologies for Sustainable Energy: Sustainable energy, systems such as ones that capture solar and windy energy, are therefore excellent possibilities for certain types of structures. Often, such systems are utilized with active designing principles.

4. Components for Sustainable Buildings: By prioritizing the purchase of steel, wood, concrete, and completion items like carpet and furniture from companies that practice ecologically responsible production or employ recycled materials, designers increase their commitment to sustainability.

5. Landscape Design Using Native Materials: Landscaping selections can have a significant effect on the amount of water consumed by civic buildings. By utilizing indigenous trees, plants, and grasses, architects can significantly minimize watering requirements.

Landscape design can also be included into a passive energy plan. Solar energy gain within a structure can be minimized by growing trees that shadow the roof and glass throughout the hottest part of the day.

6. Management of Rainwater: Whenever rain showers on an undeveloped land, the remaining water seeps into the earth, recharging the native water table. When a structure is added to the site, alongside parking areas, pathways, roadways, as well as other irrigation, precipitation behavior changes.

Water is drained away from these areas and into gutters. By using rainwater harvesting measures including pervious paving, which helps to decrease runoff, and detention ponds, which collect runoff and gently release it again into the earth the harmful ecological effect of buildings could be mitigated.

2.2. Green Buildings

Structures which are designed, built, and managed in such a way that they outperform strength and durability in terms of ecological economic, safety, and efficiency. The prudence with which the built environment is designed, constructed, operated, and repurposed or demolished in an ecological, and resources sustainable way.

Environmental protection is an approach that integrates environmental concerns throughout the residential construction industry. This indicates both energy efficiency, land improvement resource-efficient structural engineering and materials, interior climatic quality resident care, and the apartment's total influence on the environment are all considered throughout the design, excavation, and management of a residence [3].

2.3. Sustainable Construction

To construct and manage a healthy designed environment that is resource efficient and ecological in essence, with an accentuation on seven fundamental principles throughout the construction process: resource conservation, resource reuse, resource recycling, nature protection, toxic elimination, life cycle costing, and a quality-focused approach.

According to one survey, the most frequently stated impediment to achieving sustainability and growth is expense, this indicates that the gap is because sustainable strategy must have economic meaning in order to make green projects increasingly sustainable and profitable [4]. Therefore, sustainable construction can be characterized as an endeavor to:

a. Minimize or decrease negative, effects on the environment environmental assets, and any non - renewable raw materials in order to increase the built environment's durability.

b. Enhance the health and efficiency of the occupied space.

c. Minimizes building costs to operating costs and incorporates a lifecycle perspective into community design and implementation.

III. A SUMMARY OF THE VARIOUS BUILDING CERTIFICATION METHOD AND REQUIRMENTS

It is clear which, despite their structural and score procedures variations, all strategies concentrate the same environmental concerns, including energy usage, water conservation, environmental performance, raw material utilize, and building production planning [5].

BREEAM examines transportation and pollution as distinct environmental factors, whereas LEED integrates them within the energy efficiency and sustainable project execution criteria. However, energy efficiency contributes for greater than 20% of the overall certification score in all grading schemes.

Additionally, the assessment methodologies can be evaluated depending on the building categories investigated, certification standards, the product lifecycle phases addressed throughout the assessment process, and the inspection reviews conducted before to certification.

It's also essential noting that the most of the environmental evaluation methods covered here, such as "BREEAM", "LEED", "HQE", and "DGNB", are commercial tools created inside an academic context and backed by governmental organizations or agencies, as well as industrial groups. Besides the main goal of promoting sustainability inside the construction industry, all of these techniques place a premium on economic and financial incentives as a means of increasing energy efficiency.

Reduced peak and off-peak energy usage, water conservation, and enhanced waste management all contribute to decrease operating costs, while the market value of the building grows as a result of the facility's certified environmentally sustainable profile. Lastly, but certainly not latest the certification evaluates interior air quality and temperature efficiency. Sustainable certification, in this sense, strives to enhance the quality of life and efficiency of building occupants by having an implicit but very specific impact on financial and social concerns [6].

However, and particularly for the abovementioned certification schemes, the issue of sustainability in construction management is a global, strategic one that demands a common vocabulary and evaluative instruments in order to overcome constraints and capitalize on opportunities.

IV. SUSTAIABLE CERIFICATION AND ITS EFFECTS ON THE CONSTRUCTION INDUSTRY

While sustainability certification is an excellent instrument for sustainable construction management, the most compelling reason to influence the building sector is the straight and indirect expense savings that may be realized by the building's ownership and consumer.

Within this regard, the environmental benefits stated previously must be quantified in terms of reduced operational expenses and a raise in the building's advertising worth. The fundamental question is whether the anticipated economic benefits are sufficient to cover not only the higher investment costs associated with making a building 'greener,' but also the not insignificant certification expenses associated with convincing the construction market, especially developers [7].

4.1. Sustainable Development Advantages and Specifications

A dynamically beneficial type of construction that respects the native environment while providing enough yields to the user or constructor is referred to as sustainable construction. Whereas these structures may appear complex and time-consuming to work with at first, they provide the following advantages [8]:

1. Efficiency in terms of cost
2. Safe for the environment
3. Depends on renewable materials
4. Construction that is robust
5. Housing that is conducive to the residents' health
6. Managed resource consumption and less reliance
7. Pollution prevention
8. Outstanding development

4.2. Management of Building Project

It is highlighted that sustainable building and resources, as well as project management from resource selection to location to each stage of construction and maintenance, all play a critical part in constructing a completely sustainable building. An excellently project will always outperform an aesthetically pleasing or costly project in terms of quality, productivity, and durability.

A very well (sustainable) construction also adheres to the rules established by the environmentally friendly building council and rating systems in order to be classified as a green building follows various building codes, and incorporates innovative ideas in order to create a user-friendly and environmentally friendly system by developing its own concept, supplying guidance for measurements that can provide recognition and verification of an increased level of dedication for sustainability achievement [9].

4.3. Procedure of Management and Steps

Each building project's management can be categorized according to its system, scale, location, and accessibility.

However, the fundamental steps for designing a sustainable structure are as follows:

1. Evaluation of the Objectives and the Location: The initial step of sustainable building management is defining objectives for achieving sustainability and environmental development, defining building regulations, and developing a plan in conjunction with the choosing of an appropriate location.

However, in accordance to sustainability and evaluation systems the chosen location should be located near adequate essential amenities like schools, playgrounds, markets, libraries, transport infrastructure, communication services, universities, medical centers, and hospitals, among others, to at least five of these accommodations located inside a one-kilometer radius.

The position of the site may not be a home for a variety of animals and must be resistant to erosion. Site study for sustainable building must also incorporate assessments of viability and project requirements, as well as early site choice and planning [10].

2. Resource Choosing or Assessment: The choosing of construction materials is the main critical aspect of sustainable building and also the most challenging undertaking, construction materials must be approved by approved authorities such as LEED and BREEAM [11].

The effect evaluation process for resource choice can be summarized as a two-method consisting of;

a. classifying inventory streams that contribute to particular environmental effects like carbon dioxide.

b. characterizing and analyzing the effects of every other inventory stream on the correlating environmental streams.

The method is described in additional detail in Figure 1:

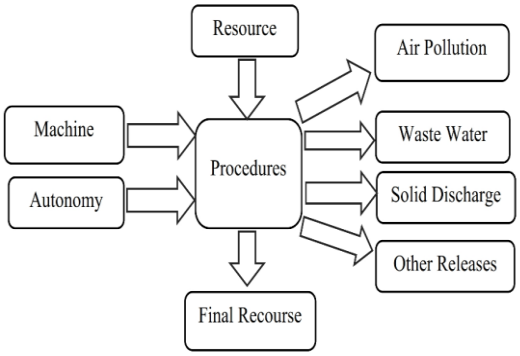

Figure 1: Evaluation of Environmental Effect and Resource Choices

Life Cycle Assessment (LCA) is indeed a material selection process that requires a designer to determine the optimal resource for a structure's building [11].

This is performed in a series of stages, as illustrated in Figure 2:

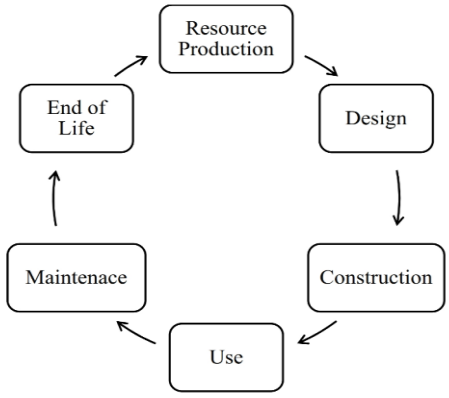

Figure 2: Procedure for practicing a generalized life cycle evaluation in order to select a resource

3. Engineering and Design: A feasibility assessment and site analysis are conducted before to the start of any construction. The concept assessment and site choosing analysis findings are incorporated into the planning process.

Construction must flow in order to preserve quality, which can only be accomplished by regular oversight and examination. Quality control, constant inspection, and design modifications to fulfill requirements are all critical characteristics that must coexist in order to achieve the desired outcome and maximize job efficiency. Craftsmanship, planning, and monitoring also perform a significant role and all of these components must embrace the notion of sustainable construction and adhere rigorously to the specifications of sustainable building categories [12].

4. Planning of materials: Labor, equipment (electrical and mechanical), tools, and additional assets such as water are all examples of resources.

Due to the fact that water is the primary component of all living organisms, the importance and requirement of water are magnified in the construction organization. Furthermore, water is a critical component without which no building work could occur. Likewise, the equipment, plant, and instrumentation employed consume energy, cost, and time, even though their primary aim is to decrease time requirements.

To resolve this issue, well-managed schedules and procedures must be closely followed to ensure that the construction is completed on time and within budget; then, the construction could fall short of expectations. Additionally, to save time and money, obsolete equipment such as level machines must be changed with a

speedometer, theodolite, or, best yet, a total station, that is better exact and faster. Furthermore, additional modern equipment that operates quickly and efficiently must be utilized [13].

5. Energy: Fuel supplies are depleting and electricity and energy availability is dwindling, particularly in developing countries, where energy efficiency is the article's focal point.

The development is being stymied by the world's energy shortage. Therefore, sustainable management introduces the principle of onsite renewable energy for particular residential buildings in order to address these issues [14].

6. Assessment of The Project's Staff: It is advised that the professional staff appointed to a sustainable building project include someone with in-depth knowledge of present construction methods or developments in engineering and management.

Additionally, the staff must contain a specialist or at the least minimum, a sustainable building qualified expert.

The basic objective of this stage is to guarantee that the project proceeds smoothly and that each step incorporates the sustainability approach in order to enhance the project's overall function and longevity.

It should be highlighted that appropriate assessment at all steps of building projects time management, planning, controlling, and operating, and consistent delineation of responsibility on the job location are all critical components of building management all of whom contribute to the end result of effective and sustainable building projects that is both cost-effective and environmentally sustainable [15].

V. MANAGEMENT OF THE PROJECT AND THE STAGEs OF THE BUILDING'S LIFE-CYCLE

A project manager is an expert in the whole life-cycle of a building and supervises the various phases in order to maximize the utility of the building at the lowest possible cost over its useful life. From a project manager's perspective, the building's service life should not begin at handover but rather during the design process, specifically during the preliminary briefing.

Early involvement of project manager during the design stage can help to minimize the need for major repairs and modifications during the operational period. However, little attempt has become made in the building projects sector to require the project manager in the planning stage.

To make sure from the start that building services encourage core business and to minimize the cost of significant repairs and modifications, the project manager must be involved throughout the design procedure.

Whenever project managers are involved early in the design phase, they can identify problems and contribute essential knowledge on the building's efficiency and operating expenses. At the procedure stage project managers are responsible for managing built assets and incorporating the controlling services required for an organization's successful commercial operations and overall satisfaction of occupants. These constructed assets begin to deteriorate the instant they are finished and placed into use, necessitating care during the building's life to ensure their efficient and economical utilization.

VI. BARRIERS IN THE CONSTRUCTION OF SUSTAIANABLE STRUCTURES AND THE ROLE OF PROJECT MANAGERS

Creating and executing new inventive methods for procuring, designing, constructing, utilizing, and maintaining development is widely acknowledged as a barrier for the building industry, particularly for sustainable construction. At the services stage project managers are responsible for managing built assets and incorporating the regulating services necessary for an organization's successful commercial operations and the maximum pleasure of occupants.

At the process step project managers are accountable for managing constructed assets and including the regulating services necessary to ensure an organization's financial success and general occupant pleasure.

These constructed assets begin to deteriorate the moment they are finished and placed into use, necessitating care during the building's life to ensure their efficient and economical utilization. Such constructed resources start to deteriorate the moment they are completed and put into service, demanding ongoing maintenance to guarantee the building's effective and economical operation.

Such innovative approaches should satisfy an even higher bar set by customers, industry, and society in terms of timeliness, cost, performance, safety, and effect on the environment. The combination of historically distinct processes and managerial functions is the much-needed adjustment that will improve the building process's efficiency.

Therefore, sustainable design as a catalyst for these transformations should address several critical issues:

a. Enhancing the construction application's efficacy and efficiency through increased communication between critical stages.

b. Producing high-quality goods in a healthy and comfortable work environment while minimizing adverse effects on the project's environments and occupants.

c. Creating, long holistic enhancements to the constructed environment in order to satisfy evolving customer, industry, and community requirements.

These critical problems illustrate the problems inherent in the practice of sustainable building, that also are not due to a lack of available knowledge, innovations, or assessment methodologies.

Moreover, the practice of sustainable building has difficulties in adopting new approaches and operating methods for using new innovations. New innovations necessitate some process adjustments, as well as consideration of risks and unforeseeable costs.

The decision-making stages, new tasks, players, and roles, and new modes of networking that are necessary to overcome the key obstacles.

VII. CONCLUSIONS

Sustainability is concerned with the ecosystem and living on the planet, and it should be the primary goal of any building project in the modern period. This could really be accomplished through appropriate management of building project practices, beginning with material choice and progressing through supply chain management, positioning, development, completing, and decorating, and finally to productivity and servicing of the framework and its processes, including recycling and dropping.

Building practices are shifting away from old technologies and toward more sustainable ones. While this is encouraging, the time has come to change construction processes by integrating project management solutions for all types of construction.

Residential dwellings require additional attention because their life expectancy is very short and the rising population still desires to construct a new residence during their lifetime.

Therefore, protecting the environment and keeping the world secure from all environmental risks is the final solution as it is impossible to live a productive and resilient life without it. This article covered building management strategies that aim to create structures as sustainable and environmentally friendly as feasible. Sustainability should be become essential not just in developed countries, and yet increasingly in developing ones, to ensure that we can continue to live on the earth for an extended period of time.

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