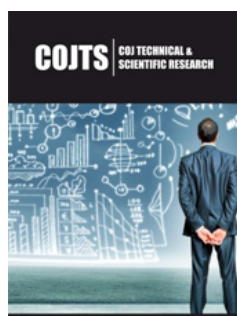


Greener Buildings: A Step towards the Betterment of Healthy Indoor Air Quality

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Abstract

Climate change, global warming, and increasing pollution have made it vital for policymakers all over the world to adopt greener measures for a more sustainable future. It is widely acknowledged that one of the most important steps towards achieving sustainable development on a worldwide scale is the adoption of green design and technology in buildings, which can reduce their negative environmental effects. Economic viability is crucial in encouraging the design, construction, and usage of green buildings, in addition to technological advancement. There is currently an international trend to develop 'green' structures. Greener buildings may impact the Indoor Environment Quality, despite being largely motivated by external environmental goals like energy or carbon (IEQ). Localized green building rules, particularly those in poor nations, frequently fail to consistently acknowledge IEQ or health as important considerations, leaving these topics understudied. Consequently, it is vital that green buildings perform holistically to be effective. The present study presents a complete assessment of recent studies on the economic viability of 'becoming green', including cost-benefit analysis from the standpoint of building life. The major goal of this article is to present a thorough overview of the difficulties that researchers encounter daily and the research that is currently being done to improve Indoor Air Quality (IAQ) by implementing green practices in buildings. In an effort to achieve a better thermal climate and greater energy efficiency, the growing concern about green buildings may have unforeseen effects for the comfort and health of the occupants.

Introduction

Urbanization and modernization for the betterment of our lives has deteriorated the air we breathe. Its significant impact on human health has been addressed several times by the World Health Organization (WHO) in various documents and meetings, and has been carried out at various levels. People spend majority of their time indoor at homes, offices, or schools, therefore, Indoor Air Quality (IAQ) has become an area of interest in recent years [1-3]. Further, economic studies and researches have highlighted the great importance that IAQ now has in all environments. The severity with which Indoor Air Quality (IAQ) is being challenged and our understanding of the interactions and causalities among the numerous elements that have an impact on indoor air quality have undergone considerable changes during the past 30 years. IAQ also has strong repercussions in the competitiveness of an organization, considering the increase in difficulty in carrying out its job in the best way, its performance, and the social and economic competitiveness between countries, due to the influence on the attention, degree, and number of days lost. The World Business Council for Sustainable Development (2007) reports that building stock accounts for 40% of total energy consumption. Apart from energy consumption, it involves the consumption of natural resources, Green House Gases emission and other pollutants thereby influencing climate change and global warming with demand driving further environmental impacts [4]. Thus, adoption of green design and technology in buildings, which can mitigate negative impacts on the environment, has been recognized as a key step towards global sustainable development. In addition to technology development, economic viability plays a pivotal role in stimulating the design, construction and use of green buildings [5]. The global concern for climate change, global warming and increasing pollution has made it imperative for the policy makers throughout the world to devise green strategies

for sustainable future [6]. Thus, in order to reduce the negative influences of buildings on environment, green buildings are being planned and made. This may create better Indoor Air Quality (IAQ) for occupants with less natural resources consumption [7].

Green buildings: future's necessity

The need for a healthy and comfortable living environment is critical to one's mental and physical well-being. The three most important factors affecting residential structures are health and safety, environment, and comfort [8,9]. The idea of sustainable development introduced in 1970s has grown in significance recently, including varied disciplines and being used on a variety of various territorial scales. In reality, when choosing materials, energy sources, production processes, design choices, or places for construction placement, a measure of sustainability is essential to evaluate the competing alternatives [10]. The idea of "green building" has been brought to light within this framework, and there are numerous definitions in the literature. 'Green buildings' as defined by the United States Environmental Protection Agency (USEPA) are structures that use resource-efficient procedures and are environmentally responsible throughout the building's life cycle [11]. Green buildings are certified using two main rating systems: LEED and BEAM Plus [12,13]. The need for a high quality of life has led to the introduction of several new features in indoor building settings as a result of enhancing economies and population rise. Another factor which may affect IAQ and human health is the evolution of various building types over time. Consequently, it is crucial to examine the IAQ in various end-use buildings to identify any potential indoor pollutants in particular types of buildings that are to blame for negative health effects. To date there is no systematic analysis of peer-reviewed IAQ studies that specifically encompass both residential and commercial building environments, despite the two decades of IAQ research from many angles [14]. The existing residential buildings may, thus, undergo adaptation to a new reality. To ensure that we remain resilient and sustainable, future houses need to be planned effectively to avoid disease propagation, minimize the environmental effect, and maintain and improve the comfort of people spending most of their time at home.

Green buildings: their impact

Buildings and construction activities play an important role in urbanization by creating living and working spaces and contributing to the national economy. However, buildings and associated construction activities can also have profound negative effects on the natural environment and resources [5]. Almost all green building evaluation standards provide largest credits for energy-saving design. Thus, studies on building energy performance are of great importance [7]. Research on green buildings not only focuses on reductions in energy use but also the human health of occupants inside the building. However, along with these direct effects on the human health of occupants, buildings also influence health indirectly through their contribution to environmental pollutants generated from energy production. Energy efficiency realized through green building practice reduces greenhouse gas emissions

and other harmful air pollutants, such as particulate matter, sulphur dioxide and nitrogen oxides, all of which are associated with the combustion of fossil fuels for electricity and heat production [15]. IAQ is an indicator of air quality within buildings, and has a very strong impact on the quality of life in residential buildings and productivity in the office and public buildings as people spend more than 90 % of their time indoors [12]. Prominent air pollutants found indoors are Volatile Organic Compounds (VOCs), Particulate Matter (PM), biological pollutants, other organic and inorganic compounds primarily emitted from building materials, paints, or furniture. These pollutants are well-known causative agents of allergies, hypersensitivity, lung infections, and Sick Building Syndrome [11]. Hence, measures may be adopted to reduce such emissions. In order to further validate these findings, more study is required to create a more detailed meta-analysis [16]. This shows that energy can be saved by green buildings in general, but more research is required to narrow the gap between the design and operation phases. Only by making constant efforts can every green building genuinely be able to have a healthy surrounding for a better lifestyle.

Conclusion

'Green Buildings' are constructions that are specifically designed to consume less energy, water, materials and assure sustainability while increasing the comfort. They are outperformed conventional buildings in terms of energy efficiency. The actual energy use of green buildings greatly varies. The nations should plan and permit the green building movements for the development of new buildings, their maintenance and design standards to create better living and working conditions.

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