

Social Benefits of Sustainable Design-An Overview

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Abstract— This paper provides an overview of theory on the human benefits beyond energy saving of building design. Identified human benefits include improved health outcomes, psychological well being, reduced stress, improved cognitive performance, and improved work, and life satisfaction. While many building variables affect these outcomes, there is growing evidence that the high impact design features are connection to nature, incorporation of daylight and sunlight in buildings, sensory change and variability, and improved personal control over ambient conditions. Many stakeholders move to the conservation beyond energy saving and look at impact on the people and society.

Index Terms— Green Buildings, Goals, Indoor Environmental quality, Productivity, Health Benefits

I. INTRODUCTION

We think of buildings as investments in things: real estate, land, technology. Yet, we build to provide habitats for people to work, live, learn, and recover from illness. Investing in people requires a dual approach of reducing risks and promoting positive experience. At the present time, building practices and standards focus on avoiding health and safety risk, such as illnesses and absenteeism associated with poor indoor air quality. There are no standards, or even guidelines, on how to design to promote health, well being, and other positive experiences such as engagement with place, work effectiveness, and sense of community. This paper will focus on building design as a vehicle for promoting positive human experience and outcomes. The analyst forecast global market to grow at a CAGR of 9.6% during the period 2016-2020. To prevent the worst effects of global climate change and minimize other negative environmental impacts, it is therefore important to address the environmental impacts of buildings.

“Green” or “sustainable” buildings use key resources like energy, water, materials, and land much more efficiently than buildings that are simply built to code. They also create healthier work, learning, and living environments, with more natural light and cleaner air, and contribute to improved employee and health, comfort, and productivity.

The objective of the review was to examine the state of evidence on green building design as it specifically relates to indoor environmental quality and human health.

Overall, the initial scientific evidence indicates better indoor environmental quality in green buildings versus non-green buildings, with direct benefits to human health for

occupants of those buildings. A limitation of much of the research to date is the reliance on indirect, lagging and subjective measures of health.

II. GOALS OF GREEN BUILDINGS

The basic goal of green building is attractive, comfortable, affordable shelter that does no harm to the Earth in its manufacture, or its use or disposal. This overarching goal is driven by four further goals:

1. Reducing impacts on the Earth from constructing buildings and their materials
2. Reducing impacts which arise during occupancy
3. Reducing the impact of the structure at the end of its life
4. Creating a more desirable human experience
5. Cognitive health of the occupants



Figure: I Goal of Green Buildings

III. TRIPLE BOTTOM-LINE BENEFITS

Green building is not a simple development trend; it is an approach to building suited to the demands of its time, whose relevance and importance will only continue to increase. The benefits of green building are manifold, and may be categorized along three fronts: environmental, economic, and social.

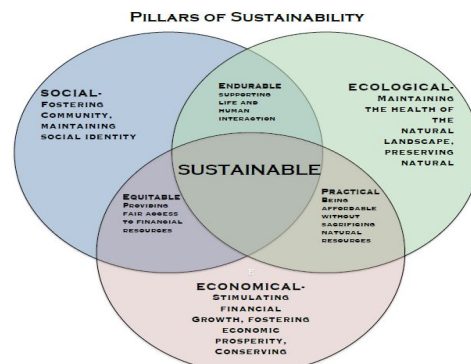


Figure: II Sustainable developments

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- A. Environmental Benefits like Emissions Reduction, Water Conservation, Storm water Management, Temperature Moderation and Waste Reduction.
- B. *Economic Benefits* like Energy and Water Savings, Increased Property Values, Decreased Infrastructure Strain, Improved Employee Attendance, Increased Employee Productivity, Sales Improvements, Development of Local Talent Pool.

26%	Less energy
30%	Less Indore waste
50%	Less solid waste
33%	Less CO2 emission
30%	Less water usage

- C. *Social Benefits*- The benefits of green building on energy and water conservation are well researched and recognized. However, the indoor environmental quality and human health benefits of green buildings have not been as thoroughly evaluated.

IV. THE SOCIAL IMPACT OF BUILDINGS

It is generally recognized that buildings consumes large amount of water, wood, energy and natural resources used in the economy. Green buildings provide a potential promising to help address a way of challenges facing globally, such as:

- The rising incidence of allergies and asthma, especially in children.
- The health and productivity of workers.
- The effect of the physical school environment on children's abilities to learn and
- Increasing expenses of maintaining and operating state facilities over time.

We are excited about the next evolution. Energy savings, water savings are all measurable payback, which is great. But if you look at the costs that go into a building, 90 per cent of costs are not about energy or water, but about people and productivity. It has opened up a new science- buildingomics and opened a whole new business justification beyond it's the right thing to do or water and energy savings but really about the cognitive well being of occupants.

Buildingomics is a Harvard term- they are looking at it as a holistic study of impact of buildings and conditions on cognitive effects on health and sleep patterns of occupants.

V. THE MAJOR SOCIAL BENEFITS OF BUILDING GREEN FOR NEW CNSTRUCTION

Commercial green buildings experience a 3.5% occupancy ratio increase and a 3% rent ratio increase. ENERGY STAR buildings achieved 3.6% higher occupancy rates. Green building is the practice of building to be energy and resource efficient throughout a building's life-cycle from sitting to design, construction, operation, maintenance, renovation and deconstruction. Green buildings use natural resources efficiently and fewer in quantity and reduce wastage, this leads to lower both utility bills and impact on the environment. Like energy, waste, and water benefits are predictable and productivity and health benefits are uncertain. Energy and water savings can be predicted with reasonable

precision, measured, and monitored over time. In contrast, productivity and health gains are much less precisely understood and far harder to predict with accuracy. The main benefits of building green are included the following:



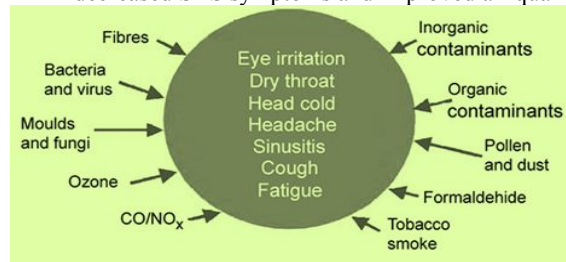
Figure: III Social benefits of green buildings

- A. Better health of building occupants
 B. Improved comfort, satisfaction, and well-being of building occupants
 C. Occupant safety and security
 D. Lower greenhouse gas emissions and air pollution
 E. Improve attendance and improve productivity

A. Better health of building occupants

Indoor environmental quality, especially air quality reduces the respiration problems, skin irritation, moisture problems and air born diseases.

1. *Sick building syndrome*- it includes headache, fatigue, dizziness, irritation of the skin, eyes and nose and difficult to breath. Many studies have found of the links between health and indoor air quality. Sustainable design increase ventilation rate above 10L/s up to 20L/s per person were associated with decreased SBS symptoms and improved air quality.



2. *Allergy and asthma symptom*-Building factors like moistures problems, molds, and dust mites are strongly associated with asthma and allergy symptoms. Improved HVAC system and cleaning humidity control, elimination of inside smoking and using building practices that reduce moisture.



Figure: IV Different sources of indoor air pollutants

3. *Transmission of infectious diseases*-airborne transmissions can be reduced significantly through ultraviolet irradiation of air near the ceiling, improved ventilation, and reduce crowding.

B. Improved comfort, satisfaction, and well-being of building occupants

1. *Day lighting*-Day light enters a building via four primary mechanisms; direct sunlight, clear sky, clouds and reflections from ground and nearby objects. Daylight elements such as good lighting, window size and view out have a pivotal role in emotional satisfaction and reduced absenteeism for employees and reduce eye strain. Daylight reduces cooling loads, save energy, improve people attitude and health.

2. *Thermal comfort*-

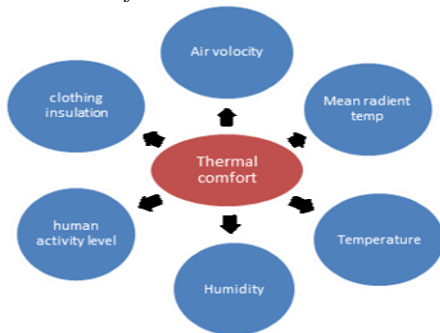


Figure: V important variables that control thermal comfort

The building thermal comfort is influenced by occupant activity, clothing levels, stress, age, gender, and individual preference. The most effective way to improve thermal comfort and satisfaction is by using individual controls for temperature and ventilation which are the part of sustainable design.

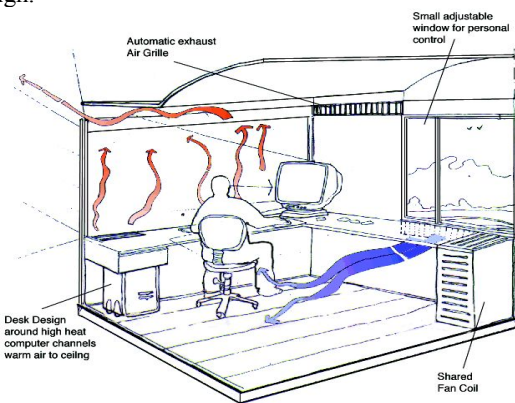


Figure: VI various Indoor thermal comfort factors

3. *Perceptions of air quality*- over the last three decades the public has become more aware of indoor air pollution. There are various sources of indoor air pollutants in buildings. Various studies show that people spend 65 to 90 percent of their time indoors. Studies show that the human exposure to air pollutants indicate that indoor air levels of many pollutants may be two to five times, and on occasion more than one hundred times, higher than outdoor levels. Green buildings reduce volatile organic

compounds, use non chemicals for garden, removal lead based paints, humidity control to 40% to 60%, products with lower emission rate of formaldehyde and improve ventilation improve air quality.

Psychosocial well-being- Sunlight can create glare and heat gain in buildings. If it is not controlled properly, enhances psychologically functioning and job satisfaction compared with spaces lacking and sun.



Figure: VII Domains of psychological well being

4. *Overall satisfaction*- Several futures were associated with higher level of overall satisfaction; they are -Openable windows; views out; responsive building management; places to go at break time; thermal mass

5. *Green is good for sleep too*-According to the United technology study, there was 26% higher cognitive function scores in high performing in green certified buildings and It benefit to sleep quality in nights

Green is good for sleep too
Better building = Better sleep + Better health + Better cognitive function

BUILDING ENVIRONMENT

BLUE-ENRICHED LIGHT (such as daylight) during the day has been shown to improve sleep quality at night

MELATONIN
A larger contrast between daytime light exposure and night time light exposure results in more melatonin, a hormone that promotes sleepiness, being released in the evening

SLEEP QUALITY SCORES
25% higher
The scores were associated with 2.8% higher cognitive function scores the next day

SLEEP QUALITY SCORES
6.4% higher
in high-performing, green-certified buildings vs high-performing non-certified buildings

SLEEP QUALITY
In addition, there was 26% HIGHER COGNITIVE FUNCTION SCORES IN HIGH-PERFORMING, green-certified buildings vs high-performing, non-certified buildings

Figure: VIII green vs. non green buildings overall well beings

C. Occupant safety and security is the other benefit

D. Lower absenteeism and improve productivity
Sustainable design futures improve performance in attention and concentration level; improve performance on logical thinking tasks; improve organizational level performance; self rating of productivity.

E. Other benefits to the building owner

- Better worker retention and recruitment
- Lower cost of dealing with complaints

- Decreased risk, liability, and insurance rates
- Greater building longevity and
- Better resale value

F. Indirect benefits to society- The value to society of environmental preservation and pollution reduction in municipal infrastructure requirements, local and regional economic growth

CONCLUSION

The paper cited above clearly shows that building design can have a significant impact on human health, well being, as well as work performance. There is also evidence of links to economic value, particularly building rent and value. The high impact building variables – those that affect multiple benefits for building occupants are daylight, sunlight, personal control of ambient conditions, and connection to the nature. The challenge for sustainable design is how to incorporate these elements, especially nature, where trees, gardens, and parks are not readily available. It is evident also that improved indoor air quality reduces illness symptoms and absenteeism that can be costly to organizations.

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