Sustainable Architecture

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Abstract

Sustainable architecture is the key towards improving current global warming around the world. Much has been written about sustainable architecture but however slow progress when it comes to implementation. This literature review comprises of the background towards the current strategies in place and the future of sustainable architecture. The research for this literature review was done online information was taken from websites and some books and journals. Sustainable architecture and smart buildings should be the current model of state of thinking when designing for construction development. Sustainability in architecture is not limited only to energy use and waste. It can't be segmented into various subcategories because it represents a fundamental and intrinsic combination of factors related to our existence on this planet. The impact of this literature is to inform upcoming designers to consider sustainable architecture as a future way to living as global warming threatens humanity.

Keywords

Sustainable architecture, Sustainable buildings, ecofriendly buildings, ecological architecture, green buildings.

1. Introduction

Sustainable architecture seeks to minimize the negative environmental impact of buildings, so there is a need to improve the efficiency and the use of materials, energy, as well as the surroundings. Sustainable architecture should pay attention to energy and ecological conservation in the design of the built environment. Yet some say sustainability is dead: regenerative architectures the new green architecture.

The word "sustainability" and the expression "sustainable architecture" are important words used in design and architecture because they stand for: functional and formal. Objects that are considered sustainable must show ecological awareness, a relationship should show between its appearance and functionality .Sustainable architecture designs and that should try to improve the limit on environmental impact at the same time its objective is to achieve efficiency, positive impacts on health on the inhabitants. Sustainable architecture means being able to satisfy consumer's requests, through research on the natural resources witch are completely reusable.

The following review of literature is made up of: (2.historical background) as to how this whole process started. (3. The benefits of green buildings) the review discuss the advantages and disadvantages of the current strategies currently in place.

(4.Current case studies) this shows current buildings with the status sustainable architecture. (5.Conclusion) The review gets concluded in addition with directions for future research in the field.

2. Historical Background

From the beginning of the 20th century there have been five influential paradigms that shaped sustainability in architecture and the built environment. In the past 120 years architectural discourse has been influenced by the economic and ecological crisis associated with industrialization (see Table 2.1). Thus for thinking on sustainability we distinguish seven paradigms.

Table 1. Sustainability paradigms influencing architecture in 20th and 21th century

Paradigm	Years	Influencer	Paradigm
Bioclimatic architecture	1908–1968	Olgyay, Wright, Neutra	Discovery
Environmental architecture	1969–1972	Ian McHarg	Harmony
Energy conscious architecture	1973–1983	AIA, Balcomb, ASES, PLEA	Energy efficiency
Sustainable architecture	1984–1993	Brundtland, IEA, Feist	Resource efficiency
Green architecture	1993–2006	USGBC, Van der Ryn	Neutrality
Carbon neutral architecture	2006–2015	UN IPCC, Mazria	Resilience
Regenerative architecture	2016–Future	Lyle, Braungart, Benyus	

The first paradigm named Bioclimatic Architecture was dominated by ideas of Wright in 1906 on organic architecture (Uechi 2009), Corbusier and Breuer in 1906 on sun shading (Braham 2000), Atkinson in 1906 on hygiene (Banham 1984), Meyer in 1926 on the biological model (Mertins 2007), Neutra in 1929 on bioregionalism (Porteous 2013), Aalto in 1935 on health and precautionary principle (Anderson 2010) until formulation of the Bioclimatic Architecture paradigm by the Olgyay Brothers in 1949 and Olgyay (1953). Buildings of those architects showed a tendency of rationalism and functionalism while being fascinated by the beauty of nature. Bioclimatic adaptation, hygiene, safety and the notion of experimental and empirical design was not developed. Until the brothers Olgyay set up the first architecture lab in the 1950s combining academic research and practice. This was a major change that moved architecture into the scientific and empirical research world that is evidence based.

The second paradigm named Environmental Architecture was dominated by the ideas of McHarg in 1963 on design with nature (McHarg and Mumford 1969), Ehrenkrantz in 1963 on systems design (Ehrenkrantz 1989), Schumacher in 1972 on appropriate technology (Stewart 1974) and Ron Mace in 1972 on universal design (Thompson et al. 2002). Buildings of those architects showed a tendency of inclusiveness of environment and biology from the building interior to urban and planning scale.

The third paradigm followed the first energy crisis and was dominated by the ideas of the American Institute of Architecture (AIA) in 1972 on energy conscious architecture (Villecco 1977), the American Solar Energy Society (ASES) including the work of Balcomb in 1972 on passive and active solar architecture (Balcomb 1992), the Passive and Low Energy Architecture (PLEA) society in 1980 and Herzog in 1980 (Herzog et al. 2001). Buildings of those architects showed a tendency of inclusiveness of solar and energy saving design strategies. The

first ideas of energy neutral buildings and renewable energy integrated systems were introduced in several building prototypes and concepts. The use of empirical simulation and measuring based technique to quantify building performance was based on energy codes and standards that were created in this phase.

The fourth paradigm named Sustainable Architecture was dominated by the ideas of Brundtland (1987), ranging from Baker on sustainable designs (Bhatia 1991), Fathy's congruent with nature designs to build architecture from what beneath our feet (Fathy 1973) to Sam Mockbee. Along with many others, they expanded the purview of sustainable design by embracing aesthetics and human experience in addition to environmental performance.

The fifth paradigm named Green Architecture was dominated by the ideas of the US Green Building Council in 1993 on green and smart design, Van der Ryn in 1995 on ecological community design (Van der Ryn et al. 1991), ARUP in 1996 on integrated design (Uihlein 2014) and Feist in 1996 on Passive Haus Concept (Feist et al. 1999). With the emergence of this paradigm the greening of architecture proliferated globally with more complex and broader environmental considerations (Deviren and Tabb 2014).

The sixth paradigm named Carbon Neutral Architecture was dominated by the ideas of the Kyoto Protocol in 1997 on carbon neutrality (Protocol 1997) and UN IPCC report (2006) on climate change. The work of Bill Dunster on Zero Energy Development and Ed Mazria on the 2030 Challenge had a strong impact on architectural research and practice. With the EU 2020 nearly zero energy targets for 28 member states, energy neutral architecture became a reality embracing resilience, dynamism, and integration.

For the coming 20 years, we will be on the verge of the seventh paradigm named Regenerative Architecture. This paradigm will be dominated by the ideas of Lyle since 1996 on regenerative design (Lyle 1996a), Braungart and McDonough since 2002 (McDonough and Braungart 2010) on cradle to cradle design and Benyus on Biomimicry (Benyus 2002). We are on a verge of a paradigm shift that operates from a positive impact creation through environmentally effective sustainable buildings. Three of the presented cases studies, in this research, serve as showcases for a positive impact creation.

3. The Benefits of Green Buildings

Sustainable architecture brings multiple benefits, to achieve that we have to look at certain aspects such as material efficiency, renewable energy initiations, management of non-renewable reserves and reduce threats to biodiversity

Sustainable architecture is not limited only on reduction or elimination of negative impacts on the environment, sustainable architecture tries to have a positive impact on the environment by generating energy or increasing biodiversity. These three categories: environmental, economic and social, Should impact sustainable architecture in a positive way.

3.1. Energy Efficiency

Sustainable architecture has a unique construction and design features that enable it to be ridiculously efficient, especially in terms of conserving energy and water.

3.2. Health Efficiency

People who live or work in Sustainable architecture enjoy better indoor air quality in addition to a number of other health and wellness benefits.

3.3. Cost Efficiency

Reducing these costs by incorporating a solar energy system and other sustainability measures this can drastically improve the overall cost efficiency of a building, especially for businesses that fall within the industrial and manufacturing sectors.

3.4. The Disadvantages of Green Buildings

Green architecture may be a dream come true for most ecologists and environmentalists but it also presents hindrance in the industrial world. This is a very difficult task, as it requires expenditure of many resources and investments. This is also one of the major problems that green architects have to face in order to fulfill the goal of reducing impacts of constructions, which can only take place by the help of deforestation that has caused notable Ozone Depletion. Immense deforestation and human violations into various ecosystems, like the development of roads in the Amazon Rainforest, has caused environmental disruptions and has significantly increased the risks of endangering biodiversity. On top of that, building green structures also costs more as special equipment has to be bought and maintained, because of which people are not yet drawn to this system.

3.5. Air-cooling Features

Particular cooling components that control precisely the indoor temperature in green buildings don't exist. The only thing that influences it is natural ventilation, which cannot be regulated.

3.6. Location

To amend sun exposure, green building may need a correct structural orientation. It influences how natural light enters the building, how to shade some part of it. As far as the building will contain recycled resources the location of the building is affected by the land's humidity, the circumstance of the surrounding area.

3.7. Availability of Materials

In urban areas materials can be found easily than in rural areas. Green buildings require special materials. A lot of eco-friendly materials re not available in most parts of different cities. So sometimes these materials are hard to find and transportation fees may be high. Time to build a green building in some cases takes more time than an ordinary one. Sometimes it takes too much time to find the needed material. The client can delay the construction.

3.8. Green Roofs

Green roofs consist of several layers plus a vegetation layer, culture medium, drainage, isolation, waterproofing membrane, and roof support. Green roofs are heavier than simple once, so the roof's strength should be improved in order to construct this type of roof correctly.

3.9. Cost

Many believe that the cost of green building is cost-prohibitive. You need to invest a lot of money. However later with energy saving possibilities the invested money may come back.

3.10. Low Indoor Quality

Green buildings are eco-friendly and healthy, but too much emphases are put on sealing them. This isolation may cause indoor pollution. It can be harmful to the health of the occupants. Damage to health can also cause fluorescent lights. Their radiation in isolated places can lead to health problems.

4. Conclusion

Sustainable architecture should be taken into serious consideration. Therefore, sustainable planning is needed and more of a cultural approach is required than a simple branch of traditional architecture. The goal here is to designing a structure with minimal impact on humans and the environment of non-harmful materials, this should help preserve the relationship between man, building and environment. Information and legislation should be implemented in cities worldwide about global warming and its effects. It is important to understand the process at a young age then this will better shape the future. A true revolution

in architecture can no longer be ignored. Unfortunately, architecture doesn't have any immediate answers, reflecting the complexity of cultural change, a time-consuming process that also requires conviction to embrace new approaches like making a project's lifecycle 100 per cent sustainable, for an architecture that has no negative effects on living beings or the planet. The motivation for choosing the literature included in this work consists in the clarity of Reasoning, the representative nature of research, diversity of specific tools and research Methodology. However, further research is needed clearly to categorize the difficulties caused my achieving sustainable architecture so we can prepare for a more improved way of living that's better than sustainable architecture

References

[1] Afhami, Reza, Mostafa, Ali "flexible architecture housing" Magazine Book of the Month art in an era of demographic changes, No. 92,177 (2014).

[2] Edvard, Brian, translation: Shahrouz TehranI, Iraj, "printing guidelines on sustainable architecture", Tehran, Mehrazan publishing (2010).

[3] Shateriyan, R " Tehran's climate and architectural" a second edition of Simaye danesh publishing (2009).

[4] Azimi, N "physical plans of national, regional in Iran: a step for Sustainable Development " MA, Shiraz University, Faculty of Engineering (2010).

[5] AlksandEr, Christopher and Serge Chrmayf (1996), areas of public life and private life, translator M. Mazini, publisher Tehran University, Tehran.

[6] Falamaki, Mohammed Mansoor (2002) roots and theoretical tendencies of architecture, Faza publishing, Tehran.

[7] Memariyan, GH (2005), course in Theory of Architecture, published by Soroush Danesh, Tehran.

[8] Adams ،w.m.(2001) ،green development: environment and sustainability in the third world (2ad edition) London: routledte.

[9] Edwards ،brian and paul ،hyatt(2001). Rough guide to sustainability. London: riba publications.

[10] Asadpoor, Ali, a model of stability in the Iranian desert architecture, our magazine, No. 25, 2006.

[11] Poordeyhimi, SH, the impact of shadow of the instruments on the amount of thermal energy through windows, Soffe magazine, Issue 3_4, 1990.

[12] Azizi, M., Soffe magazine, No. 33, Eleventh, 2001.

[13] GHobadiyan, Vahid "Climate check of traditional buildings in Iran", Tehran University Press, Fifth Edition, 2008.

[14] GHiyasvand, J., interaction Architecture and Renewable Energy (stable), construction paper, No. 38, February 2006.

[15] Memariyan, GH (2005), familiar with Iranian residential architecture typology introverted, Soroosh Publications of 2008.

[16] Mofidi, Majid Mahmoodi, M. Analysis of the architecture of Yazd funnel and find the optimal way of your work, Arts Magazine No. 36, 2008.

[17] www. Logha tnameh.com

[18] www. Mehrazi. Blogfa.com