APPLICATION OF SUSTAINABILITY PRINCIPLES IN THE CONSTRUCTION INDUSTRY

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Abstract: The construction industry has provided societies with facilities and infrastructure projects that meet their needs and fulfill their requirements, created up to 7 % of the world's job opportunities, made around one-tenth of the world's Gross Domestic Product and stimulated growth of other industries. On the other hand, it has been proven to have a negative impact on the environment (Mthalane, 2009). The construction industry accounts for 40% of the CO2 emission worldwide, 30% of Raw material usage, 40% of energy consumption and 20% of fresh water consumption (Wilkinson and Reed, 2006). The United Arab Emirates has experienced one of the world's biggest construction booms in the last 20 years, and the negative effects of this boom on the local environment have been obvious. As a result, the environmental and economic authorities of the UAE started to realize the need for adapting sustainability, and made this concern one of the top priorities of the country. During the last decade, the government of the UAE has spent huge amounts of money to direct the construction industry towards sustainability. The authors in this research aim to introduce a new concept to measure sustainability in the construction industry. The Maturity model in construction industry will be created by studying different maturity models in other fields, understanding how maturity is defined, assessed and achieved, and studying related case studies. In the current research, the focus will be more on sustainability in construction of building because almost 40% of energy consumption comes from buildings. Thus, it makes a major contribution to a more sustainable future.

Keywords: Construction industry, sustainability, CFC, construction materials, LEED**.**

Introduction

One out of three people during the middle of the last century were living in cities and towns. Nowadays, the majority of the world's population lives in urban places, and it is forecasted that by 2015, there will be 23 "mega cities", and 19 of them will be located in developing countries (Lopez, 2010). This rapid growing of the population and the huge expansion of urban areas has led all the nations and even other creatures to compete for resources. Urban regions are known for their extensive use of natural resources and prolific generation of waste substances. They also import goods and services, and export waste products, leaving an impact not only on their immediate environment but also on distant environments over a longer time period. The challenge of civic authorities is to provide adequate living conditions, water, sanitation, public transportation, and waste management features prominently in all urban development policies and action programs.

Today, we are painfully beginning to learn that environmental resources are limited and are quite sensitive to everything that we do. We are starting to experience the effects of the actions of generations that came before us. To make sure that future generations will not experience worse, we need to be aware of the ideals and requirements of sustainability. As we become aware, we need to put what we learn into action as that is the only way we can allow nature to catch up with the rate at which our requirements grow. This does not mean having to stifle human development. On the contrary, it means sustaining the supply of resources so that we can, in turn, sustain human development. As, the UN Secretary General Ban Ki-moon once said: "Sustainability is the most promising path forward".

Literature review:

The ecosystems from which humanity lives require a continual input of energy and continual preventive intervention to keep them from breaking down. Nothing in today's world

regulates itself automatically for the human benefit; social forces have to intervene continually to correct environmental conditions. That is why knowledge about the ecological basis of our life is so important. Mankind operated with an attitude of inadvertent sustainability until the time of the Industrial Revolution. This attitude was not deliberate, but was the result of a limited population using simple techniques for farming, industry and general human activity. Nature was therefore able to cope with all pollution caused by humans. In order to meet the increasing demand for the resources, more industrial activities have grown without taking the resulting environmental degradation seriously, and the enterprises that produced these negative effects were not held accountable for them (Chen, 2010). In the mid-20th century, environmental movements became aware that the price of the material benefits that were being enjoyed is a serious environmental cost. Later in the century, environmental problems expanded to cover a global scale. The global community demand became highly dependent on non-renewable energy resources, which was clearly demonstrated in the 1973 and 1979 energy crises (Bertrand 2008).

The environmental conditions worldwide continued to become more critical, as water and air pollutants have increased, significantly higher temperature levels have been detected around the world, and most importantly, many ecosystems have been adversely affected. With such a chain of negative health and environmental impacts, the global community attention increased towards the problem of unsustainable human practices.

Global Warming:

Global warming has become a major economic and political issue. In the late October 2006, the British Foreign Secretary Margaret Beckett sought to redefine climate change as a global security issue. Up to a fifth of the World's wealth could disappear and the lives of billions of people put at risk within this century, unless we invest now in creating a global low-carbon economy (Will, 2004).

Global Warming results from many factors, the linkage between pollution and global warming is very complex, with expectations of gradual increases in understanding the consequences in terms of local climate and its instability (Will, 2004). There are many examples, such as forestation, adopting a worldwide measure in energy saving, pollution control and carbon fixing Carbon dioxide and various atmospheric gases called "Greenhouse Gases," transmit incoming sunlight but absorb outgoing infrared radiation, thus raising the average temperature of the earth's surface. Carbon dioxide, a major byproduct of fossil fuel combustion is clearly the most influential greenhouse gas. Methane gas is actually twenty times more powerful than carbon dioxide volume wise, but its presence in the atmosphere is in smaller amounts and short lived when added to the atmosphere (Qader, 2009). Since the Western Industrial Revolution in 18th to 19th centuries people has mainly relied on in fossil fuels to generate energy (Dobbelsteen, 2010). Since then, the usage of the fossil fuels has been dramatically increasing, which has resulted in huge CO2 emission. The below graphs demonstrate the increasing Worldwide level from fossil fuel burning, and CO2 concentration level in the atmosphere for the last 162 years:

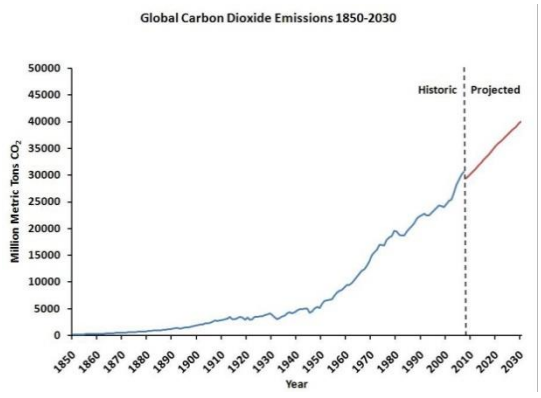

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Fig.1: Global Carbon Dioxide emissions from fossil fuel burning (Source: Carbon Dioxide information analysis center (CDIAC))

In 2009 the United Nations Department of Social and Environmental Affairs revealed that over the past 420,000 years, the CO_2 content in the atmosphere has varied cyclically in a period of 100,000 years, between a minimum value of about 180 ppm in volume and a maximum of 290 ppm. CO2 level today reached 380 ppm and is rising at the incredible rate of about 2 ppm per year. The scientists now know that an increase in temperature in the earth surface, can release CO2 from the ground and seawater and conversely, an increase of greenhouse gases that will cause a further rise in the atmospheric temperature.

Sustainability in construction Industry

The benefits of implementing sustainable practices in construction can be grouped under environmental, economic, social, and cultural aspects. All these include improved regulatory compliance requirements; reduction of liability and risk; enhanced reliability among customers and peers; reduction of harmful impacts to the environment; prevention of pollution and waste (which can result in cost reduction); improvements in site and project safety (by minimizing injuries related to environmental spills, releases and emissions); improved relationships with stakeholders such as government agencies, community groups, and clients (Bansal, 2002). The effective usage of appropriate plant and equipment's, minimizing wastage, economic design and improved quality in construction leads to winning more projects resulting in increasing market share and profitability. Many researchers have voiced their opinion that sustainability and cost effectiveness are the key elements for the long time survival of any organization. Therefore it is vitally important to construction companies to implement sustainable construction practices in order to increase their market share and ensure their long term survival. In addition, reducing environmental impact ensures optimal use of resources and enforces measures which improve the company's competitiveness (Bansal, 2002). There are tangible and intangible benefits of sustainable construction as mentioned below:

Tangible benefits

- Cost saving from improved energy management.
- Cost saving from operation efficiencies
- Increased revenues and new markets from providing low-carbon products and services

Intangible benefits

- Competitive positioning in the market
- Improved shareholder relations
- Employee-related benefits

The three major areas of the construction industry that are associated with the CO_2 emission are the materials manufacturing, construction and operation (Cullen, 2009). CO_2 emission in construction industry is categorized as direct emissions that are from the burning of fuel, and indirect emissions from the use of electricity from grid supply, use of company vehicles, and business travels and wastages. The following is an estimate of the Global and Industrial CO_2 emissions:

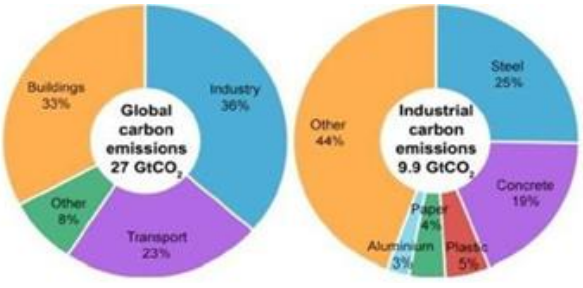


Fig.2: Global and Industrial CO_2 emissions (Source: Allwood and Cullen, 2009)

The material usage in the construction industry

has been the most significant since the year 1900. The construction industry's material use has risen to an alarming level (Krygiel and Nies, 2008).

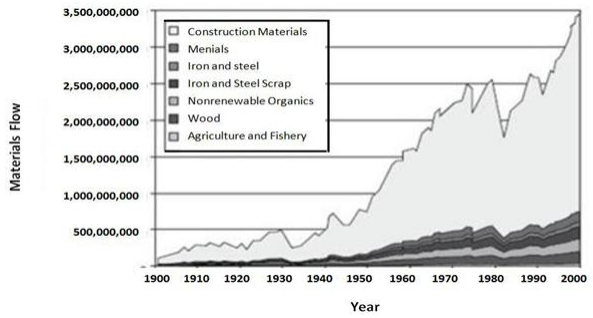
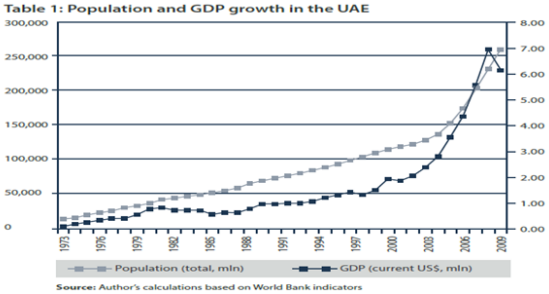


Figure 3. Shows the materials flow (in tons) in various industries from the year 1900.

Examples of effective ways to reduce CO2 emissions in construction industry are using modern construction technologies that lead to a reduction in quantity of building materials, or using of alternate low-energy consuming materials (Sengupta Nilanjan, 2008). The UAE's urbanization has been increasing rapidly along with its rapidly increasing local and immigrant population. The country's industrial areas and business activities also have been expanding rapidly. The commercial exploitation of oil in UAE began in 1962, bringing with it wealth and an increased demand for foreign labor. The UAE's GDP and purchasing power now rank it among the wealthiest nations in the world (Khalfan, 2007). For a country like the United Arab Emirates (UAE), urban development is a major concern of policymakers, planners, public officials, and environmental advocates. Among all the nations in the Arabian Gulf region, the UAE has emerged as a hub of commerce, stability, security, and peace.

Table 1: Population and GDP growth in the UAE



Source: Author's calculations based on World Bank indicators

Fig. 4: UAE GDP Growth

According to the 2005 Human Development Index Report compiled by the United Nations Development Program (UNDP), the UAE has risen in rank to occupy the 41st position among the developed nations of the world. Because of its economic growth and relatively open immigration policies the UAE accounts for US$36 billion, according to estimates of the Arab Real Estate and Construction Association. In the next five years this amount is expected to double, making the UAE "the pearl of the east" (Khalfan, 2007). UAE's past is rooted in the connection between the land and water. Many generations spent half of the year fishing and pearling around the islands and the other months farming and ranching in desert oases. This bond can be maintained by securing visual and physical links between the city and its surrounding landscape and by communicating this heritage to future generations. Local traditions are further preserved by incorporating historic architectural forms that are well-suited for the lifestyle and climate. Forms and patterns that are unique to Arabic society should pervade the city and punctuate the skyline (Saravanan,2011). The islands, sand dunes, sea, coast lines and native wildlife all blend to create UAE's incredibly intricate, sensitive and unique natural environment. This extraordinary mix has coexisted with the people living within it for thousands of years. It is very crucial to protect these critical resources and preserves the connection between humans and the surrounding environment even as the city's population triples in size. With a heritage tied to life in the harsh and unforgiving desert, UAE's leadership well understands the lessons of traditional desert living, where sustainable practices and resource conservation are not just slogans, but are essential to survival in such surroundings. That's why the UAE's leadership understands the tremendous challenges posed by climate change, environmental degradation and the need to find sustainable energy sources. "The fact that a

separate category has been introduced for Corporate Social Responsibility is testimony to our leadership's commitment to make social and environmental sustainability an integral part of business excellence. " Sheik Mohammad Bin Rashid said (Saravanan, 2011).

Conclusions

Sustainability concept is really essential in constructions because of the importance of saving resources and protecting the environment. Thus, in order to encourage and to lead the companies to implement the standards which are based on sustainability into their projects, assessment tools such as LEED were launched. Therefore, it is recommended to firms and construction companies to use these rating systems to evaluate their projects in terms of green/sustainability because it helps them to reduce the impacts on the environment as well as maximize their benefits in long term.

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