

Environmental architecture and how we adapt to live in the surrounding environmen...

[Design](#), [Architecture](#)



Chapter 1

INTRODUCTION

The Environmental Architecture is not new. It has appeared in the ancient civilizations in the aspects of human attempts to adapt and live in the surrounding environment. These aspects of adaptation were varied in different ways such as: the use of construction materials available in the local environment and the methods used to deal with the elements of the environment and their determinants like rain, wind, sunlight etc. For example, the human civilizations of ancient Egyptian used local materials like wood, brick and papyrus in their architectural systems such as housing for workers while they used natural stone and carved in the mountains such as temples. Other civilizations went to several environmental processors such as domes, vaults and interior spaces, and all this was in the context of human adaptation to its environment. This trend was prevalent throughout the ages and times and the environment was not ignored at all, as various ways were tried to cope with the environmental elements until the industrial revolution.

With the beginning of the Industrial revolution in the nineteenth century all theories of traditional architecture has changed, and full and strong concentration on the function and economic efficiency as a source of the design had been emerged. As a result, architects ignored to satisfy the human physical needs such as temperature, humidity, light intensity and non-physical needs such as social, psychological and cultural aspects. The physical comfort of humans greatly depends upon the following physical

factors; temperature, air quality, lighting environment and acoustic environment. Architects tended to unify the architectural vocabulary of the world and treated buildings as a machine. Hence, a wide gap between architecture and environment came into being. Those who interested in studies of nature and environmental balance called this architecture as 'Destructive Architecture' because of its negative impacts on the environment. The rise of science in the Renaissance led to the Industrial Revolution which has enabled environmental engineers to produce reasonably comfortable conditions in almost any building in almost any climate. Some of the most visually powerful architecture of our era has taken technology and pushed it to the limits of its capabilities. The engineering systems associated with this architecture, however, have required high-grade energy to deal with the environmental problems resulting from the building design.

In Europe, in the mid-nineteenth century, industrialization urges steps as well as scientific discoveries reform the human understanding of nature. There was scientific development in construction techniques and architecture, especially in the use of glass and metals and development in the techniques of artificial lighting and air conditioning. John Ruskin, the English art critic and one of the first who observed the environmental degradation caused by industrial progress, proclaimed that architecture should respond to the environment. He stated " God gave us earth to live upon for some time, but its ownership should devolve to our children and grandchildren, so we have no right to ignore them and involve them in

punishment for crimes they never committed or even to deprive them of the blessing of their God-given.”

Modernity, in general, is the antithesis of nature and is also a global response to the technical progress. Modernity, in the twentieth century, has appeared in this sense clearly in the work of some architects like Walter Gropius, Mies van der Rohe and Phillip Johnson. It also included the intuitive design and the organic trend in the work of some other architects like Le Corbusier, Alvar Aalto and Frank Lloyd Wright. Those architects had been considered as giants and the founders of modernism. Despite the fact that each of them had a contrary view of architecture, they put the first stone and the core of the contemporary environmental architecture.

The interaction between humans, architecture and the environment is a major manifestation of human civilization. During the Industrial Revolution there was a misunderstanding of that interaction as humans believed that they have to demonstrate their ability to conquer nature using the tools and technical capabilities and they did not discover their mistakes until the environment crises emerged. Destructive Architecture did not destroy only the environment, but also destroy the identity and cultural characteristics of the place. Therefore, architects have begun to redefine the word ‘ Green Architecture’ to convince buildings users its advantages and its ability to meet the functional needs of the buildings, but the problem is that green architecture concentrate always on the rationalisation of energy consumption and to achieve physical comfort for users.

Green Architecture aims to reduce consumption of natural energies and to use natural materials in buildings construction. Such architecture achieved two important goals at the same time. Firstly, it reduces pressure on natural energy resources, and secondly, it promotes and increases the efficiency of architectural systems. Consequently, green architecture is a sustainable method of green building design. It is design and construction with the environment in mind. Thus, green architecture generally works with the key concepts of creating an energy efficient environmentally friendly house.

The world's population is now more than 6.8 billion and continues to grow by 83 million people per year. This extreme growth in human population is mortally taxing the Earth and its resources. During the second half of the last century, the world's urban population has increased tremendously.

According to the UNFPA, "in the 1950s there were no more than 200 million urban residents, but by the end of the century their total number was close to 3 billion and it is expected to increase to approximately 5 billion by 2025" (Ghiaus C. & Allard F. 2005). These figures highlight the need for more housing developments around the world to cope with the population growth, but that means more energy consumption and environmental degradation.

In the book "The Energy Saving House", Salomon and Bedel stated, "Without energy, there would be no life and no technical development."

(Salomon T. & Bedel S. 2007) In the UK, approximately 50% of the whole carbon dioxide emissions can be attributed to buildings, in which of 27% originate from residential housing. However, housing is vital to us all - to our economy; our environment; to every individual and family for whom a home

represents so much more than just a place to live. From this point of view, the architectural design will be a highly powerful tool in ensuring new housing developments are built to minimise their impacts on the environment, contribute to the energy efficiency and carbon dioxide emissions. As long as humanity only used the energy it needed for survival and for its primary needs, the world's energy consumption will be stable.

Finally, Le Corbusier stated " Architecture is one of the urgent needs of man, for the house has always been the indispensable and first tool that he has forged for himself," and also claimed " the house is a machine for living in." (Le Corbusier, 1923) From this point of view, it is possible to say that designing a house is something like manufacturing a new car, which needs a planner, experts and tools to be finished and must be tested before being used.

Chapter 2

METHODOLOGY

This chapter focuses on the qualitative research method has been used to gather an in-depth understanding of sustainable architecture. It was crucial to identify what type of method should be used to arrive at the aim of the research. The decision was made to gather the relevant information from specified individuals dealing with the similar challenges. The best method to achieve the target was questionnaire paper being emailed to each one. The questionnaire paper focused on specific matters such as: sustainability, architectural design and the relationship between them. This means a non-

numerical data collection and explanation based on sources of data must be investigated and analysed to come up with results at the end of the research.

2.1 Research Aim and Objectives

Architects, designing buildings, considered the extreme impact of the environment on buildings and how a building can be protected from the environmental effects. Environmental scientists are concerned as to how much buildings impact upon the natural environment. Where there is mutual influence on each other, it is important to establish the impact of buildings on the environment. Housing forms a fundamental part of a nation's building stock, hence research in this area will have significant effects in protecting the environment especially in the conservation of energy consumed in these buildings and consequently, reducing emissions of carbon dioxide to the atmosphere.

“ The goal of sustainable design is to find architectural solutions that guarantee the well-being and coexistence of three constituent groups: land, buildings or building products, energy,” (Jong-Jin, K. 1998). This study aimed to diagnose housing problems to find out what has been done and what can be done in the future and then find the architectural solutions of these problems that will be considered as main principles of a sustainable design in order to meet the targets of the government strategy. In 2008, the UK Government confirmed that all new homes will have to be zero carbon from 2016.

The aim of this study is to help architects and designers put into practice ideas and approaches that allow them to design homes in an ecological and sustainable way. By following principles of sustainable design that are the results of the research laid out in the following chapters and creating a method to assess architectural design (table of assessment), architects might be able to meet the following objectives:

Organise the interior and exterior spaces of the house to better effect.

Assist both the environment and the house occupier by saving energy and money.

Create a healthy and affordable environment.

Choose structural types and materials that are environmentally friendly.

Avoid resource depletion of energy, water and raw materials.

Prevent the degradation of the environment caused by facilities and infrastructure throughout their life cycle.

Create a successful high - performance building.

Identify the principles of sustainable home design that meet this target.

In conclusion, architectural design is a highly powerful tool ensuring new housing developments are built to minimise their impacts upon the environment, contribute to the energy efficiency and carbon dioxide emissions. The principal objective of this study is to find principle of sustainable design used as a guide by architects to evaluate their design. Thus an evaluating method would be designed to be used as an assessment tool.

2. 2 Research Method

To meet the objectives of this study, the research methodology adopted require gathering relevant information from specified individuals facing the similar challenges and compiling databases to analyse these knowledge and opinions thereby arriving at a more complete understanding of how well-designed sustainable housing benefit the environment. The target population are architects who reside in the UK and are involved in architectural practice or theacademictraining of architects.

Data collection will consist of surveys with architects using a questionnaire method sent by email to a number of them. This kind of survey was made because it was possible get the names and email address of the target people. This is a rapid means of gaining information. Although, questionnaires often seem a logical and easy option as a way to collect information, they are actually rather difficult to design in such a way to be understandable and easy to answer. A structured questionnaire with six questions was developed to aid in collecting the requested information. The aim was to send emails to approximately 100 architects who undertaken a range of roles and who come from different communities and universities within the UK. Followings are the questions that structured the questionnaire paper through the research:

- 1)How can an architect support the environment?
- 2)How would you define a sustainable housing design?
- 3)From your experience, what are the principles of sustainable design?
- 4)In what way nature can be used as a guide for any design?

5) What are your key concerns as a designer interested in sustainability?

6) How do you judge the success of a building in the green age?

These questions highlight the importance of interrelationship between architecture and sustainability in terms of environmental conservation. Professionals' answers to these questions assist the research key findings and results at the end of the study and played a main role in creating the principles of sustainable design, which is the main objective of the research.

2.3 Questionnaire Responses

The survey identified 102 architects selected to form the sample selected from four universities. These were including Cardiff University, Bath University, Sheffield University and Brighton University. There were two reasons for choosing these universities, firstly, they have a school of architecture with respected staff of architects, and secondly, they originate in different parts of the UK. It is perceived this might help attain different points of view and attain a range of answers. Twenty seven architects responded the email representing an overall response rate of 26.4%. A total of 16 out of 27 responses answered the questionnaire representing 59.2% and the rest gave different reasons for not answering the questionnaire, for example, five of them have no time; three are not practicing architectural design and the last three are involved in other kind of studies like history of architecture and interior design.

Figure 2. 1: Questionnaire answers rate.

Within this poor response rate and the small group who responded, the return answers of the questionnaire provided significant information that would be one of the bases to put the structure and principles of this research. After collecting the data, answers for the questions above could be summarised as follows:

1. How can an architect support the environment?

Reasons underlying the use of this question were that the role of architecture as a responsible profession is of far reaching significance. Architects contribute to protecting the environment by designing environmentally responsive buildings that have less impact on the environment. Architects can assist at every stage. As they can shape the environment physically, they have the ability to influence how people live, whether they walk or cycle, whether they recycle and how much energy they use. The consequence is architects can generate new forms of architectural expression that are closely linked to local conditions, such as; microclimate and topography, natural resources and the cultural heritage of a certain region.

2. How would you define a sustainable housing design?

Sustainable design means doing the most with the least means. It is about ideally using passive architectural means to save energy rather than relying on wasteful mechanical services. Sustainable design aims to meet present needs without compromising the stock of natural resources remaining for future generations. Sustainable design can be defined as ecological design

that integrates seamlessly with the ecological systems in the biosphere over the entire life cycle of the built system. Sustainable housing design has less dependency on fossil fuels on terms of its energy demand, uses low impact materials for construction, mostly self sufficient in terms of its energy usage, has facility to conserve water and dispose waste sustainably.

3. From your experience, what are the principles of sustainable design?

Sustainable design can be summarised as embracing: energy efficiency, the choice and provenance of materials, sources of energy, consider energy implication in site selection and building orientation, take advantage of natural ventilation, specify efficient HVAC and lighting systems, water control, affordable design and efficient use of spaces, healthy indoor environment, landscape and infrastructure, building systems and structure, sustainable dispose of waste and planning design. These answers would be the cornerstone of proposed principles of sustainable design.

4. In what way nature can be used as a guide for any design?

We can learn from nature in terms of adapting to climate which can be a guide for any design. Bio mimicry is the examination of nature, its models, systems, processes, and elements to emulate or take inspiration from in order to solve human problems in habitation. Nature provides inspiration, information and analogy. Nature should be imitated and our built systems should be mimetic ecosystems. Very often there are rich architectural traditions that work with, and are not against nature. Many of the principles appear to have been forgotten over time. In the Glass House at the National

Botanic Garden of Wales near Carmarthen, the architect Lord Foster buried the structures in the ground to integrate them within the landscape and make passive use of the thermal mass of the soil to reduce energy demands for space heating.

Figure 2. 2: Glass House at the National Botanic garden of Wales

Source:(<http://www.flickr.com/photos/iqbalaalam/3719205123/>)

There are other lessons to be learnt from nature with regard to the efficiency, performance, adaptability, variety and tremendous beauty which organisms display when under close observation. Considering that nature obeys the same physical laws as man-made objects, this should be seen as encouraging making it worthwhile to study principles and mechanisms.

5. What are your key concerns as a designer interested in sustainability?

Dr. Hasim Altan, lecturer in Sustainable Environmental Design at School of Architecture of Sheffield University, claimed “ My main concern is that buildings are being designed without any consideration to climate change impact and adaptation to changing climate, and therefore we will be repeating same mistakes over and over again, and will be left with a building stock still unsustainable for future generations.” Sarah Mc Cormack, MSc Teaching Assistant at Welsh School of Architecture of Cardiff University, stated her concerns as “ The lack of will to make sustainable design a key priority and the lack of knowledge of most Architects to design sustainably and holistically.” Prof. Chris Tweed, BRE Chair in Sustainable Design of the

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Built Environment at Welsh School of Architecture of Cardiff University, expressed concern at the integration of people and the designed built environment. He believes that this integration would assist society achieve the desired/necessary environmental conditions without using excessive amounts of energy or causing irreparable damage to the environment.

Others concerned about various topics linked to the issue of sustainability such as: the choice and the provenance of materials and the energy needed for their transport and refinement; the integration of technologies and components to use renewable energy in a satisfying way especially one that controls the impact on and potential for the appearance of the building; designers should be aware of the connectivity of all systems in nature and these should be integrated as part of the built system's processes; designers should also beware of making excessive claims about the sustainability of their designs because ecological design is still in its infancy.

6. How do you judge the success of a building in the green age?

Some of the architects who responded to the questionnaire said that the success of indoor environment, use of low impact materials, self sufficiency and operational sustainability. Others said it is economically, environmentally and socially sustainable, and also being full of beauty and delight, whilst others believe that the success of a building is all about minimal operating energy, and embodied energy, while providing optimal conditions for its occupants. The success of a building is dependent on its

overall performance including its utility value, but the beauty and design is an important as its usability and function.

2. 4 Data Analysis

As mentioned before, the objective of this study is to design an evaluating tool, which can be used to assess any housing development in term of sustainability. Analysing the data collected from the answers above sorts the following results:

A successful green building is one that integrates seamlessly with the natural systems in the biosphere, with minimal destructive impact on these systems and maximum positive impact.

The buildings that are currently being constructed are not even prototypes for a green age. They are only minor attempts at sustainability and this is an evident that completely new thinking of green architecture is required.

Ideally, a building should be designed, constructed and operated in sustainable way.

In fact, most buildings still do not perform completely sustainable because of the way in which they are designed. Using sustainable materials, renewable energy resources, energy efficient appliances and managing the waste is not quite enough to make a building performance sustainable.

There are more and more to do in terms of environmental architecture.

Today we have to tackle climate change and global warming, to improve human life and to enhance economic systems. We therefore, need to be answering our sustainability agenda by addressing environmental, social and economic factors in the architectural design to minimise the negative

environmental impact of buildings.

In doing this so, we will create sustainable urban environment with sustainable communities. This can be done by creating principles of sustainable design, which can be used as a guide by architects and designers.

New urban developments, at any scale should be designed to help residents create thriving community that draws upon local resources whilst reducing its ecological footprint and environmental impacts.

In conclusion, analysing the data has led to investigate the most appropriate and effective factors that affect buildings performance in the design stage. Some of which may not seem as much important for the first time, but with deep investigation we can find the real impact of each one. Thus, the research aims to define these principles in the following chapters.

Chapter 3

LITERATURE RIVEW

3. 1 Introduction

“ The construction industry has a significant impact on the environment,” (Boussabaine, A. and Kirkham, R. 2004). Environmental impacts can be classified into two main categories: atmospheric and resources. Atmospheric impact includes the greenhouse effect and ozone layer depletion, whereas resource impact includes contamination of air, water and Earth. The impact of construction on the environment could take place across a wide range of its activities loosely grouped into offsite, onsite and operational activities. “ Offsite activities include the mining and manufacturing of materials and

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components, transport of materials and components, land acquisition, project definition and design. The impact on the environment can be significant in the following areas," (Uher, T. E. 1999):

Consumption of renewable and non-renewable resources such as minerals, water and timber for building materials and components. This may also lead to the loss of biodiversity.

Pollution of air, water and land from manufacturing and transportation.

Committing land for a new facility may lead to deforestation, loss of agricultural land, expansion of urban areas with associated transport and social problems, more demand for water, electricity and other services, and loss of biodiversity.

Decisions about project goals influence the design, construction and operation of the facility in areas of resource usage, quality of indoor environment, traffic issues, recycling, waste management, maintenance and life of the facility as well as social environment.

In environmental terms, housing accounts for about 27% of UK CO₂ emissions through energy use, with all buildings contributing to around 60% in total. " Under Government plans, from 2016 all new homes will be built to a new zero carbon standard, and by 2050 the nation's entire housing stock will be virtually zero carbon," (Energy Saving Trust). House building in the UK is a major activity - delivering about 150, 000 new houses per year with an enormous impact on human lives in almost every way (<http://www.goodhomes.org.uk>).

The UK Government believes that there must be a commitment to the common good in house building and reformation for both policies and activities in the context of Building Regulations and that this commitment must look to reduce environmental impact at the same time as enhancing human health, community cohesion, quality of life, and national economics, (DEFRA). Despite all the Government policies and commitments, at present energy use in buildings continues to grow rather than lessen, with potentially devastating consequences for climate change and fossil fuel dependency. The construction sector in the UK is considered as the largest user of material resources of any sector and is also the highest producer of waste. With high-quality design, well-versed practice and authentic commitment there will be a distinguished opportunity for new housing to make a most important contribution to solving these issues. Therefore, new homes must be designed and constructed with human health in mind, carefully planning the financial costs and avoid profound impacts on the environment. To understand the meaning of well-designed and sustainable housing, there are three fundamental subjects that should be searched in detail to identify the principles of sustainable design that can protect and benefit the environment. From this point of view, the followings are the three main pillars of sustainable design:

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Figure 3. 1: The three pillars of sustainable design

3. 2 Environmental Issues

Environmental issues can be defined as negative aspects of human activity on the biophysical environment. The significance of environmental issues throughout society has raised its profile. It is also becoming much more recognised as a subject to study in universities and colleges around the world. The most important environmental issues currently taken into account may include climate change, pollution, environmental degradation, and resource depletion. These issues and much more others have concentrated the attention of architects and designers on the environment and they believe that additional action and superior care are required to be taken. Consequently, those involved in housing design are persuaded to respond and find out alternative and improved accommodation solutions, in which development can be undertaken in an environmentally efficient way. The need to provide additional shelters (building more houses) and infrastructure for a growing population will have further impact upon the environment and make a stronger case to search for ways to make the housing design more sustainable.

“ The three main environmental problems currently facing the planet are climate change, loss of biological diversity and population,” (Langston C. & Ding G. 2001). Stuart Johnson stated: “ Having an appreciation of these fundamental environmental topics is a prerequisite for effective decision making to enhance the environmental performance of our buildings,” (Johnson S. 1993).

3. 2. 1Climate change

Environmental scientists define climate change generally as a long-term change in the statistical distribution of weather patterns over periods of time that range from decades to millions of years regardless of cause. Climate change continues to be a subject of intense public and political debate. It may be a change in the average weather conditions or a change in the distribution of weather events with respect to an average, for example, greater or fewer extreme weather events. Climate change may be limited to a specific region, or may occur across the whole Earth. In recent usage, especially in the context of environmental policy, climate change usually refers to changes in modern climate and generally known as global warming.

Global warming

The Intergovernmental Panel on Climate Change (IPCC) predicts temperatures will rise between 1.5-5.8°C this century. A 3°C rise in temperature will

melt the Greenland ice sheet. It may take thousands of years to melt completely but if it does, global sea levels will rise by seven metres.

According to the IPCC, global sea level is likely to rise by 10-90cm over this century. Low-lying coasts will flood, affecting many human settlements, including some major cities. Some natural habitats will be lost. Many areas will have more extremely hot weather, like the unprecedented European heat wave of 2003 which caused around 30,000 heat-related deaths. The UK is also predicted to see heavier rain falls, with an increased risk of flooding.

Figure 3. 2: Global average temperature 1979 - 2011.

Source: Dr Roy Spencer, NASA Scientist, (www.drroyspencer.com)

The greenhouse effect

The natural greenhouse gases effect is to trap heat emitted from the Earth's surface, keeping the climate system in balance and the temperature about 30oC warmer than it would otherwise be warm enough to support life. The main greenhouse gases that affect the planet are carbon dioxide, methane, nitrous oxide, and water vapour. The amounts of these greenhouse gases in our atmosphere have been increased by human activities especially burning fossil fuels like coal and oil, industrial process, waste disposal and treatment, agricultural, and residential and commercial developments. This is throwing the climate system out of balance and causing global warming. Carbon dioxide levels in the atmosphere have increased from about 280 ppm in the mid 18th century - the start of the industrial revolution - to around 379 ppm today.

Figure 3. 3: Global anthropogenic greenhouse gas emissions broken down into 8 different sectors for the year 2000. Source: IPCC

There is a danger that if societies do not considerably control emissions this century we will reach a point when, even if we stop all emissions, the Earth will continue to warm. One of the solutions is to reduce all the carbon dioxide emitted from housing sector and this could start from the housing design stage. This method of reducing emissions to the atmosphere is called sustainable housing and is now being carefully considered in the UK,

especially by architects and designers who are responsible for all buildings design.

On the other hand, “ Carbon dioxide is good for the environment,” (Carlisle J. 2001). in fact, far from being a poisonous gas that will cause destruction on the planet’s ecosystem, carbon dioxide is arguably the Earth’s best friend in that trees, wheat, peanuts, flowers, cotton and numerous other plants significantly benefit from increased levels of atmospheric carbon dioxide. Increased atmospheric carbon dioxide does not just make a plant bigger, but also makes plants more resistant to extreme weather conditions. Another benefit of enhanced atmospheric carbon dioxide is that it helps the tropical rainforests. Consequently, it is very important to keep the climate system in balance with all its greenhouse gases.

3. 2. 2 Loss of Biological Diversity

Biodiversity is the grade of variation of life forms within a specified ecosystem, biome, or an entire planet. Biodiversity is a measure of the ecosystem health, and this means greater biodiversity implies greater health. Biodiversity is in part a function of climate. Biological diversity or biodiversity is a term we use to describe the variety of life on Earth. It refers to the wide variety of ecosystems and living organisms: animals, plants, their habitats and their genes. Biological diversity can have many interpretations. It is most commonly used to replace the more clearly defined and long established terms ‘ species diversity’. Biologists most often define biodiversity as the entirety of genes, species, and ecosystems of a region.

This definition has an advantage, which is that it seems to describe most circumstances and presents a unified view of the traditional three levels at which biological variety has been identified:

Species diversity.

Ecosystem diversity.

Genetic diversity.

Biodiversity supports ecosystem services including air quality, climate (e. g. sequestration of CO₂), water purification, pollination, and prevention of erosion. Biodiversity's relevance to human health is becoming an international political issue, as scientific evidence builds on the global health implications of biodiversity loss. This issue is closely linked with the issue of climate change, as many of the anticipated health risks of climate change are associated with changes in biodiversity (e. g. changes in populations and distribution of disease vectors, scarcity of fresh water, impacts on agricultural biodiversity and food resources etc.). Due to human activity the world's biodiversity continues to diminish at an increasing alarming rate, in Britain alone, over 100 species have been lost since 1900.

While it has been acknowledged at various levels that the target to halt biodiversity loss by 2010 has not been met, setting the target has certainly increased public awareness. Over the past 10 years, both policies addressing biodiversity loss and indicators assessing progress have been improved significantly. Biodiversity policies promote the protection, conservation, and sustainable use of biologically diverse ecosystems and habitats. In doing so,

they create significant public benefits and contribute to social well-being. However, the implementation of biodiversity policies will often benefit different groups to a greater or lesser degree. At times, some groups in society lose out under certain policies. For example, in establishing a proper right to facilitate the management of a biodiversity-related resource, people who previously had unrestricted use will be adversely affected.

Figure 3. 4: Status of Biodiversity Action Plan priority species and habitats in the UK: 2005Source:(DEFRA).

Deforestation:

Deforestation is the removal of a forest or stand of trees on a massive scale where the land is thereafter converted to a non-forest use. It is often resulting in damage to the quality of the land. Forests still cover about 30 percent of the world's land area, but the world's rain forests could completely vanish in a hundred years at the current rate of deforestation. Examples of deforestation include conversion of forestland to agriculture or urban use. It is one of the primary reasons for global warming.

There are many causes of contemporary deforestation, and forests are cut down for many reasons, but the biggest drivers for deforestation are the corruption of government institutions, the inequitable distribution of wealth and power, population growth and overpopulation, and urbanization.

Deforestation causes multiple social and environmental issues. Recently, there has been a growing recognition that immediate and short-term of deforestation jeopardise our lives on Earth. Therefore, it is imperative for us

to understand the effects of deforestation on our lives and environment, and utilise the knowledge in with effective solution. First of all, deforestation contributes to an alternation of local and global climate through disruption of natural cycle.

Figure 3. 5: The effects of deforestation, disruption of natural cycle.

Source: Lyrfutures08's Weblog.

There are two types of consequences of deforestation:

Positive Consequences.

Negative Consequences.

For the positive consequences, deforestation has made possible the needs of the social groups. Forests always are in the way for residential houses, buildings and factories. Roads, which are built for trading and easier transport, may have negative impact on forests. Economically deforestation contributed much and made positive changes in the lives of humans.

There are also a lot of negative consequences, such as: exposing soil, flooding, drought, disruption of water cycle, loss of biodiversity, climate change, desertification, increased population, and irreversible environmental changes. So, there is an urgent need to prevent or at least control deforestation. There are some suggestions which should be considered.

Reforestation/Plantation.

Wildlife sanctuaries: not only save the wild animals, but also the woods and

trees.

Commercial forestry plantations.

Water management: improper water management causes the deforestation.

This should be controlled.

Use recycled items.

Farming practices.

Support conservative organization: support the organization through donation, money, time etc.

In conclusion, there are direct and indirect causes of deforestation. One of the major direct causes of deforestation are logging, urbanization and construction. Not everyone recognises that construction is one of the primary causes of deforestation. Many experts have put forth convincing arguments that forests are cleared for growing population and raising building developments more than for any other reason. This issue should be kept in mind while selecting a site for new development is required.

3. 2. 3 Population Growth

Under the UN medium scenario, by the year 2050 human population is assumed to reach nearly 9.2 billion up from nearly 6.7 billion today. This assumption is based on the continued fertility declines that may happen today and in the future. Otherwise, world population could reach 11.9 billion by 2050 if fertility remains constant at today's rates.

Figure 3. 6: UK Population Projections.

Source: ONS (www.thenextwavefutures.wordpress.com)

Population is not the only force applying pressure to the environment and natural resources. As the number of people continues to increase, the environmental challenges humanity faces in this century and beyond will become harder to address. Today, the richest areas in species diversity and the most threatened by human activities are occupied by billions of people, who are increasing at a collective rate of 1.8% annually. Based on this trend, the planet's major renewable natural resources are strained and the atmosphere has been dramatically altered. It is clear that the 21st century will witness even greater damage to the environment unless urgent solutions to be taken place.

Most academic efforts study the environmental impact of population growth focus on the global scale. More than 98 percent of the world's population growth is occurring in developing countries. Countries in Europe, along with Russia and Japan, have shrinking populations because births are not keeping pace with deaths. Despite wide recognition of population growth in the UK and its ecological consequences, there is no universally accepted estimate of how many people the nation can accommodate. The number of people the UK can hold is ultimately a question of balancing quality and quantity. It is a choice based on values rather than a formula, but so does the way those people choose to live and how they are governed.

The Office of National Statistics ONS suggests that England will soon become the most crowded place in Europe. Forecasts suggest that the population of

the UK will increase by 33 per cent in the next 50 years as it becomes the most crowded country in Europe. It is estimated that 23, 000 such rental properties are needed yearly, between 2008 and 2011, to meet minimum housing requirements and bring stability to the housing market, (Brierley, W. 2006). Using a simple calculation, if assumed that the average members of each family is 4 people and according to the ONS suggestion, so the population of the UK will increase by 20, 130, 000 people (33% ? 61, 000, 000) - the estimate UK population in 2010- then an additional 5, 032, 500 properties should be built in the next 50 years. This means that 100, 650 such new properties are needed yearly. There are many other factors must be taken into account when putting strategies for future housing including; demolish some of the existing old housing stock; major developments that need clean up some existing houses such as Heathrow airport expansion and the 2012 Olympic Village; and the influx of immigrants. James Slack had wrote in October 2007 an article in the Daily Mail news paper said that " At least 95, 000 houses to be built every year until 2020 to cope with the record influx of immigrants, an increase of 30% on the latest Government estimate," (Slack J. 2007).

According to these factors, the UK Government has put a plan to build 3, 000, 000 properties until 2030. This reflects two things, first one is that the Government has considered the above factors and put a new housing strategy to cope with the needs of new homes in the future, and the second one is the hugeresponsibilityof architects and designers to manage and

protect the environment, keep society integrated and cope with the financial crises.

3. 2. 4 Pollution

Pollution is the introduction of contaminants into a natural environment that causes instability, disorder, harm or discomfort to the ecosystem i. e. physical systems or living organisms. In other words, Pollution is the action of environmental contamination with man-made waste. This includes mainly land, water, and air. Pollution can take various forms including chemical substances or energy, such as noise, heat, or light. Simply, the environment is our physical surroundings. This includes both human (man-made), social and physical (natural) features. Natural features include soil, the atmosphere, vegetation and wildlife. Human features include housing, transport and industry. Social features include things such as culture, language and political systems. Geographers are concerned about human action in the environment. Human interference with the environment causes problems such as soil erosion, global warming and acid rain. You may ask how we as individuals can have less of an impact on the environment. Our actions can help to increase and decrease the problems highlighted above. For example, turning off lights that are not being used helps reducing global warming.

Although pollution had been known to exist since people started using fire thousands of years ago, it had seen the growth of truly global proportions only since the onset of the Industrial Revolution during the 19th century.

Figure 3. 7: The industrial revolution pollution.

Source: www.jspivey.wikispaces.com

The Industrial Revolution brought with it technological progresses especially after the discovery of oil and its practically worldwide use throughout different industries. Technological progress had probably become one of the main causes of serious deterioration of natural resources. At the same time, progress of natural sciences enhances the understanding of negative effects produced by pollution on the environment. Both developed and developing countries face environmental pollution problems. There are three major types of environmental pollution:

Air pollution

Water pollution

Land contamination.

Some of the most important air pollutants are carbon dioxide, carbon monoxide sulphur dioxide, nitrogen dioxide, ozone, volatile organic compounds (VOCs) and airborne particles, with radioactive pollutants probably among the most destructive ones specifically when produced by nuclear explosions. Some water pollutants are: insecticides and herbicides, food processing waste, pollutants from livestock operations, VOCs, heavy metals, chemical waste and others. Some soil pollutants are: hydrocarbons, solvents and heavy metals.

Figure 3. 8: Pollution Causes.

Source: rtebjerg et al. (2003) www.eea.europa.eu.

Fossil fuels (oil, gas, coal) are the main resources of environmental pollution. Burning of fossil fuels produces enormously high levels of air pollution and is extensively recognized as one of the most important objective areas for reduction and management of environmental pollution. Fossil fuels also considered as one of the sources of land contamination and water pollution. This is clear when oil is transported from production area to further destinations by pipelines, so any oil leak from the pipeline may occur will contaminate soil and subsequently pollutes groundwater. When oil is producing from the ocean or transported by tankers by ocean, an oil spill may occur and pollute ocean water. A very recent example was the oil leaking into the Gulf of Mexico in 2010.

Along with other pollution sources, agriculture is the largest generator of ammonia emissions resulting in air pollution. Agriculture can cause water pollution and land contamination as well through chemicals such as pesticides and fertilizers. Not only that, but trading activities also may be another source of pollution. For example, it is been recently noted that packaging of products sold in supermarkets and other excessive retail outlets generates large quantities of solid waste that ends up either in landfills or municipal incinerators leading to land contamination and air pollution.

The residential sector is a significant source of pollution generating solid community waste that may end up in landfill or incinerators there by leading

to land contamination and air pollution. The construction industry is a major generator of pollution, where although construction activities also pollute the soil, the main areas of concern are: air, water and noise pollution, as it is responsible for around 4% of particulate emissions, more water pollution incidents than any other industry, and thousands of noise complaints every year. In spite of that, still there are so many ways to prevent or at least control pollution such as effective construction site practice. The first step is to prepare environmental risk assessments for all construction activities and materials likely to cause pollution. Specific measures can then be taken to mitigate these risks.

The UK Environment Agency and other government bodies are putting increasing pressure on construction companies to reduce pollution and conform to environmental regulations. In the past the pollution fines have been low and environmental regulations slack, and it could have been perceived as cheaper to pollute than to prevent pollution. This situation is now changing, and enforcement of environmental regulations is not only very expensive but can be irreversibly damaging to the reputation of a firm. Measures to reduce and control pollution are relatively inexpensive and cost-effective, and the construction industry needs to incorporate these into an environmental management strategy. By employing these practices, the construction industry is well positioned to clean up its act.

3.3 Sustainability

The word sustainability is derived from the Latin *sustinere*. Sustainability is a concept which deals with mankind's impact, through development, on the

environment. “ Sustainability is not a point we reach, but a journey we take” (Langston C. & Dink G. 2001). Dictionaries provide more than ten meanings for sustain, the main ones being to ‘ maintain’, ‘ support’, or ‘ endure’.

Sustainability is about environmental protection, sustained economic growth and social equity. Sustainability does not require a loss in the quality of life, but does require a change in mind-set, a change in values towards less consumptive lifestyle. These changes must embrace global interdependence, environmental stewardship, social responsibility, and economic viability.

3. 3. 1 Definition

Sustainability provides a framework under which communities can use resources efficiently, create efficient infrastructures, protect and enhance quality of life, and create new businesses to strengthen their economies. It can help us create healthy communities that can sustain our generation.

Sustainability is not a new concept. In fact, it is the latest expression of a long-standing ethic involving people’s relationships with the environment and the current generation’s responsibilities to future generations. For a community to be truly sustainable, it must adopt a threesome approach that considers economic, environmental and cultural resources. Communities must consider these needs in the short term as well as the long term. To find out what sustainability exactly mean, it is important to have a look at several definitions of sustainability as are listed below:

“ Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs.”

(United Nations World Commission on Environment and Development).

“ The earth belongs to each generation during its course, fully and in its own right, no generation can contract debts greater than may be paid during the course of its own existence.” (Thomas Jefferson, September 6, 1789).

“ Sustainability refers to the ability of a society, ecosystem, or any such ongoing system to continue functioning into the indefinite future without being forced into decline through exhaustion of key resources.” (Gilman, R., President of Context Institute).

“ Sustainable development focuses on improving the quality of life for all of the Earth’s citizens without increasing the use of natural resources, beyond the capacity of the environment to supply them indefinitely” (Langston, G. A. and Ding, G. K. 2001)

“ Sustainability is the emerging doctrine that economic growth and development must take place, and be maintained over time, within the limits set by ecology in the broadest sense – by the interrelations of human beings and their works, the biosphere and the physical and chemical laws that govern it. It follows that environmental protection and economic development are complementary rather than antagonistic processes.”

(Ruckelshaus, W. D. “ Toward a Sustainable World,” Scientific American, September 1989).

“ Sustainability is an economic state where the demands placed upon the environment by people and commerce can be met without reducing the capacity of the environment to provide for future generations. It can also be expressed in the simple terms of an economic golden rule for the restorative economy: Leave the world better than you found it, take no more than you

need, try not to harm life or the environment, make amends if you do.”

(Hawken, P. “ The Ecology of Commerce”, 1993).

Sustainability clearly is a strategy by which communities seek economic development approaches that also benefit the local environment and quality of life. It has become an important guide to many communities that have discovered that traditional approaches to planning and development are creating. Sustainability does not require a loss in the quality of life, but does require a change in mind - set, a change in values toward less consumptive lifestyle. These changes must embrace global interdependence, environmental stewardship, social responsibility and economic viability.

With regard to architectural design, sustainability may mean that housing design will have to look at and learn from the traditional architectural responses to climate of the past.

3. 3. 2 History of sustainability

The first establishment of a national policy for environmental sustainability came in the US in 1969 with the passage of the National Environmental Policy Act (NEPA) whose purpose was to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony and fulfil the social, economic and other requirements of present and future generations, (U. S. EPA), In 1972, the first international conference on the Human Environment was held in Stockholm by the UN. Both the developed and developing countries attended the conference to discuss the right of all humans to a healthy and productive

environment. The conference resulted in an action plan with detailed recommendations to national governments on how to influence human impact on the environment. Then the UNEP was developed and located in Nairobi, Kenya. In 1983 the Brundtland Commission was convened by the UN. It is formally known as the World Commission on Environment and Development (WCED). The Brundtland Commission's work provided the basis for the UN Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992, also known as the Earth Summit, an unprecedented international meeting of delegations from 178 countries and representatives of more than 1, 000 NGOs. Its purpose was to develop a global consensus on measures needed to balance development pressures against an increasingly imperilled global environment.

In 1992, a full text of Agenda 21 was revealed as an outcome of the UNCED held in Rio de Janeiro, Brazil, where 178 governments voted to adopt the programme. It covers topics on virtually everything regarded important for a sustainable future. A special session of the UN General Assembly (UNGA), the Earth Summit + 5, was held in 1997 to review and appraise the implementation of Agenda 21. The special session of UNGA took stock of how well countries, international organizations, and sectors of civil society have responded to the challenge of the Earth Summit.

In December 1997, a historic agreement was adopted in Kyoto, Japan by more than 150 nations and known as the Kyoto Protocol or the Kyoto Climate Agreement to protect the Earth's atmosphere and climate. It was opened on 16 March 1998 for signature by parties to UNFCCC, setting targets for

industrialised countries to cut their greenhouse gas emissions by 5% below 1990 levels by 2008-2012. In 1992 the Protocol was opened for signature at Rio de Janeiro and entered into force on 16 February 2005 after two conditions have been fulfilled:

It had been ratified by at least 55 countries.

It had been ratified by nations accounting for at least 55% of emissions from what the Treaty calls “ Annex 1” countries. See figure 2, 9.

As of November 2009, 187 states have signed and ratified the Protocol. Five years later, exactly in 2002, the Earth summit + 10, was held in Johannesburg, South Africa. It brought together ten of thousand of participants, including heads of State and Government, national delegates and leaders from NGOs, businesses and major groups. The Johannesburg Summit presented an opportunity for the participants to focus the world’s attention and direct action toward meeting difficult challenges, such as: improving people’s lives and conserving the natural resources. The Summit resulted an opportunity for the Leaders to adopt concrete steps and identify quantifiable targets for better implementing Agenda 21.

Signed and ratified

Signed, ratification pending

Signed, ratification declined

No position

Figure 3. 9: Kyoto Protocol participation map 2005

Source: Wikimedia Commons.

In December 2009, the environment ministers and officials were met in Copenhagen for the UN climate conference to trace out a successor to the Kyoto Protocol. The Copenhagen conference resulted in a document called the Copenhagen Accord. The positive side of the conference was that the Copenhagen Accord, for the first time, unites the US, China and other major developing and industrialised countries in one effort to control global GHG emissions. On the other hand, the summit did not result in a legally obligatory deal or any commitment to real one in the future.

3. 3. 3 Sustainability in Practice

Sustainability has become one of the biggest challenges we face in the 21st century, so practicing sustainability is a comprehensive experience for people to learn about sustainability problems and discover some of the solutions. People should explore and get knowledge about shelter, water, waste, energy pollution and biodiversity. Professor Susan Buckingham from Brunel University stated “ I will certainly be keen to use sustainability in practice in my teaching on education and sustainable development and feel it is a most useful addition to the literature. It gives higher education institutions, and people working and studying in them, useful strategies for becoming more environmentally sustainable.” (Corrigan N., Sayce S. and Taylor R. 2009)

Sustainability has to be integrated to the education, from compulsory to higher education, as students should now consider the current and future impact of their operational activities on the environment. Education is the key to developing the concept of sustainability among people in order to support a sustainable environment. Each individual must be responsible for his/her own actions and understand how these actions affect the environment. If people are not even aware of issues surrounding the environment, they cannot be expected to take the environmental impact of their behaviour seriously.

The U. K. government proposed that every school should not only teach the importance of respecting the environment, but should also operate a practical working sustainable policy. Sustainability is taught across the national curriculum and can fit into the teaching requirements of any subject. The governments, local authorities, broadcasting companies and the media all have a valuable role to play in the continuing education of the public regarding sustainable issues.

“ In 2008, the UK Government published a strategy for sustainable construction which reflected the industry’s commitment to reduce its carbon footprint and consumption of natural resources, whilst maintaining a strong construction. The initiative was within the wider context of concern for global warming and climate change, which has led to UK national targets for reduction in carbon dioxide emissions by 34% from 1990 levels by 2020 and by 80% by 2050.” (Lyons, A. 2010)

However hard the UN, EU and UK Governments push for the implementation of environmentally sustainable policies, the communication and application of information on sustainability cannot occur at any point along the line without the co-operation of environmentally aware individuals. At a global level, sustainability is a complex issue and is difficult to determine accurately for any resources. A firm grounding in environmental issues from an early age will be essential to providing a community of responsible and aware adults, capable of taking the UK and world towards a safer and healthier environment.

Whether in usual life or work, the gap between awareness and action is often the biggest challenge facing governments, organisations and individuals in implementing sustainability. In brief words:

Sustainability boils down to this: do not eat your seed corn.

Sustainability highlights the need to build life systems that can supply the present without compromising the future.

Sustainability is about people, how to foster a robust workforce and strong communities.

Sustainability addresses innovation, how to spark it, nurture it and protect it.

Sustainability can be a lens to focus on values and personal commitment on the built environment and markets.

Sustainability is about natural resources, how to use them, renew them and account for environmental capital.

Sustainability is also about buildings, how to design, construct and operate them to reduce their impact upon the environment.

Sustainability is about built environment, how could be healthier and more productive.

Sustainability can be the power of strong economy.

3. 4 Architecture

Architecture is the art and science of design and construction of buildings to cover the human needs of its human such as housing, by using materials and construction appropriate methods. Architecture is both the process and product of planning, designing and constructing form, space and ambience that reflect functional, technical, social, and aesthetic considerations. It requires the creative manipulation and coordination of material, technology, light and shadow. Architecture also encompasses the pragmatic aspects of realizing buildings and structures, including scheduling, cost estimating and construction administration.

The diagram in figure (3. 10) shows that effective architecture is about creation a fresh approach provides an all inclusive planning, design, structure, professionals with best practice and good imagination adapted to the individuals needs. The result of that came out as a complete understanding of human functional and non-functional requirements and aspirations, which was a measurement for a successful architecture.

Figure 3. 10: Standards of architecture and requirements.

Up to this stage, the operation of success architecture is not completed unless environmental requirements are adopted. Since antiquity, human beings have reacted to the surrounding environment, using their abilities to

develop techniques and technologies in such internal psychological balance with nature that humanity historically lived attuned to the environment. “ Learning to manipulate clay, stone, marble, and wood, man penetrated their properties, and his techniques gave expression to his aspirations toward the divine. In architecture, environmental harmony was known to the Chinese, the Indians, the Greeks, and others. It produced the temples o