

**An Evaluation of Sustainable Construction in Ireland and the UK**



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# Introduction

Sustainable Development has been defined in a number of senses but the most acceptable definition of this term states that it is the developmental process in which the demands of the present generation is met without compromising with the needs of the future ones. The human lifestyle is improved while preserving the crucial resources of the nature. The viable schemes under this action have an ability to combine the social, economic and the environmental aspects of the human activity (Magdani, 2015).

Construction Sustainability is a broad term which talks about carrying out construction activities without having a negative impact on the environment and society. Under this, the Construction activities are optimized in such a manner that does not have adverse effects on the resources, surroundings and living ecosystems. In order to meet the prevailing environment and social challenges, the need of Sustainability Assessment is increasing day by day as it doesn’t poses any negative impact on the living ecosystem rather incorporates a number of measures that optimize the Construction costs.

The practice of Sustainable Building Design and Construction is usually followed to create structures and use processes that are environmental friendly and resource efficient throughout the life cycle of a building. Development of sustainable buildings minimizes the use irregular use of water resources, natural resources, energy and land. Simultaneously, it also aims to reduce the emission of wastes in the environment (University of Cambridge, 2008). A lot of construction and demolition wastes are generated at the global level. These wastes are hazardous for the environment and have to be disposed off at a suitable place so as to avoid pressure on the land resources. The other alternative for this could be the recycling of the wastes to minimize the risks of harmful impacts of the wastes. Moreover, the sustainability of the Construction activities could also be increased by using appropriate materials for building which are eco-friendly and simultaneously strong enough to bare the natural and man-made forces.

The following Dissertation is Research Report which primarily aims to evaluate the actual meaning of the Sustainable Construction and how its elements are bought into action by the governments and the local citizens. The report will both qualitatively as well as quantitatively investigate the effects of Construction on the environment and social surroundings. The report will focus mainly on the Irish and the UK Construction Industry and what the government and legislative body is doing to promote the activities of Sustainable Construction in this industry (Building and Construction Authority, 2007). The first section of the report, the Literature Review, will unveil myriads of thoughts and Perceptions of different researchers over Sustainability and its incorporation in the Construction Industry. This section will also evaluate the manners in which Sustainable Culture can influence the lifecycle costs of the buildings and the role of the government of both Ireland and the UK in promoting the idea of Sustainability in their individual Construction sectors.

The following section talks about the Research Methodology undertaken to evaluate the minds of all the shareholders involved in the Irish as well as the UK Industry. This section will include both the Qualitative and Quantitative methods but will mainly focus on the former one. In this section the sample population would be evaluated using questionnaire technique whose results will unveil various perceptions of the people in context to Sustainability and its implementation across the Construction Industry (Charles, 2008). This section will also include the case studies which will highlight the actual status of Sustainable Construction in the considered countries.

Following this will be the evaluation of the Research process under the Findings and Outcomes section. This unit of the Dissertation will propose the actual outcomes of the Research Process which would be derived from the questionnaires and other research methodologies. The prime results could also be derived from the discussed case studies that outline the ongoing efforts in the direction of implementing sustainability in the Construction Industry in both the countries. This section would be followed by a set of recommendations that would allow the future readers and evaluators to implement the best practices of Sustainable Construction and even make them aware of the key drivers that would be required to encourage more and more people to widely use the elements of Sustainable Construction (J Kim, 1998).

The pivotal aim of this report is to unveil the true meaning of the Sustainable Construction and its present and Future implications in the Irish and the UK Construction Industries. The report also aims to evaluate the impacts of Construction sector on the environment and on the Society. The Irish and the UK Construction Industry is in immediate need of installing the elements of the Sustainable Construction as the environmental challenges are increasing at an alarming rate across the globe. Through a deep analysis, this report could also be used to evaluate the extent to which the Sustainable Construction is needed by the undertaken countries and what all is being done by the leading political parties and legislative bodies to attain the supreme benefits of these sustainable activities. The future implications of the Sustainable development are not so clear in the Construction Sector. Hence, this report also has an objective to clear out the actual role played by the Sustainability factors in the Construction Sector and its positive as well as negative impacts on the environment (Kjeldgaard, 2010).

The hypothesis for this Research Report states that there is no negative impact of the ongoing Construction activities on the environment and even there is no need of sustainable elements in the Construction Industry. Another hypothesis for the report could be that the government legislations and incentives are doing nothing in the direction to promote the elements of Sustainable Construction in the Irish and the UK Construction Industry.

The scope of this Research Report is limited to the Irish and the UK Construction Industry and both of these countries would be critically evaluated for the sustainable practices in their Construction Sector. This Report will also unveil the impact of the activities of this sector on the environment and its contribution in the Global Warming. The Scope of the report is also restricted in analyzing the precise role of the of the legal and government bodies only in promoting the concept of Sustainable Construction in their respective Construction sectors. Moreover, the analysis of the precise impact of incorporation of Sustainable Construction elements on the Cost lifecycle of buildings and infrastructures also falls under the scope of this Research Proposal (Constructor, 2015).

# Literature Review

Sustainability is defined as a desire to carry out lucrative activities without depleting the resources in the environment. In more simple words, the Brundtland Commission has described this term as “fulfilling the needs of the present generation, without compromising the demands of the coming generation”. Sustainable Construction, in a broader sense, is used to describe the application of the elements of Sustainable Development in the Construction Industry. In a Construction industry, the Primary task is to produce, develop, plan, design, alter, maintain or recreate the environment by building houses, government and private offices, monuments, public places, etc. The major stakeholders in this industry are the manufacturers, suppliers, clients and the end user occupiers (Education, 2016).

In the world of Construction, the buildings often have the capacity to make a great contribution to a more sustainable future to our planet. The population in the developed nations is expanding at a rate of addition of one million people per week. This is an alarm for the clever minds across the globe to optimize the sustainable performance of the buildings that are designed either for work or for living. Sustainable Construction aims to meet the housing, working environments and infrastructures without compromising the upcoming demands of the future generation. A Sustainable Construction not only incorporates the elements of the good environmental performance but it also talks about Economic efficiency as well as about the Social responsibilities. The prime issues that are to be dealt in order to effectively implement Sustainable Construction elements are: design and management of the buildings, construction technology and processes, resource and energy requirements, transformations in technology and products, ethical standards of the country and the company, health safety rules and equipments, interdependencies of landscape, varieties of financing models and the social factors of the countries (Harbour, 2016).

A Construction Industry of a Country however can contribute in a number of manners to the Government in the case of Sustainable Development. For instance, when the government plans to revitalize town centers, the Construction Industry could contribute in this by regenerating the houses instead of investing in creation of new houses. Moreover, the buildings could be designed to use the water and energy in a more efficient manner so that it is equally available for all. During the construction of new buildings and infrastructures, the Construction Companies could implement a number of measures so as to minimize the mineral extraction and save it for the upcoming generation. The Construction companies could also introduce numerous law, policies, rules and regulations in order to protect the countryside from the ill-effects of the construction and its impact on the health of the people. On the social level, the firm executives could also train their subordinates conveying them the actual benefits of sustainable Development. These activities allow the Construction Industry to play a pivotal role in the delivery of Sustainable Development. The environmental and social problems prevailing at the global level has challenged this sector to provide a better quality of life to all the people it serves and through these activities the companies could definitely minimize the adverse impacts of Construction on the environment and the local communities (Jennings, 2017).

The Sustainable Construction elements demand a lot from Construction Industry. *Firstly*, the projects under such companies must exhibit a sensible and judicious use of the natural resources of the country throughout their entire life cycle. The Designing principles of the company should primarily focus on the smart use and management of the material and energy. The projects could eliminate maximum of the carbon footprints and could even reutilize the essential substances released from the industries as waste. The industries’ strategies could be designed in such a way that the natural landscape is preserved in all its forms. The leaders in this could encourage the subordinates to use more and more renewable energy in place of degradable resources of energy. Apart from this, the choice of the construction materials alongwith the technological elements choice could also make a lot of difference in delivering high quality services to the client without compromising the upcoming demands (Cork, 2011). *Secondly,* the projects need to economically feasible in order to create a smooth channel and flow of the financial resources in and out of the industry. If the industry succeeds in maintaining an Economic Sustainable environment, then it becomes quite easy for the firms to be compatible with the changing demands of the clients across the construction’s lifespan. In order to have the Economic sustainability of a great level, the projects could be integrated with the larger economic frameworks of local, regional and global monetary flows. This will not only give a strong financial support to the projects, but will also show a positive impact of the economy on the society as well as on the environment. The Entrepreneurs involved in this sector must also ensure that the funding arranged for the projects must be from all sorts of legitimate sources and this information should be transparently conveyed to the clients as well as to the higher authorities so as to avoid future objections related illegal funds and support. The projects designs should also be flexible so that they could be easily adapted to the future demands, transformations, user needs, ownership, laws and economic fluctuations. If the projects are readily adapted to the changing demands and needs of the clients then they could easily invest a huge amount in such projects. In the end, to have an Economic Sustainability, the projects could be designed with affordable prices so that all sorts of client could invest in them and the company could have a large customer base rather than restricting its target market to only rich clients and the organization with heavy turnovers each year. However, the Operating Costs of the projects are determined by the returns it receives on the investment, so the industry could focus on minimizing its initial designing and manufacturing prices. *Thirdly,* the projects must also convey a high level of contextual and aesthetic impacts (Yuanjian & Zheng, 2017). The projects undertaken must reflect high standard of architectural quality so as to match the prevalent cultural expression. The materials incorporated and the design used in the buildings play a crucial role in reforming the physical, cultural and the human environment. The Construction industry could restore the buildings by reusing or remodeling their structures. This will contribute in saving the useful land resources of the environment. The programming strategies of the firms falling under this industry could be flexible in usage, innovative and could have long term adaptabilities too. The Architectural quality and the aesthetic impacts could be placed upon the clients by introducing strategies that focus on the space, spatial sequences, movement, tactility of the materials, light and the ambience of the building and its surroundings (Cook, 1999).

Governments all over the world have already introduced a number of policies to support the concept of Sustainable Construction. The elements under Sustainable Construction will not only save energy for the coming generation but also promises to give a quality of life to the current generation too. Under the prevailing challenges in the energy sector, sustainability will undoubtedly become the most trending concern of the future constructions (Vadera, et al., 2008).

*Ireland* has a great reputation as a country with a high quality environment in an era where the whole world is facing a number of intensifying environmental threats. The Construction Industry in Ireland is comprised of myriads of firms, including large multinational buildings, service companies, manufacturers of building related products and materials, engineers, architects and providers of building management services. This industry has undergone a number of changes and a fundamental contraction in the last few years. Till the year 2007, the Construction sector was considered as the key driver of the economic growth of the country. But after this year, this sector has experienced the worst contraction of its time. The Residential Construction activity collapsed and even the private and Non-Residential activities suffered a number of uncertain problems. In order to boost up the economy, the government of the country is working extremely hard in the area of Sustainable Construction, mainly as a result of legislative and policy drivers. This step is considered as a successful one by most of the researchers and will definitely provide a great boom to the sector in the coming years (Kenny & Hogan, 2009). The Irish Government has considered a number of key drivers of the Sustainable Development. In the Construction Industry, Buildings are playing a pivotal role in achieving the energy saving and climate change targets. The energy consumption and CO2 emission values varies a lot between different buildings. A directive, named as EPBD (Energy Performance of Buildings Directive) consists of a number of provisions that are specifically designed to improve the energy efficiency of both the residential and non-residential buildings (Walsh, 2010). This directive has been applied to all the new and existing buildings with a floor area of 1000 m2 or greater. In order to allow all the buildings to fall under this directive, ne improved energy standards have also been set up for all the buildings in the Republic of Ireland in the revised Building Regulations which became effective from the year 2009. A prime stipulation of this directive is the introduction of an energy performance certificate to promote greater awareness among the energy saving buildings. Even the Public Sector Buildings were with the floor area above 1000 m2are legally required to have Display Energy Certificates (DECs) displayed in a specific place visible to the common public (Technologies, 2011).

The EPBD was re-casted in the year 2010 and was implemented by almost all the member states by July 2012. The new directive introduced an innovative concept of “nearly zero” energy buildings. According to this concept, the buildings should exhibit a very high energy performance and by the end of the year 2020, new buildings must consume nearly zero energy and should be powered highly from renewable sources of energy. Under this new directive, the member states were asked to produce national plans by the year 2011 that would be implemented to increase the number of buildings under the concept of “nearly zero” energy. They were also asked to list out the financial and other incentives they would be requiring for this great transition. The existing buildings were renovated to adopt smart ways of construction and designs. The buildings were reconstructed to implement smart meters and replace the existing heating, hot water plumbing and air-conditioning devices with the ones which are more energy efficient working on the renewable energy sources (Foundation, 2011).

Apart from the EPBD, Ireland produced its first National Energy Efficiency Action Plan (NEEAP) in the year 2009under which the government was encouraged to achieve a 20% reduction in energy demand by the year 2020. This Action Pan was designed to cover all the buildings and infrastructures under business, residential, transport and energy sectors (Geoscience Ireland, 2013). To set an example for the Private Sector buildings, the government tried to implement this Action Plan firstly on over 33% of the Public Sector buildings and infrastructures. A second directive was submitted by mid of the year 2011.

The UK Construction Industry accounts for about 9% of the GDP and employs over 3 million people. The buildings are responsible for almost half of the carbon emission, half of the water consumption, over one-third of the landfills and nearly 15% of the raw materials consumption in the country. This sector of the country needs to minimize the carbon footprint value and even the rate of the consumption of non-renewable energy resources (Education, 2014). The rate at which the energy is consumed is also a great matter of concern and obviously a major source of carbon emission in this country. To combat the prevailing energy scarcity and sustainability issues, the government of the UK formed the low carbon Industrial Strategy as well as the Strategy for Sustainable Construction under which the new residential and non-residential buildings aim to be “zero carbon” from the year 2016.

In the year 2008, the UK government introduced an effective strategy for the Sustainable Construction. This strategy was a joint initiative of the Construction industry and the government and intended to promote a great example of leadership and behavioral change. It also aimed to benefit both the involved entities and the wider economy on the whole. To deliver this strategy significantly, the Government along with the industry devised a number of measures to reach the targets related to the Sustainable Construction. The issues related to Sustainable Construction, such as biodiversity, Climate Change, Scarcity of the resources and Improper Landfills, were met under these targets (Network, 2010). A number of key targets were set to be achieved under the strategy. These could be achieved by increasing profitability by incorporating methodologies that encourages the people to use the resources in an efficient manner, encouraging the firms under this sector to adopt the sustainable products or ways of working and Enhancing the image of the sector in the target markets by encouraging them to address the issues related to Corporate and Social Responsibilities. The Development of the strategy involved a number of crucial stages under the coordination of the Department of BERR (Business, Enterprise and Regulatory Reform). The strategy targeted the areas of Procurement, Design, Investment, and better Sectoral regulation and worked along with the other crucial departments of the country to fight with the prevailing environmental issues of the climate change, water use, biodiversity, waste management and the environmentally sound use of the resources and raw materials (Commission, 2017).

In June 2006, the government produced the Sustainable Procurement National Action Plan which aimed to deliver a number of methods and strategies to the government, so that they can implement innovative ideas through the public procurements. The leaders of the European Union were encouraged to achieve the goals by the year 2009. In the Action Plan, it was discussed that what and how a government buys goods, services and capitals so as to find the most apt reason and place to implement the elements of the Sustainable Construction (Establishment, 2017). One of the key barriers to this Action Plan was its cost of implementation. Yet, the researchers believed that this Action Plan carried a lot of potential to cut over a lot of waste being produced by the Construction Industries, seeks innovative solutions for the ongoing environmental issues and even create a resource efficient public sector to set an example in front of the other sectors in the country (Smart, 2013).

# Research Methodology

Under this section, there will be a discussion of the systematic plan that would be adopted to conduct the research. The elements under this process are used to collect data and information in relevance to the research topic and use this information to draw candid results for the research questions. It is often essential to consider the underlying concepts and theories of these methods so as to implement them in a proper way. The selection of the Research Methodology is quite crucial and it entirely depends upon the probable conclusions one can make about the research topics. For the most appropriate results of the report, the researcher must include those methods that are able to fulfill the overall aims of the study and even ensure that a large population sample has been considered so that the conclusions and their related recommendations are reasonably accepted by the readers and followers. This section of the research paper is used to answer the two prime questions, i.e. how the data would be collected and organized and what all tools would be used to analyze the collected data in order to draw specific conclusions. There are a number of available methods which can be chosen by the researcher to reach to a certain set of Conclusions. This section may also discuss the problems that occurred and what all measures were taken by the researchers to prevent them while using the available resources at that time (Team, 2017).

The research Methodology on a whole could be simply bifurcated into two major Categories: Quantitative and Qualitative. The Quantitative research methodologies often deal with numbers and logics and its prime focus is on the unchanging data of the undertaken population. The results of such research methodologies are always numerical and are analyzed using a number of Mathematical as well as Statistical research Tools. The quantitative approach is usually followed when the researchers only needs a numerical analysis of a problem but when they need to analyze the depth of any reason behind a particular problem, then such methodologies fail. The data collected using this method is in the form of number and statistics and is precisely arranged in the form of tables, charts, figures and other myriads of non-textual forms. Moreover, the researchers use tools such as Questionnaires and Computer Softwares to collect this type of data (Wyse, 2011). The most appropriate and widely used methodology of this type is the *Likert Scale.* This methodology is used to statistically evaluate the perceptions of the group of people over a certain issue or problem. A five point scale is given to the respondents and they are asked to give their answers on this scale. On this scale, 1 is Strongly Disagree, 2 is Disagree, 3 is Neutral, 4 is Agree and 5 is Strongly Agree. This scale helps the researchers to directly transform the opinions of the people into Numerical Data.

The most Common Sources of Quantitative data include: **Surveys,** which are conducted either online or in person, help the researchers to evaluate the opinions and thoughts of the myriads of people by asking them similar questions. The questions being asked are quite simple and usually options are provided to them from where they can make their choices easily. **Observations** are used by counting the frequency of any event or phenomenon. The observational data is coded to translate them into precise numbers. **Secondary Data**, which is generally collected from Company’s Annual reports, websites, journals, books and articles (Publishers, 2016).

The other type of Research Methodology is the Qualitative Research which is the primarily exploratory research. The tools under this methodology are used to gain a deep understanding of reasons, opinions and motivations of different stakeholders associated with the research process. The results of such processes are descriptive in nature rather than predictive as in quantitative methods. When the Qualitative Research Methods are applied, the researcher usually emphasizes on the natural settings and the point of views and perceptions of the research respondents. The collected data often helps the researchers as well as the readers to develop their own concepts and theories and hence such an approach is called an Inductive approach of developing original perceptions over a certain event rather than testing the already proposed theories under the deductive approach. The Qualitative data is collected through direct encounters i.e. through personal interviews. The dynamic nature of the interview or the group discussion processes engages more and more respondents towards the process and they also participate actively by contributing their opinions in a best possible manner. There is a unique feature of this methodology as it allows the researchers to in observing, recording and interpreting the non-verbal communication which is exhibited by the respondents as their feedbacks during interviews and group discussions (Pandey & Pandey, 2015).

Under the Qualitative methodologies, the researcher has the capacity to gain a deep understanding of a specific organization or event rather than just surface viewing the description of a sample population. The tools under this study are not meant to manipulate the variable but to allow the meaning emerge from the participants. They aim to unveil that how the participants derive meaning from their surroundings and how this derived meaning influence their behavior towards certain event or organization. The most prevalent data collection method under this methodology is the Observation tool in which the there is selection and recording of the behavior and response of the participating candidates in their respective environments. This tool is used to generate a deep analysis of the topic undertaken or the organization being evaluated, for obtaining such information which is otherwise inaccessible and even to conduct research when all the other methodologies are inadequate to draw proper conclusions from the research process.

The only Problem with the Qualitative approach is that it is very time consuming as a deep analysis is done of the chosen topic. The tools being used generally give a nominal level of data which is usually difficult to quantify (Statistics, 2016).

This Research Report will be using the Questionnaire methodology to collect the data from the respondents who are either directly or indirectly affected by the elements of Sustainable Construction. The Questionnaire method is preferred because it allows the respondents to select their answers from a precise set of answers and hence the researchers are able to direct the process in a particular direction which will definitely yield a candid set of results for the research process. This methodology has also been undertaken because most of the stakeholders of the Irish as well as the UK construction industry could be encouraged to participate in the research process as the Questions being asked are quite easy ones and are related to all the participants in one way or the other.

**Questionnaire**

Questionnaire is a research tool and consists of a set of questions relevant to the chosen research topic. The questions often are provided with a precise set of responses from which the participants are asked to choose one or more than one appropriate answers. Questionnaire is used both as a statistical as well as a Qualitative tool of analysis. No survey can achieve success without a well-designed questionnaire. This methodology has been chosen here due to a number of benefits associated with it. For instance, the Questionnaires are quite practical in use. Moreover, a large amount of responses could be collected from a large sample of population within a short time span. So, in this sense, this methodology proves to be time saving as well as cost effective. The results of the questionnaire could easily be analyzed by the researcher and analysis may be conveyed in the form of graphs and tables to the reader. The results could be used to test the pre existing theories or could also be used to create entirely new theories that have the elements of almost all sorts of responses received during the research process. The results are usually quantified for an easy comparison of the thoughts but at the same time, it becomes quite tedious to evaluate the changing perceptions and behavior of the respondents through numerical values. Hence, this is the only loophole of the Questionnaire methodology.

Myriads of questions could be asked to the participants of the survey so that a proper evaluation could be made over their perceptions towards the role of Sustainable Construction elements and even over the impacts of the Construction activities on the surroundings. For the survey the Constructors, Architects, Workers, Managers and the customers are asked different types of questions. Some of these questions are:

Question1. Does Construction activities have any impact on the environment?

* Yes, a great impact
* No, these both units are independent
* There is a mild impact on the environment

Question2. Are the prevailing Construction Practices in your industry are satisfying?

* Yes, they are completely satisfying
* No, a lot more has to be done
* There are no such practices in my industry

Question3. Do you use Sustainable Construction activities in any of your projects?

* Yes
* No
* Haven’t heard of this concept yet

Question4. Do you believe Sustainable Construction would lead to any benefits?

* Yes
* No
* Cannot say anything

Question5. What are the probable benefits of sustainable elements in the Construction Industry?

* Minimizing the Construction Costs
* The less contribution in degradation of the environment
* Increase in competitiveness on project bids or proposals

Question6. Is there any specific role of government and legislative bodies in the implementation of Sustainability in the Construction Industry?

* Yes
* No
* Know nothing about it

Question7. Is there any substantial impact of sustainable construction elements on the reduction of construction costs?

* Yes
* No
* Not sure

Question8. Does future technological advances will allow for the construction costs to be reduced and meet projected targets?

* Yes
* No
* No change

Question9. Sustainable Construction is a way to reduce Global Warming?

* Strongly Agree
* Agree
* No Difference
* Disagree
* Strongly Disagree

Question10. The environment and sustainability is more important than saving costs on constructing buildings and infrastructure?

* Yes
* No
* Cannot say anything

Question11. Is the government and the other legislative bodies are doing anything to promote the elements of sustainable construction in the construction industry?

* Yes
* No
* Cannot say anything

Question12. What are the key drivers of Sustainable Construction in a country?

* Legislation
* Self Legislation
* Energy Costs
* Resource Efficiency

The above is only an excerpt of the questions that would be asked. The different respondents would be asked different set of questions according to their positions in their industries and their understandings towards the concepts of Sustainable Construction.

**Case Studies**

The University of Surrey has been rebuilt and refurbished without imposing any ill impact on the environment. The university had a number of buildings that needed a reformation as most of these structures were not meeting the standards of the Sustainable Construction. The renovation option was far better than setting up of an entirely new building as it has a number of cost-saving benefits. All of the 1960s buildings had a similar structure of heavy concrete. After the renovation, the constructors have ensured to include a number of sustainable equipments and products. For instance, as a part of the project, double gazed insulated panels were fitted in place of older single glazed ones in nine buildings of the university. This approach reduced the heating requirements of the buildings up to a great extent. Also, the buildings were equipped with the advanced cooling plants that contributed less heat energy to the surroundings while maintain an optimum temperature for the building. The usage of such equipments has made the university’s annual energy usage to drop by around 8,000,000 KwH and even the heat loss has been lowered by 60%. The use of the advanced technology in the buildings has also reduced the emission of carbon dioxide by 2,000 tonnes per year. This is definitely a significant achievement by the university as it has improved the life span of the building while contributing towards the sustainable construction activities (Hunt, 2010).

Another example has been seen in the design and construction of the new green wing of the London Hospital. The hospital at the Great Ormond Street is the well known hospital for children. The hospital planned to refurbish in the year 2008 and the project was completed in the year 2011.The green aspects of the nee Extension’s design include an advanced ventilation system across the building that allows easy movement of air and hence maintains an optimum temperature for the patients as well as for the people at work. Also, the glass extrusions across the entire hospital allow plenty of light with options for solar heating in various chambers of the hospital. The energy saving and creating options of the newly extended building has allowed the building to save 20,000 tonnes of carbon dioxide emission on the annual basis (Murray, 2010).

In the republic of Ireland, a multinational biotech company, Genzyme, is also listed along with such buildings that have successfully installed the concepts of sustainable construction in their design and construction. This company has a LEED Gold office building in Waterford. The building was certified as a sustainable one six years back in the year 2011. The new construction project has succeeded in diverting 96% of the wastes from the landfills while the building was in the midst of its construction process. Also, the company has decreased its energy usage by 35% while contributing less heat energy to the surroundings. Apart from this, due to implementation of effective water management plans, the building has minimized its water usage by 78% thus recreating the water sources for the other people in the surroundings (Kriss, 2014).

# Findings

From the above questionnaires and the Case studies, this could be deduced that the Construction activities definitely have adverse impacts on the environment and the other social entities in the surroundings. The Irish and the UK construction sector both are in a need of quick adoption of more and more elements of sustainability to not only increase the cost related benefits for the company, but also to reduce the pressure on the environment due to the irregular waste dumping and ill-maintained energy utilization practices across the industry. The construction sector has experienced a huge resurgence in the growth since the year 2015 and hence this achievement is bound to have a number of detrimental impacts on the environment and its pivotal constituents (Cork, 2011).

A research report submitted by the UK Green Building Council has unveiled that the Construction sector of the country uses more than 450 million tons of the materials annually and most of the raw materials used by this industry has an adverse impact on the environment. The products incorporated in the construction jobs often have an impact on the surroundings as the “raw materials” are extracted in an uncontrolled manner. The number and tools used at the site of the constructions like the chemicals and diesel by the diggers and trucks also has a bad influence on the health of the people surrounding the construction sites and the environment.

The research process has revealed that the Construction sector at present is contributing around 25% to the air pollution, 40% of the water and water resources pollution, 50% to the landfill waste and nearly 55% to the climatic change. Around 45% of the global energy is used by the construction sector. These estimations suggest that in the coming decade the emissions from the industries in the Construction sector will grow by 2%. This points towards another finding of the report that that the construction sector is at present contributing a lot towards the Global warming. The recent statistics suggests that it is quite essential for the Construction Industry to bear the responsibilities for causing Global Warming. The construction activities contribute around 30% to 50% to the total CO2 emission. The researches have shown that around half of the UK’s total CO2 emission is due to Construction activities which also include rebuilding and maintenance of the buildings and Infrastructures (Kenny & Hogan, 2009).

Another contribution by the Construction Industry towards the environment degradation is through energy usage. It is believed that a lot of energy is required in the lifetime of a building. Majority of the electricity used by the buildings are sourced from the Coal power plants. Even the heat produced by these buildings is radiated directly into the environment. Hence, the construction industry is not only inefficiently exploiting the energy sources but is also having a great contribution in raising the temperature of the planet by converting the utilized electricity into heat energy. To cool down the temperature of the buildings, these are equipped with Air Conditions which directly contributes towards more and more energy usage and simultaneously emits more and more CO2 in the environment.

The governments of the leading nations have been involved in implementing the concept of the “Zero- carbon” buildings in the Construction Sector. This concept has proved to be of a great use, but at the same time the energy utilized in the building materials (such as cement, steel, aluminum, etc.) cannot be neglected. This type of energy is called the “Embodied energy”. The energy required in the transportation of the building materials is also classified as the Embodied energy (Magdani, 2015). Although the people involved with the Construction industry are doing a lot of efforts in minimizing these energy inputs and replacing them with renewable sources, but, by such a replacement the efficiency of most of the business operations of the Construction Industry. The government is planning to make energy efficient buildings which will use less energy input in the coming years. But this concept is also a little bit contradictory as the more the buildings become energy efficient, the more the content of embodied carbon will increase. The less carbon being released during the construction of the building, the bigger is the contribution of the embodied carbon to the carbon footprint. It is believed that in coming years the embodied carbon will make up to 100% of a building’s carbon footprint.

The Construction activities of this sector also emit CO2. The bigger is the size of the industry the more is its contribution in the CO2 emission. The big projects often require giant machineries such as tower cranes, excavators, etc. to complete the construction projects. The large size of the project also means a lot of wastes would also be generated. The most epic example was seen in the UK where the waste generated was 100 million tonnes in the year 2010 as compared to the 30 million tonnes of the year 2000. Hence, it could be deduced that the increased usage of big machineries and generation of wastes are quite high for large scaled projects as compared to the small ones.

The positive impacts of sustainable activities within Construction Industry is not restricted to only environment but it also aims to maximize both the economic viability and social benefits of employment and empowerment. The Sustainable designs suggested by the efficient architects often has an aim to build such buildings that allows the people to work within the environmental limits and even are profitable and healthy place to work and live. But there are a number of potential barriers faced by the people who are genuinely in the favor of implementation of the sustainability concepts across the Construction Industry. For instance, whether the people are associated with the public sector or the private sector, they are more concerned with the benefits that promote economic viability over the ones that contribute towards environmental stability. Hence, with such mindsets, the leaders are unable to implement the change plans in a complete sense. The people are more concerned with the lucrative outcomes rather than the ones that aim to provide long term stability to the sector. Apart from this, there are a number of factors that have the ability to hamper the Sustainable Construction designs (Jennings, 2017). These factors are the uncertainty in the economy of the country, rapid urbanization activities, lack of effective architectural planning and lack of effective leaders with proper training, skill and knowledge. During the times of economic turmoil, the countries often shift their focus from the activities that have long term impacts over certain sectors and focus all their resources to rebuild the economy of the country. The implementation of the Sustainable factors is no doubt an expensive task which needs a lot of investments and financers to buy the leading technologies and products that could easily save energy and minimize the contribution of the Construction Sector in the Waste Production at the global level. Hence, in times of economic crisis the government usually feels reluctant in investing in such expensive plans. The other barrier for the implementation of sustainability plans is that due to the expensive costs of the activities the clients are unwilling to pay higher upfront capital costs for potential savings in the long term (Cook, 1999).

It is believed that the Design often has a capability to minimize the environmental impacts of the construction activities alongwith optimizing the socio – economic viability of the same. The design is suggested and implemented by the engineers. It is the engineer who makes the most judicious choice of the resources to be used. The locally available resources such as materials and labours could be incorporated at the right places by the engineers. The efficient engineers could also ensure the recyclability of the materials and systems and even introduce a good quality of structural, electrical and mechanical systems.

The Construction Industry needs to embrace the sustainable design and construction and for this it requires a set of efficient professionals to set up standards for the followers so that they follow certain rules to focus on sustainable construction. Moreover, there could be use of such materials and technologies that reduce waste and recycle or reuse most of crucial materials.

The Environment Protection Act (EPA) has already highlighted that the protection of the environment should come above all the other requirements of the Construction Project. It is the duty of the leaders and mangers to inform all the workers about these rules and their importance in the projects. The rules as a whole and even their snapshots could be incorporated in the contractor orientation process. According to the regulations prevailing in the current legislative bodies, the industries should ensure that discharge of the pollutants should be minimized. For this, there is a recommendation of minimizing the exposure of soil during the construction activities (Charles, 2008).

The research process has also revealed that there are number of chemicals that are used during the construction process. These chemicals are harmful both for the contract workers as well as for the surrounding people if not handled in a proper manner. The government and legislative bodies of the countries are trying their level best to install, implement and maintain effective pollution measures in the construction projects. The government has also ensured through a number of plans and rules that the industries working under the Construction sector must minimize the discharge of the pollutants from all sorts of high level equipments they are using. There are some prohibited discharges that are completely banned to be released in the surroundings so as to protect both the construction workers as well as the people living in the surrounding areas. These banned products include the waste water discharged from washout of the concrete or as a result of painting. Moreover, the government has also banned the discharge of oils, fuels and other pollutants used in vehicles equipment operation and maintenance (Harbour, 2016).

The government of the UK and Ireland has profoundly promoted the concept of “Green Buildings” and it has definitely contributed a lot in the direction of Sustainable Construction. The Green Building process, being in favor of environmental friendly materials, has contributed by saving up to 300 metric tonnes of carbon dioxide being emitted by the Construction Industries. This concept has been widely adopted in the Construction sector and it is believed that by the year 2018 almost 70% of the industries will become a part of this initiation. The prime benefit of this concept is its lower operating costs and this is the ultimate reason that many new investors are being attracted towards this sustainable concept. The followers of this activity are encouraging more and more constructors to be a part of this concept by building projects that are both sustainable and energy efficient at the same time. For such a purpose a great step has been taken by the government to collaborate with the leading institutes and prepare a specific Construction guide for the firms which enlists them a number of ways that could be adopted to build effective Green Buildings while incorporating various federal rules and regulations (Shanahan, 2013).

The prime beneficiaries of the concept of Sustainable Construction are the end users who either live or work in such buildings. The findings reveal that they are quite satisfied by what the government, the legislative bodies and the constructors are doing in order to contribute in the direction of Sustainable Development. Moreover, the people have even begun to reject investments in such projects that does not assure about attaining complete sustainability in the coming years. This shows that the customers have also considered the safety of the environment as their priority and as a result the Constructors are encouraged to build a sustainable environment for these people.

# Recommendations

The building environment of the Ireland and the UK needs to become more sustainable if the public bodies as well as the citizens want to reap supreme benefits from the contribution of the Construction Sector in the Country’s economy. In order to have a balance in the environment, the development process in the Construction Industry should meet the demands of both the present and the future generation.

The above research has revealed that the companies that have a standard set of rules and regulations regarding the sustainable development are proving to be more successful than the others that do not possess such policies; hence, the government should adopt strategies that encourage the formation of such specific guidelines for the companies. Moreover the government could also setup long term commitments for improving the environmental performance of all the building whether they are public or private (Neill, 2012). This will not only attract more and more people towards the concept of Sustainable Construction but will also create long term incentives and policy certainty for the Construction sector in both the countries.

The ruling parties as well as the legislative bodies should set an example of a strong leadership in front of all private and public bodies. Under the effective leadership, accompanied by good communication skills, an industry can easily implement the required elements of sustainability in their core business strategies. Good leaders often have the capability to convey the utmost benefits of an activity or events (Connect, 2017). So, the Construction Industry could hire leaders who can convince the people involved with the company to adopt the sustainability elements and convey this change plan among all the others in the industry. Also, to attain the desired outcomes, the industry could also arrange for regular training sessions and meetings through which the various stakeholders of the Construction industry could communicate with one another and even propose ideas and thoughts that could be rapidly implemented in the ongoing change plan in the sector.

The long-term benefits of Sustainability could only be attained if the industries and communities are brought into sustainability agenda at a very early stage. The elements of Sustainability should be promoted as critical factors of business and should be incorporated as an integral part of the balanced corporate strategy which also includes the business ethics, financial responsibility and the green policy. The Construction industry could also seek help from the other professions and industries in the country to co-design new pathways and strategies to create a workforce that is required by the Construction Industry to adapt all the elements of sustainability (WSBF, 2015).

The construction of the buildings is definitely having an adverse impact on the environment and its pivotal constituents. There are a number of recommendations that could be adopted by this sector so as to minimize the ill-impact of the Construction industry on the surroundings. For instance, the industries under this sector produces tonnes of wastes annually and there is a need of proper area for dumping. But as it is well known that irregular dumping of harmful substances can cause hazardous impact on the land resources, hence it is advised to recycle the produced waste as much as possible. The industrial and construction byproducts could be used to in road and infrastructure construction (Fielding, et al., 2012). The use of waste material will not only reduce the environmental impact but at the same time will also contribute in the reduction of costs that would be required to create new buildings and infrastructures from scratch. For recycling and reuse of the materials, the government has already issued proper guidelines that could be followed to properly reutilize the elements that could probably damage the land resources if dumped without processing (Obeid, 2011).

In a similar manner, in order to save the renewable and non-renewable resources to meet the future demands, the Construction sector could also be asked to install those products and practices that have the capability to minimize the irregular use of such resources. For instance, for water conservation the executives could ensure that the newly constructed buildings are equipped with water efficient products including WaterSense labeled products. Also, the newly constructed buildings could also be equipped with adequate metering systems so that the usage of water could be monitored and a water-efficient landscape is created. Efficient water management activities could also be practiced at the building sites. For such a purpose, the strategies need to be implemented at the building designing stage only so as to incorporate the elements of Water Management System in the core design of the buildings (Brown, 2003).

The next recommendation towards the Sustainable Construction could be judicious use of energy and a gradual shift towards the use of more and more renewable sources of energy. The buildings could be constructed in such a manner that there is a facility of onsite energy generation. The company executives could be encouraged to upgrade to more energy efficient equipments that give maximum output while consuming less energy. The renewable sources of energy, such as Solar and Wind energy could be used to generate electricity. Although the initial costs of such implementations are quite high but their long term returns are quite high and hence compensatory. For better results, the household’s energy use could be compared to others across the country and then recommendations could be gathered from myriads of sources for judicious use of energy. The architects could also be encouraged to set the energy targets and achieve them in the given timeframe while utilizing the available resources only. The Industry could also encourage the purchase of green electronics and dispose of the old electronics in a proper manner. The new electronic products being purchased should be registered under the Electronic Products Environmental Assessment Tool (EPEAT). Such products are Energy Star compliant as they use quite less environmental sensitive substances (IGBC, 2013).

The buildings that have been abandoned could be demolished and the lands could be cleaned up and reused for further construction activities. The Cleaning up of the lands and the reinvestment process will definitely take off the pressure of the undeveloped and open lands. These acts could be sustainable for the industry as these lands are already infrastructure ready so only few resources would be needed to construct the buildings. There need to build new roads and utility lines would also be eliminated (Shanahan, 2013).

The Construction industry in both the countries is quite vast and the government alone cannot implement the sustainability elements across the industry. So, in this case, the government can join hands with other private partners to create a clear and consistent vision for the future of the Construction Industry. This vision could be communicated to all the stakeholders of the company so that they are prepared for the upcoming challenges and transformations. The public and the private sectors could address both the short and the long term pressure and changes in the Construction sector by attracting more and more investors towards this industry. As the incorporation of sustainable activities across the industry is an expensive task, so there is a need of lot of investments from myriads of sources.

# Conclusion

Sustainability has never been a single activity that could be adopted in a single period of time within a sector. It is a gradual process which has to be attained by a set of people and even needs a regular monitoring to ensure its effective implementation across all the units of an Industry. The Construction Industry in the UK and the Ireland is in an urgent need of adoption of a number of sustainable activities that could ensure better living for both the current and the coming generation. The elements of sustainability are not enlisted in any journal, article or act, but it has to be learned and evaluated by one’s understanding of the environment and its various entities.

The leaders in the Construction Industry are working quite hard enough to evaluate the current status of the environment and pace it with the demands of the Industry to survive in the business world. For this, the government has formed various committees that keep a close watch over the activities of the people involved in the Construction sector and their impact on the surrounding environment. The present researches in the environment have shown that the planet’s temperature is rising abruptly due to myriads of anthropological activities across the globe. The major contribution toward this global problem has been done by the Construction Sector. The industries release a number of Green-house gases that are accumulated in the environment and has the potential to trap the heat. This is the only reason why the temperature is increasing over decades. So it could be said that if the constructors adopt certain measures that have the capability to minimize the release of gases in the environment then there are chances that further heating of the planet could be stopped.

Another problem that the Construction sites create for the environment is the discharge of the wastes. The improper landfill methods adopted by the firms have creates a wide area of barren lands across the countries. These lands can neither be used for reconstruction nor could be used for agricultural purposes. The improper landfill methods are accompanied by the discharge of hazardous materials as the wastes which cannot be dumped in open areas. The harmful substances not only make a land infertile but also have shown a number of ill effects on the health of the people living in the surroundings.

The emission of the Carbon dioxide in the environment by the construction site is serious problem for the environment. The increased level of carbon footprint is making the atmosphere polluted and hence a number of health issues are arising due to this. The government has although introduced all proper measures to fight with these health ailments, but a lot has to be done to combat these issues from the roots. For this, the sustainable practices should be introduces as a rule and not as a choice to the people. The environmental impacts could be neglected for a while but the health issues are making this plane non-livable for the present as well as for the coming generation.

The Irish and the UK government have already done a lot in order to implement sustainable practices in most of its sectors. A number of plans and acts have been introduced for the Construction Sector and their stakeholders have also been made aware of the existence and crucial benefits of such acts. The rules and regulations have been precisely designed for the construction sector and it has been ensured that they do not obstruct with the core working strategies of the firms. The public sector has also approached the private firms to design the most appropriate ways and methodologies for the Construction firms that encourage them to equip the buildings with energy efficient products and materials.

The Architects are being trained to introduce and implement a wide variety of sustainable instruments and materials in the newly constructed buildings that are both energy efficient and also contributes less to the pollution level in the environment. For instance, the water being released by the buildings during the construction process is being recycled to make it free from the harmful substances that could cause the lands to become infertile and even cause ill effects on the health of the people. Similarly, the constructors are being encouraged to use renewable sources of energy for electricity production so that there is less pollutant contribution on emission of energies from the buildings.

The clients could play the prime role in encouraging the firms to implement sustainable elements. This is because the clients are the prime assets for a company and in order to meet the changing demands of them, a company can incorporate all the elements that suit them. For this purpose, a client needs to be aware of the prevailing laws and regulations related to environment protection and Sustainable Construction and even compare these to that of the other countries. The Government could also boost its countrymen over this by informing them about the current policies and rules that are framed to save the environment and even about the Construction rules that are to be followed by all the constructors and the clients before commencing any new project or refurbishing the old ones.

The Sustainability could not be implemented by the government or the legislative bodies only, rather their needs to be a contribution from the various stakeholders of the Construction sector who are highly influenced by the success and failure of the sector. The government could encourage the constructors by framing rules and regulations and the constructors in return could encourage the clients to invest in only those constructions that promise to deliver sustainable services throughout the life. Moreover, there is no harm in involving the global bodies that are already working in the direction of implementing the sustainable practices across the globe. The interferences of such organization ensured quick implementation of standard rules and regulations across all the units of the Construction Sector and even help the constructors to compare their activities from those prevailing in other developing nations.

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