PROJECT FAILURE MODE ANALYSIS FOR DEVELOPING SUSTAINABLE HOUSING

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Executive Summary

Housing is one of the most important needs of the human society. Through the years, the development of different housing models has flooded the entire market of real estate as well as that of the engineering and architecture branches of the society. Professionals in the considered fields continue to expand their array of creativity so as to come up with a proper presentation of beauty and practicality that a house should actually conform to. During these years of development though, the said branches of social development is faced with an environmental issue that they should give proper attention to.

Apparently, the never-ending creation of structures and the maintenance that they require has caused Mother Nature its life. Global warming, as a result of this particular harm to the earth, is now being realized by every human being around the globe. Yes, there has got to be a solution to this and stopping from establishing infrastructures such as hosing cannot be the practical answer to the problem. Instead, the current years of development has welcomed the proper sense of understanding structural creations of homes through the application of sustainable housing plans. However, no matter how alluring and supposedly beneficial this approach is, the are still some possible risks and problems that need to be given attention along the way of its application. For this reason, this study shall be focused on the establishment of the procedures to be used as project mode analysis for the creation of sustainable housing projects around the globe.

TABLE OF CONTENTS

Executive Summary

1. Introduction	4
1.1 Statement of the Problem	5
1.2 Significance of the Study	6
2. Literary Background	7
2.1 Background of the Review	7
2.2 What is meant by sustainability?	7
2.3 Policy Background: Energy Use in Buildings: The International Policy (EU)	8
2.4 UK Energy National Legislation	10
Summary of Review	12
3. Discussions	12
3.1 Background	12
3.2 Implications of Understanding	13
4. Conclusions	17
References	19

1. Introduction

Presently, major climate changes are occurring in a global measure thus affecting many ecological and environmental conditions in the planet. All of the evidently noticeably climate

shifts phenomenon in the planet can be scientifically traced as effects of the rising global temperature brought by major changes in the Earth's atmosphere. Ozone depletion caused by ascending pollution rate brought by industrial revolution of the humanity is determined to be the most influential factor for this phenomenon.

Climate change resulting from a warmer Earth has been determined to posts many environmental effects. Among of these is the rise in the global water level caused by the melting Polar Regions because of the hotter atmospheric conditions. This condition can adversely affect the water current resulting to the disruption of the balance of fresh water and salt water and the distribution of the oceanic temperature. In addition, atmospheric and meteorological activities namely typhoons, hurricanes, and tornadoes are also affected including the seasonal changes such as winter, monsoons, snow and summer.

The rise in the Earth's temperature and ozone depletion can also affect ecological and environmental aspects. Ultraviolet radiation can damage human health through skin disorders and diseases, optical damage and others. Crop yields and forest productivity will be significantly decrease since hotter atmosphere will dry up farms land becoming hostile to vegetation, alter irrigation systems, and will ignite forest fires. The normal balance of oceanic ecology will also be damage because ozone depletion will result to increase in water's temperature. This condition will lead to increase plankton production and will disrupt the water's life-support system. Fisheries and other marine life will die due to suffocation, hot temperature, and lack of food resources. Indeed, changes in Earth' atmospheric condition and global temperature brought about by ozone depletion have many adverse effects on the capability of the planet to support life and their survival.

Certainly, having noted these facts, it certainly becomes obvious how much attention the earth is already in need of at present. The land, the air, the sea and everything else is becoming polluted practically because of the fact that human individuals tend to find better ways to advance their technology and their ways of living while caring less about how the earth is practically faring with its struggle for survival. The important consideration over this fact is an attention getting issue that should awaken not only those in authority but everyone at least to

give proper care to the earth that gives them the life and the sustenance that they need to be able to live. Consequently, one particular influential branch of social development has place focus upon this issue and generated practical ways of solving the problems caused by humans to the earth's environment. This branch of social development includes the collaboration of the engineers and architects around the globe to establish a practically beneficial process of building sustainable housing. How does this particular matter work? This study shall give a clear view as to how matters could be dealt with conscientiously while giving proper options of development for those who are in charge of the said process of coming up with sustainable housing infrastructures.

1.2 Statement of the Problem

As repeatedly mentioned within the primary section of this study, the main problem to be tackled herein is the practical ways by which sustainable housing projects could established. How is this particularly viewed to be completed? Through the implicative research of on the project failure mode analysis that shall be discussed within the context of this study. The following are some of the implicative questions that shall be used as guidelines towards establishing the thoughts that make up the entirety of this report:

- Sustainable housing has been keyed as the most practical ways of establishing modern homes. In a much less-general context, what then is sustainable housing really about?
- Keeping a good and resourceful outlook with regards the raw materials to be used in building sustainable housing is what the said approach of home establishment is all about? How does this particular system work and how does it affect the function of the home as a liveable place to stay for the family or for the ones owning the structures?
- Bringing about major changes in the ways by which structures are built is not an easy task. Everything must at least be perfect and well thought of. Truly, handling all the possible risks and planning for their occurrence even before they happen is an important matter to consider especially for the project contractors

involved. In this regard it should then be asked as to what particular project failure mode analysis approach could be used to assure that the newly established sustainable houses are rather 90-100% risk free?

These questions shall serve as the backbone of the entire dissertation to be handled in this presentation of facts and documentation. Basically, the researcher of this study shall look back every now and then through these questions to be guided well as to what the study is practically pertaining to and is intending to establish to help the advancing world of professional structural building.

1.2 Significance of the Study

There is no end to the establishment of liveable homes. Truthfully, the world has opened its arms to accommodating millions of human population to be housed in their own dream homes. However, the creation of one of human's basic needs may not be that easy to accomplish especially if environmental concerns are given attention to. Specifically balancing the ways to which a particular housing should be for the users and for the environment is practically a risky process, hence, the application of a proper project failure mode analysis is an essential part of the project creation. This is the reason why this research is viewed as very important sense of application in the field of building structure industries. Hence, to establish this study's significance better, the following review of literature is viewed to have a practical contribution to the success of instantly creating the possibility of building sustainable housing facilities established in a much safer and a lot assured way.

2. Literary Background

2.1 Background of the Review

The Public Agenda describes Climate Change to be caused by human activity, consisting of burning fossil fuels through the usage of land uses such as agriculture and construction. One of Europe's main targets is to reduce 45 millions of tonnes of carbon dioxide, by 2010 whilst make the building sector more aware of energy efficiency in the better planning, and

construction of buildings. There are general frameworks in place to achieve these targets such as the Energy Performance Certificates and the Code for Sustainable Homes. These Energy efficient measures are an important part of the Governments Energy strategy, as well as being a focal point for Investment.

The Building Act (1984) set the Building Regulations standard for the interest of the public interest in the occupancy, use and performance of buildings. The Building Regulations control much of the regulation between existing partnerships and place a weight on existing businesses as they have been. (Carbon Trust, 2006) The Communities and Local Government communication with the Building Regulations is considered to be very weak. (Department for Communities and Local Department, 2007b). The main reason for this is because of the amount of pressure that the Communities and Local Government puts on the Buildings regulations and their continuous amendments to the guidelines.

2.2 What is meant by sustainability?

Sustainability has a variety of underlining definitions, which are linked to the effects of human activity. Zimmermann, et al. (2005:1148) reveals that sustainability is defined as a state in which social order is underpinned by a suitable economic framework and can prevail in the long term without overtaxing the earth's overall capacity. For instances the United Nations Division for Sustainable Development (2007) links sustainability to the development that meets the needs of the present without compromising the ability of future generations to meet their own needs and reduce the impact it can have on the environment. This definition contemplates that the basic needs of human survival i.e.: food and shelter should be further developed, without disturbing the futures generation needs. The ambition of sustainable development is known to not exceed the carrying capacity of the earth, as in the concept of environmental utilisation space. (Klunder, 2004:114) This follows through into the definition used by Brochner, et al (1999:368) who believes that sustainability is only used as a means to build more homes and tackle the aging and growing population. Paul Appleby, (2006) in the Regenerate Magazine

reveals that engineers like to think of sustainability as a means of minimising energy consumption, whilst architects concentrate on the embodied energy of building materials, transport planners on reducing car use and planners on ensuring health and education provision and employment. There is no standard definition of sustainability as it very vague however in the context of sustainable construction sustainabilitycan be directed towards the reduction of the environmental and health impacts consequent to construction, buildings and the build environment. (Klunder, 2004)

2.3 Policy Background: Energy Use In Buildings: The International Policy (EU)

The EU Directive was designed so that it can meet the Kyotoâ's Protocol set targets, on the reduction of carbon emissions. The Kyoto Protocol is an International agreement built on the United Nations Framework Convention of Climate Change. (UNFCCC, 2007) The Kyoto hopes to reduce about 45 millions of tonnes of carbon dioxide by 2010 in all European assigned Member states. (Warren, 2006) The Directive is in place in order to minimize energy consumption in existing, new, sold, rented, leased commercial and residential dwellings through, the use of efficient guidance and measures. (Warren, 2006). According to the UK's Consumer Council (2007) approximately a third of the UK's total carbon emissions come from heating our homes and the water we use. The Directives main purpose is to make the building sector aware of energy efficiency and the use of renewable energy resources in the better planning, and construction of buildings. (EPBD Buildings Platform, 2003-2006)

The Europeans Commission Directive on the Energy Performance of Buildings (2002/91/EC) was created in 2002, and put into practice in January of 2003. The Communities Climate change and Energy strategy were confident that in 2004, the Energy Performance of Buildings Directive would lead the way as a successful enforcement within the UK. (Janssen, 2004) However this proved to be false as the government failed to set up any financial incentives for buildings owners leaving the Directive inefficient. (Baufritz, 2006) In other words,

there wasn't sufficient demand to provide information to building owners, by the Construction sector as it will be pretty costly for them as they would be reluctant to accept extra expenses.

The Energy Performance of Buildings Directives aims to 'promote the improvement of energy performance of buildings within the Community taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness.' (European Energy Performance of Buildings Directive, 2007). The Directive on the Energy Performance of Buildings is responsible for providing a general framework, of the energy performance of existing and new buildings. The framework enables customers to consider whether their build needs further construction or renovation to meet the standards. (EPBD Buildings Platform, 2003-2006)

Building energy performance certificates such as the Standard Assessment Procedure Standard which come in form of ratings and can be met by improving the fabric of the building, better insulation and sealing of fabric, heating and lighting, lower carbon fuels heating appliances (Department for Communities and Local Government, 2006b:14) For insulation the Directive reveals information on Air-Condition and boilers and ensures that inspections in buildings should be carried out if these are more than 15 years old, as they are a large consumer of energy. The Directive is also responsible for training and qualifying experts and inspectors. There is a concern that experts and inspectors being trained are not fully aware of the situation at hand because, the Directive is not specisialing the training. The Association for the Conservation of Energy in ENDS Report (2005) reveals that the monitoring and compliance have been a big problem as building officers just don't have the resources and they are getting no additional help.

2.4 UK Energy National Legislation

The Energy Performance of Buildings Directive became an integral part, of the UK National Legislation in 2006 although not being successful at first. The Energy Performance of Buildings Directive has only just recently been phased into the construction industry and will

continue to settle until the 4th of January 2009. (Department for Communities and Local Department, 2007c) The planning and building environment of the Communities and Local Government (previously Office of the Deputy Prime Minister) is in charge of England's Building and Planning Regulations.

The main aim of the department is to ensure that sustainable development principles are firmly embedded in policies in order to achieve the 20 per cent reduction of C02 emissions by the year 2010. (Department for Communities and Local Government, 2007a) They may achieve this reduction by, using the code and Energy Certificates as Indicators to lowering the emissions in homes throughout the country. The communities and Local Government are responsible for the protection and enhancement of the environment by offering a safe, healthy and sustainable environment. The Energy Performance of Buildings Regulations (2007) are expected to influence the market and encourage additional investment by using selected guidelines to meet this goal.

The Building Regulations attained under the Building Act (1984) and maintained by the Sustainable Buildings Division is responsible for the protection of the public interest in the occupancy, use and performance of buildings. (Department for Communities and Local Department., 2007b:5). The regulations are not actively in place with larger companies as there is a gap emerging between development control planning and building control in newer areas of interest. (Department for Communities and Local Department., 2007b:8). The Buildings Regulations are set to include the Energy Performance certificates (implemented by the Buildings directive) in June of this year. The Energy Performance certificates, can act as a selling point for future buyers by, indicating how energy efficient a home is. This is an advantage for buyers as they won't need to spend money, on raising the performance of the building. The Energy Performance certificates can also benefit the original home owner by providing information and an estimate cost, on how to tackle the running costs of improving the energy performance of their home. These Energy Certificates are not required for any (off-plan) sales or lettings, which means that buyers won't be able to see the property until it is completed. (Department for Communities and Local Department, 2007c) This is a disadvantage for buyers

as they would have to pay extra for increasing their home ratings. If developers want to take interest in this matter, then they can add a tax in the buyer's capital so that when buyers begin the performance assessment, it will automatically be deducted from their true costs.

The Building Regulations Part L concentrates on fuel and energy conservation and sets regulations on maximum carbon dioxide emissions for whole buildings on the construction of new buildings, and the renovation of existing buildings. Carbon Trust (2006) anticipates that Part L has reduced 25% of carbon emissions from the 2002 target. The Department for Communities and Local Government recognizes that Part L will continue to improve the regulations criteria and produce a much effective use of guidelines. The Part L is an integral part of the Planning and Building regulations which, help set the agenda from the EC Directive on the Energy performance of buildings. There is lack of a clear future vision for the purpose of Building Control, the current piecemeal approach to regulatory change and the complexity of guidance. (Planning Portal, 2007) The newly revised edition of Part L2A has been slightly amended to include the following changes for new buildings;

- Section 1: Capping the carbon emissions allowed to be designed into the building

- Section 2: Imposing minimum construction quality criteria (Carbon Trust, 2006)

The Carbon Trust is an independent company funded by the Government, aimed at helping the Business and Public Sector in the UK move to a low carbon economy. The Carbon Trusts main goals are to improve skills in the construction workforce through a better understanding and knowledge of construction materials, components and building design.

Summary of Review

The discussion of the different legal guidelines of building construction in UK presented in this section provides a proper picture as to how the particular approaches to building structures is being strictly followed in the country. Through carrying this matter into consideration, it could be noticed that the creation of the needed project failure mode analysis would become much easier to accomplish as the guidelines are already manipulatively

understood in accordance with the proper application of project risk management procedures needed to assure that the structures would be able to function well for the role that they are to take in the field of human life advancement of which they are actually expected to assist in.

3. Discussions

3.1 Background

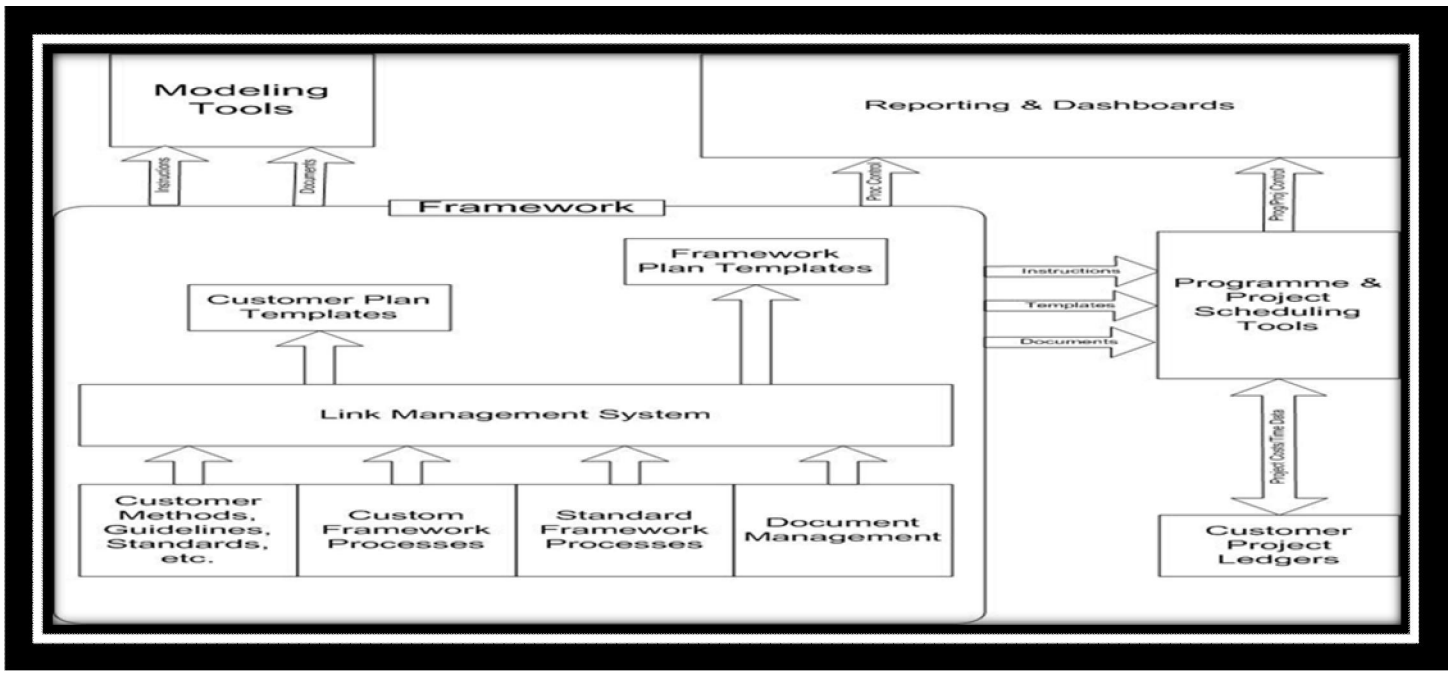
The construction industry is under a great pressure by the Government and IPPCC to meet primary energy targets and reduce CO2 emission targets. In addition the construction industry needs to tackle affordable housing by building an estimate of 200,000 homes by 2016. (Department for Communities and Local Government, 2006b) Zimmermann et al (2005: 1155) argues that these demands are set to increase in line with future population and in particular an expanding building stocks. The Department for Communities and Local government believe this is the time to implement sustainable homes, and reach zero carbon. The reality is that building more homes, will only double the amount of energy being produced and have as much negative impact on the environment as it is so doing right now.

Brochner, et al. (1999) reveals that Government orientated target need to be informative and understood correctly by contractors. It is in the contractor's responsibility to obtain the adequate materials and exchange information with clients for the build. Bon and Hutchinson (2000:3112) reveal that the construction industry buys from other industry and is constructed of a quintessential assembly infrastructure and it is not easily influenced in changing output characteristics. The contractor needs to have the correct performance specification knowledge to pass on to their team as well as actors involved. Myers (2005) discusses that there is not enough information on sustainability development to equip contractors with the understanding that they need which, thus causing a lack of interest even after being given their own sustainability agenda. Construction companies tend to use their own initiatives and targets as they, feel the government is slow in applying information in an appropriate manner. This matters greatly in the construction industry as it reflects the outcome performance. International standards contain general principles in dealing directly with the

performance standards in buildings. (Myers, 2005: 371) They have been long used since the 1980s when they were first introduced in order to reveal maintenance and life cycle standards. An integral part of the International standards is that it encourages for the protection of non-renewable natural resources. (Ball, 2002: 424)

3.2 Implications of Understanding

As based from the collected data presented above, it could be seen how the different guidelines of building structures in UK could identify the necessary procedures of project risk management or project failure mode analysis procedure that should be carried into consideration when establishing sustainable housing around UK. In this section, a finding on the possible approach to be used for this aspect of management control in establishing sustainable housing could be considered as the diagram presented below:

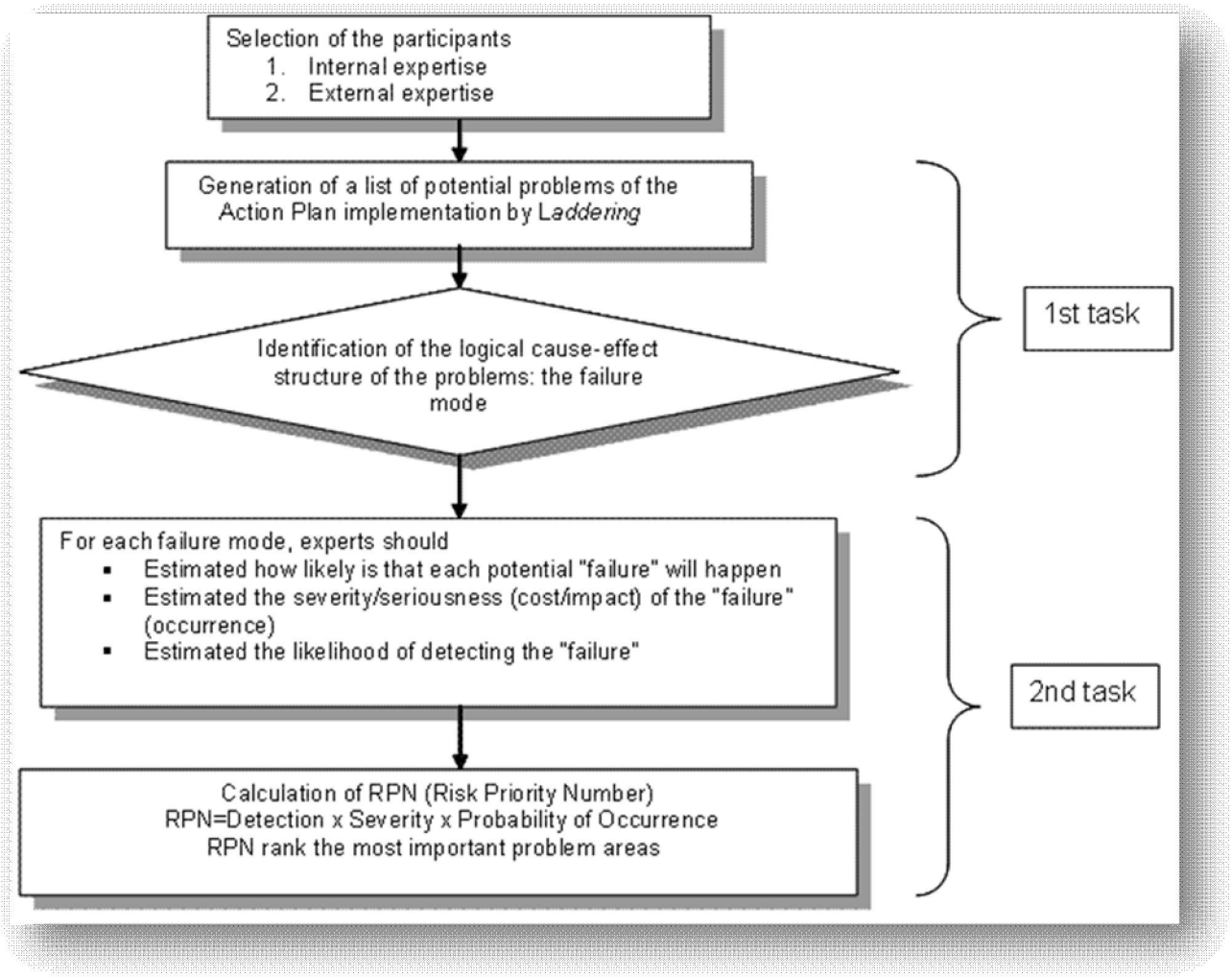


Source: http://www.goaldart.co.uk/FrameworkIntegration.jpg. (August 28, 2009).

From the diagram presented herein, it could be noticed how the approach of building assurance is established even during the beginning of the project itself. From this diagram, it could be noted how important is documentation and planning is in the field of establishing the first steps of the project. From this particular matter, it could be noted that the collaboration of the ideas of the project contractors with that of the ideas of the customers or the clients to whom the houses are to be built for head starts the beginning of the building process. Basically, the ideal manner to which this process is based gives way for the contractors and the owner of the sustainable homes to exchange their ideas with regards the sustainability of the house and how its features fit the needs and demands of the people who are to live in it later on.

Following this process is the establishment of the linked management between the people involved in the structural establishment of the sustainable housing projected upon. The management officials are given practical guidance with regards their role in the project and the flow of communication linage that they are to use to assure that the projects would be completed on time with the perfect control needed to assure its established strength.

After establishing the above considerations, it is also expected that the materials, facilities, tools and machineries to be used are double checked before the project starts. The platform for the project completion is also expected to be assured and viewed in balance as seen from this diagram. Regular reports and mandating commands from the officials in charge in the project are all expected to have a controlling effect on the process to which the project of creating sustainable homes shall be undergone. The instant consideration that is given to all these aspects of building sustainable housing facilities for human families could be seen to have an almost the same process to which other particular establishments are built. However, because of the new sense of building the houses, which includes the involvement of installing energy control gadgets and other structural feature considerations, the massive consideration on improving control and communication during the project establishment becomes a very essential, if not the most important aspect of the building process. This could be better explained as follows:



Source: http://www.orgap.org/internal/orgapet/images/fmeaflowchart2.GIF. (August 28, 2009)

From this diagram, the identification of the role of the different stakeholders of the project creation on sustainable housing facilities could be better identified. The sustainable buildings group consists of government oriented departments who are involved in the various policy implementations and schemes. The sustainable buildings group constitute of the, Office of the Deputy Prime Minister, The Department of Trade and Industry, Department for Environment, Food and Rural Affairs, and the Office of Government Commerce. The Office of

the Deputy Prime Ministers key function is to meet their required target of reaching carbon neutral by 2012. The Department for Environment, Food and Rural Affairs produces reports on policies (Sustainable Procurement action plan) that are needed to improve the environment. The Building Research Establishment are the central key players in these energy initiatives as they implement the measures into place as well as offer additional information to other sectors. Furthermore, they are responsible for sending out inspectors to homes.

The Building Research Establishment is a consultancy, certification, testing and training service functional since 1921. (Building Research Establishment, (2007) The Building Research Establishment Environmental Assessment Method was first created during the early 1990's and was also known as the green building challenge. The voluntary environmental assessment method for buildings is based on a set of categories on score card that need to be identified and measured against. Thistlewaite (2007) revealed that BRE must not in any way influence or distribute its personal data with its clients. BREEAM has been internationally acknowledged as 'the most successfully executed programme for promoting sustainable building practices, and influencing other initiatives worldwide'. (Building Research Establishment, 2007)

The long term planning groups involved are the Sustainable energy Policy network group and Senior Officials Policy group who have helped to reduce the white energy white paper by bringing environment concerns to the heart of policy, by defining a long-term strategic vision for energy policy combining our environmental, security of supply, competitiveness and social goals. (DTI, 2007).

It has been said that the Building Regulations controls much of the regulation between existing partnerships and places a strong emphasis on existing businesses. (Carbon Trust, 2006) The Communities and Local Government communication with the Building Regulations is considered to be very weak. (Department for Communities and Local Department., 2007b). The main reason for this is because of the amount of pressure that the Communities and Local Government puts on the Buildings regulations and their continuous amendments to the guidelines. To add to this, there is a complexity of actors involved who don't mix together to

meet general targets. These actors are all part of internal departments within the Local Government and are expected to meet their own targets.

Crowhurst, (2001) reveals Local Authorities are in the dark about sustainable construction as they do not yet have a full comprehension about it therefore they have not written environmental policies on the subject. Crowhurst, (2001) also highlights that the government are obsessed in their sustainable appraisal systems that they forget to include criteria in planning policies and working practises in local areas. On the contrary Local Authorities don't need to know everything as they are not responsible for construction and demolition. Other actors involved are builders/architects and clients (residents) who are an essential part of these sustainable construction measurements. (Crowhurst, 2001)

4. Conclusions

One of the Governments top priorities is to tackle climate change, by minimising the use of energy in buildings as they are responsible for producing half of the UK's energy. The Local Governments aim of reducing the countries emissions through the construction of more developments is having an impact on how sustainable measures are being produced. Various sustainable construction measures are in place to help reduce the amount of energy being produced in buildings such as Energy Performance Certificates, and the Code for Sustainable Homes which set criteria to meet level standards. The Code for Sustainable Homes measure does not seem to be clear on how it will help improve the Governments zero carbon targets by 2016, as well as the extent of usefulness for home buyers.

The Local Government is implementing these new energy initiatives in order to form better relationships with existing businesses however they are not yet effective. The Building Regulations control much of the regulation between existing partnerships and place a weight on existing businesses including the Construction Industry. The Communities and Local Government also pressurise the Building Regulations because, of new schemes being introduced therefore an uneven friction occurs between the two. The result of this leads to

insufficient information being passed down between the partnerships. This also leads to a higher number of uneducated businesses and inspectors.

The issues of cost arise in the culture of consumer buying habits through access to Eco goods also included is the Code for Sustainable Homes targeted at home buyers to reduce the energy efficiency of their homes. This also adds pressure as consumers are pushed into thinking they need to comply and, if they are not involved they will automatically be socially excluded from the practice. The Thames Gateway demonstrates the importance of the measure needed in its policy but, does not actually analyse its effectiveness. This pretty much demonstrates position of the Government, in meeting their standardised targets resulting in an ineffective strategy.

With this necessity to building houses considered in this phase of structural establishment development, it could be noted that the utilization of the project failure mode analysis suggested in this research in connection with the establishment of the projects pertaining to the building of sustainable housing structures around UK would be a much impressive sense of control in connection with the guidance to building provided by the government. Believing the indication of the of the guidelines established by the government and living through the said principles is seen as a practical sense of expecting success on the process of pursuing the creation of sustainable housing for the human society living in the different communities of UK at present. This is of course repeatedly mentioned as a process of specifically saving the earth from devastation while giving the people the shelter that they deserve to have.

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