The Use of Integrated Design to Deliver the Energy Efficiency in Buildings at Least Cost

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A thesis submitted in partial fulfilment of the requirements of the University of Westminster for the degree of Master of Philosophy (London – UK)

January 2017

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School of Architecture and the Built Environment
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Abstract

This study gives us a concise overview to describe the different types of energy efficient buildings, focusing on the verification of design, interference check, prove feasibility, practicability, attitudes, and saving cost. Energy efficiency in buildings may require specific solutions and evaluation. The aim of this study is to investigate the impacts of using the integrated design to deliver energy efficiency in buildings at least cost. Also, this research seeks to mitigate the barriers that impede achievable cost reductions. The literature review and based discussions lead to generate of propositions and questions.

In chapters about the methodology and analysis, the two associated approaches have been employed, the quantitative and qualitative, qualitative and quantitative approaches, examined by research, offering rich expressive analyses and viewed as harmonizing. In this research, the both qualitative and quantitative approaches utilized the research practice that face the problem of construct the gathering data; and are subject to avoid potential bias; in order to examine the impacts of the integrated design on the energy efficiency in buildings and the cost.

This study undertakes a number of recommendations, and identifies lessons to be learned; also, promote improving the design of the energy efficiency in buildings. With these contributions, the research helps prospective users to utilize the integrated design as a potential method offered to energy efficiency in buildings at least cost.

To improve the future work, this study will research further trends to cover the subject areas deeper, in the present questions as below: -

- To investigate the role of public to mitigate the barriers.
- Examine new ways of improving communications to achieve the aim of study.

Acknowledgements

I would like to thank all the following people for their help to produce this dissertation:

Dr. Junli Yang, University of Westminster, for his assistance and advice throughout the process.

Mr. Malcolm Smith, University of Westminster, for his assistance and advice throughout the process.

The thirty professionals who generously gave up their time to be interviewed and provided invaluable insights into research areas.

My family and friends for their endless patience and support.

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List of Abbreviations:

Abbreviation	Mean
AIA	American Institute of Architects
ASHRAE	The American Society of Heating, Refrigerating and Air-Conditioning
BREEAM	Building Research Establishment Environmental Assessment Method
CIBSE	Chartered Institution of Building Services Engineers
CITB	the Industry Training Board for the construction industry
CO2	Carbon dioxide
CSHS	Climate Smart Home Service
DECC	Department of Energy and Climate Change
DMG	Design Methods Group
EAC	The UK Parliament: House of Commons: Environmental Audit Committee
EDRA	Environment Development Research Association
EEB	Efficient Energy Buildings
GB	Great Britain
GEA	Germany energy and food provider
GHG	Green House Gas
ID	Integrated Design
IDP	Integrated design processes

IEA	International Energy Agencysx
IRMA	Information Resources Management Association
IT	Information Technology
IWGEECE	Interlaboratory Working Group on Efficient-Energy and Clean-Energy
JCCA	Association of Japanese Consulting Engineers
NZEB	Nearly Zero Energy Buildings
UK	United Kingdom
UNEP	United Nations Environment Programme
USA	United State of America
ZEN	Zero Energy Buildings

Declaration

I hereby certify that all material in this dissertation which is not my own work has been identified through the proper use of citations and references. I also confirm that I have fully acknowledged by name all those of individuals and organisations that have contributed to the research for this dissertation.

I further declare that this dissertation has not been accepted in part or in full for any other degree, nor is it being submitted currently for any other degree.

The dissertation contains (42572) words, exclusive of tables, diagrams, references and appendices.

I confirm that a digital copy of this dissertation may be made available to future student of the University of Westminster.

Student's Name: Saffa Gabber

Student's Signature:……..

Date of Declaration: 3 January 2017

Preface

This dissertation completes the Master of Philosophy at the University of Westminster, London. This research is to mitigate the barriers that impede achievable cost reductions when applying integrated design processes during the design of energy efficient buildings. Also, is considered as relevant to both the research and to industry professionals.

It is hard to live in modern life without thinking about saving energy. For many years ago, thinking about the construction materials in this industry; have been the major concerns for all professionals. And the competition about the energy efficiency in buildings has grown widely.

But in recent years, there have been huge improvements in the way of construct buildings. For projects directly affected by energy efficiency activity that it is the greatest for cause concern however, the conventional design of what is left behind once. Many new buildings that are possible to have an efficient energy input and make a difference to new buildings, it is my interest in this area that led me to look at the concept of saving energy at least cost for this research project. And the development of new design style now more than before, and the needs have increased especially by the professionals and the public, and more recently that its development has increased a lot.

At the start of research for the study, there was much in literature regarding implemented the integrated design to deliver energy efficiency in buildings that has been recognised. However, the literature was failing to take on account, for the most part, and the impact of the new design activities on reducing the costs. In the primary research; data can be collected and did not bear this out, the most significant findings in this study has been the questions it has raised regarding built out energy efficiency in buildings and the factors that are responsible for shaping it. Living directly in touch with a number of energy efficient construction development, give the spot to the policies control. The implement of integrated design has been changed rapidly to meet new needs in current world to deliver energy efficiency in buildings.

Chapter 1: General Introduction

1.1 Introduction

The construction industry has become one of the most important economic sectors in the world (Halpin and Senior, 2010). At its development, at some stage the construction industry adopt the integrated design as a method to deliver energy efficiency in buildings at least cost. The role of integrated design is expected to expand when the use of energy efficiency in buildings become more popular in industry. Therefore, there is a real need for modernising this industry to enable it to face continuing development opportunities that lie ahead. These challenges need more changes and improvement in design methods to increase the use of energy efficiency in buildings (Biesbroek, et al., 2014).

The use of integrated design in construction industry has become more familiar to deliver the energy efficiency at least cost. Many energy efficient buildings projects have been implemented with the integrated design method rather than the traditional methods, and have been successes (Harding, 2015). This has led to increase interest in new design methods and approaches, including using integrated design to deliver energy efficiency in buildings. Integrated design has two objectives: to manage people and to manage the energy efficiency in buildings. Failure of traditional design methods to satisfy project stakeholders, increasing project complexity, newly established energy efficiency in buildings, and an anticipated increase in investment. In summary, innovation and designers see the adoption of integrated design as a method to overcome most of the problems face the energy efficiency in buildings implementing (MacKenzie, 2010).

Designers collectively have different sets of norms, attitudes and skills pattern. The research discusses the definition integrated design, energy efficiency, and cost. It also, explores the differences between integrated design method and traditional design methods and the influence of integrated design process on the development of energy efficiency in buildings approach (Marco, 2016).

Improving the implementation of energy efficiency in buildings through the adoption of integrated design is essential to overcome the barriers facing such as these projects. To confirm it's the

optimal choice, it is vital to adopt integrated design process in like this area of construction industry, communication, information technology, problem solving and decision making, know-how and data transfer (Joel Ann and Gail, 2013).

1.2 Rationale

This study as it is proposed aims to impart knowledge to the field on integrated design by identify to overcome the barriers that prevent integrated design from delivering energy efficiency in buildings. It will focus on the importance of recognising the design barriers and analysing the advantages of applying energy efficiency in buildings at least cost (Gray, and Kinnear, 2006).

These will lead to the development of an understanding of integrated designing in energy efficiency in buildings, in obliging diverse client's criteria. In the last three decades, the design of energy efficiency in buildings often became preoccupied with more accommodating. This leads to the creation of rigid policies to achieve the energy efficiency in buildings, and often considering the diverse needs of clients and stakeholders (Ding, et al, 2012).

However, standardization and design principles alone as an approach cannot fully address the desirable integrated design characteristics of energy efficiency in buildings; the client will conceptualize energy efficiency in buildings in diverse ways and will have varying budget constraints and beliefs about the importance of energy efficiency (Filippini and Hunt, 2011).

Georgiev, et al. (2008) explains that better design should understand the problem space by applying the critical thinking through exploring potential and restraints in the design case. Design solution and multidisciplinary responses can guide the integrated design to frame design features. New integrated design and traditional methods may have the role to lead the attributes of a systematic relation in the design case. Integrated design articulation can correlate the design characters to the bonds between each part of a design.

Consequently, broad the outline of integrated design must target many and different stakeholders. Therefore, it is important to develop a strategy to overcome the integrated design barriers to deliver the energy efficiency in buildings at least cost, based on the participation and moving occupation that will move the designer's role beyond built environmental design; and to create shared value by users, and have knowledge of energy efficiency effects (Keeler and Vaidya, 2016).

The design language is more than a rational or expressive character; it is an inspiration elevated the work's image. Integrated design is design methods to bring all disciplines together that are typically working separately in a structured form, for the purpose of producing sustainable buildings with higher performance (Gliner et al. 2016). All the buildings of integrated design are considered all disciplines like architecture, civil engineering, and HAVC.

Eris (2004) mentions that there is a significant relationship between the design parameters and finding the appropriate levels of design factors with keeping boundaries within the limitations to strengthen the design system. In this way, the design will perform perfectly to reduce the cost that will spend by clients.
Based on that, the roles of integrated design parameters can be divided into: -

1. Produce buildings with higher environmental performance,
2. Lower the costs,
3. Inviting collaboration,
4. Spurring innovation,
5. Saving time.

Also, there are some functions of secondary parameters like: -

(Health and safety requirements, contribution of renewable, construction control and operation).

To identify these parameters' specifications, designers could use the standards and codes; also, they could determine energy saving targets. In the same time, parameters are detailed to the nature of each of facilities (Tichkiewitch and Brissaud, 2013).

When applying the integrated design, specialists of various disciplines will work together even though they come from different professions. The qualitative and quantitative aspects of the physical and functional properties of the element are inputs to its design process. Some of the design parameters determine the cost, design, and risk of component development. Larsson (2005) said:

"The engineers, therefore, are tightly bound by the earlier agreed upon design parameters. As a result, their inputs for energy efficiency are usually not optimal, but rather add-on features or an attempt to rectify inefficient design decisions made earlier." (Larsson, 2005, p.:67)

For instance, in a pre-agreed built form that exposes large building glazing to the west, engineering inputs are limited to the selection of an energy efficient glazing system and to provide additional air-conditioning load by choosing an energy efficient HVAC system.

1.3 Research Goal:

Aim

The aim of this study is an investigation into the impact of using the integrated design to deliver energy efficiency in buildings at least cost.

Objectives:

This research provides a comprehensive and critical assessment of the integrated design role in delivering energy efficiency in buildings at least cost, based on the latest published figures and original quantitative and qualitative research. Combining theoretical literature and empirical analysis with research's extensive experience in the field, it seeks to identify the obstacles to any development in this sector of industry and to propose appropriate solutions to improve this sector (Gary, 2009). Therefore, four specific objectives have been recognised in order to achieve the goal of the research and propose the answer to the significant research problems.

- To examine existing approaches those achieve in cost reductions in the design of efficient energy buildings.
- To identify barriers which obstruct savings in design costs?
- To point out processes which reduce or eliminate the barriers identified?
- To validate the effectiveness of the processes identified.

1.4 Structure of the Dissertation

In this chapter of the thesis almost a brief illustration of the structure of the dissertation which will be adopted in the other of the following chapters logically, with taking into account the needs of this research. Also, in this chapter will be illustrated how to apply this structure.
Chapter 1 identifies the research rationale, the aim and the objectives of the research, and present the structure of the study and its contribution to knowledge.
Chapter 2 reviews the literature on how to use the integrated design to deliver the energy efficiency in buildings at least cost, and the actors in this sector of the construction industry. It also explores the current position of the implementation of energy efficiency in buildings. The aim is to assess this situation from many angles: construction industry, components of this process, and design methods. It aims to examine these factors with an eye toward the potential cost reduction in an implementation of energy efficiency in buildings (Rudestam and Newton, 2007).
Chapter 3 outlines the methodology of the research, its choice, and strategy. This chapter also explains the combined quantitative-qualitative methodology, identifying the questionnaire design and underlying propositions. It identifies the questions for the survey, including the type of relevant data collected and the method of "content analysis" used to attain to conclusion and recommendation. The chapter, also, discuss the limitation of the research methodology (Zaal, T., 2009).

Chapter 4 presents an analysis of the data and likelihood factors of analysis. The chapter goes to evaluate the reasons for the acceptance of integrated design in the construction industry (Zundle and Bougdah, 2006), the form it has taken, and the success in identifying the barriers and potential

problems facing applying the integrated design in delivering the energy efficiency in buildings. It considers ways to overcome these barriers (Lynne, 2005).

Chapter 5 draws conclusions and recommendations on the basis of the foregoing analysis, linking them to the propositions of the research to assess the barriers and potential problems confront and deal with applying energy efficiency in buildings.

1.5 Chapter Summary

This chapter has presented a rationale for the selected area, offered the study aims and objectives and agreed on a brief description of the contents of the next chapters of this study.

Chapter 2: Literature Review

2.1 Introduction

Buildings consume approximately 40% of the energy, and nearly 70% of the electricity used in most countries (WEC: World Energy Council, 2016). Building surfaces are well suited to renewable energy production. Current problems in buildings with the approach based the renewable energy production. Strauss and Corbin (2008) propose a research project in buildings to design a low-cost hybrid solar electric building, which has the ability to accumulate energy directly to a building surface, forming the feature of using low energy in buildings.

Two of the greatest challenges in the construction industry design process, and implementing energy efficiency in buildings. Integrated design needs to be promoted in high-performance buildings in order to deliver energy efficiency (Plamer, 2011). Statistics released by the UK Department of Energy and Climate Change (DECC, 2012) state that energy consumption in the UK steadily increased by 20% in the past two decades; and reveal that the residential sector consumes an estimated 26% of the total energy used in the UK, of which an estimated 48% was used for heating. The UK government is seeking to implement the best methods of reducing energy consumption and one of the sectors being targeted is the construction sector (ADEME, 2007). Energy reductions can be achieved by improvements to the design and construction of the building; energy in the building can also be made more efficient by using renewable sources of energy such as solar and wind power (Garcia et al., 2012).

Vidar Lerum (2007) explains how the building can be a high-performance building (HFB) with energy efficiency should carry significance design? Also, he suggests judging building only on its design and built objectives, it needs to find the fact to proof that building is within of HFB. The designers can investigate buildings if contribute to HFB standards to act as energy efficient buildings by using guides of VidarLerum (2007) that have been set in his research; which clarified by use a number of contemporary design examples from around the world that comprise the evaluation of the disclose of hidden features of design construction projects. This will enable them to participate competently in their own designs. All design disciplines have to draw the anticipated outcomes of their design that could help in planning and explore the actions expected of their design, also, the need to be proved for more diverse functionality and to utilize those outcomes (Suh 2013; Malmqvist 2013).

Edwards (2001) explains that existing buildings that can be renovated or retrofitted, thus also can minimize the environmental impact that a new construction might create. Not only is this route more design, the design could be quite beautiful with the juxtaposition of old and new construction. The designers should think about the choices for materials and finishes, and what impact each may have on the specific goals of the project. As the team gets acquainted with one another, and the client is on board with the Pre-Design discussions and a vision is created, they are then able to move on to the further design stage, as a Schematic Design (Edwards, 2001).

When the engineers plan for the integrated design of buildings they mostly follow their own strategies. And most of the developed countries use their strategies for the conservation of the energy in their buildings.

This chapter presents the main points of the literature review about the integrated design, energy efficiency in buildings and the cost with consideration given to the different arguments and thoughts cantering about those topics through a number of researchers. This chapter includes the definitions, features, opinions involved in the application of integrated design to deliver energy efficiency in buildings with low cost. This study discusses the concepts of ID, EEB, and cost and their impact on the progress of the projects. It also explores the differences between ID and

traditional design and the influence of the cost on both the development of the EEB and ID. And it will outline the background knowledge of the latest research in integrated design and energy efficiency in buildings; in addition, study the relationship between the cost (De Lit and Delchambre, 2011).

Even the available literature on the subject is somewhat limited; the literature reviews in this chapter present a valuable overview of the researches and studies in related aspects of the subject. The idea of merging integrated design with energy efficiency in buildings under the shade of cost represents an effective understanding to cover a wide range of notions (Zeng, 2012). These ideas are ground and base on the consistent adaptation of supporting the innovation and develop the initiative and developing new strategies. The development of integrated design techniques and the application of energy efficiency in buildings need to examine and find if it is in the same level as the altitude of vision and the needs in both trends (Larsson, 2009). This research will attempt to redress this and fill the gaps within the subject.

The efficient energy buildings (EEB) market in the world has grown rapidly in recent years and the work has expanded. Major projects have grown more complex, and start to seek for new approaches in design for these projects which have not been successful. Arvin et al., (2002) explain this has led to increasing the interest in new methods and approaches, including integrated design (ID). ID concept that originated in the USA and has been transferred to other developed countries (e.g. the UK) and developing countries. ID has two main objectives: to design efficient energy buildings and to minimise the projects' costs. Several designers have emerged failure of traditional design methods to satisfy projects owners, and increasing project complexity, additionally, the project's owners showed some interests in the adoption of ID as a way to overcome some of the sector's performance problems (Bentley, 2009).

However, the study of methods which enable the integrated design to deliver energy efficiency in buildings; need to undertake the latest improvements in these aspects to enhance a full understanding of the aim of research. Also, it will help to replace the existing construction methods,

and eventually lead to the creation of possible solutions to help overcome barriers that so far have proven difficult to clearly identify and characterise (Keyson, 2013).

It aims to create a fundamental basis for designers to make the design process remarkable to ensure that design can achieve the energy efficiency in buildings. Here the question can be posed, what are the well-definition and adequate picture about the knowledge areas surrounding the integrated design? The anticipated objectives to understand this type of design is to draw the outline the concept of the integrated design, and also identify the trends of the design work, and figure out the identity of all the influences at work which reflect the ability to this type design to meet project requirements seamlessly (Kiel, 2008).

Deutsch (2011) explains that integrated design is making a decision about the process that seeks to adjoin the synergistic, holistic and integrated elements of design for the most effective outcome. In reality, characteristics of the factors that affect the integrated design can be deduced, that depends on a number of practical aspects at different levels; and also, include the direct and indirect effects of the costs.

In addition, it indicates the involvement of specialists in these areas to work to gather simultaneously through the use of their own methods and available tools that result in complementary solutions. Macaulay (2008) defines integrated design as a collaborative method for designing buildings which emphasizes the development of a holistic design. The concept of integrated design encompasses all stages of design in order to work collaboratively and more closely involves aspects of architecture and construction, as well as saving energy and the costs.

Stansinoupoloset al. (2008) defines integrated design as a whole system design, depending on the main concept which optimizes each component of a system independently and leads to complete systems, especially when energy efficiency becomes a goal. Lesniewski (2006) from the American Institute of Architects (AIA) defines integrated design as a method that improves design results by integrating all project components into a collaborative process that supports the skills and thoughts of team members to increase project's value. Therefore, Integrated Design is an approach which

brings together all the design teams working on a project - architects, engineers, and other consultants - to collaboratively consider all functional characteristics of design from the concept stage to the submission of design.

Aroul et al. (2011) state that energy efficient buildings are buildings that have been designed, constructed and operated in an energy efficient method, using materials and energy efficient systems. Energy efficiency is something that delivers more services for the same energy input or the same services for less energy input. And this consistent with a more simple definition by Fawkes (2013) explains that energy-efficiency is aimed at reducing the amount of energy required to provide building services. Therefore, an energy efficient building is a building which uses less energy to design and construct than an average and uses less energy to provide the same services as other conventional buildings.

The literature review chapter in this study has number of goals in assess, evaluate and analyse what had been written in the main areas of research in depend of the importance of them (integrated design, energy efficiency in buildings, cost).

2.2 Integrated Design:

2.2.1 Literature Review:

The integrated design has become one of the most important construction sectors in many countries. It is among a number of sectors in the current stage of development in the construction industry which has a different contribute too many economies. Therefore, there is a real need of modernising in this industry to enable it to face the continuing development opportunities that lie ahead. This challenge requires more changes and improvement in the construction industry and design to participate in the global competition of the 21st century (Cheng et al., 2007). Many successful projects now indicate that integrated design has been used to create comprehensive energy efficiency buildings on a reasonable budget for more than two decades. Although,

implementing integrated design is not an end in itself, for any project it is necessary to accomplish most design tasks. It is obviously essential for all stakeholders to understand applications of integrated design concepts.

Improving the integrated design processes (IDP) through the adoption of new methods which are preferred to overcome barriers facing the achieving of efficient energy in buildings. It is vital to adopt a good design practice in problem-solving, decision making and know how to transfer the technology (Kiel, 2008).

According to the Oxford English Dictionary, the *verb* integrate means 'to combine (two or more things) to form or create a whole (something)', or 'to bring (people or groups with particular characteristics) into equal participation in larger group'. These two definitions are both present in the meaning of 'integrated design': it involves bringing various designers together to create a detailed plan of a building. By doing this, the different functions of the building – the shape, look, use value, etc. – will be considered as a whole, and not separately.

Design as a generic term is defined differently by different domains and individuals. Consequently, 'integrated design' involves bringing various designers together to create a detailed plan of the look and function of a building, resulting in a building which works as a whole. Among the most important attributes in the style of the integrated design which effectively relies on the style of redundancy in the design which can also obviate from the need to use a number of modern technologies in the application of energy efficient buildings (*S*tansinoupolos, 2008).

This type of design needs the development in the construction philosophy and the operative conditions implemented in the projects, it requires a comprehensive understanding of design concept and construction policies. The procedures of the integrated design process allow to all of the owners, consultants, and the construction firms always argue about the number of factors to give a minimum of control and manage the projects. Integrated design requires the minimum number of designers as possible or the recommended, and the minimum number of the

professionals, therefore the cost of employing the staff in this type of design is less than what to spend for hiring staff which increases the firm's profits (Del Monte, 2009).

The integrated design can handle the requirements of the variables that affect the inter-relationship of the project team including (owners, designers, contractors, other stakeholders). Unlike the traditional design, the integrated design must be able to lead all contributors in the projects and have a full understanding of this new design role. Also, this design should make other stakeholders participate in the involvement of their responsibility, and that will reflect on the operational design measures, and the organisation's structure. Bazjanac (2008) states that in particular construction industry, and the designers should decide the strategic decisions which occur at a number of events.

Integrated design is the process that controls the decision making and can authorize any stage in design team which enhances decision centralization. Study the integrated design and analyse all the factors that have a real contribute on the whole process of design, which points out the identification of these factors and take in consideration the risk, tangible and intangible, keeping in mind that the strategic process in a construction firm which is based on previous design (Perkins + Will and Stantec Consultancy, 2007).

The organising of integrated design involves understanding and controlling all activities related to the materials and technologies, including all aspects of acquisition, specifications, and implementation. The construction industry directs the designers in the material design for the project. The construction firms should then participate in specifying and sorting of all materials in accordance with the project particular conditions and specification (Birkeland, 2002) from the Environment Development Research Association (EDRA).

Integrating the design is a tool to optimize the design of a physical entity or process. It is important to distinguish between the traditional design and integrated design; while (Busby Perkins & Will and Stantec Consulting), one of the Canadian Consultancy, 2007), define the design process as: -

"It's the technical review process that has a close reciprocal of engineering design with the value of the design which derives from the traditional design".

By contrast, and they define the integrated design as: -

"The matching of project decisions and directions with the expressed requirements of the stakeholders, from a value derived perspective."

Which seems different from other researcher's definitions, and they express the relationship between the construction industry and integrated design can offer. Construction industry provides the integrated design with a mechanism by which to evaluate the entire cost versus workability with regard to the project. This facilitates the input of alternative methods and materials and the co-ordination and co-operation of team members. States that integrated design could be categorized as a brainstorming exercise. Often what appears to be an excellent recommendation result in a more optimal overall project design and implementation. Horst, and Rittel (2013) as members of (Design Methods Group (DMG), define the design as a proactive, creative problem-solving service. It involves using a structured, multidisciplinary, team- orientated approach to making explicit the construction industry system using functional analysis to expose the relationship between time, cost, and quality. Strategic and tactical decisions are audited against the system at different stages through the development of a project or the life of a facility.

The design in the project includes the steps of the design includes the processing of all construction activities in the projects from inception to completion including determining, formulating, designing, developing, installing and coordinating the required elements of the delivery process of the project. To shoulder these responsibilities, the designers should have enough experience and qualifications to be able to manage the design of the project and meet the construction industry requirements (Zamenopoulos, et al*.,* 2007). The key to controlling the design of construction projects is, therefore, the way in which contributors are organized, so that their skills are used in the right manner. There is little point in the construction industry developing its design skills if they are not then implemented effectively. Even project designs are varying in terms of size, the time that they take, the resources they require and how the design can influence project activities. The

planning of projects plays an effective role to interrupt the desired project achievements (Deutsch, 2011).

To control and the integrated design, it should include all elements of successful design of the project that contribute to project quality as stipulated and required by the construction industry, according to the design approved by the integrated design team and constructed by the contractor.

Also, it includes the technical specifications, material choosing, and measurements, contractor installation capabilities, building codes and policies. Lesniewski (2006) a member of the American Institute of Architects (AIA) argues that quality of integrated design is hard to define within the construction industry. Also, he states that quality management includes all activities of the overall design function that determine the quality policy, objectivities, and responsibilities and implements them by design means such as planning, control, assurance and the improvement; failure to meet project requirements in either dimension can have serious negative consequences for design the project.

The knowledge of integrated design could include the availability and capability of experienced designers and the service's resources, particularly the ability to make the most effective use of the professionals involved in designing the project (Harding, 2015). The construction industry duty is to control and coordinate all consulting design and planning construction services at the project level, by means of organisation, design acquisition and team development.

There are some examples that give a clear illustration of the extent of the obstacles' influence can have. This is based on the data that can be drawn from those involved in the design (Smithers, 2002). In order to promote an understanding of the philosophical framework for integrated design, it is necessary to identify the background that the concept of this type of design can be derived. Integrated design was developed in the middle of the last century and was initially elaborated to meet the requirements of the combined design disciplines; at the beginning of the design stage and later was extended to other stages (Venhaus & Dreisitl, H., 2012).

The objective of integrated design concepts is to be able to act in an effective manner to help to reduce the costs rather than have a more direct impact on the design. There are many benefits that can predicate to obtain from the use of integrated design in different aspects, especially at the performance level, the amount of energy usage in buildings and saving the financial resources. There are some influencing factors and barriers that have a real impact on the efficient functioning of the integrated design process while maintaining the design elements (Cheng et al. 2007).

Defining the concept of integrated design when work in design efficient energy buildings; depend on the importance of the design and the extent of the impacts on the interest earned when the design is planned using technology and materials to achieve energy efficiency through integrated design, also, on the type of energy efficiency. Maher (2000) explains that integrated design can prove its effectiveness in achieving energy efficiency in buildings; when the cost of used energy is less than that used by traditional buildings. The use of energy efficiency in buildings that have been designed with integrated design is a significant issue and continuous concern for many specialists when focusing on the importance of how to apply and use the energy efficiency with the possible lowest costs; in addition to the emphasis on maintaining the diversity of energy sources and depletion way of energy, as well as to reducing harmful emissions (CO2 emission) that affect the climate (GEA: Guyana Energy Agency, 2014).

Integrated design discussions mostly focus on the efficiency of the process of construction, efficient use of materials, and use of technology that is available in that area. It is very important to note that the buildings are deceptively complex and at their best, they connect us with the past and are the representation of the greatest legacy for the future. Cross (2011) wrote many articles and research about the integrated design, he discusses in his thesis whether the design is an art or a science and he concludes that design can be described as a district of looking for the intellectual independence.

According to Cross's (2011) opinion, to consider the design as one of the sciences thus will enhance the design opportunities to develop within the work structure. Also, it enables the designer to work with two options to adopt the design once as a science and other as an art. His outlook on

conversations around the nature and the style of the original design with the possibility of mergers between objectivity and technical outlook when appropriate design things.

Although the design has come into view as a modern contemporary style, and all develop the design to be used on residential and commercial scales, they considered design as one of the best methods to create distinctive intellectual work. Zeng (2004) follows the others in considering and examine the promise of consensus upon whether the design is a branch of science or an art,

meanwhile, there are two groups each one support one opinion against the other one (opposites)through recognising a number of aspects. However, he believes both sides are not totally wrong and he makes his own way by consolidating some aspects of both side and devising them together in one contrivance.

Maier et al., (2009) traditionally, define the design as an inherited human pattern of art that addressed a particular artefacts form of the designers' creative skills. Also, some designers don't accept the idea of being a part of any commercial business to reduce consumed resources and ecologically featured design; because they believed design is more than aims and objectives to use the minimum time or resources for effectiveness, it's an independent or collaborative human function.

Depending on what (Margolin, et al., 2002) introduce the Expansion Model in the implicit role of design is to maintaining and reinforced the economic system in two aspects; the first one to identify the consistency of the market products, the other one is the spatial structure for the tokens of economic exchange. Based on that, the design contrasts between different views sometimes towards science and at other times close to mathematics and the other toward the art, therefore, the design trying to find its own way in response to resolve the problem.

In order to enhance the separation between the standard traditional design and the integrated design in a logical and effective purpose could create a fundamental approach to design. Construction and integrated design process are not so simple, but it is also integrated with productivity, providing

shelter, embody the culture of that place and play important role in the development of the plants. With the increasing role of the technologies and the electronic devices; the construction of stable buildings becomes so much complex and costly (Attia et al. 2009).

According to Don Kumaragamage (2011), there are some differences between the two design methods, in features and elements which are listed in the table (2.1) below:

Table (2.1) Explain the comparison between the traditional and integrated design

Integrated Design		**Traditional Design**
1.	Inclusive from the outset	Involves team members only when essential
2.	Decisions influenced by broad team	Less collaboration exhibited in early stage
3.	Whole system thinking	More decisions made by fewer people
4.	Allows for full optimization	Limited to constrained optimization
5.	Seeks synergies	Diminished opportunity for synergies
6.	Process continues through post-occupancy	Linear process
Elements of Integrated Design		**Elements of Traditional Design**
1.	Emphasise the integrated design process	Define the functional requirements
2.	Conduct assessment to help identify requirements and set goals	Carry out the necessary investigation and analysis
3.	Ensure requirements and goals	Establish design criteria and perform elements
4.	Evaluate solutions	Determine potential modes of failure
5.	Work together as a team from the beginning	Perform risk analysis
6.	Think of the building as a whole	Prepare risk documents

Lewis (2004), member of ASHRAE: The American Society of Heating, Refrigerating and Air-Conditioning Engineers, defines integrated design as a collaborative process of preparing design and construction that results in optimized project system solutions. For integrated design to succeed and be beneficial to the project, the entire project delivery team must be committed to understanding, engaging with and others who involved in the process from project inception through operation and maintenance.

Del Monte (2009) who is a member of the AIA defines integrated design as the best method to design a building by achieving the needs for design in projects. An integrated design process enhances collaboration work among the team members during all design stages. The best strategies for integrated design will:

1. Encourage the best communications among teams;
2. Plan the design process; and
3. Promote integrated working among design disciplines.

Also, in order to make the integrated design obligations, it should:

1. Identify design strategies
2. Set integrated design goals
3. Use whole system analysis
4. Base decisions on cost-effective design and
5. Integrated design factors

There are different elements which interact with each other, but if some of them affect the building in different ways, then the results will be costly and inefficient.
The main factors can be stated as:

1. Site
2. Climate

3. Orientation
4. Landscaping
5. Materials
6. Installation.

The complete integrated design process is relying on complex inputs; and most clients start with the identification of the basics needs for their buildings (Saunders, 2002). It includes all the basics of the quantifiable requirement for space of the building and the capacity of the budget that owner can be used approximately. The important basic step starts with the need assessments that include assessment of the available and the prime data that are provided for the integrated design. It also estimates the technical requirements and the realistic special requirements. This step focuses on the program around which this integrated design will be completed (Goldschmidt, 2005).

It is much important for the designer to make a master planned at the initial stage so that it will be easier to assess all the requirements and can arrange them step by step so that process of integrated design is initiated with the efficiency style. Other main parts if the initial step is to develop the scope of the project, programming and then research on the client's needs to find the best opportunity that can be used during the integrated design process as pointed by Deutsch (2011). In the next step, client discusses it with all other stakeholders. At this step, all the engineers and other consultants will play a key role in the making design decision process.

Cheng et al. (2007). Suggest that the integrated design may have the opportunity to frame the significant keys to solve a large number of unfamiliar design problems. This can be through:
enhancing the practice of new technology; considering the main information that should be directed; and recognizing the design aspects that can play an important role.

Suresh (2011) explains that engineers need to spot on aspects of Integrated design which can be noted like:

1. Interaction design
2. Information architecture
3. Visual design
4. Usability testing

Each one of them has number of development ideas that could discuss in some topics as:

1. Ideation (e.g. usage, experience, focus areas, tasks and sharable elements)
2. Design Proposal
3. Feasibility analysis
4. Prototypes
5. Finalize design (roadmap)
6. Specification of design
7. Usability testing
8. Final lockdown
9. Marketing collateral

Horst and Rittel (2013) members of (Design Methods Group (DMG) and the DMG Journal in Germany) refer to the radical distinctive act of design work as a semantic key that could be the referent to more holistic result, thereby aims to develop the clients' satisfaction, reduce the negative environmental impacts, and organise the activities they rely upon. Also, he exclusively finds that design can play in gathering the segments of science and art of design without any boundaries could restrict the creativity of design.

Zeng (2004) (one of the famous designers) worked on organising a Systematic and Intuitive Methods in Industrial Design Conference in England, which manifested the contemporary design. In this conference, the commercial design had been established. Furthermore, he suggests that design as a hypothetical structure support the creativity and improvement in a number of trends. After that conference, suggestions of some design schools appeared to concentrate on:

1. Taxonomic processes which rely on describing the human behaviour as a tendency understands the environment in a certain way.
2. The design is an art movement to restore its activities and emphasize on simplifying it; also getting the objective access to know the philosophy of the design process.

3. Using the actions of the design to deal with the phenomenology which proposed by Hussert (2001) to study human experiences and understand the consideration of the reality of design situations.

Maher & Tang (2003) went further more to explain what the design language means? And how it is so essential tool in the way of design timeless buildings? The primary advantage of understanding the design language is to find a method that fits the design specialty and designer's views. Also, he explains how the cost can affect the design method or processes, and the way of acting alternately in each other. That could be happening naturally within a sequence of process' time in an aim to bring forth the desired outcomes; furthermore, this could be capable to systemized design's events economically.

Earl, et al., (2003) state that to a realistic point of view, if it is dealing with the design methods of the "way of" and to be determined "what time things are the happenings?", and what kind of the system required. The biggest challenge will be when design implementation faced with the challenges through force and means of implementing. During the implementation of integrated design, design variables could be affected the results of the processes because the way of interacting with the case is different from designer to another one; which may be is dissimilar results between each one in the same of the design team.

Horst and Rittel (2013) explains that in practice there is a remarkable importance of design aims and objectives in sourcing to enhance and accomplish the design work; in same time the desired goals of the design process shows there is a need for real awareness of the customer's experiences which will reflect the comprehensiveness of the clear solutions can be achieved by the designers. Depending on the ways of thinking and information collected from the verification of design case;

the use of exploration and the designer's insight; also by using of intuition to bear out the peripheral conditions of situations.

Some writers define integrated design by its uses to distinguish it from traditional design; which means a specification of an object, or strategic approach that intends to accomplish goals, in a

special circumstances, using a number of elements, to meet requirements, within legal, political, social, environmental, safety and economic constraints. While others set that the design is not just an interpretation of the designers' imagination; and some of the others also note that it's not only thinking about the design's problems: it's an active system to translate all of above.

2.2.2 How integrated design process meets methods?

Earl, et al., (2003) agree with other researchers about process and method of integrated design which work in parallel and are considered mutually, but they nevertheless remain different in the style of work. The integrated design process is a series of natural events or to visualize the design within the time sequence so as to ensure access to the expected results. On the other hand, the way of integrated design means how to design and implement things in a systematic style by using the techniques in every appropriate way. How to judge the success of integrated design to contain all the dimensions of the problem? In a realistic look, any integrated design method has its own tools that define two main concern (when and how) which they excite a lot of challenges towards applying the design (Mumovic & Santamouris, 2015).

There are a number of quantities that assume a set of interact values between each other; which have effects upon the integrated design results. There is no common tool to use the integrated design as the alternative trend to frame the desired development. Maher & Tang (2003) found the Environment Development Research Association (EDRA), he was striving to incorporate who employed in social science with design engineers to design a healthy building with less carbon emission.

Mumovic & Santamouris, (2015) pay a lot of attention to the way of studying the integrated design that focuses on how to use the artificial thinking approach to understand the method of the integrated design process analysis and enable it to work interactively with the design essential conditions.

Hence, Santamouris's general contribution concept has a deep effect on the particular dealing with the social negative impacts that related to cognitive contemporary design methods. This opened the gate to invest the science practice in design rather than rely on intuition.

Bayazit (2004) in her research about the design methods, she states and adopts with some researchers those perceptions of design process which consider the ability to use the rationality methods in the knowledge of integrated design and scientific technology, to enable it to make the difficult decisions in a harmony way without any inconsistently with the environment of work.

At the same time, Yan et al. (2009) made it clear that there are a number of areas that could constitute the design and what design concern about; that is noted here briefly and they will be dealt with in detail later. Meanwhile, they will reflect the ways of thinking about of the core integrated design, and these important issues are as follows: -

1. What are the integrative ways of designing things that produced by a human?
2. How are these ways framed when considered by the users who look at things' functions when they are in utilized?
3. The people from outside design team could play a significant role due to their works that involve in design activities indirectly.
4. To embody integrated design requirements, its concepts should be reconnected with the use of organised approaches.

Zeng (2002) writes about design theory, he treats integrated design as the works can be done in an efficient process by using the cooperative methods; also he classifies the integrated design depending on situations to direct and indirect design approach.

Traditional design has been practiced for many years, but Zeng (2002) thinks design should be uplifted to absorb all the roots of the problem so the design specialization will be increased in a natural process. The design process with a consistent approach based on the available data, taking

into consideration the type of analysis that inspired the direction of the required specifications, as follows:

1. To allow all parties and other disciplines to express their ideas and to facilitate the granting the design processes all the functionalities.
2. Give the ultimate advantages and stakeholders have the opportunity to participate and influence the integrated design process to draw their impressions on the final shape of the design.
3. There are some of the design engineers who do not pay a lot of attention to the method taken they use the integrated design.

Gorb (2012) propounds that the integration of design is one of the cognitive cases in the construction industry that could support a number of business aspects which are connected with construction characteristics in somehow. Thus, maybe lead to turn the results of some activities and interdependency with design images to beneficial outcomes. This kind of relationship enables the designers to identify the differential level of final user's visions realistically. The integrated design has the intent to embody things in an acceptable combination to optimise the appropriate design envisaged results.

2.2.3 Integrated Design Concept

Gu et al., (2001) have drawn a number of ideas consistent with the thoughts of some researchers to distinguish the integrated design principles in the direction of full understanding to these concepts.

These were some considerable studies to resolve related issues which can be summarized as follows:

1. Giving the problem its own structure
2. Synthesising
3. Finding a solution to the problem by relying on problem formation
4. Solving the problem over the adequacy of the construction environment

Botta-Genoulaza et al. (2005) state that there are a number of new values that define the integrated design and live the action of the designers to enhance the optimum role of design. The opportunities that available for designers at the new technology time, which cannot be ignored or missed out because it will give the work many wide prospects during this time; and that has the features of availability of all needs for the financial and technological resources more than before.

Blackwellet al., (2009) add their voices to others who agree that the integrated design is the concept of buildings that emerge from the designs of the buildings to create and a reasonable management of the buildings, and should be constructed efficiently on the basis of the principles of the resources.

The most important in construction industry the needs to focus on the concept of integrated design in buildings due to the rapid increase in energy demand because there is a big changing in climate and that cause incredible increasing in carbon level (Herring, and Robin, 2007). Existing buildings that can be renovated or retrofitted can also minimize the pollution impacts that a new construction might create. Not only is this route for more design, the design could be quite effective with the juxtaposition of old and new construction.

Yao, et al., (2007) explain integrated design discussions mostly focus on the efficiency of the process of construction, efficient use of materials, and use of technology that is available in that area. It is very important to note that the buildings are deceptively complex and at their best, they connect us with the past and are the representation of the greatest legacy for the future.

Construction and integrated design process are not so simple, but it is also integrated with productivity, providing shelter, embody the culture of that place and play important role in the development of the construction industry. With the increasing role of the technologies and the electronic devices, the construction of stable buildings becomes so much complex and costly, which means the seeking for more alternatives are increasingly demandable greater than before (Attiaet al. 2009).

While it is important to keep the scope of investigation broad, goals and objectives must be firmed up. Integrated design alternatives should have the chance to develop based on a synthesis of the entire team's skills and knowledge, (Perkins and Stantec Consultant, 2007). According to the integrated design process, in this phase, the core team is joined by an energy specialist, cost consultant, and certification coordinator to name a few. A designer should be analyzing with the team on how they want efficient energy to affect the design, and how the building should be used to maximize the efficient exposure. In addition, the designer should pick up on how the client wants to the space to feel, and experience the patrons.

All the time he attempts to achieve the design concept successfully and is presented to the client for approval; as what Lebjioui et al., (2016) explains:

"All architectural, civil, mechanical and electrical systems are assessed for their expected performance and impact on all other systems as well as on the goals and targets."

Within this concept, all the professionals should have to come up with the best possible design solutions for their specific sector of knowledge. Integrated design as a science explains the actual science of design involving the construction of efficient energy buildings. As state by (EESI: Environment and Energy Study Institute, 2006) and this state that the building as it is actually designed by using the integrated design of all the interacting elements and according to this concept; many people believe that the building ends at the place where the boundary or outer surfaces enclose in the field of engineering. But according to the engineering point of view, it is much more than it, all the aspect from where energy enters into the building are included in the design.

That is why while the construction of the efficient energy building engineers has to focus on all the elemental features and the complete environment around it. Design science is an important part of the engineering science that draws upon physics, chemistry, architecture and the life sciences. And design process. Therefore, several frameworks related to the design of energy performance have been proposed (Sorrell, 2007).

2.2.4 Design Approach Involve

The notion of efficient energy is becoming more of a preferred approach rather than an option in current integrated design achievements. It needs to prove the success of use the of the Integrated Design Process (IDP) to plan and execute a project with maximum design features. IDP is a "Collaborative process that focuses on the design, construction, operation, and occupancy of a building. As for IDP, the process is comprised of seven different stages. Based on the type of occupancy, specialized team members are chosen strategically to partake in either all or a few of the stages.

For start, the core team will come together and begin the IDP. Generally, the core team is comprised of the client, architect, landscape architect, civil, mechanical, structural and electrical engineer. However, for a wider scope of perspective, other specialists such as a contractor, building operator, estimator, ecology, and energy specialist may be present.

Arguably, the most important part of this is choosing the site or base building, given the nature of occupancy. Reed, (2004) explain that at this stage, the designer should begin thinking about choices for materials and finishes, and what impact each may have on the specific goals of the project. As the team gets acquainted with one another, and the client is on board with the Pre-Design discussions and a vision is created, they are then able to move on to another stage of design. The goal of this stage is for the team to come up with a design concept.

For exploring innovative technologies, new ideas, and fresh application methods in working towards the broad goals and objectives should set out in Pre-design stage. Design alternatives should be developed based on a synthesis of the entire team's skills and knowledge (Stumpf, et al., 2001).

Here is where all the hard work that was specified on paper to transformed into the fully finished, efficiently brilliant and well design buildings. In this stage, designers can follow contractors closely

to make sure their work complies with design efforts. Next, the designers along with team members need to bring the Integrated Design Process has the ability to bring together a strong team, and create a high design building operators up to speed. For a successful handover, all operations must be explained and demonstrated with the vast knowledge that was gained in the prior stages. The final stage of design is after occupancy; the team doesn't stop working here.

They have to "observe and maintain operations, measure and verify, re-commission, and preserve building performance evaluations. The post-construction portions of the process provide feedback loops, which facilitate continuous optimization of the building's after occupancy" (Rowe, et al., 2007). Lessons learned from this phase have the ability to positively influence future builds by the team and firm. As mentioned previously, the integrated Design Process has the ability to bring together a strong team, and create a highly efficient design for buildings.

Linthicum (2000) explains the design and its characteristics in a scientific approach as a contemporary design as the "way of thinking", this idea has been supported by another researcher Irani et al. (2003); who states the visual design dimensions, and he was not different from (Rowe, et al., 2007), who draws the shape of thinking of the engineers when they plan the significant design. Zhu and Zeng (2007) described the obstacles that concerned the human thinking and how they can be sorted out by using all means of the design to overcome these obstacles.

While other writers look to the integrated design from another different angle like (Yao & Zeng 2007) who focus on studying the trend of design in exploring the nature of problems and whether

the integrated design concentrates on the solutions to problems or the problems of solutions? He discovers there are some of the undesignated policies lead the correlation between these two parts that compose this equation. In his study, he finds that the architects focus on the solutions more than analysing the problem. And the integrated design teams are eager to demonstrate a competence in choosing the suitable solutions that have the capability of achieving excellent results.

Holford et al. (2003) explain that whenever the users hire a building professional; their demand that they want to construct a building with all facilities, they need walls around all the building, but they never think about the saving of the energy; never think in which direction the air ventilation will be good, what should be the construction style of the building, in which direction they should have a window in their building for better air ventilation, and where they will have electrical energy spots.

It is a bitter reality that they would not think about all these aspects. Because they know they have limited financial resources within which they can fulfil their basic needs only, they cannot employ all the facilities, therefore; they bear energy barriers all the life.

Dorst et al., (2001) share the same views with other writers that on the other side, and by using the dissimilarity, the designers who adopt the design as a science; they could use a different direction to employ design in their solving problems like integrated design; they may be utilized the information collection process to enhance the effectiveness of problems solving and controlling integrated design outcomes.

Harvey (2006) makes clear principles that it is important to develop a strategy to minimise the integrated design barriers in delivering energy efficiency in buildings that will move the designer's role beyond built effective design to create shared value by users. This strategy should consider the individuals involved in the design, the environment they work in, and the environment of the building itself.

Designers need to consider various aspects at the beginning of the project or before that. Also, some of these aspects will be addressed when integration strategies applied during buildings design and

later in buildings performance. The relationship between them has come out depending on the several of developments over the last three decades in both the theory and practice. During the integration design application, there are some unforeseen difficulties may occur related to the role of the users and stakeholders in processes. And dealing with such difficulties within the integrated design could be different from the way by the traditional design. Features and characteristics of the integrated design represent the knowledge of the concept of design problem that consists by identified the nature of the problem and the presumption way to solve (PWaGSC, 2011).

2.3 Energy Efficiency in Buildings

2.3.1 Literature Review

Energy Efficient Buildings (new constructions or renovated existing buildings) can be defined as buildings that are designed to provide a significant reduction of energy, (Department of Energy and Climate Change DECC, 2012). Aroul (2011) states energy efficient buildings are designed, built and operated in an energy efficient manner, using materials and energy efficiency systems. In the UK energy consumption levels in the domestic dwelling sector have been inefficient since the early 1990s due to increasing energy demand, and the government since then has started to promote the development of energy efficiency in buildings (IEA: International Energy Agency, 2008).

The UK service energy in the residential sector in 2004 accounted for around 11% of all final energy use, equal to the EU average. By contrast, the Spanish figure was only 8% but it is recording massive growths and has been multiplied by 2.5 between 1980 and 2000, (Hermelinket al, 2012). In this section, this study will explore how organisations and researchers have worked on improving effective methods to reduce the energy use in different types of buildings, and measuring systems.

Data analysis given indicates that buildings design and the way of construction highly related to the energy consumption. It is estimated that 48% of all the energy consumed by the sector of the building is used in the constructed buildings. And the most important factor that increases the energy wastage is the incorrect designing of the indoor household environment and it is estimated

that seventy-six present of the total energy is consumed in the building sectors and its large proportion is wasted on the improper building material used. Safety is also paramount in buildings and it is the era of energy efficiency (Suh 2001; Malmqvist 2001). And it becomes the main cause of the depletion of energy. Many researchers are working for that and calculations are also executing for the judgment of the energy use and the different ways in which it is used.

The traditional buildings are not different from other buildings but the energy cost is high there. So design teams focusing on what must be taken to reduce the energy in traditional buildings (Hong, et al. 2006). These two factors are known as the largest energy wasting factors and it is estimated that 50% of the energy covered by these two factors. Many countries are now seeking and conscious to achieve a target of new carbon intensity levels. The UK businesses worried about the security of their energy supply are taking action, with 50% saying they are investing in renewable energy sources (wind, PV, etc.) and 43% saying they are installing onsite power generation such as a result of these concerns. The Main focus of the companies to control these two factors and it is said that if these two factors are controlled, then approximately 40% of the remaining building load can be reduced (based on data of energy 95.65%) (Building Research Establishment Environmental Assessment Method: BREEAM version: BREEAM 2008 Offices Energy 95.65%).

This chapter explores the literature related to the energy efficiency in buildings, technology transfer, and differences between traditional and unconventional methods. These fields underpin all aspects of the study and its objectives of identifying the barriers. The first section of the literature review seeks to examine the meanings attached to the term integrated design as a new designing method and the development of its central concepts and definitions. It covers the reasons of why the old design methods fail to meet the construction industry needs and exploring the factors that influenced its development and the problems encountered during its evolution. It explains the areas of knowledge and compares integrated design with other design methods. The section concludes by highlighting the factors that distinguish integrated design from the other methods of design.

Since energy efficiency in buildings concept has been originated and developed in parallel with introducing the integrated design, it started to be applying in many countries and designers looked

at its role in serious and deep consideration. It is necessary to focus on the complexities of the way of adopting new methods that have different features from what used before. Thus, the second

section of the literature review explores technology transfer between new and old methods, highlighting the barriers and how and technology transfer from old methods. This study seeks to address not only the transmission and adoption of the transferred technology but also the problems, complexities, and challenges encountered in technology transfer (Gero, 2002).

Assessing the impact of barriers to the uptake of new ideas and technology is central to the objectives of this study. The other section of the literature review investigates the concept of barriers and some of the recent work in the field of barriers differences. The study considers barriers at the recent work in the field of differences. The study considers barriers to deliver the energy efficient buildings in many fields, with special reference to its relationship with construction industry and the participants of professionals in this sector of the construction industry firms' owners, consultants and contractors (Stumpf, et al., 2001). The dimensions of investigation the highlighting of the influencing of the development and considers the implications for introducing energy efficiency in buildings.

Many design teams are related to one of the professional bodies now. They have worked to draw a new design that could control energy use and give a good hope for the future of efficient energy building designs (Environment and Energy Study Institute: EESI, 2006). In these unadventurous building designs now a day a solid line is drawn between the elements of the physical building parts and the equipment that could decide to use by the designing team.

New techniques are used to try minimizing the wastage of energy in the buildings. Following the new technologies, high-performance design practices are moving swiftly towards a true amount of energy use. There are procedures can be used to save the energy from wastage, also helpful is the renewable of the energy. Different studies show that most of the wasted energy is due to the improper use of the varied. Specialists in the specifics industries and consultants for many other

fields are also needed in the integrated design process (Zeng, and Gu, 2001). It is said that for a well integrate design; all the design disciplines should collaborate with each other in all aspects.

2.3.2 What Does Energy Efficiency Mean?

The Oxford English Dictionaries define the energy as 'the power derived from the utilization of physical or chemical resources, especially to provide light and heat or to work machines.' It also defines the efficiency as 'the ratio of the useful work performed by a machine or in a process to the total energy expended or heat taken in. In the same way, these definitions are illustrating practical views about what these terms mean.

Rosenquist et al (2004) explain that energy efficiency means "using less energy to provide the same service"; it is different from energy conservation which means reducing or going without a service to save energy. For example, energy conservation might involve turning an incandescent lamp off; while energy efficiency might involve exchanging this lamp with a compact fluorescent one (this lamp needs less energy to produce the same amount of light). Energy efficiency and conservation in buildings help to minimize greenhouse gas emissions (Dasgupta, 2013).

In the Figure (2.1) the distribution of energy consumption with different sectors explained, which shows that buildings sector consumes more other sectors it takes about forty percent and especially the residential consumes more than the commercial sector by twelve percent.

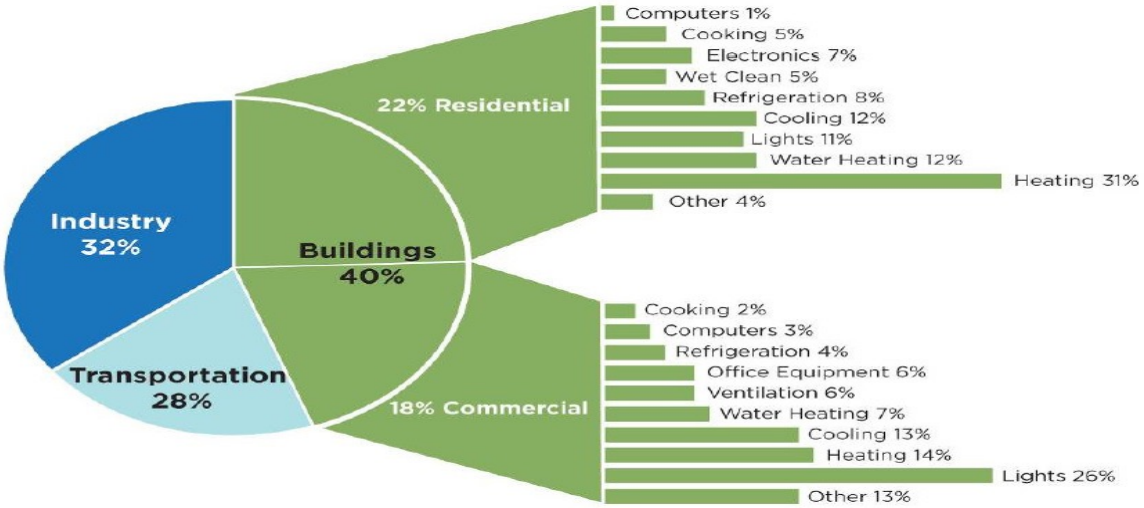


Figure 2.1 Distribution of energy consumption within different sectors (Source: Voss et al., 2013)

Onwards all public and new buildings will have to be 'Nearly Zero Energy Buildings (NZEB)' and follow the high energy-performance standards established by the European Union; additionally, they will have to add a significant contribution in their energy requirements from renewable sources. According to the Directive 2010/31/EU state, the Members must also promote the use of renewable in existing buildings undergoing the major refurbishment, (Voss et al, 2013). In most of the advanced countries, large private sectors are working on the strategies to lower the consumption of the energy that is why they are aware of this problem.

There are a number of methods and preventive measures to reduce the scarcity of energy adopted by the engineers and builders; particularly at the completion of the energy in the buildings is highly dependent on the performance of professionals Vajna (2014). The Level of the used energy is also important for the control of energy level. The main focus of the engineers is to make the building more efficient, than automatically, use of energy proportion increases significantly, due to the use of many appliances which it is the main cause of the depletion of energy. The literature review of these core concepts advances the objectives of the study and leads to a discussion of the development of energy efficiency in buildings and its institutional context in the next chapters of this study.

Energy efficiency in buildings is a method and project delivery system that applies modern techniques to design and construction in order to manage both time and cost and assure quality of the project. All phases of the design and construction process from inception to completion of energy efficient buildings maintain particular requirements that meet the appropriate the size, type, and complexity of the project. Aroul (2011) further suggests that in the developing new saving energy methods, by relying on the selected basis of professional qualification and experience of the skilled people among workers offering professional energy efficiency services.

Energy efficiency in buildings is implemented on the basis of the scope of experience of the professional. Execution of the energy efficiency in buildings projects is depending on the cost of the project. The construction industry is responsible for developing the plan to achieve the goals of the projects within the established schedule by the saving energy plan. Also, the flexibility allows energy efficiency in buildings to be efficiently tailored to the specific needs of both commercial and residential buildings and gives way to coordinated with the availability of resources (Hardell & Fors, 2005).

These interpretations of energy efficiency in buildings concepts have led to much potential in the construction process, including researching and development institutions. This understanding has raised the problem of lack of communication that is characteristic of the design old methods in the construction industry around the world. The above-cited definitions of energy efficiency in buildings focus on the separate elements of these methods. These concepts and definitions are examined in this study and, as will be seen later, the study was found that a bond between the design and the energy efficiency in buildings projects is an essential element in any successful construction process (Hermelinket al., 2012).

As stated before, this study seeks to understand some of the historical development of energy efficiency in buildings in order to develop recommendations for its adoption in any further development. In this section that process by reviewing the history and evolution of energy efficiency in buildings. However, the design and build energy efficiency in buildings system have

been adopted on a wide range. This approach with the new design and construction provides the facilitating to the saving energy system in the construction industry, which will give an opportunity to build one phase of the project while the other phases are under design (IWGEECE, 2000).

Neither the designers nor the firms by (using the traditional methods) faced the delay and overrun in schedule and high cost thus led to finding the ways of new methods that should be introduced to the construction industry. Implementation of two different methods of saving energy at the same time by construction firms could let the conflicts to happen between the fans of each one of them. The new method of saving energy that has created and has a commitment to replace the conventional methods, but any new method needs to search for a new identity that it clearly defines itself through the use over years (Pelletier et al. 2003).

In many countries, firms that practice energy efficiency in buildings depend on a number of features to provide high levels of service and performance: first, the designers have the ability within the construction firms to provide services; second, saving energy system will be used to provide the services; third, this new saving energy needs to prove its experience to be trusted by all who concerned; fourth, the rudimentary principles supporting the work of saving energy that construction firms are looking for; fifth, the abilities of professionals who have the rich skills in this new saving energy system can be enhanced the construction industry capabilities (Selkowitz, 2005).

These features can take a place in the evaluation and consideration of the elements that will reflect on cost and time with a real control on measurable factors in projects. Construction industry tries to involved in supervising and appointing the ways that boosted the energy efficiency in buildings to state a base for the new saving energy method. Modern construction engineering has a growing complexity of works exerts new demands on our professionals and our experiences and consequently requires that a new approach to the construction industry that should evolve to enhance efficient energy in the planning and control of modern construction projects (Dasgupta, 2013).

Until a few decades ago, the traditional methods of using energy in buildings extensively adopted. Many construction firms started looking for the alternative new saving energy system to execute existing and new projects in an effective way and to save cost. As saving the energy in buildings became one of global concern for all construction firms even in rich oil countries, there are many reasons to move for the energy efficiency in buildings and think about it seriously. So, the thinking about the reasons behind choosing the new method was concentrated on the failure of the classical methods to achieve the guidelines of the cost and schedule, also, these are considered as the most important construction project variables (CEC: California Energy Commission, 2005).

In the same time, thus cannot neglect the role of the traditional methods in past and meet the needs of the time to deal with major shortcomings in the industry itself. But when the construction industry requirements had expanded, then the traditional could not satisfy the requirements and

needs. Energy efficiency in buildings did not emerge is simply in the statement of supporting the introduction of energy efficiency in buildings to improve, develop and introduce new approaches in the field of saving cost in construction industry (Selkowitz, 2005). Ways of controlling the delivery of energy efficiency in buildings that seem to be as critical as the application of technology and the forms of the building reflect many changes in the industry.

The designer of energy efficiency in buildings should be able to collect all the data correlated to the project. The construction designers are responsible for all identities and must ensure that all requirements meet the project needs. Also, they need to be qualified in this new area of saving the energy and they can able to use the technology to serve this new approach. To absorb all the collected data, it is important to interpret these data in a way embodied the technology (Levine, et al., 2007).

Efficient energy buildings have faced a number of problems at the beginning which cause a major delay to the delivery process with unpredictable events and inappropriate decisions. The dealing with such of these problems creates unique solutions to particular problems that could happen during the design of these projects (Banfi, et al., 2006). An additional positive approach to design

the saving energy could lead to an extra use of the saving energy techniques and adaptation of communication between provides the information and stakeholders. Executing the judgment of the energy use and the different ways in which it is used.

Data analysis given indicates that buildings design and way of construction highly related to the energy consumption. It is estimated that 40% of the global energy use in buildings and 33% of greenhouse emission is emitted in countries (develop and developing) (UNEP: United Nations Environment Programme, 2009). And the most important factor that increases the energy wastage is the incorrect designing of the indoor household environment and it is estimated that large proportion of the total energy that consumed in the building sectors is wasted on the improper building material used (Malmqvist, 2011).

These two factors are known as the largest energy wasting factors and it is estimated that 50% of the energy cover by these two factors. The Main focus of the companies to control these two factors and it is said that if these two factors are controlled. In traditional buildings, the energy wastage is so high there. Therefore, design teams focusing on the procedure to find the ways of how to improve reducing the energy use in the traditional buildings (Friedman, 2000).

2.3.3 Concepts of Efficient Consumption in Buildings

As the energy consumption, industrial production and automobile usage around the world increases gradually, the efforts to meet the steadily increasing energy demand. Traditional buildings consume as much as 40% of the primary energy consumed worldwide and are major contributors for emission. Therefore, to optimized the aim of reducing the energy usage by a support and promote the energy efficient measures. The goal of these measures is to decrease the energy use of the building and provide the building's energy needs with on-site renewable energy supply (Burton, 2000).

These outcomes of a concept to consume and increase the amount of energy generated by the renewable power are on the building’s site. Also, to encourage the increase of as various saving

energy technologies are deployed on the building site. This can address the energy efficient measures that may be implemented to cut down the power consumption. The energy-efficient features implemented in buildings for energy savings is justified with a case study (Binswanger, 2001).

Thus effects of the Carbon dioxide (CO2) emissions across countries at different levels of development received global attention on what has been done to mitigate these emissions. The continued growth of global emissions of carbon dioxide due to energy consumption and their adverse effects on global warming forces the world to prevent any further damage.

Many scientists and engineers have been working towards making energy production more environment-friendly. While power generation technologies are examined and improved with regards to carbon dioxide emission, a major push to examine how to diminish the amount of power that utilities of a building must use leads to energy conservation which further leads to energy efficiency. Using energy efficient techniques instead of what is done traditionally diminish the total power utilization of the building (Aebischer**,** et al*.,* 2006).

Materials of the building's energy needs are met by the on-site installed renewable energy systems. This paper is intended to identify and understand the possible energy efficient upgrades that can be made in a building. These buildings gained popularity due to the following features (Atif, and Galasiu, 2003):

1. Energy efficient technologies are deployed so that the net energy usage of the building is decreased adequately and hence the energy demand will be low.
2. Renewable sources being available either on-site or off-site and suffice the energy requirements of the building and sometimes supply more energy than required.

It is said that technology makes the saving energy targets much easier and achievable. Different approaches are used to explain and understand the concept of efficient energy. Different ideas drive different approaches. Barnerjee, et al., (2003) explain the reason for that because there are a lot of

options to measure the energy consumption and to conserve the cost, energy and the carbon emission. There are two actions that indicate the similarity of both the concepts that are:

1. Minimizing the demand of the energy by using it passively
2. Generating of energy efficiency from the efficient renewable resources.

The effort did not peak a high level with the huge petrodollar investments made in oil producing in the 1970s, which delay the efforts to find new methods of saving energy. In the last decades, investors and stakeholders of projects have become increasingly aware of the new construction of energy efficiency in buildings system as an alternative to the traditional systems. The main reasons for this change were the failure of the traditional methods to satisfy the needs of saving energy, particularly with regard to project overrun in terms of time and cost (Saunders, 2005). This was mainly due to the complexity of projects; with the high of financing spend.

Since many years ago, project owners and investors have generally expressed their dissatisfaction with the traditional methods of project delivery, because of overruns in time, cost, and inefficiency of the energy of the traditional saving energy systems. Stakeholders felt that the traditional design was not able to compete to meet the needs of their projects, due to the separation between the design stage and the construction stage, which caused a lot of troubles between the members of one stakeholder's team (Claridge, et al*.,* 2001).

Another problem that often appeared in the traditional saving energy system was the development of the relationship between designing the energy efficiency in buildings and reducing the cost of the project. In addition, the complexity of projects and created overruns in term of time and cost to investors. These factors lead stakeholders to look for alternative methods of improved efficient energy buildings.

Bernstein and Griffin (2005) explain that the construction industry has adopted the concept and demand of the saving energy process. Lack of definition and interest of stakeholders generated competition among construction firms, who sometimes made commitments that were impractical or

impossible to keep. As a consequence, many energy efficient buildings projects meet the owners' expectations in reducing the cost. The energy efficiency in buildings was not understood well as process and there was differentiate between the saving energy in the construction industry and reducing the cost, the latter concept generally referring to a new method.

It is important to note that in the late 1960s in the USA, the public agencies played a great role in increasing the use of energy efficiency in buildings and making the process more popular, also, the private sector uses it commonly. Unfortunately, and mainly because of traditional policies,

regulations and restrictions systems had not achieved by the new changes and stay behind all the improvement in other fields. This is due to some of the constraints that evolved with the use of energy efficiency in buildings by both private and public sectors. (McNeil et al. 2009) note, for example, that laws prohibit adopting energy efficiency in buildings without knowing the total cost of construction. But this didn't influence its use in other parts of sectors.

There was an anxiety because of the way of proving the abilities of this new method. The construction firms require a long history of experience and successful performance. Thus, many small firms lacking the basic skills of saving energy started looking to obtain the assistance in their works. The newer to construction industry need to educate themselves to understand the principles of energy efficiency in buildings, which take more cost, efforts and the workforce in firms. New method of implementing the energy efficiency in buildings need the co-operation and the co-ordination to gain the appropriate solution to get a high reduction in cost and delivery time, even it is difficult to understand the means of it and to force the requirements which may be will reflect on the quality of the works International Energy Agency, (2016).

2.3.4 Embodied Energy

A prominent definition of embodied energy is as follows:

"The quantity of energy required by all of the activities associated with a production process, including the relative proportions consumed in all activities upstream to the acquisition of

natural resources and share of energy used in making equipment and in other supporting functions i.e. direct energy plus indirect energy." (Kaming et al., p. 67, 2015).

The elements of embodied energy are manufacturing, transportation and the disposal of energy. It has some connections with this study by considering the energy efficiency in buildings through the use of materials that have internal energy, also the energy which can be reduced during the processes of transportation during construction or performance of buildings. Also, some governments encourage investment in the Climate Smart Home Service (QG: Queensland

Government, 2009) to help the residential sector to become more energy efficient due to the reduction of greenhouse gas emissions. There are a number of issues which need to be resolved before examining the performance of buildings, particularly the gap between designed energy use requirements and the actual achievements.

This is the amount of energy required to build/ transform/ or renovate a building (towards a greener building also). The embodied energy it takes to build a house from the ground up requires land use, power, water use, travel, etc. All these things require a certain amount of energy to perform the tasks. Now, if we are building an efficient energy building or renovating a building towards the efficient energy, the energy we embody into the building can be paid back or return in only several years through the savings in energy, materials, and footprint.

2.3.5 Renewable Energy

Badescu, and Sicre, (2003) state that the energy creates from a form of work produced from renewable resources. Renewable resources include water, geothermal steam and water, air stream flow, and sunlight. A calculation to design building for the amount of energy over an annual or quarterly period that is required to cool/heat the building and maintain that level of “comfort” or “thermal balance”. The heating or cooling load and design of a building related directly to the energy calculation. Mostly in non-residential building, team of building maker will get the total budget for the construction of a building. For instance, any business can expand its business more;

it has no time to brief the building maker in the whole duration of construction. Rather, it provides a sketch and total budget to the constructors, now the team of constructor builds the required building according to their own understanding. Voss et al. (2012) point out the main elements for the promotion of nearly zero-energy buildings (new and existing buildings) in the UK and some European countries:

1. Regulations
2. Economic incentives and financing instruments

3. Energy performance certificates' use and layout in relation to nearly zero-energy building standard
4. Supervision (energy and audits)
5. Information
6. Demonstration
7. Education and training

McNeil et al. (2009) explain that most energy efficiency measures are cheaper than most kinds of energy production; also, they add that the application of energy efficiency in buildings is required to reduce the Green House Gas (GHG), 2009). Systems, codes, and controls are important issues to be considered by designers to increase the efficiency made available by developments in technology.

2.3.6 Energy Crises in Non-Residential Buildings

The energy use, such as lighting, ventilation, heating, cooling, refrigeration, IT equipment in the non-residential buildings is more complex as compared to the residential buildings (Oak et al., 2016). An observation for over the last two decades the energy consumption in the European found that non-residential buildings have enhanced by seventy-four percent, which is a remarkable high change.

This high change is due to invention and penetration of IT tools and devices, for instance, air conditioning systems, heaters, exhaust fans, coolers etc. this shows that the demand of electrical energy in the non-residential areas is high than residential buildings. It has been estimated that the average energy consumption in the non-residential areas is 280 kW h/m, and all the non-residential buildings including for example educational institutes, hospitals, industries, hotel and restaurant, banks, and sort of offices are facing energy barriers today. In analysing the use of energy in the hospital found it is high from all other buildings and it is very important that there should be energy efficient system in the hospitals but due to a poor performance of building makers the hospitals face lots of energy issues. The buildings makers construct a whole building without focusing on ventilation openings, without considering the sunlight and without best electrical spots etc.

Bertoldi (2000) explains that there are many methods and preventive measures to reduce the energy crises adopted by the engineers and builders; particularly completion of the energy in the building is highly dependent on the designer's work. The Level of the used energy is also important for the control of energy level. The main focus of the engineer is making the building more efficient, than automatically, use of energy proportion increases significantly, due to the use of many appliances. For the valuable output, building needs a well-developed and most important thing which is the correct information about all the integrated design needed. By adopting the integrated design for all required proportions of the buildings is dramatic energy efficiency is gained.

2.4 Cost

Cost is an important factor that is involved in envisaged to the construction of the buildings, and in most of the cases it remains one of the main essential parts of the project for the engineers because any activity or arrangement that will be planned for the buildings depends upon the expenses. It is much important that the costs must also be that easily stated by owners and building professionals so it does not create in the further processing (Bordass, et al., 2001).

Sometimes, if the utility costs increased, increasing the energy usage and decreasing the insulation thermal will be balanced within the building. One challenge to the construction industry is the

extent of maintaining high quality in design and efficient energy that affects cost. It is a common case in construction that the contractors are regularly looking for cheaper building materials and tries to obtain client and designers consent to replace the materials in constructing buildings to reduce the cost of construction work (Acharya, et al., 2006).

There are many strategies in construction, but any strategy for energy efficiency should consider the cost-effectiveness. Different researches are done on the procedure to control the efficient energy

and many new technologies are emerging, but important thing that this is the era of computer technology and much impressive work is done in this field to control and to save the energy. To implementation of a construction project successfully, it usually requires a big fund. The buildings in Europe are the major client for a number of investors and part of the largest generations in Europe countries (Brauers, and Zavadskas, 2012).

At the costs combined with the essential efficiency measures; they should consider the integrated design and efficient energy (Jakob, et al., 2006). Efficiency issues associated with applying the integrated design and efficient energy criteria which may increase the capabilities to reduce the cost of new construction and major modernization in conventional buildings. In addition, the impact of costs of buildings on the design process could reflect the decreased requirements of structural components, e.g., less thick walls, less reinforcement, glazing, and frames, etc.

Bertoldiet al. (2003) point the two primary cost factors that influence the integrated design of achieving the efficient energy in buildings are:

1. The design budget
2. The resources for potential buildings components

Any changes in building design requirements or a decrease in the level of general specifications of a building will lead to unplanned changes in the cost, and maybe that will be more than the percentage of designated incremental cost. At the cost level in the criteria for an efficient energy

facility, the designers may be can balanced the effect of available financial resources by incorporating the design through integration and/ or mitigation measures (Krepchin, 2006).

Kaming et al. (2015) study the influencing of the factors and they found the cost overruns occur more frequently and more serve problem than time overruns. They pointed out that the major factors influencing cost overruns are changing design, inaccurate choosing material and degree of complexity. Recognition and application of the cost lead to the following principles for integrated design method to deliver energy efficiency in buildings:

If possible, there is the need to take reasonable steps to prevent any financial reluctance. Regardless of the owner's interest, there is a need to minimize the potential for less financial reluctance.

Managing the reduction of design's requirements as explain byBordass**,** et al. *(*2001) and avoiding having any risk may affect the safety of the structure or lead to the achievement less of energy efficiency. These principles are reflected in the integrated design criteria and in the energy efficiency related costs. Building's design costs influenced by the implementation of the cost's restraints, also, that's could include:

1. Saving in the cost of structure design
2. Minimizing the cost of efficient energy

Whatever decisions are taken in the reign of buildings or before in design works, they are nearly always taken after consideration of factors other than purely economic. Acharya et al., (2006) explain that there are many important causes of high cost related to owners' involvement, contractor performance, and the early planning and design of the project. Important causes are financial problems, changes in the scope of design.

Aurisicchio, et al*.,* (2006) explain that the integrated design promotes the importance of cost and its vital contribution to the energy efficiency in buildings and realisation of this, these days growing significantly. With a major increase in construction work, the demand to lower the cost of efficient

energy buildings places high expectations upon the delivery of an integrated design process (UNEP DTIE: United Nations Environment Programme Division of Technology, Industry and Economics Sustainable Consumption & Production Branch, 2009).

The components of integrated design and cost play a key role to meet requirements, in addition, to help to lower the cost and the amount of energy use. At the conceptual stage, the type of design approach is typified by cost which enables it to deliver significantly higher energy efficient capacity with lower expenditures in achieving energy efficiency in buildings; that will provide advanced

design capability to control differently. The process that relies on the role of cost may be applied whatever the integrated design provided, for example, with design and build, the construction and management of building and finance for the building (Guy et al., 2000). However, because of a diversity of the services provided by the cost determination often involves in complex procedures.

2.5 Barriers

It is essential to involve the most kinds of activities including all tools in these areas of design such as the processes, materials, and stakeholders; in a purpose of earmark the research's features in particular as they associated with the barriers type and solutions (UBC: University of British Columbia, 2000). The main obstructions, solutions, and set of assumptions will be highlighted primarily in order to demonstrate the active processes and interpreting the main factors of integrated design and efficient energy.

This observation indicates that there are a number of groups of barriers have an influence on the integrated design and the energy issues, and there are a number of aspects on the basis of which the energy barriers can be classified. Different researchers have described the energy barriers work with respect to timeline, Balaras (2001) classifies the main categories of barriers that have a real impact on the building industry are: -

1. The financial barriers,

2. Institutional and administrative barriers,
3. Awareness,
4. Shortage of Advice and skills, expenditure and benefit.

2.5.1 The Financial Barrier

It is one of the common highest-ranking issues in the most of the countries, even in developed countries. Greening et al*.,* (2000) point out that it has been found that if building manufacturers

have all facilities, like wide space, all sorts of building materials, good trade skills of construction and all other constituents that are required during construction of a building that will lead to very less energy barriers then the building will be perfect from all aspects. Thus, it is clear that high economy plays a significant role in the reduction of energy barriers. On the other hand, lack of funds is generally one of the most common barriers to applying the energy efficiency in buildings.

When people give their instructions to the building makers, that they have thoughts of possessing a huge building within limited resources that will become difficult for the manufacturers (Lombard et al, 2007); in such situation, the construct of a building will be only by focusing on the basic needed elements. Energy efficiency feature in the building is usually less focused than other aspects. As the building maker first try to use good material in the walls, design of the building, according to the living style of the people, thus within limited- budget can just construct a simple building without concerning about the energy will be required in the building during and after the construction.

Balaras, (2001) explains that the current limited financial resources are hitting all the European countries, even some are affected badly than others but all are facing energy barriers. Although the developed countries awareness about the energy barriers, they are making policies in order to resolve these problems; and they still are facing the same issues. But the situation of poor underdeveloped countries is alarming; they even have no awareness about the how to deal with the energy barriers.

2.5.2 Institutional and Administrative Barriers

There is an existence of a large number of barriers due to the institutional and administrative problems which can affect the energy efficiency negatively. Mostly energy crises occur due to poor administration and low training. The administrative forces do not focus on the problems which will arise due to a poor performance of the building makers. It has been found that in most of the less developed areas a person has no awareness about the energy crises; they did not design the buildings according to the energy use (Schleich et al., 2007).

While many projects of construct buildings are in irregular arrangements, there is no concern about if they will construct a huge building in an area where all other buildings have single story buildings, in such situation, it will become difficult whether to have sunlight for all around the huge buildings or not? Brown (2001) points out that in such similar cases, the administrative in that organisation is responsible. Moreover, in case of different investors build an industrial project or any industry proposes in highly populated areas, the people near the industrial area will continue to live and build new houses. They cannot enjoy natural energy resources well; also the heat energy of industries affects the buildings and inhabitants negatively.

Alderfer, et al., (2000) explain that the ventilation of air in the homes also fills the homes with smoky air. Thus, it is the responsibility of the administration that they should declare the clear rules and regulations about the construction of buildings. They should forbid the construction of industries in populated areas and there should be a proper system of energy use in the buildings. Only most developed countries have real efforts to build effectively designed buildings which they construct according to energy efficient use and measures. But most of areas in the whole world are unable to construct the buildings with energy efficiency requirements.

Claridge, et al. (2003) some would hire a cheap building professional who can work at low rates. The correct design makers are engineers who have better knowledge about the design of building construction. An engineer can guide a building maker that how he can construct an energy efficient building. But the majority of the population in the world cannot afford to the engineers, they don't mind to live in the building which has no energy system. Unfortunately, peoples have limited

resources; thus, an ineffective design of buildings is a big problem of the modern time (Gillingham**,** et al**.,** 2005**)**. It can only be eradicated if administration trained all the building makers.

The energy efficiency of a building can usually determine by the choices made by the builders on behalf of future owners (or users) who will pay all the energy bills and also, they will responsible for any type of energy system damage (Greening, et al., 2000). If both the owner of the building and the person who have to live in the building on rent show mutual cooperation, it will be

convenient for both they can make an energy system in the building working efficiently. But both have opposite perception. The owner thinks that the person who has to live in the building must expend money on the energy correction system. On the other hand, the person who has to live in the building on rent basis thinks that it's not his responsibility since he is not the owner of the building. It has a survey conducted that twenty percent of residents who are on rent basis are fewer chances to have effective insulation system on the roofs and ceiling. And thirteen percent are fewer chances to have an insulation system in the walls. Therefore, there are some variables responsible for the poor energy system in such buildings if the case will happen (Florides, et al., 2002).

2.5.3 Awareness

Sometimes, one of the problems if there is no adequate insulation inside and outside the buildings, and due to that the building will remain warm in the summer season and will remain cold in the winter season (Dreiseitl et al*.,* 2012). This will result that the whole operation is ineffective; it needs to reconstruct the whole building according to the energy efficiency rules. Thus, it is the biggest problem of most of the people in the world that they waste double budget when they try to construct their resident from un-experienced constructors.

Betsy del Monte (2007) explains that there is a lack of public understanding of an integrated design process to deliver energy efficiency in buildings, also there is a lack of knowledge about both the integrated design and energy efficiency in buildings with the means of lack of common language and understanding between the same design team themselves.

The lack of energy efficiency form can be delivered through integrated design concepts and practices which happen at a design or practice levels. More than many cases in non-residential building team of building maker can get the total budget for the construction of a building (Heiselberg, 2009).

2.5.4 Design Coding

McCloud et al. (2013) explain that because of the lack of knowledge about energy efficiency and integrated design, in particular, there are regulatory disincentives; integrated design and energy efficiency codes frequently specify the minimum standards which must be reached meaning what code compliance only can happen at a basic minimal level. Industry performance in integrated design and energy efficiency above code minimum can, therefore, be discouraged. Additionally, codes and regulations are often specific to individual parts of the design process, which means they don't take into account overreaching needs and expectations of the client. Therefore, each individual code or regulation can slightly change the client's overall needs for energy efficiency to be met (Lohnert, et al., 2003).

2.5.5 Resources

Tekn et al. (2005-2010) state that at barriers level, the lack of financial system and materials availability may constrain resources workability to aligned with what's needed to implement integrated design to achieve the energy efficiency in building; and reducing the amount of fund affordable for both the design process and the building materials can have a negative impact on the whole integrated design process. The selection of the site and the nature and size of the project have as much to do with minimizing resource use and maximizing efficiency as does the design of the building (Fawkes, 2013).

2.5.6 Technical

Baker and Steemers (2000) explain that a lack of awareness of energy efficiency can also cause technical problems. Incorrect specifications of building materials, incorrect data used in design and calculations or input errors in design or compliance testing, are more likely to occur in the design of buildings about which there is relatively little knowledge or research; these can have a significant negative impact or the successful integrated design to deliver energy efficiency in buildings.

2.5.7 Relationship between Design Barriers and Reduced Cost of Energy

The design barriers and reduction of the cost of energy efficiency in building to provide efficient energy system; in the present, there are a number of energy barriers in the buildings and the population of every country going to increase day by day. The architects and engineers try to design the buildings with the minimum energy problems. But still, due to limited resources, small property and less technology, they construct buildings that have lots of energy difficulties (Schlomann, et al., 2001). The energy barriers are not faced by just the poor countries only, but the most of developed countries also facing same problems or maybe more than that.

In order to reduce the energy consumption issues, the policymakers and building observers have laid out different policies. Although these policies have improved the overcoming of the energy barriers, still other problems affect the energy efficiency in the buildings (Deutsch, 2011). For instance, the energy efficiency features of the buildings show a discrepancy, according to the geography, the building type, the climate, environment, building location and economy.

The difference between developed and underdeveloped countries also affects the energy efficiency (Watson and Labs, 2007). Thus the designers of specific area of the world have its own style of construction according to their local environment. So the complexity for the policymakers is that it is almost impossible for them to develop a single strategy for the solution of all energy crises which people experienced in different cultural and different locations. Thus, they should make policies for the reduction of energy crises, according to geography, economic development of that place, lifestyle and culture, technology and use of the new technologies. Seefeldt (2003) explains that the energy design barriers: observation shows that there are a number of barriers which impeding the

energy efficiency in the buildings. In the economic perspective, it is an obvious fact; there are a large numbers of unidentified cost-effective possible drives for the improvement of energy performance in larger buildings. Seefeldt, et al., (2000), agree with Seefeldt (2003) about the evidence which points to the most consumers and designers, even the society in general, have no

interest in the investment of economy and time on the energy efficiency; and they are not keen on the investment in energy saving. Explain.

2.6 The Ability of the Integrated Design to Achieve Energy Efficiency in Buildings with the Reduced Costs

The comparison between the cost of new buildings, (which include high technologies and all the materials that have been implemented to improve the use of energy efficiency) with the costs of traditional buildings; reveals that there are no more expenses than what have been spent in the traditional buildings (Levine et al. 2007). There are a number of variables that act on an integrated design which are not able to work independently without some level of interaction. Taking into consideration should be given to the effects of cost in different design stages and during the construction and subsequent performance; also, will reflect on the performance of buildings. With regards to delivering energy efficiency and achieving maximum energy savings, it is necessary to adopt and established a reliable tool derived from specific instances in energy efficiency in buildings (EAP UNDP**,** 2000).

The efficient use of energy in buildings differs in priorities, especially in old and existing buildings; and has been used widely in modern constructions which can lead to savings in required energy. However, the application of new technologies and techniques in existing and traditional buildings could transform them better to low-cost energy performance (Gero, et al., 2004). This holistic approach to saving cost and energy within the integrated design takes the cost to be considered as a reliable factor which has significant effects on all dependent and non-independent variables.

At the same time, it provides an outlet to the environmental performance of buildings, including save other results and achieved and leads to other useful results when applying the integrated design. Incorporating integrated design with energy efficiency in buildings has become one of the significant issues for many of designers, engineers and many of other parties. The desired and predicted outcomes of the integrated design often helps the energy efficiency in buildings due to its

role in limitation of use the energy and cutting down the unacceptable environmentally impacts of using energy (CO2 emission) during and after the construction of buildings. Also, it is due to role in minimizing the loss of energy (Roth, et al., 2005).

2.7 Summary

This research for the number of reasons will evaluate the available information which led the literature review to identify the main types of barriers that could prevent the integrated design from achieving energy efficiency in buildings at least cost: lack of awareness; rigid design coding; limited resources; and technical issues. By reviewing all the available literature and evaluating these collected data, this study will be able to analyse them in accordance to the categorisation of research areas (Edelson, 2002). This categorisation helps the study to make evaluation and analogises between patterns, to identify the information's complex outfits and analyse them.

Integrated design allows experts from all disciplines to analyse the unique opportunities and constraints of the building site and to collectively explore synergies between disciplines and with other sites. While it is important to keep the scope of investigation broad, goals and objectives must be firmed up. Therefore, Integrated Design is an approach which gathers all the design disciplines (architects, engineers, and other consultants) to work collaboratively on a project by considering all functional characteristics of design from the concept stage to the submission of the design.

The concept of efficient energy buildings is beginning to be popular in the construction of buildings designed by using the integrated design. Bell, et al*.,* (2000) point out the concept of the building with efficient energy consumption means the building having the arrangement so that, its net

energy consumption over the complete year is approximately equal to the renewable energy. Sources to renew the energy are mostly arranged at the time of integrated design plan. Most of the constructed buildings by using integrated design, they work on having the sources of the efficient energy acquired partially in the renewable energy process.

The initial cost is a cost which tends to be high when compared to other costs throughout the project; it is also used; to examine the effectiveness of the integrated design and the ability to achieve low cost-energy efficiency in buildings.

Cost is one of the most important influences on the work of integrated design and energy efficiency in buildings and steers other variables in order to achieve that. Additionally, to achieve maximum energy savings it is necessary to adopt and establish a reliable variable derived from specific instances in energy efficiency in buildings. CABE (2006) state that:
"to lower the cost by using less energy consumption in buildings, and put this in mind: buildings that have been designed with approach are more likely to save costs, energy and maintenance than those which have been designed with another approach".

The conclusion can get from what have been submitted before, that the literatures review of different resources on the design, energy efficiency and cost and all related topics, indicate that power competence of the buildings acting a vital performance in the low consumption of energy; and integrated designs of the buildings can be identified are much important for the low consumption of the energy. The literature review after assessing these numerous data in this study, can give the meaning to the goals of an integrated design that can be used in developing the performance of the saving energy in buildings and the policy-making for energy efficiency process, and this could be a real challenge especially when concerns centred on the save of costs (Suh, 2013, Malmqvist, 2013). The literature that have been reviewed in this chapter, support the current research literature in identifying the definitions for each one of the main areas in this study; and explore variety wide range of views about the trends of research in this study.

Chapter 3: Methodology

3.1 Introduction

This research has a strategy that will be developed in accordance with the method of collecting required data to enhance the propositions that stated previously. Any research depends on number of philosophical statements about what establishes 'usable' and methods are applicable for the enhancement of facts and information acquired in the given study. It is important to identify what these conventions are. In this chapter of methodology which defines by Creswell (p. 43, 2003) as:

"Methodology refers to how the researcher goes about practically finding out whatever he or she believes can be known".

The research implies a combination of quantitative-qualitative approach to employ the field survey questionnaire and case studies. Therefore, this research has chosen to utilise a process of continuous progression to obtain further information in two directions, as Christopher and Lampard (2002) explain:

a. Quantitative approach
b. Qualitative approach

The descriptive and interpretive approaches in research design for this dissertation are the (survey and interviews) that will be analysed within qualitative and quantitative methods.

The field survey is the first suggestion of this research's strategy as a quantitative approach. In addition, to spotlight on study's objectives that stated in beginning; the power of exercise collection of prime data by the questionnaire will enable this work to fill shadow gaps of missing information in literature review. Watts (2016) indicates that the qualitative approach

in research needs to accumulate the field survey; in order to bring the propositions into existence and form the essence of the testimonials to compare the recommendations' findings.

In the survey of this study used the questionnaires to assess the views of and informants and to evaluate the policies, skills, etc. To analyse the participants responds the descriptive statistical method was used. Face-to-face interviews was used beside the questionnaires methods to assembly information collected. Also, in this research a justification was used to examine the reasonability for any information collection method.

The other research's strategy will be the interviews, which will be developed as qualitative approach. Environment-Based Design: EBD (2015) explain that this study could encounter a number of barriers which influence as one of the goals of this study. The existing knowledge in available literature will be utilized as a major aid and suggestions that are the most rewarding areas to be considered. The interviews that are conducted by the researchers with professionals who have the chance in the implementation of energy efficiency in buildings projects with a low cost, hence these interviews have contributed to the promotion of knowledge and enrich many aspects through the process of formulating the questions. The structure and organise of drafted questions is the process that based on the nature of the propositions themselves (Brinkmann, 2014). The questionnaire has been formulated based on the available data in propositions, through the review of the literature on the ID, EEB, and Cost in the developed and developing countries.

Grauch et al., (2003) have described that formulated the quantitative analytical units and qualitative approaches, as well as interviews and discussions by considering barriers and variables which face the construction industry. The qualitative approach in the strategy of this research will meet the needs of research and the high level of interdependency. So that will enable the refine and examine of methods and interviews' techniques (Blessing, et al., 2009).

Lastly, number of methods were recommended and applied to find the reliability of the study and applicable scenario for the mixed method that have been debated. After that, this chapter

ended with number of aspects to frame the research design; and discuss any predication for the study development approach.

3.2 The Research Methodology

This research has considered and adopted both quantitative and qualitative approaches at the same time. However, a debate has taken place to find the best method that draws the direction of research methodology to be selected and adapted. White and McBurney (2012) discuss the quantitative-qualitative argument, in that it focuses on methods, more than methodologies. The methodology linked to the core philosophy concept that derives from the methods that have an ability to develop, and these methods are not the same level in an iterative way. The importance of addressing propositions and research questions are considered as they are more importantly relate to the interest of developing the search of the research strategy solutions (Hennie, 2009).

The specialists who have actual experience in the implementation of construction projects from the early stages to the delivery of work will have the potential to enrich the answers when they have interviewed because they have the real practical experience and they will help to support the qualitative approach of the research since this approach is based on real experiences in life (Hunt and Colander, 2013). The factors that have involved in the process of a comprehensive understanding of the work conditions will contribute to finding a variety of research sources.

The purposes of these approaches are to use implicit answers as one of the elements of this approach and consider them seriously, even though it represents their own point of view (Trochim, 2002). The connecting process between the interpretative perspectives of participants in answering the research questions with their own accounts at the

implementation of the project; will significantly contribute to the development of their knowledge to understand the conditions of the issues that are under investigation. The process of managing the interviews require a professional skills and care, because the failure to manage them will reflect possible results that are not achieving the planned goals, also, in the case of there is no availability of mutual trust and goodwill, the interview will lose its features as a form of social interaction that could enrich the study with valuable data (Clark and Ivankova, 2015).

Variables and constants play a significant role to show their influences especially when they have own coherence structure as their importance and precedence to interact with a number of challenges in work (Savin-Baden et al., 2013). Therefore, the selection and identification of limited variables and constants were through the quantitative approach which has been adopted in this study and also, to facilitate a chosen process for these variables and to focus on the limited number of them.

Campbell and Holland (2005) refer to justify the selection of using both approaches (quantitative, qualitative), there are some reasons behind that:

1. The relationship between ID, EEB, and the cost have been analysed in accordance with the approach of the quantitative.
2. To overcome the problems that arise by the lack in literature review; this study has combined both of two approaches.
3. Many professionals had involved in ID and EEB projects, and have been contacted to conduct the research quantitative approach.
4. The participants have helped this study to identify and assess the primary data.
5. The process of cross-checking the findings of each method and compare them have been alleviating by using the combination of two approaches.

The results of the combination of the two approaches if they work integrally have allowed the subject under investigation to avoid the over-dependence on any single type of method-

logical school (Tichkiewitch et al., 2003). To enable the study to achieve and identify both dependent and independent variables that linked to barriers, it should use the qualitative approach on the base to form the proposition; while the quantitative approach base on formulated structured questions for the questionnaire.

3.3 Method

The Methodology Chapter should clearly list the methods used for each objective with a clear strategy. It should commence with a review of available methodologies and a statement that justifies the chosen methodologies.

The questionnaire is a survey of a group of people that represent professionals and pre-professionals who are in direct or indirect touch with industry (many disciplines). Invitations were sent to 150 randomly in a diverse range of sectors and have accepted by 108 persons. The 150 included the professional (88), and the pre-professional (62). The questionnaire contains both quantitative and qualitative questions; some of them dealt with several issues including policies, investment, innovation, skills and engagement (Silverman et al., 2011).
Sincero, (2012) states that there are advantages and disadvantage as reasons for using survey in this type of study, as: -

Advantages of Surveys

1. High Representativeness

2. Low Costs

3. Convenient Data Gathering

4. Good Statistical Significance

5. Little or No Observer Subjectivity

6. Precise Results

Disadvantage

1. Inflexible Design

2. Not Ideal for Controversial Issues

3. Possible Inappropriateness of Questions

In analysing the responses and assessing the results in this study, the views of participants have been compiled in this survey from who are inside the industry; and an initial image about how integrated design can play in achieving energy efficiency in buildings at least cost. This questionnaire is the initial informative collecting data in this research (Holliday, 2007).

The quantitative research strategy can include a significant relationship between the reasons and the results, in addition to the collected data; without showing any sufficient links between them. The questionnaire and interviews are in needs to the technique of collecting a great extent than usual information when studying the literature review that will be used in cross-sectional approach (Floyd and Fowler, 2014).

Interviews are in three types (structured, semi-structured or unstructured). In this study, the structured interview and unstructured are excluded and were not considered appropriate for this study. Fellows and Liu (2015) explain that the semi-structured interview allows for an in-detailed collecting data into the study topic. Bell (2000) states the semi-structured interview as a focused approach confirms that all topics are in major imperative for the researcher and

dealt with. Also, depending on the type of the research and needs to cover the particular study objectives and the semi-structured approach has been considered for this research.

The advantages and disadvantages of face-to-face interviews

Advantages:

Wengraf (2001, p.194) explains what requirements need to be aware of in the interview:

"That you must be both listening to the informant's responses to understand what he or she is trying to get at and, at the same time, you must be bearing in mind your needs to ensure that all your questions are liable to get answered within the fixed time at the level of depth and detail that you need".

An advantage of this synchronous communication can be listed as:

1- The respond of the interviewee is more instinctive, which has no extended reflection.
2- In interview can use a tape recorder which is more precise than writing.
3- The interview has lots of potentials to motivate the informants.
4- The interview method has more flexibility.

Disadvantages:

1- The researcher should keep a mind on the questions to be asked and the answers are given.
2- The tape recording could also cause of not writing any notes during the interview.
3- The interview is synchronous communication of time and place which could increase the time and costs.
4- In the interface between researcher and informant, enough clues could end the interview.

In this research, respondents can reveal their thoughts around the research's concepts and the cross-sectional design during the interviews, which are parts of dependent research method that considered as an approach could be reliant on it. At the same time, the technique of interview which used in this study as a research method depends on the research size to bridge the gaps for the lack of data more than other techniques. Ragin (2014**)** indicates that the compatibility between the qualitative research strategy and the cross-sectional approach when using the same way of collecting prime information will offer the opportunity to investigate and enhance the research objectives with required information like what has been found in this research**.**

In depend on the research objectives the interpretive method has been applied in this study, the interview methodology was implemented as the most appropriate approach to use in collecting information in systematically method, which led to deep understand of research questions. In more details, it:

1. Use different technique to collect information; and
2. Delivers a complete picture about informants' perspective

In addition, the Face-to-face interview like any research methodology practice in employ the collecting or analysis data method. Furthermore, the mixed of collecting data methods were adopted offering a full coherent position of a particular situation. The interview approach in this study uses of multiple methods in collecting information and literature. Yin (2003) explains that the statistical method as one of the descriptive methods, can be used evaluate the mixed (qualitative and quantitative) data, which was adopted in this study.

This study in depending on the nature of aim and objectives, has adopted the interpretive and descriptive stance due to their advantages in announcing the details of participants' perceptions, this study deems the interview approach is the suitable strategy for this study.

3.4 Research Strategy

In the research strategy which is the way in the research objectives that can be investigated and there are generally two kinds of strategy quoted by the researchers studied, namely qualitative and quantitative (Bell, 2000, Fellows and Liu,2015). Mix research is considered to approve the 'Scientific Method', where researchers collect facts and study the relationships between one set of facts and another.

One of the most uncomplicated strategies in mixed methods approach is the sequential explanatory strategy which used in this research. Mitchell et al. (2012) explain in this type of strategies, generally, the quantitative data will be given the main concern within the analysis stage of the research. This strategy is described by more than one stage of collection and analysis for both quantitative and qualitative data.

Creswell (2003) states that:

"The trustworthiness of qualitative – quantitative research can be established by using four strategies: credibility, transferability, dependability and conformability, and are constructed parallel to the analogous quantitative criteria of internal and external validity, reliability and neutrality."

This study adopts this debate and takes the use of the term trustworthiness as it is used by number of other researchers to cover all these, study the philosophical statements also one of the research design strategies.

There are a number of benefits and disadvantages that can be identified from the use of this strategy as having the possibility of using sequential explanatory design within a specific holistic view in the purpose of operating the results obtained in the qualitative study, which will be delivered in order to clarify the quantitative results that conducted first. At the same time, qualitative information and findings approach may be will show unexpected sudden

outcomes when the quantitative study which could have confirmatory effects during the research is carried out (Morse and Richards, 2002).

According to Myers (p.: 187, 2009):

> "The research method is a strategy of enquiry, which moves from the underlying assumptions to research design, and data collection. Although there are other distinctions in the research modes, the most common classification of research methods is into qualitative and quantitative."

There are no differences between each one of them and every approach has its own advantages and disadvantages; even some researches preferred using the mixed methods as in this study. This combination between these methods led to a reliable methodology based on the nature of the research.

In chapter 2 the literature review has revealed that the integrated design does not have a number of fix guidelines that can be submitted to energy efficiency in buildings in the same method. There is no one certain objective that can be perceived impartially of its surrounding environment. It could be stated that it supports to take an interpretative method to research subject.

In the spot of the study topics and the research objectives, the information gathered will be comparatively particular in reality, mirroring the professional knowledge, views, and

perceptions and therefore a well suited to a mix research methodology. Creswell (2011) explains that individual's views affect their conducts and evaluations and the literature review has exposed that integrated design concept will affect the research approach. In investigating the concept of integrated design and the energy efficiency in buildings required to adopt the important and investigate the attitudes, opinions, and values of interviews on the study.

Remler et al. (2014) identify the main advantages, feasibility and disadvantages, which can be stated as: -

3.4.1 Advantages and feasibility

The benefit of using this design is that it is generative, clear, emergent and uncomplicated to use. In order to facilitate the implementation of design which has been divided into a number of processes that do not intersect with each other.
The study nature when using this type of design provides the ability of description and analysis.

3.4.2 Disadvantages

Time is one of the main obstacles that delay the completion of design through slowing the collecting information process.
The fact that the design at different stages will transform the difficulties from stage to the following one (Plano Clark, et al., 2003).

There are many different strategies can be adopted for each objective, and bring it towards achieving the aim of research. These include reviewing the available literature, face-to-face interviews, and questionnaire. Accordingly, for the research strategy should be planned as a consequence of specialism of the study.

In order to determine the possibility of using non-generalised research strategy, Mitchell and Jolley (2007) define number of different of (neither exclusive nor exhaustive) types of research strategies, which it can be developed by adopt one of them, as: Exploratory, Descriptive, Explanatory, Analytical, Critical, Predictive/ Confirmatory, Action, Applied**.**

The discussion about choosing one strategy of them to match research objectives depends on the advantages and disadvantages of each one; and steered by the research's nature (Zunde; and Bougdah, 2006). For these justifications, the literature review considered as the best strategy to meet the need of the objective to eliminate the barriers.

In every research, it is important to have a decision to identify the appropriate strategy that can apply to study objectives. The research in question have chosen the applicable strategies for each objective depending on the strength and weakness of the strategy (Gliner, et al., 2016). Any objective could be able to interact within a development strategy, so it will be able to achieve the research goal.

These strategies that suite this study define the tools that directed research in path of attaining research goal. Therefore, the questionnaire may be the best appropriate strategy for this objective of point out processes that eliminate the identified barriers as it supports focusing them and utilise them at the same time by all these ingredients. To choose in which direction the research should appoint one of qualitative, quantitative or mixed of them as research strategy to carry the study (Zaal, 2009).

3.5 Sequential Exploratory Strategy

Sequential exploratory strategy consists of two phases, each one of them has its own advantages and the ability to complete the other one, and the first stage gaining a real importance due to its ability to raise the quality and analysis the collected data; which is different from the second phase because the last one is more concerned about the quantitative combination of data and analysis (Miles et al., 2013). The interpretation stage has to integrate what has been found in these two phases. There are a number of similarities features between exploratory and explanatory sequential strategies.

Also, Hoffman (2003) agrees (Miles et al., 2013) as they point out that there is one of the goals to determine the approach: choose a distribution of the phenomenon within the group of samples that have been picked up. Illustrate the use of qualitative design phase is considered

as the most appropriate for use when the examining takes place, and what sets it apart is the quality of the distinct results this process could give and perhaps can be applied to other cases.

Creswell (2013) explains in his notes that the main focus in the use of this approach is to explore and identify the phenomenon and that it is more appropriate to understand the situation, also this is can make it in contrast with the illustration sequential approach. The qualitative results can be interpreted by using the quantitative information collection which is in the simplest case is the purpose of the strategy. This is consistent with (Morgan et al., 2013) opinions about the case of any researcher needs to examine a tool for developing his study's model, it will be as discussed in the sequential exploratory strategy.

The scientific approach is considered as one attribute of the quantitative research that adopts this approach. It is the process of examining the researcher's objectives by using a strategy that can be based on the research's foundation. Yvonna et al. (2005) explain that always, the researchers are focusing on collecting facts and comparing; based on the strategic analysis and determine how to contribute to the development of the research processes, which can be either quantitative or qualitative type.

Golafshani (2003) explains that vast majority of researchers may face a number of difficult problems in the collection of information from the qualitative analysis and this is an additional burden on researchers. But the obstacle of time in delivering each stage will put extra pressure on researchers during the implementation of explanatory sequential approach and exploratory models and this is one of the frequent mistakes in the research.

Identifying people's perceptions and attitudes about saving the cost will contribute significantly to defining the type of strategy. This may be either qualitative or quantitative strategy approach and may be considered the ideal and best suited for this research to

determine, which has been chosen in this research as means of processes, events, and structures to suit this study. This explains the attention that will give to the process of interpretation of what may be considered as the thoughts of the people and test the aim of using the scientific approach to understand these process (Amdurer, 2014).

Howell (2012) refers to the ontological constructivism that can be made through the adoption of qualitative research strategy which could be reflected by emphasizing different views of people, and what they think to assume the realism as one objective unit or it is a natural in itself to achieve a particular goal position? In addition, this is expressed from the standpoint of study the realism on how it is structured and whether its existence objectively or not? Thus, has been determined what is the ontology? And which part of the social system is it?

A number of researchers think that there are no potential outcomes from a close distance monitoring when conducting research so that these researches could lose their uncertainty and objectivity. The hard facts objectively collection process is the core goal for any researcher when the search for using knowledge of the position, which is a contradictory theory of knowledge. The qualitative research approach is taken from the Gnostic position to investigate the natural origin of the scope limits of human knowledge and with regard to its validity to separate between thoughts and opinions. This may provide researchers with the possibility to study the approach, which provides them with the ability to set limits for facts in a realistic manner (Creswell, 2013).

The qualitative research approach contributes significantly in accommodating different views and opinions of the different professionals involved in projects. Lindlofet al. (2002) explain that the environments play an important role in identifying and note the existence of objective reality. The owners and all other stakeholders may have interests in managing the projects even there is a full contrast between knowledge and understanding of their views. There is the need to simplify and determine the appropriate strategy to adopt it (Strauss & Corbin, 2008). The researchers in some earlier studies have pointed out that all stakeholders of

external interests have no ready comprehensive rules that can be applied consistently to all projects. In the reality, to organize the performance of the work of the stakeholders' interests

that has to be a commitment to help the approach that connected with a particular way to provide an interpretation.

Anderson (2012) explains that among the most substantial influences that affect the study of external interests is the style of collecting data, which can be explored in the literature review, which is so paramount in determining the attitudes and ideas in interviews. The actions and administrative decisions affect people's views and behaviour. Of the most appropriate topics at the complete methodology of qualitative research are the individual experiences, opinions, and perceptions that can be collected autonomously and compare its normal in accordance to the theme and objectives of the research.

Interviews are influential strategies to apply within the sequential explanatory mixed method designs, allowing the develop of data collection method both qualitative and quantitative paradigms.
The sequential mixed method can be classified to:

(i) Explanatory (quantitative and qualitative),
(ii) Exploratory (qualitative and quantitative).

Both of them have the attributes of answering different research questions. If the method used to investigate the theoretical basis in study; it must be depending on the study requirements. The research sequential design could be drove by the theoretical phenomenon, as it based on its outline and not on methods (Creswell, 2009). A wide range of the strategies are suite this research objectives, and are essential to support the integrated design with the necessary tools to deliver the energy efficiency in buildings at least cost. Following to what have been submitted before, it matched the first and second objectives of this study in achieving the costs reduction by examine the approaches and overcoming the barriers.

3.6 Research Design

Floyd and Fowler (2003) describe the survey method that interested in the social environment, also the views and the attitudes of a certain group of people; they agree with other opinions who add that approach in a specific and have all features of definition; that within the framework of determining the time as one of the primary means of collecting data from participants in the survey. Bell (2000) refers to a general definition of 'survey', but he notes that each survey is unique and can be applied to a wide range of patterns. The survey samples are similar in kind and cannot be applied or generalized in all the surveys. This approach has been chosen in this research as interviews and questionnaire method in this research because it is the most likely and appropriate to achieve some of the objectives of the study.

In the survey, there is a relationship between the attitude and the objectives; this what Viswanathan (2005) suggests to establish the reasons and results for any survey as the aim of applying the analytical survey approach. The investigation about the reasons and results interested the qualitative researchers, even it is common in quantitative researchers and variables of the language that is not in context; also based on a cross-sectional design that draws the casual influence from researches. The quantitative research strategy often can adopt cross-sectional research design to examined collected data (Marshall, et al., 2010). A cross-sectional design may be will able to facilitate the possible relationship between the delivering of a project's goals on time and budget with the strategy of stakeholders' interests; valent in the aim and response to research objectives.

Research design can be defined as the similarity of a resemblance in the appearance and characters as the architectural plan. In this research design, the discussion around the research problem can take a place through the logic procedures to examine the applicability and the reliability of collected information.

Yin (2003) adds that:

> "colloquially a research design is an action plan for getting from *here* to *there*, where 'here' may be defined as the initial set of questions to be answered and 'there' is some set of (conclusions) answers" (p. 19).

The researcher devoted time to find various models for research design and the best appropriate one to achieve the research objectives of this research is considered to be ***Cross-Sectional design***, also called the ***Mixed Approach***. To find the answer to a key research question, this research will explore the possible relationships between integrated design and energy efficiency in buildings at least cost and it is believed that a cross-sectional design will be able to enable this.

Every research when to be conducted, it needs a principal proposal to illustrate the research design and spot light on the headlines of study plan.

3.7 Quantitative Approach

In this research, a number of studies have outlined the research's literature review, and explain that the most relevant demonstrated works to be continued to provide the best available basis for considering the differences in many aspects and performance. In this study, as a general framework for real perceptive to barriers and apply some changes to suit the aims and objectives of the study. This study employs the primary data in the questionnaire because they are more comprehensive and practical than other findings. Bourke et al., (2016) in more prominently, the research will suggest that these data become most

appropriate when applied where exist little variation which is relatively constant between professions.

Davies and Hughes (2014) explain that the reasons behind the research to utilize all the collective data in the questionnaire, which are, belong to the nature of these data that are comprehensive and practical more than other collective data. More prominently, the primary data in this research will be most appropriate as a finding if professions are constant and limited difference exists. To be fair in a straightforward way, here in this research structure that the data will suit the research aims and objectives when changes can be applied in order to understand and overcome the barriers.

Some of the factors that affect this research can be summarised as:

1. The challenges that could be encountered.
2. How to overcome the potential faced problems and barriers?
3. The actors in applying integrated design to deliver efficient energy in buildings (Fischer, ed., 2005).

Earl, et al., (2003) suggest that in addition, there is a number of the fundamental connections to control and drive the variables by using a technique of the statistical regression, which has carried out to measure the impacts of these variables and barriers relayed to the actors of the construction industry. Also, there are a number of the statistical analyses methods that can be used like Pearson's correlation coefficient, factor analysis, and chi-square tests were carried to evaluate different groups of variables.

3.8 Qualitative Approach

What, when, why, how, and who involved in construction projects are what the quantitative approach seeking to establish. Yin (2006) explains that it is important to ensure the quality of collected data; it should be resolute in enhancing this study by enriching with a number of

interviews. The study aims to identify the key elements involved in this process. The reason for choosing these participants is due to the fact that those participants have been involved directly or indirectly in implementing projects using integrated design to deliver energy efficiency in buildings.

It was also challenging to contact the professionals, and this was one of the most important obstacles that faced this research. The interviews state that research method can contain the number of data collection sources with clear evidence to describe the investigation of the real-life phenomenon (Jackson et al., 2012).

3.9 Similarity and Differences between Qualitative and Quantitative Approaches

Denzin and Lincoln (2000) illustrate that it is not a condition that quantitative approach is often followed by the qualitative approach which frequently aims to reconnaissance and selects the outcomes; from this the quantitative approach will be the representative of the quantification of information. In the same time, this will permit the outcomes to be transferred from a model to a relevance whole group and the capacity of the occurrence of different thoughts in a given model. Although there are two reliable research approaches that have different essential feature; they still have some common objectives and functions.

In a congenial way, as there are a number of similarities and differences between the two approaches (quantitative and qualitative), but the most important point in that differences in the quantitative approach has not any resilience to adapt and change with the situations in response with different circumstances property (Creswell, 2003). However, the qualitative approach is more often has the capability to adapt, allowing the promotion of cooperation between all parties in the research. According to Franklin (2012), some features of the quantitative method in the advantages and disadvantages are possible.

3.9.1 Advantages of Quantitative Approach:

a. They have the authority to verify the new cases
b. They provide useful communication information
c. They have the ability to recognize the mechanism of prearranged questionnaire
d. They have the ability to rehabilitate the prime data to the numerical form.

3.9.2 Restrictions on Quantitative Approach:

a. Difficult to implement statistical form
b. Hard to reveal a deep explanation of the connections between the study actors

Franklin (2012) also, refers to the Advantages and Restrictions of the qualitative Approach which is detailed in next sections.

3.9.3 Advantages

a. Can represent the numerical information
b. Can bring real groups assessment
c. Can engage a wide range of participants
d. Can determines the informative guidelines
e. Can impart the statistical form to replace the verbal information
f. Can increase the connection and relation between variables

3.9.4 Restrictions

a. The explanation is hard with this approach if there are no limitations
b. Identify the research's case seems a mystery in this approach.

Table 3.1: Differences between quantitative and qualitative approaches

(Source: Smith et al., 2009)

Orientation	**Quantitative**	**Qualitative**
Assumption about the	Can be measured by	Multiple realities

mean elements	questionnaire.	
Research purpose	Establish relationships between measured variables	Understanding the roles of variables from participants' perspectives
Research methods and processes	- procedures are established before study begins; - a hypothesis is formulated before research can begin; - deductive in evaluating.	- flexible, changing strategies; - design emerges as data are collected; - a hypothesis is not needed to begin research; - inductive in evaluating.

Domegan and Fleming (p. 24, 2007), state that the:

"The mixed between qualitative and quantitative in research aims to explore and to discover issues about the problem on hand, because very little is known about the problem. There is usually uncertainty about dimensions and characteristics of problem. It uses 'soft' data and gets 'rich' data'".

3.10 Questions

The interview with any one of the interviewees must be of a typical character by addressing the study objectives that should begin with it (Loseke et al., 2007). During the meeting, it will focus on the main points that the researcher will take the advantage of information that will be collected from the interviewee by asking random questions, regardless of the fact that the interviewee had participated in a real process of implementation for any stage in a project. The interviews could be willing to go into detail in areas of their interest or concern, whether

or not they were related to the study (King and Horrocks, 2010). The interview can move on to the organized questionnaire with open-ended questions. The researcher will end his

questions by asking specific questions, taking into consideration the fact that the questions of an objective data. The time factor is an essential element in such interviews that maybe last for a longer time than is initially will be intended.

That will facilitate the derivation of the questions for the questionnaire. The intent of the comparison between the findings of the field survey will qualify the questions to ask the professionals who will be interviewed; in order to find and trace a border of the nature of the questionnaire (Saris et al., 2014). Discussions on the basis of available theories as well as the review of the literature review; questions will be classified into eleven groups. The projects that have been studied by the researcher by conduct interviews with the professionals in projects and who have had contributions in the construction process. Hunt and Colander (2013) mentioned that the process of addressing the research questions requires ideas for the advancement of the process of developing a strategy research.

The estimate interview duration was not just over two hours, much of which was spent on explaining what was required. Responses were taken down by the researcher in the of the form text notes. The questionnaires have consisted of a number of questions that have been listed and have been asked to interviewees as well. These questions have categorized into eleven groups. Each group is concentrated on some issues that need to be clarified; and have a real lack of details with inadequate information in the literature (Bradburn et al., 2004). These types of questions as one dimension of data collection resources required quite care in responses to draw up and enhanced the study with a full notable picture; put the respondents own print in collaboration to this research.

The importance of this study in developing upon the questions answers, which has been resulting in opening new method gate and widening the research's resources. In the same way, (Patton, 2002) who explains this data collecting method is the only way and great chance for any researcher to be more close to the real life of the project. In accordance to that; we can see these groups of questions in questionnaire appendix.

3.11 The Questionnaire

Invitations: 150, Professional : (88), Préprofessionnel : (62), Replie: 108 (72%), Missed: 42 (28%)

When responses were received, (28) per cent of them did not answer because these responses were incapable to participate to questionnaire in a technical way. Some of the answers were reflecting participants' concerns; and may be these questions are too sensitive because they were worried to reveal their extent of experience. Also, they have not answered some questions depending on the level of education of some of them.

Comparing the interviews with questionnaire, there are number of differences between them. The questionnaire is the unique method among other collecting data methods has wide ranges of participants, on the other hand there is disadvantage of not being able to customise as the other methods. There are different types of questionnaires, but this study uses two of them as:

(1) Self-evaluation survey; (2) Course evaluation survey which is used in Semi-structured interviews.

3.11.1 The survey

By using the responses in the questionnaire survey, the aim to develop the relationship between variables that influence the investigations have been carried out in this research. Following, Floyd and Fowler (2014) who suggested that the approach which has been taken in methodology can be used to create boundaries that have significant impacts. Responses have been influenced by the way of collect data as well as the fact of the evaluating process to these data.

Fellows and Liu (2015) explained that the integrated design, energy efficiency in the buildings and cost cannot be neutral but are main actors of what is evaluated in participants' responses. Many participants might have given positive responses, hoping that this could improve the industry (Huang, 2012). Some respondents might have given negative responses due to dissatisfaction about the act of some parties that have a role in the whole process. In interviews and questionnaire some issues of are very sensitive and some participants might have experienced the evaluation as a 'performance control'.

3.12 Limitations

1. **Stable Energy Strategy**

Investment is facing a number of problems that lead to a loss of momentum and impulse, and this results in changes faced by the construction industry due to the continuing change energy efficiency policies and unexpectedly.
Within a lengthy time, energy policy makers are trying to take advantage of energy efficient applications in buildings by applying a clear strategy (Finnvedenet al, 2003).

2. **Funding**

There are two major restrictions on funding that have been observed by participants due to low certainty of stakeholders about any new method and fluctuations in energy efficiency sources. To offset any kind of old traditional buildings with new energy efficient supply, which increasingly growth needs but finance is relatively consist of the decarbonisation cost and urgent expenditures to secure any future demand (Collier et al, 2007).

The planning and decision-making are united in assessing any risk could affect perceived technical and sub energy efficiency systems. Responses raise a number of big issues that represent a major challenge to industry including the decline of investment. Mahoneyet al. (2006) indicate that to ensure trusty investment is more flowing to take-up the developers in a

stage of improving the new technologies for integrated design and energy efficiency in buildings.

3. Maintain Investment

Diverse and mix efficient energy resources are more essential to rely to meet the growth needs, that's recognised by participants who indicate it and introduce it to maintain taking cost to lowest as possible. Gillingham et al. (2009) illustrate the concerns of participants about secured and continue investment in context of overcome obstacles that affect delivering the research's targets.

The respondents insisted on the lengthily thinking in the deal with shortage of designing energy efficiency in buildings opportunities. Also, explain how participants state a number of issues like investment in decarbonised and lowering the costs.

4. Public engagement

Communication about the energy efficiency system in buildings has an important engagement in debate with public to draw adequate image of the relationship between both of them. Participants are eager to give justifications to improve perceptions of public's views in the direction of using the integrated design to lessen cost of energy efficiency in buildings (Jeruchimet al., 2000).

5. Policies

Brown et al. (2015) refer to the development of policies which face a lot of challenges; and respondents referred to them; in same way the planning face that. In addition, they mentioned to the changes in level of demand and how that is affects the carbon emissions.

Investment in energy efficient buildings will affect by some problems caused by the unclear government policies; one of these problems is less investment in using integrated design to deliver the energy efficiency in buildings.

6. Energy efficiency in buildings and climate change

There are a number of challenges that were identified by respondents which are related to factors that influencing some factors such as emissions goals, lowering prices of energy sources, uncertain policy indications and the occurrence of significant environmental changes. Also, the actual decarbonisation goals are more potential to keep and hand over towards bring new infrastructure for industry.

Dobbelsteenet al. (2012) explain there are many additional challenges for the design and the cost of energy efficiency in buildings, which indicated by participants, including climate change during future with a speed of weather change which cannot be determined in advance exactly. In order to gain the whole energy efficient buildings without any prescriptive, the route to targets of 2050 which will meet and face challenges.

7. Energy Efficiency in Buildings and Skills

Competent construction industry with integrated design to implement energy efficiency in buildings, facing a severe lack of experienced workers. There are a number of factors that have a significant contribution in the process of loss of technical expertise and their transition to other industries. Pye Tait in CITB report (2013) explain how the skills can impact on economics and strategies, as says:

"There are critical skills and knowledge needs among the building professional workforce. Architects, planners and surveyors need knowledge of energy efficient materials, systems and technologies as well as installation processes and impacts of energy efficiency system and measures, also, how to apply them to buildings with different fabrics and of different ages".

The report of Environmental Audit Committee in House of Commons in the GB (2009) highlight is a large need for the expertise of people value especially when economic

conditions facing the growth and recovery, to have a role in managing the process of implementation of the integrated design to achieve energy efficiency in buildings.

There are a number of direct impacts that greatly affect the implementation of the scientific researches and are linked to the investment process and efficient energy at least cost. Efforts to promote the use of energy efficiency in buildings, at a cost of a few always be so difficult that lead to instability.

The geopolitical circumstances have significant impacts on sustain investment in the integrated design to efficient energy in buildings, and that could be to increase it or may be a negative. These are real challenges that affect moving the professional people from industry to another one, leaving the construction industry in shortfall regarding technical workforce and that will lead to defer any improvement in this sector of this industry. Workforce movement influences have identified by participants clearly, which put more challenges on supporting the industry and keep a secure development in reducing the cost of designing energy efficient (Waterfield, 2011).

3.13 Strength of the Methodology Strategy

This methodology has efficiently absorbed the modern studies strategies occurring in wide range of studies. By considering the high rate of responses and contributions from nearly most of people who were surveyed, the research greatly engaged in spreading the knowledge in future. Responses have enabled the research to propose a theoretical understanding when planning for further investigation about the subject. Study strategy may control objectives:

a. Guides future development of methodology for applying energy efficiency in buildings
b. Furthers research of methodology strategy to direct control new policies
c. Endorse the effective collaboration between researchers and professional people in the industry

d. Focus on the importance of methodology to evaluate the implement of integrated design instead of traditional design in such buildings

3.14 Summary and Conclusion

In this methodology, the combined quantitative and qualitative methodology is set out. The chapter explores the analytical techniques that engaged in the study and clarifies the reasons behind selecting these methodologies. Maxwelland Loomis (2003), illustrates that the quantitative approach was selected to highlight the impact of groups of variables, namely, basic variables, institutional variables, variables related to research three elements (integrated design, energy efficiency and cost) adopted and problems facing industry. The qualitative approach was selected to conduct the based data collection and to examine the generated propositions and questions, which were based on the literature review and the based discussion.

Teddlieet al. (2008), explain that the mixture of both the quantitative and qualitative approaches facilitated the crosschecking of the results of the one method against those of the other. The two approaches are jointly on balancing. Also the research methodology defined the justifications and the participant as units of analysis.

For the purpose of expanding the understanding process to explain the fact; (Holstein, and Gubrium, 2000) illustrate the use of the qualitative approach widely and intensely will be the right path to focus in a close understanding perspective. Also, to recruit the quantitative

approach adequately to answer questions that need the description of the used methods, as well as in the use of survey, that's because the quantitative approach seeks to highlight the facts that could have seen by the largest number of individuals. Evaluating, comparing and classifying the responses could be linked to professionals' experiences through the analysing processes, will led to clear and an inclusive conclusion.

Heyvaret (2016) explains that the research could recognize the questionnaire items related to literature review lack data, all kinds of barriers, and the problems facing this sector of construction industry. The key assumptions that the research is consist of are integrated design, energy efficiency in buildings, cost, and the problems facing construction industry.

One of the key assumptions in the research is that the integrated design needs to be applied properly because the barriers are not receptive to adopt it. The initial assumption and questions could create the barriers that impede to achieve the design of energy efficiency in buildings with low cost. This research's methodology outlined the analysis process for both the quantitative and qualitative approaches to the questionnaire's results. This is statistically assessed a level of confidence. As will be seen a statistical regression technique was also used to analyse the relations between the variables (Chilisa, 2011).

Participants are often chosen with the anticipation that they were meeting firm requirements. Chosen the model in qualitative research is always about a few of non- typical situations. Though, it is crucial in improving a real considerate for further choice could be formulating it. Qualitative approach generally is defined by the examining and the analytical. The outcomes are not usually to be employed and apply them in all situations (Denzin, and Lincoln, 2010).

This examination was carried out to evaluate the impact of the variables on the take-up of whole process. Further analyses were carried out to give more evidence on different groups of variables.

This research has drawn up the useful methods like research methodologies, strategies and research design to study the role of data collection tools, analysis methods and participants to form the final outlines in this research of information collection.

The most attribute of this study are the descriptive and interpretive data collection that has been assessed and evaluate by the mixed methods and mainly by using Likart Scale which is defined as a descriptive statistic. Evaluating the trustworthiness of the mixed approaches results is complicated, but strategies used in this study, will empower the possibility of trustworthiness

to find applicable research results. Also, to ascertain the standardization of this study the trustworthiness has been used; because as Creswell (20030 suggests it covered four strategies used by researchers: credibility, transferability, dependability and conformability. In this study the trustworthiness has been applied due to the wide knowledge that a number of research have used the same path.

The explanation of the qualitative approach, adopted by means of leading analysis to literature and questionnaire and interviews. For the purpose of expand the understanding process to explain the fact; Gubrium, and Holstein, (2000) illustrate the use of the qualitative approach widely and intensely will be the right path to focus in a close understanding perspective. Also, to recruit the quantitative approach adequately to answer questions that need the description of the used methods, as well as in the use of survey, that's because the quantitative approach seeks to highlight the facts that could have seen by the largest number of individuals. Selecting interviewees and participants in questionnaire from different projects was based on criteria (Dale, and Vope, 2015):

a. The process, ***b.*** the type of projects, ***c.*** the availability of staff, ***d.*** the value and size of the project and ***e.*** the availability of resources.

The research similarly clarified the propositions and questions for the questionnaire and defined the type of the relevant data and observations to be collected while leading the

interviews with the professionals who play role in the accomplish of a number of projects. Hammersley (2008) explains that outcomes of the interviews were drawn up to adopt a manual form of analysing these findings, which is the result of extraction and classifying the

information collected from the interviews. This includes a long-term government strategy for a decarbonized system, which works towards the integration of electricity, heat, and transportation systems.

To integrate of efficient energy systems in construction industry, the government strategies should work towards that integration. There is a significant lack of implementing energy efficiency in traditional buildings, which affect the performance and possibility of achieving the targets realistically; while the calls for the consideration of cost effectiveness (Irani, et al., 2003). Lastly, this explored strength and criticism of the methodology and underlined the problems encountered in this research.

Chapter 4: Analysis

4.1 Introduction

The literature review and the methodology chapter revealed a variety of potential influences on the implementation of integrated design to deliver energy efficiency in buildings at least cost. On the basis of these influences, the research covered a number of perceptions, which in turn formed the basis of selecting the variables to be explored in the qualitative portion of the study. Data related to influences were collected by means of in-depth interviews with participants who have the chance to share in designing energy efficiency projects from inception to completion (Newson et al., 2015).

This chapter nominates a form of content analysis to get further outcomes from the context of interviews. As the researcher did not record the interviews conducted for this research, the content analysis had to be conducted manually. The interviews' texts were organised in a tabulated framework in order to extract the object structure, the qualifying structure(s), and the abstract element(s) for the variables. A code was then assigned to each abstract element in order to facilitate cross-referencing across all instances. This allows frequencies of occurrence for each abstract elements derived from the interview texts helps to determine the relative strength and influence of the perceptions and their related variables on their introduction and implement of low cost of integrated design to deliver energy efficiency in buildings (Marshall, and Reason, 2007).

The analysis in this research consist of the methods of collect information systematically. These methods reflect all experiences levels of skilled, professionals, experts and stakeholders and their perceptions. Each study has its own way of collecting data, in this research the main source of data that adopted were literature review, interviews, and surveys.

In this study which use the mixed method (qualitative and quantitative), the priority of the analysis in such research is the searching for meaning, concepts and themes through the interpretation of what is reviewed of documents of the subject.

Yin (2003) explains the needs in every study to find and identify the missing links in the data base. In this study the categorisation and organisation are the process of analysis data, to find meanings and themes of study that arise from data.

Face-to-face interviews that used in this study, were noted, recorded and transcribed. Number of questions were open-end and posed to which the responds should be in writing.

This chapter employed the content analysis technique to analyse the interview test and relate the results with the findings of qualitative survey.

4.2 Identify the Analysis Unit and Study Variables

One of the most important concepts in research design is the unit of analysis (Mrucket al., 2002). the definition of initial research questions and propositions will influence by the unit of analysis for both (quantitative and qualitative) approaches. Creswell (2012) states that: "Although units of analysis are typically defined as individuals, groups or organisation, they could almost be any activity, process, and feature". In this research, supportive data will collect from interviews (qualitative approach); the unit of analysis is the major entity that is analysed in the study.

The literature review has guided the researcher in defining the unit of analysis and in selecting the variables for the study; and individual participants (owners, consultants, contractors, and government officials' members) through questionnaires (quantitative approach) which are working as secondary parameters in this study. In accordance to the literature review in this research, the questions will be classified to eleven groups. A variable is any entity that can take on different values, which are not always quantitative or numerical (Yin, 2006).

In same time, there is a possibility that they might influence the development of research subject as independent variables. The variables are categorized into groups and each group into subdivided small group; these categories are consistent to the quantitative study and the

propositions of the qualitative study also explored basic variables. The study has focused on the most important factors, even there are a large number of variables can be selected (Trochim, 2002).

4.3 Identifying Limitations

In order to compare the low costs designed energy efficient buildings, which have been selected to investigate; the differences between the projects that have been approved as a basis of comparison purposes also use the common features between them for the general examination.

The purpose of determination the projects that have been selected to suit and identify the needs of the research as Glaser et al. (2008) explain may help in collecting the required information. Yamagata-Lynch (2010) illustrates that there are a number of limitations which can be considered in the final analysis of the outcomes and they have some sort of negative impacts on the research, in other words he summarises these limitations in next sections.

4.3.1Construction Methods

Designers and all stakeholders realized more and accommodate alternatives to the traditional design to reduce the cost of the energy-efficient buildings construction.

4.3.2 The Importance of the Project

Developing an understanding of the process of collecting the available information on the selected project to study will lead to increase the knowledge about the type of characteristics of each project in terms of sizes and the value of each one.

4.3.3 Potential Projects Resources

The ability of projects to enhance the research with the necessary data is heavily dependent on the nature of the project, which significantly influences the style of the comparison between them.

4.3.4 Building Purpose

The opportunity to select project was limited, but the research managed to cover different types of buildings. The required experience and anticipated problems in implementation of such projects were expected to give better results to this research.

4.3.5 The Communication between Design Team

For the purposes of this study, projects design teams are divided into two categories: those with effective communication and those with a poor communication. It is easier to integrate with team players than with others. Explanation that if the staff have expertise in construction, it is expected that the dovetailing interacting of the project team with the client will be easier. The client who does not have expertise will have more problems during the projects stages, especially the communication side (Dainty et al., 2006).
In the selected projects, the availability of experienced staff was taken into consideration to examine the impact on cooperation and coordination within the team and how this reflects on the take-up and implementation of the integrated design to deliver the energy efficiency buildings with a low cost (Shuttleworth et al., 2008). As shown in figure (4.1) there are two out of five projects are unsuccessful due to ineffective communications, which means how important the role of successful communication:

Figure 4.1 Shows Proportions of Projects Success are Due to Ineffective communications
(Source: Danityet al., 2006)

Opie (2004) suggests that the adoption of the interviews approach is a challenging because of the possibility to have the process of collect a lot of information from different sources, and this make it distinctive in enriching the research with useful data. Moreover, they are for being real experiences directly from the reality of people's daily life, as well as they are the closest to visualize by the readers because they are examples of describing the complexities of their daily life and facilitate of real an understanding. The interviews method has advantages of its applicability to contemporary real-life.

Tashakkoriet al. (eds), (2003) explain that the professionals that participated in the selected interviewees list were able to identify the names and the addresses of clients, firms, consultants and contractors, who have the potential to partake in projects. The researcher has contacted all participants to arrange initial meetings. Extensive interviews that conduct with a

number of professionals involved in a number of projects, including owners, designers, consultants, contractors, and all of whom had participated in that projects from inception to

completion related to the assumed quantitative approach and the other sections of the questionnaire. Following (Oppenheim, 2000), the database of collected observations will be analysed to make a significant contribution to the conclusions and recommendations.

4.4 Analysis

The categorical variables can be analysed using Likert Scale tests and there are many other tests. For instance, can test the association between firm type (size, projects, history, and etc.); and the type of staff profession; also, used to determine the association between firms' types and the number of energy efficiency projects that have been implemented by them (Onwuegbuzie, et al., 2003). The frequent of energy efficiency projects associated with the companies' types that were assessed.

4.5 Discussion

4.5.1 Content Analysis of the Interviews

There are five stages that make up what is proposed to draw on what should have been displayed in the qualitative approach (Glaser, et al., 2008):

1. Define the questions;

2. Determine the collecting data methods and analysis techniques;

3. Organise the gathering information;

4. Arrange the field survey; and

5. Appraise and examine the collected information.

To recognise information engaged in the research; the focus on a number of aspects is to be considered, including unpublished documents, archive records, interviews, direct

observations and the participants' observations. The risk in the competitive situations; in joining and handling this existing knowledge to give new insights and to identify in detail the facing problems, barriers, benefits and disadvantages of implementing integrated design in energy efficient buildings. Mangabeira, et al. (2004) explain that it is also important to find out what should be changed and reform to assume the way of low cost acts in integrated design process by taking advantage of the experiences of others countries. It is essential to describe how the collected data and information were used to derive the barriers resulting from the impact of the institutional variables on the take-up and execution of the integrated design. In this research, the finding will be classified in terms of the variables of the research outlined in another chapter. Exploring the participants' answers will formulate the basis for the barriers to be put in a framework.

The method used to prepare the analysis structure of the interviews in a technique called ***"content analysis"*** (Krippendorf, 2012). This structure is the result of extraction and classification of all information obtained from the answers of the interviews. This way of analysis dissects the interview and places sections of text with similar understanding concepts into discrete classification. These classifications give a number of indications as the method of uses that we can understand and draw a full picture from the text. In this way, "the answers" means all form of communication, whether oral or written.

Denzin and Lincoln (2010) offer a solution for ensuring that interviews are rigorously applied to analysis. The content analysis for this study will carried out by interviews and questionnaire, although use of an analytical programme that would no doubt speed up the analysis process. Participants think the questionnaire is a solution that could involve in gathering all the linguistic techniques of discourse analysis.

Face-to-face interview is one among many ways of conducting dissertation even it is structured or unstructured or between which knowns as the semi-structured, to recognised and interpreting the views of skilled and professionals and experts. Creswell (p.52, 2003) defines interview as an examination to find response to study's questions request the available and wide range of facts and proofs. Yin (p.68, 2003) defines the interview

> "Interview as an empirical inquiry that investigates a contemporary phenomenon within the questions context, especially when the boundaries between phenomenon and context are not clearly defined."

Denzin and Lincoln (p. 193, 2000) state that interview can be simplified:

> "looking at multiple actors in multiple settings enhances generalisability".

Creswell (2003) explains that face-to-face interviews are customized for analytical generalisations. The aim of this research is to broader the set of findings to achieve the generalisations of some theoretical prepositions.

Semi-structured interviews have been designed (depending on the needs of this study) and used in this research to gather data by concentrating on missed information in literature, through using a group of essential questions. Every method has advantages and disadvantages, in this study the interview as a method of gathering information has these advantages, and according to Floyd and Fowler (2014):

1. They are most appropriate method to get precise data;
2. Specific, constructive suggestions can be obtained through the face-to-face interview;
3. The number of participants have contacted in this study were limited due to size of research.

The interviews and survey in this research are descriptive and interpretive, they use the analyse through the mixed methods (qualitative and quantitative) methods. These descriptive and interpretive (interviews and surveys) in this study tends to analyse the collected data, interpret and theorise against the theoretical framework. In other word, interview can be classified to the following groups, as:

1. Unstructured Interviews
2. Structured interviews
3. Semi-structured interviews
4. Focus-group interviews

Writing this study would like to include gratitude and thanking to all the participants who have share in responses to questions in interviews within the outline of the research. Identify the problem by using an inclusion of all of the questions contained in the questionnaire, as well as a description of the methods and techniques that can be used in data collection; in same time the nature of the proposals, analysis and respond will need for more research (Flick, 2006).

4.6 The Variables

In this section, the variables have performed in a number of designed questions which answered by participants to explore them. Singh et al. (2008) explain that the categorical variables can be analysed by using ***Pearson chi-squared tests; Fisher's Exact tests and there are many other tests.*** For instance, by using one of these methods can test the association between firm type **(size, projects, history, and etc.)** and the **type of staff profession**; also, used to determine the relationship between firms' types and the number of energy efficiency projects that have been implemented by these firms.

Using the effective statistics methods such as scientific method, or differences between means; or Likert Scale; and relative frequencies to distinct the relationship that control variables which measured on a sample of subject, thus, will led the researches to concentrate on examine theory (Smith et al., 2009).Hanson et al. (2005), indicate that the recurrent of energy efficiency projects correlated with the companies' types. Also, these variables can be classified into four main categories as:

4.6.1 Elementary Variables

There are many variables that can be identified by conducting questions in the questionnaire that are designed to get information about these variables. Primary variables are important for classify the typical features of responses (Krishnaswamy, 2009). The results of this survey indicate that the majority of respondents are vary in their dealing with any of variables because they have a wide range of experiences in their profession and are more responsible for controlling the basic guidance during the data collection process.

4.6.2 Dependent Variables

This category deals with:

a. The stability of funding to accomplish implement of efficient energy
b. How to adopt the integrated design process?

4.6.3 Institutional Variables

Bergold(2007)suggests the questions that are represent the independent variables, are identified to influence the main performers of construction industry. These variables deal with:

a. Barriers facing implement of integrated design to deliver energy efficiency in buildings.
b. The possible difficulties.

4.6.4 Other Variables

These variables include all other variables that affect the implementation firms. The professions of participants are classified into six categories on the basis of projects type:

Category 1: Building

Category 2: Excavations
Category 3: Roads
Category 4: Electro- Mechanical
Category 5: Bridges & Culverts
Category 6: Water & Sewage

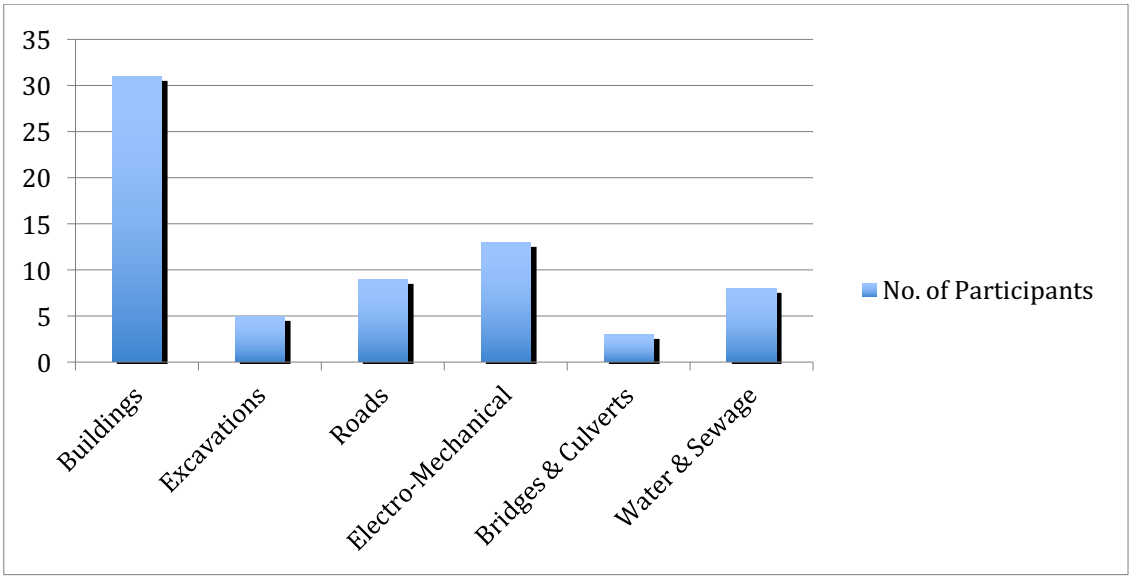


Figure 4.2 Distributions of Participants According to Their Professions

As shown (4.3) in the figure, 41 per cent of all respondents are professional, while 50 percent pre-professional.

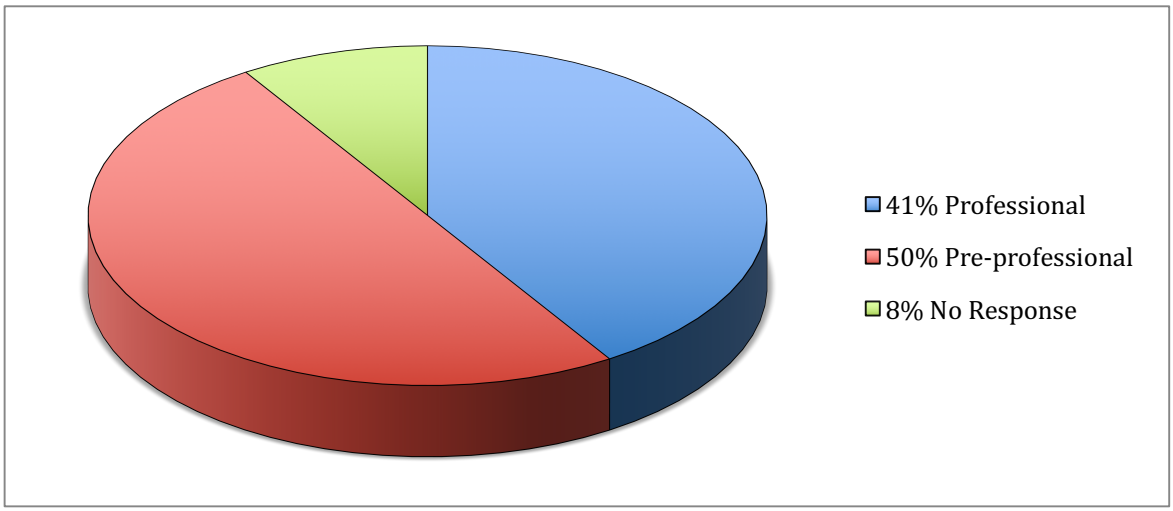


Figure 4.3 Responses Distribution to Their Profession

Responses showed how have reflected on the real changes in construction industry and especially the energy efficiency in buildings. That is also implies that the fund required to enhance integrated design is less than that required for traditional design. Brown and Wang

(2015) suggest that the systems of arranging funding need about thirteen percent or more of investment to reveal the demand of financial capability in order to implement the integrated design at least cost. These modest funding revealed that those respondents concerned about the financial capacity to execute energy efficiency in buildings projects. Consequently, the professionals are heavily involved in developing the funding for use of the integrated design process. This may be attributed to the fact that their experience reflecting the relationships between all parties, and how is that will reflect on the whole process (Dodoo, et al., 2010).

The survey shows that the participant's perceptions about the value of investment in energy efficiency buildings projects will be increased in the next few years. However, the investment in this sector is mostly financed by organisations and firms, which interested in using integrated design to deliver energy efficiency in buildings at least cost (Gillingham et al., 2009).

Responses did not regard the educational, assessment and organisational level for the innovation process. Also, a large number of innovators are qualified in this sector of

construction industry, but they gained the experience by practice (Maxwelland Loomis, 2003). The table (4.1) below indicates that almost forty-three per cent of those participants have their experience within twenty-five years or more, which implies an accumulation of experience.

Table 4.1 Distribution of Participants Classified by Experience

Years of experience	Number of Participants	Relative Frequency
Less than 15 years	11	0.101
15 -19 years	19	0.175
20 – 24 years	35	0.324
25 or more	43	0.4
Total	108	1.00

Table 4.2 Distribution of Participants by the Education Level

Level of education	**Number of Participants**	**Relative Frequency**
Short courses after GCSC	14	0.129
Colleges	21	0.194
Undergraduates	42	0.39

Master's degree	27	0.25
PhD	4	0.037
Total	108	1.00

The table (4.2) explains the education level of participants and how their qualifications tend to facilitate the implementation or encourage widen the use of the integrated design to reduce the cost.

4.7 Potential Obstacles

This research studies the possible problems and barriers that linked to the effects of variables and barriers, which need the take-up to all the process of the implementation of energy efficiency in buildings. As (Braunoeller and Goertz, 2000) explain by using the Likert scale, the respondents precisely defined their opinions; the potential problems or significant barriers could impede the implementation of integrated design in energy efficient buildings; these roles can be unequal. Nearly about 68.4 per cent of respondents powerfully agree that there is an inequality in evaluating the impacts of these possible problems. The statistical results reveal strong inequality in this sector of industry.

Gustavsson, et al. (2010) indicates that the outcome discloses that the level of concern about these barriers is extremely high, and to overcome these barriers need more co-operation and co-ordination in all processes levels. As to prevailing situations may not a problematic to transform the influences in the industry. Also, they affect the take-up to reduce the cost of implement the design of energy efficient buildings. Another barrier and potential problem is the decision-making process in local authority. The questionnaire reveals that 71 per cent of responses are firmly affirmed this barrier. Another imperative potential problem is the rate of skill-qualified workers who occupied the major roles in this industry (Borg et al., 2012). Funding also plays another burden on the distribution of skilled workers; the statistical analysis shows how negatively the funding can influence that.

Collier (2007) illustrate that there is another barrier that is the existence of the visible gaps seventy per cent between the skills of qualified and non-qualified workers in this sector of the industry; which concentrate especially on the high level roles seventy-one per cent.

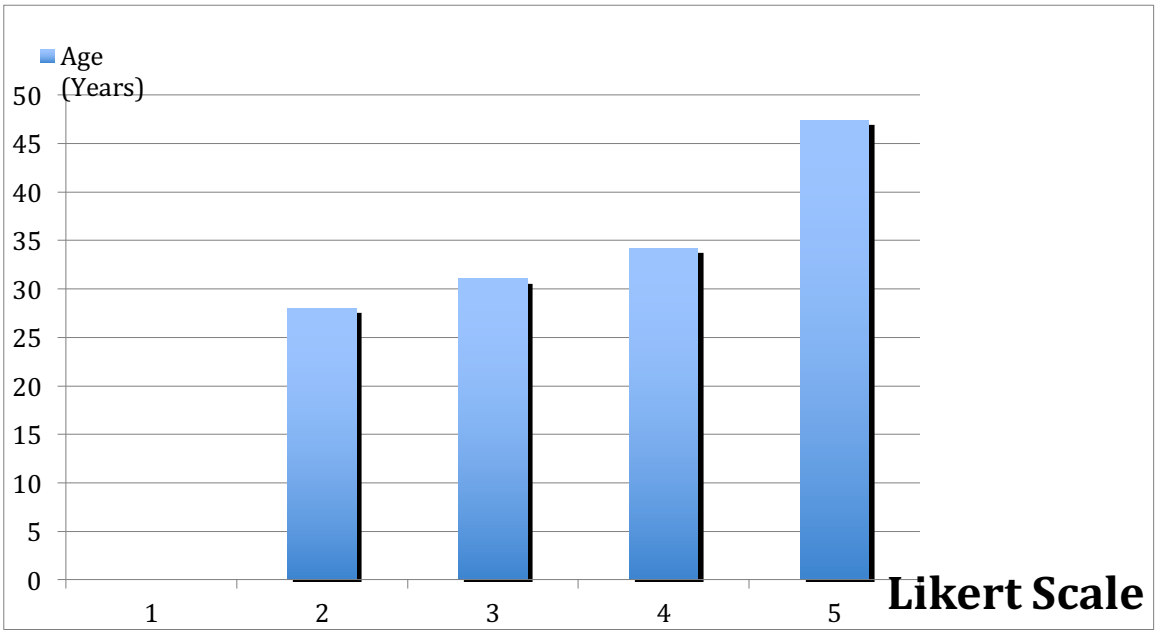


Figure 4.4 Distributions of Experts According to Their Ages

(Source: Shulruf et al., 2008)

4.8 Individualism related-responses

In this section, some of responses are focusing on investigating on the workforce's education level, in same time to find the highest level among them. The questions in Tables were posed to professionals. McCarthy (2005) explains in order of further analysis to be carried out to expose to the influence of the elements of professionalism. Thus, this study examines the relationship between all these dimensions and the implementation and take-up of the role of those skilled staff. Responses have supported the opinions of adopting integrated design to lessen the cost of achieving efficient energy buildings, as illustrate before. Co-operation and co-ordination is extremely high, which means a level of concern (Kemmelmeier et al., 2003). These results from the analytical point, this may have negative impacts on the implementation and take-up of energy efficiency in buildings.

4.9 How knowledgeable are you regarding the subject matter in this sector?

The table (4.3) and figure (4.5) below, show how the participants were knowledgeable about the questionnaire and the study elements.

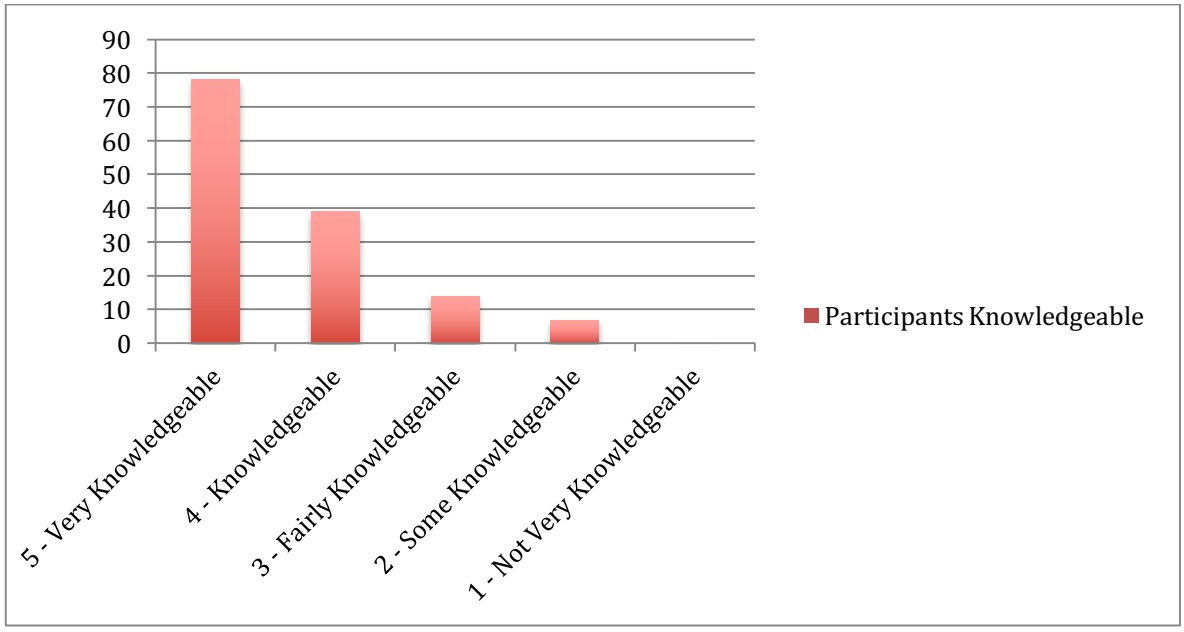


Figure 4.5 Participants' Knowledge

The responses expose that sixty one per cent were strongly feel that there are no clear authority's policies, indicating that the level of concern about this problem is extremely high. Lack of authority's policies is may be a barrier to implement and to take-up of innovation process and get out of it (Lalwani, 2006).

The UK Parliament: House of Commons: Environmental Audit Committee (EAC), UK (2009) explain the statistical analysis that shows the positive relationship between all parties is based on mutual advantage indicating that the lack of attention to this problem would impede the performance of the firms. There is another high worrying about the problem of

relationship between the employment policies and rules in one side, and on the other side are the skills; which respondents in this study have expressed. The seventy-five per cent of responses believe in the needs to change this barrier as one of the major factors in this problem (Bertoldi et al*.,* 2003).

UK/DEFRA (2004) state that problems prevail of understanding the relationship between skilled workforces upon other tasks, indicate how much the demand to adopt the integrated design as participants proposed to; which reveals that seventy-seven per cent of responses think this may be is one of the barriers. The outcomes of survey show there is a significant problem, in nearly fifty-seven per cent of responses referred to that by exploring the qualifications of groups' skills could be triumphed over the single's skills; which is a barrier that propose to implement integrated design to rule these relationships (Kinnear and Gray, 2002).

Roth et al. (2002) explain that the communication is another essential ring; the responses have highlighted to facilitate the relationship with public that can prevail upon the fact of collaboration between the two parties. In questions 1- 6 examine the barriers to change that are potentially to impede the implementation of integrated design to achieve the energy efficiency in buildings. Understand the relationship with public is a fundamental fact, with which different industries cope in different ways. Notable management for like these types of relationships means that staff proactive interface of communicating which could happen with the public to attainment an essential interchange level of communication (Seymour, et al., 2013).

One of the other important barriers to change is a dominant role of communication. About seventy-nine per cent of the respondents, which reveals an indication that a high level of concern regarding the equality in built the relationship with public, should be considered. The lack of equality with society is a problem and barrier to change (Hofested, et al, 2010).

When responses were received, twenty-eight per cent of them have not answered due to incapability of participants technically. Some of questions were reflecting their concerns; may be these questions are too sensitive because they were worried to reveal their extent of experience. They have not answered some questions depending on the level of education of some of them.

4.10 Limitation of the Methodology

This research has taken its role through applying the questionnaire and the propositions. There are a number of main points, one of them to measure the immeasurable. These immeasurable can be recognised or identified in accurate way from the collection of data in questionnaire. In this study, the main controversial analysis of factors and concern sources that guide the power of research to produce and direct the research claim (Hammersley, 2013).conclude that is not possible to replicate the accuracy of indicators without access to original data and a more detailed description about the analysis factors that used in his study. This has obligated the creation of a combined index, which he terms the "Energy Efficiency" index.

The reason for this combined "Energy Efficiency" index lies within the limitations of the construction industry itself and is attributed to the reality that this sector is dominated by the values and attitudes. This is attributed also to the fact that the construction sector is considered a developing industry. This may have skewed the results. One of the major difficulties in the nature of questionnaire, that it is designed to generate hard data for dialectical evaluation (Seymour, et al., 2013) add for the purpose of a serious verification of multivariate data structure, must provide the tools to encourage researchers to verify the model.

The survey in any research is clearly unable of providing many of the values that could be held by the professional group and would, therefore, obstruct, or at least delay, the very objective of the study (only for some parts of the questionnaire). Adopting a mix of the participants in the survey solved this problem.

Higgin and Jessop (2013) explain there is another limitation in the methodology involves the communication, which has been known for many years to be a very important factor for a successful construction sector. The researcher sought all the help of respondents, and the procedures didn't cause any misunderstanding. Lastly, all the nominated professional people for the questionnaire were from constructed building projects, and this may be evaluated as a limitation. Furthermore, conducting the same study on projects other than those selected for this study could, however, provide some comparative results.

4.11 Difficulties Encountered During the Research

As stated earlier, a discussion is now successfully going on regarding the methodology amongst all researchers. In addition, the researcher encountered problems and difficulties in conducting this research. These are defined as the researcher has been obliged to investigate all related issues that have tackled in this type of study. Moreover, there is no plenty of studies are available about this subject in the construction industry specifically (Creswell, 2011).

Brown and Wang, (2015) explain that the government officials, professional association and private institutions are lack awareness of the role of designing energy efficiency in buildings with low cost. There are no official bodies to oversee the profession and professionals in this field. The long history and massive development in the construction industry are enhanced this study, and put a lot of obligations in the research investigation.

Throughout the different stages of the study, the researcher found that some of the respondents and the interviewees couldn't distinguish the elements of the role of integrated

design to deliver energy efficiency in buildings. This will lead to some consumed time in explaining the concept of integrated design to them. In table (4.4) below we can see the questions have sent to participants about the greatest potential for future integrated design technique in the UK construction industry, and how their answers reflected with the Likert scale (Heine et al., 2002).

Table 4.3 the types of questions have sent to participants

Questions	**Mean**	**Standard Deviation**	**Mode**
10. Which of the following statements describes your views on using integrated design for low cost energy efficient buildings development in the UK?	3.421	0.942	4
16. Where is the greatest potential for future integrated design technique in the UK construction industry?	3.329	1.446	4

Some respondents and interviewees were hesitating to answer the questions or to fill the questionnaire because they were not used to doing such type of survey. The researcher had to Exert more efforts to tackle this problem. In addition, some of the respondents were not clear in answering questions related to the basic variables that they considered too sensitive, confidential or related to their status and their firms (Baumgartner & Steenkamp, 2001).

In determining the framework of the study and the respondents, twenty-eight per cent of them did not respond to the questionnaire. Despite all these difficulties and problems, a scientific methodology was designed for the research. This was followed by identifying the objectives of the study, collecting the required data, making the necessary analysis, standardising the results and drawing up the conclusions and recommendations (Braunoeller and Goertz, 2000).

The approach that was taken in methodology, used to create boundaries that have significant impacts. Responses have been influenced by the collection way of data as well as the fact of the evaluating process to these data (Denzin, et al*.,* 2005). Integrated design, energy efficiency in buildings and cost cannot be neutral but are main actors of what is evaluated. Many participants might have given positive responses, hoping that this could improve the industry. Some respondents might have given negative responses due to dissatisfaction about the act of some parties that have a role in the whole process. In interviews and questionnaire, some issues are very sensitive and some participants might have experienced the evaluation as a 'performance control'. In addition, surveys in general suffer from certain limitation, such as the predetermined nature of possible answers or the fact that most respondents tend to be more theoretical (Krishnaswamyet al., 2009).

In addition, the main limitation in like this methodology can be determined in the expectation of answers' nature and how the participants would like to see the improvement of elements within construction industry. Hunteret al*.,* (2013) suggest when the process of data collection started, it has emerged through the respondents'' perceptions, that there are key factors, which depended on implementing the process of the integrated design to achieve energy efficiency in buildings with low costs. And that does require the development of a number of indicators which can be examined and have kind of a close relevant relationship.
These indicators are: -

First is the state of the project in regard to the reliable activities, which already had taken place in the starts of others.

Second is the existence of other factors that relate to their own projects. Recognising the key factors, that are working in the context of competition with others for the purpose of comparison of the development to the level of support which is given to them (UN, 2002).

Third especially the difficulties in providing a differentiation between the key and secondary factors.

This is due to respondents' views which taking some more active stances towards coordinating different projects, in aim to enlarges the visibility of barriers as obstacles and find the successful solutions to overcome. All the methodological considerations were used to mitigate the extent possible of difficulties faced the research to find the missing information by designing the careful survey to enhance the process of collecting data, and probing (Finnveden et al., 2003).

4.12 The Survey Analysis

The discussions, recommendations and conclusions are based on interviews and a questionnaire survey of a number of respondents in the construction industry. This investigates the current situation and experience of integrated design implementation to deliver the energy efficiency in buildings and analyse the results of the questionnaire. In addition, discovers the essential prerequisites to lessen the cost of integrated the design of energy efficient buildings (Ruane, 2016).

It enables the purposes of this research to evaluate the present state of exist tools in construction industry, participant’s perceptions, given the lack of study on integrated design, energy efficiency in buildings and cost. Conclusion needs support of analyse with the evidences that had infer from the responses in interviews with those in questionnaire.

Questions	**Mean**	**Standard Deviation**	Mode

More statistical analysis, including maximum factor analysis, are carried out to evaluate the impact of institutional variables on the take-up of implementing the whole process.

In this chapter only to review those questionnaire data that are so relevant and have the effective influence on the results of research (Bergold, 2007).

4.13 Views on Investigations

Using the integrated design with low cost is probably going through unprecedented changes to make the transition in delivering energy efficiency in buildings. The demands on the integrated design could be as greatly as they are economic; increasingly to secure affordable and economical energy efficiency in buildings. Billiet et al. (2000) state that there are many specific contexts that have a significant role; which might affect the embodiment of the influence the integrated design process's impact to contribute in saving the efficient energy, and with a low-cost attribute so as to be among the main priorities of the policy makers. In same time, and in light of the ongoing changes in various industrial sectors and that requires reliance to take the advantages of available and collected information which helps decision-makers to develop future right decisions (Lindlof, et al., 2002). In recent years, we find that there is incessantly shift in focus on energy-saving systems, which requires a lot of looking as Shown in table (4.4):

Table (4.4) The Views of Participants on Energy Efficiency in Buildings

1. Which of the following factors will have the GREATEST impact on energy efficient buildings in the near future in the UK? Which other factors will have a significant impact?	3.355	0.890	3
5. In what order would you prioritise the elements of the Energy Efficiency in Buildings?	3.105	1.322	3
6. How do you expect UK policymakers to priorities the elements of the Energy Efficiency in Buildings?	2.987	1.205	3
7. What effects do you think each of the following areas in the last years on the UK energy efficiency in buildings policy has had on?	2.513	1.322	1
8. What effect do you think each of the following Energy Efficient buildings (EEB) mechanisms will have in encouraging investment in energy efficient buildings?	3.921	1.252	5
24. In which sector do you think the GREATEST low energy efficiency improvements can be made over the next 10 years?	4.171	0.51	5
25. Within the Building sector, through what specific area do you think the greatest efficiency gains can be made?	4.053	0.831	4
26. Within the commercial buildings sector, through what specific area do you think the greatest energy efficiency gains can be made over the next 10 years?	3.987	0.959	4
28. What single measure would be best taken by the current government to reach UK energy efficiency in buildings targets?	3.316	1.319	4

Table (4.4) The Views of Participants on Energy Efficiency in Buildings

Rihoux, and Ragin,(2008) states that the process of using modern technologies in an innovative way; can be considered as one of means to produce mechanism in a different style

and new. This reflects the complex situations that face various industries as a result of the growing energy demands. Thus, underlines the importance of identifying the main challenges, which could be impede to industries.

Holstein et al. (2012) indicate to tackle these kinds of challenges, our obligation need to form a new relationship between all parties; the public, policymakers, and industry professionals are all becoming more engaged in the debate; that have insight views about current and future challenges. They can frame that by identified biggest issues, with themes emerging on industry's demands and continuity, public engagement, skills, investment and innovation requirements. Ongoing challenges need to balance the significances to requirements of integrated design with least cost of energy efficiency in buildings; thus was one concern of participants have been shared in the survey (Claire and Ray, 2004).

In the reality to achieve the recent challenges that are deemed to overcome the economic situations in construction industry, that need to demonstrate the wide use of integrated design process to deliver all kinds of targets even at the short or long term of energy efficient buildings as Bryman (2006) states. Within the responses of who anticipated in this study's survey, they recognised what are crucial contribute to achieve this study's survey questionnaire.

The table (4.5) explains the views of participants on the energy efficiency in buildings and their perceptions about the how energy influence the efficiency in buildings; also, the impacts of saving the energy on buildings industry.

Those are identified as: How in high likelihood of success can use the integrated design at affordable and least cost to get energy efficiency in buildings? In addition, and across the construction industry, there are a number of indirect factors that have a significant influence on planning and decision-making (Handford and Peter, 2015). As a result, to promote an effective use of integrated design to help the achievement of the mutual goal of secure the delivering energy efficient buildings at least cost.

Through the responses have been focusing on the consequence of integrating the use of the available technology, in addition to support invention that enhances essential empowering of long-term plan to promote the integrated design to develop a best form of investment without any kind of risk. In general, the participants' perception is that, existing policies will not meet the requirements of the energy efficiency in buildings. Around 6 in 10 of responses, they expect the shortfall rises as the timeline and to the eighty per cent reduction required.

In meantime, and to enhance the role of integrated design in delivering the energy efficiency in buildings, the experts' views is given that, the policymakers should support the financial stability that can drive the policies to regularity and continuity in offering the profound changes in the design of efficient energy consumption across all kinds of construction industry and may be further more to other industry sectors (McCartan et al., 2012).

That said, participants also think confidently that such policies will have insignificant effects on the cost of integrated design to deliver efficient energy in buildings, but will keep sufficient regulations for this time and not obligations that could led to binding effects for the next decades. Hardell and Fors (2005) explain in a similar way, policies to reach targets should transit the energy efficiency systems to the associated cost reduction in various approaches. Participants support actions to be taken to develop broader framework to use the integrated design within a low cost in construction energy efficiency in buildings.

Faulkner, (2004) explains it is distinctly, there is a slight discrepancy arises in survey responses back to difference in priorities and perceptions; even in generalize all elements which are not sharing the same level of importance; however, they are broadly in alignment. Also, these priorities have been in shifting for many of generational.

4.14 Energy Efficiency Potential Technology Perceptions

Waterfield (2011) explains that the potential technology was one issue in the centre of participants concern and places the energy efficiency in buildings on top importance featured within cited measures. Continue to increase the level of investment in purpose of developing the use of integrated design and the low cost to achieve energy efficiency; it may influence the development infrastructure of this sector. These developments could take multiple trends that commensurate with the operability. In this sense, the increased investment in this sector creates many economic interests and a high increment in percentages in the provision of employment (Prindle et al., 2007).

Also, the energy efficiency occupies the utmost importance when investors identify the factors that provide significant potential to reduce energy consumption (Finnveden, 2003). Respondents believe that there are two types of short-term and long-term goals, which is obtained through the promotion of the process of increasing energy efficiency, especially the efficiency in the built environment sector and in both commercial and residential properties and this includes improving kind and implementation of thermal insulation, as well as the modern fabric of building's structures and energy consumed in transportation.

In addition, De Dearet al. (2004), they believe in the imperative of improving the management and control of energy consumption; and how to find appropriate solutions that could change the behaviour of consumers as main factors related to state a clear reduction in energy consumption within a limited scope. Approximately half of participants who are working in the industry emphasised the potential improvement for energy efficiency in buildings, this tendency is even more marked. More than half of respondents who work in manage side in industry, think the buildings as having the greatest possible over efficiency in industrial (Cheng et al., 2004).

4.15 The Innovation Concentration

One of the important points discussed by the participants is the support for energy efficiency systems, the focus in their priorities of innovation in this direction (DEFRA, 2006). In the use of modern technology; it will be as one of the close in the relations to the innovative process.

Among the questions that the participants responded to the surveys' questions were about the levels of investment and its impact on stimulating the innovation process in the coming years. Also, the majority of respondents agree that the investment should be away from the funding derived from lists of energy consumption and should support the innovation process (Newson, 2015). The table (4.5) below shows the questions sent to participants about the innovation in integrated design and the how the barriers obstacle reducing the cost, also, shows the efficiency in buildings to save energy.

Table (4.5) Questions sent to participants about the innovation in integrated design

Questions	**Mean**	**Standard Deviation**	**Mode**
21. Do you think the innovation in integrated design for the low cost energy buildings is the most needed?	4.066	1.037	4
22. What do you see as the UK's greatest strength in terms of above?	2.211	0.914	3
23. What do you see as the largest barrier preventing innovation in integrated design for the low cost energy buildings in the UK?	4.145	0.735	5

4.16 What Effectiveness is in the Policy?

There are a number of current factors need to evaluate for their effectiveness on the basis of its priority among those surveyed, as well as their contribution in influencing the building regulations relating to the policies of the implementation of energy efficiency in buildings with a least cost through the application of the use of integrated design. Thus, it should highlight a window on how to strengthen the mechanism of the process in the areas most important (Gillinghanet et al., 2009).

In the views of a number of respondents, there is an understanding to the concept of integrated design application in the process of implementing energy efficiency in buildings that could be increasingly complex for its lack of financial incentives adequate with competitive interest rates in order to be implemented on a large format. Also, Brown and Wang (2015) suggest it should be noted that the implementation of that process, that process would be unable to cover all the deficits that are not easily processed based on their priority and category on it grouped. These incentives can be clearer to encourage investors, as well as to be within the scope of easy implementation for stakeholders.

4.17 Impacts of Policy Uncertainty

In the survey, the participants were asked to assess the energy efficiency technologies in buildings by discussing the impacts that on investment risk. If energy efficiency in buildings is excluded, the risk in investment will increase because the uncertainty in policies. Participants reckon the reasons are due to combined wider geopolitical issues. As shown in table (4.6) below how the question about react with the participants' views according to Likert scale (Heine et al.2002).

Table (4.6) The level of policy decisions

Questions	**Mean**	**Standard Deviation**	**Mode**
9. At what level should policy decisions be made for the following areas?	2.789	1.535	1

The development of integrated design could be inhibited and the reason is the lack of incentives for its deployment. Responses in many trends link to stakeholders' opposition, but the impartial effects on investment risk like uncertainty of policy that may be happen because to having the comparative technology effects.

Newson et al. (2015) explain that all the participants believed there is an "apparent manipulation" of breaking the rules and policies, also they agreed on the importance of propagation of the energy technology consistent and enhances investors' confidence about the importance of continuing certainty and the trends of these policies. The outcomes of such these policies need the adequate time to ensure the availability of full capital to the energy efficiency in buildings; as well as, the support to the effects of policies, which giving the additional impetus to the process of pick out the energy technology. Therefore, there is a need to recognise the comprehended effects of distinguishing the use of technology, and widening of promoting energy efficiency policy process (Geller et al., 2005).

4.18 Existing Barriers

Respondents have identified key factors that are perceived to have a great impact on employing the technologies and innovation either in financial challenge "investment and cost" or "government policy and regulation" (Faulkner, 2004). This reflects the participants' perceptions about how clarified a stable investment to be qualified to move energy efficiency systems in buildings forward in regard to achieve planned goals. The transformative technologies could be a hurdle in market due to the risk aversion as typical barrier.
Keirstead (2006) explains that the energy efficiency demands grow dramatically to respond to challenges identified by participants in the survey, and it is vital that buildings need to consider the type of design to achieve goals. One of the imperative points must be mentioned is the innovation and efficient energy management in new and existing buildings; thus need a consistent framework, which can be coordinated by effective collaboration among all parties (Leither, 2013). Also, they think there are many of technical concerns that will reflect on changes to make the cost work in effective way.

Table (4.7) Differences between barriers and how they affect the whole process

	Biggest Barriers	**Largest Barriers to Deployment of Energy Efficiency**	**N**
1	Investment and Cost	Investment and cost	108

2	Government Policy, Legislation and Regulation	Limitations of available technology	89
3	R & D (Research & Development) and deployment of Technology	Energy Policy, Legislation and regulation	48
4	Public engagement/ acceptance	Markets, economics and pricing structure	34
5	Risk aversion/ short- termism	Technology Support, deployment and innovation	27
6	Knowledge/ attitudes	Lack of incentives	26
7	Markets/economics/ competition	Knowledge, attitude and leadership	25
8	Environmental and Climate concerns	Grid infrastructure	18
9	Safety concerns	Planning and land use	17
10	International aspects	Public engagement/ resistance to change	14
11	Lack of coordination	--------	---
12	Shortage of people and skills	--------	---
13	Low oil prices	--------	---

N: number of responses to the questions

The table (4.7) shows major realistic barriers that can indicate their influence on the process of using integrated design to deliver the energy efficiency in building.

There is a real correlation between the knowledge of the energy efficiency in buildings and the motivate innovation in response to energy demands in accordance to generate and utilise all aspects of integrated design. Also, the responses have come out with Feed-in Tariffs scheme, which was introduced by Government Department for Energy and Climate Change (DECC) in 2010, as long-term effective investment by providing the ability to increase the generation capacity.

Darby (2003) indicates that from prioritising perspective, affordability in participants' perception coming is in the first place. In the interests of participants, affordability in most policies is ineffective. In fact, thus indicates that respondents are less sure of the affordability can drive towards improving increased investment. In addition, it works in a perfect way everywhere, even this is a kind of intervention that address investment risks of demand with supporting policies encourage investors to bring home the value of energy efficiency in buildings (Part L Building Regulations applying to ALL buildings). In the same way, there is a real need to reassure the finance with alluring rates of interest.

As shown in table (4.8) below the (8) questions about the cost and investment in energy efficiency sector within the construction industry.

Table (4.8) Questions about the cost and investment in energy efficiency sector

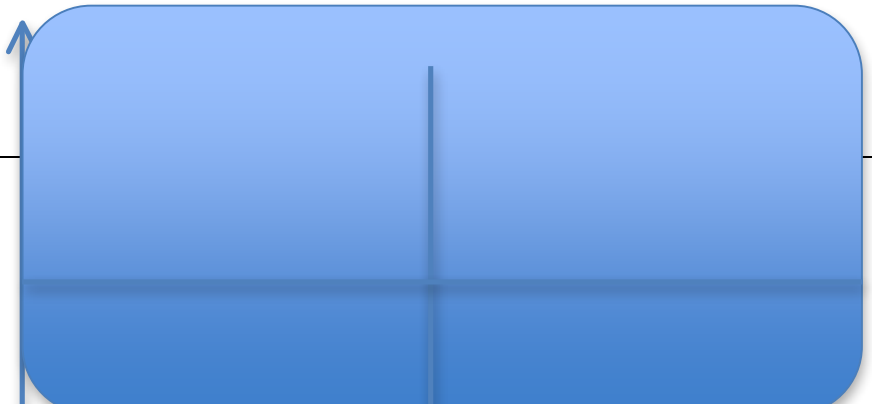
Questions (8)	**Mean**	**Standard Deviation**	**Mode**
2. Which of the following factors will have the GREATEST impact on UK properties prices in the near future? Which other factors will have a significant impact?	3.132	1.170	4
3. A wide range of housing types collectively are responsible for 32% of final energy use in the UK, while the non-domestic premises in the UK are responsible for around 17% of total UK energy consumption. (Source: DECC, United Kingdom housing energy fact file, 2013) Relative to today, how do you expect UK properties prices to change in the near future?	4.355	0.860	4

4. Which of the following factors will have the GREATEST impact on UK construction industry prices in the near future? Which other factors will have a significant impact?	2.197	1.357	1
12. In the UK, what is the level of investment risk due to policy uncertainty for the following low cost energy efficient buildings?	4.421	0.913	5
13. In order to maintain designing low cost energy buildings and meet environmental goals affordably, what do you think should happen to UK investment levels (from all sources) for the following areas over the next 10 years?	3.053	1.413	2
14. Where should the majority of funding for using large-scale of integrated design to achieve the energy efficiency in buildings come from?	3.987	1.311	5
20. What is the technology with the greatest potential for transforming the low cost energy efficient buildings by 2030?	3.224	1.312	4

4.19 The Survey Outcomes

Professionals had their say in responses about the role of research in strengthening the innovation by enabling and emphasising the collaboration rather than depending on the all other resources. Sundramoorthyet al. (2011) explain there are some challenges one of them being how to develop the human resources and the assertion on the importance of integrating the innovation features with supporting energy efficiency goals.

Good



Communication

Bad

Good Integration **Low**

Figure 4.6: Communication/ Integration Grid

(Source: Danityet al., 2006)

The figure (4.6) explains the relationship between the integrated design and the communication. Cosgrove (2006) refers to the importance of maintaining communication with the beneficiaries in this sector channels is one of fundamental in the development process of implementation of the integrated design to achieve energy efficiency in buildings with least costs, as they develop features for this industry to show the sophisticated to meet the challenges that gives it the ability of all positive contact in all industry trends construction. Communication one of the ingredients to keep the public informed on the overall changes in the sources of technology in this sector, which contributes to enrich the skilled manpower to the various opportunities in this sector (Dainty et al., 2006).

4.20 Room for Improvement

Participants in their answers consistently expressed that communication with public has ineffective attribute, because there is no provision of support to ensuring that statutory and compiled with excellent communication ties; that are able to clarify the effective relationships to have the sense of direction and presents to unite people around the common goal. Some positivity areas of communication engaged with development and implementation plans to ensure the meet and exceeds of the expectations and schedule (Cheng, et al., 2001).

This coincides with rebuilding the future relationship to draw and assigned the required persistent simplified dynamic policy, that ensures early intervention to avoid distrust, which

has serious consequences to achieve the targets. Misunderstood messages from industry may be contradictory or not delivering to adequate number of people, with an acknowledgement that public perception influenced by the industry projects factors (Goldman, et al., 2005).

4.21 What lessons to know?

Many of responses accepted the idea of improving all the areas, which this survey has dealt with but the focus on the poorly communicated. One of the most attributes that have been used by respondents was the cost, which is in contrast with communication but not perceived to be well. The importance of avoiding any escalation that affecting the delivery of service by enhanced the team approach with key communication to reinforce change systematic by supporting the mechanism of prices (Dentith, et al., 2004).

A clear view participants have been strongly stated in their answers, nonetheless were differing opinions that are divided about renewable energy. More than 75% of responses were supportive to additional development and regarded the absence in public agreement as the barrier to its development.

4.22 How to Improve Engagement?

Participants were keen to share debate of improving understanding of all challenges in this process; which needs to involve in listening directly to parties who engaged in discussion about the energy efficiency system in buildings that designed by using integrated design (Gillingham, et al., 2009).

Stakeholders have the chances to play an important role to engage one with another; each party must effectively have their words about securing the implementation of energy efficiency in buildings in a cooperative way. Again, responses confirm that all parties with jurisdiction have a deep insight to facilitate another trend to improve engagement in any future communication.

4.23 The Professionalism

In integrity, to change the energy efficiency in buildings; there are some challenges need to priorities. Availability of profession and skills within the workforce can achieve the physical infrastructure of the integrated design of energy efficiency in buildings. This applies to both the physical infrastructure and to the provision of skills and capabilities within the workforce (Oyserman, and Lee, 2008).

Responses were eager to ensure the availability of adequate energy efficiency resources to buildings within the real investment and skilled professionals' staff who can deliver the targets (Denzin et al*.,* 2005). Respondents have identified the new generation of skilled people who will attract the industry and move forward to provide secure sources of workforce that fill the shortage. Also, they have important insights to bring to the debate and confirm what many in industry and professionals, but a new approach is applied to this appeal.

4.24 Lack of Professionals

The participants in the survey raised an important point, about apparent lack of competent professional staff in this area of the industry; which in (their perception) may persist for a number of years. Also, they referred to the same shortage in some of the vital sectors of renewable and unconventional sectors. Thus could lead to increase the reluctance risk of the capital investment in this type of industry sectors. This indicates as an evident in some sectors, like the supply of energy efficiency in buildings and power supply technology, in an indication to the climatic considerations, and in consistent to the reduction of carbon emissions standards (Kemmelmeier, et al., 2003).

There are a number of barriers that could influence designing the energy efficiency in buildings industry; one of them is the skilled tradesmen shortage but in a level less than other sectors of industry (Dietz, 2010). Thus, in a someway will improve the industry. The new

entrants have an interestingly role; who work in industry with a number of attracting advantages. In same time, some of qualified people professionally who came from other industries aspects background can involve in this industry. This could support and improve job opportunities to help the growth of innovation in many industry sectors.

4.25 Skilled Workforce Retention

US Department of Energy Report (2016) explains that all construction industry sectors are seeking to retain the manpower that have long experience and actively contributed to the process of building of efficient energy projects. The process of assessing and valuing the exciting experience professionals could lead to the process of build new expertise workforce with a training under the supervision of the skilled and experienced people; thus will contribute to renewal and support the new workforce over the next future years.
Table below shows the questions about shortage in professional people differentiate with Likert scale. In Table (4.9) some of questions answered by participants about the shortage of qualified people and the statistic results.

Table (4.9) Questions for Participants about the Shortage of Qualified People

Questions	**Mean**	**Standard Deviation**	**Mode**
18. Can you identify any existing surplus or shortage in qualified professionals in each of the following sectors	4.355	1.197	5
19. In the next 10 years, do you foresee surplus or shortage of qualified professionals in each of the following sectors:	2.539	1.113	3

4.26 Conclusion

This chapter employed the content analysis technique to analyse the interview test and relate the results with the findings of qualitative survey. The use of each text allowed the extraction of the object structure, the qualifying structure(s), and abstract elements for the variables (Saladana, 2012). The frequencies of occurrence for each abstract element were calculated and cross-referenced in order to determine the relative strength and influence of their related variables on the introduction and take-up of implement integrated design of energy efficiency in buildings.

The content analysis demonstrates that most of the interviews share the view that the project's stakeholders authoritarian in approach this affected the work of other roles. These actors seem to believe in their way of design the energy efficiency in buildings. This research concludes that design like these projects is characterised by a negative influence of old design methods and impedes the introduction and development of integrated design.

The interviews indicate that promotion is not based only on merits and skills of professionals to delegate strong effects to elementary variables in this sector of construction industry considerations (Patton, 2002). Furthermore, the relationships between these variables are based mutual advantage. The interviews demonstrate that the participants are not reflecting a personal view but their opinions depend on collective general experiences in industry.
The interviews also reveal that all skilled and unskilled staff of any team is participating in the successes of projects of same trends in construction industry, and play their role in regard to their positions. In same time, this indicates the importance of hiring skilled people from the same industry or those who transferred from other industries but they have the related skills; will dominate the right method of implement this industrial sector.

The interviews confirm that the professionals play the most important role in this sector of construction industry. Also, indicate they have a lack of strategy, co-operation, and co-ordination (Flyvbjerg, 2006). This research concludes that some of the professionals' negative characteristics impede the development and implementation of such projects.

Energy efficient buildings projects are not certain operations and the interviews with professionals in this sector of construction industry disclosed a lack of strategy or frequent changes in strategy. They indicate that all actors in this sector of construction industry routinely exhibit a lack of precise strategy. This research concludes that the dimensions of uncertainty avoidance impede the implementation of integrated design to deliver energy efficiency in buildings (Polkinghorne, 2014).

Chapter 5: Conclusion and Recommendations

5.1 Introduction

The conclusions of this study are divided in accordance with aims and objectives of the study. The construction industry has seen many developments at the level of growth of the means of energy efficiency in buildings, reflecting effectively in the process of energy

consumption, especially when the construction of buildings, as well as during the early stages of planning and design, which has allocated small costs but significant savings of energy. There are a number of steps seeking to the marginal cost by designers especially during the preliminary stages of design and that's clearly contributes to the reduction of the relative costs of energy and the most important obvious increases that could occur in the thickness of building's walls and efficiency in electrical appliances in buildings, as well as the thickness of the insulating layers.

There are some amendments that are brought by designers such as dispensing with the supplementary systems which reduces the construction costs efficiently and effectively and turns the building better than other buildings improvements, but nonetheless make such decisions in the final stages of the design is still less expensive than taking after construction is completed. To take such a step in the initial stages of the design for any project must be decide what are the decisions that must be taken in the design phase for low-cost energy-efficient buildings, resulting in obtaining massive changes include aesthetic aspects of the buildings. But such decisions if taken later may lead to a substantial increase in the level of the project time allocated for the work and costs, as well as that could lead also to the damage has not been introduced in advance.

The statement posed in this study was, “The use of integrated design to deliver the energy efficiency in building at least cost”. Also, some of the problems in moving from this simple goal to practical measures have been discussed in this research. The study showed how the strategy for creating an efficiency regulation will affect the energy savings. Reducing the cost of life cycle of a building may lead to have better performance even exceeding more than the present performance.

There is no right choice, but only one index of the efficiency, and it is important to realize that the bias that may arise when using only one. For buildings, it is likely to give a fair arrangement there is no single indicator of efficiency. In fact, it is likely that the index will fluctuate depending on the choice of the rankings for efficiency. Buildings are more

complicated because of the practical design incorporates many potentials of the most saving energy.

The process of determining the consequences of the choices made by the design at the initial stages is considered one of the tasks of decision-makers and through which possess the ability to calculate age of the building costs. Despite the fact that the decision-makers often do not devote part of their time to oversee the implementation of construction stages operating or even finance. But different people involved in the implementation of the construction of the building, as well as prepare the size required for the work of the budgets, which gives a clear picture of who governs the operation of the building, and often involve incentives for the development of the division of energy use as the best.

When embarking on the design of a building, the designers are putting the energy efficiency, within the list of main design points, raises concerns but they are not the only point. And it focuses on the development of most of the buildings in construction costs very little concerned about operating costs.

There are three bases essential to classify the buildings in accordance to the ability to save energy:

1. Buildings' materials and equipment;
2. Buildings' should have all facilities to keep appropriate services running;
3. Buildings that operated in such a manner to similar buildings.

These bases restrict on the way of defining in obvious all conventional characteristics.

The aim of the current study was to develop the relationship structure to be able in regulating the nature of deliver the energy efficiency in buildings; designed by using integrated design at least cost; within which integrated design activities are recognised. For this drive, the concept of integrated design is an effective way of design to deliver energy efficient buildings. There are certain characters in this kind of design that may interpret or merged a number of results.

5.2 Conclusion related to Integrated Design

The integrated design is a process to gather all the elements together at the same time and used them to reduce the energy consumption in buildings. The integrated design is working towards the optimization status so the design can use a number of the means as the materials of thermal insulation as well as the use of the efficiency of design. Focus on energy efficiency and the systems particularly could be used in the initial stages of the design of the buildings in the most important of the main options available for integrated design to be considered. This belongs to the nature of the dialectical relationship that reflects the interaction between systems costumed and design which provides a real opportunity for the development of standards and laws that define the special construction requirements to regulate the energy efficiency in buildings policies.

Integrated design may lead to very amazing usage of energy efficiency in buildings. In addition, the construction policies can support the integrated design initiatives that promote the high development to enhance the efficient energy implementation in buildings. Integrated design intended to deliver the highly promotion through the standards and the energy efficiency schemes, and that will lead to the application highly efficient technologies in general.

There is a persistent need to reduce the cost of using the integrated design in the efficient energy in new buildings and renovate the existing buildings. Some of the traditional buildings may need to raise the potential of the cost-effectively, in considering the energy efficiency; and thus because some of these buildings have not been refurbished since long years. By increasing the energy efficiency initiatives to address the new buildings and improvements by refurbishment and major renovation.

5.3 Conclusion related to Energy Efficiency in Buildings

There are many influencing factors of the energy performance of a building; building codes usually introducing the most integrated of these factors: the building structure and operating systems. Most building energy efficiency regulations started with requirements for the building energy saving, and nearly all efficiency regulations for new buildings include most the requirements. As the building's energy saving improves, regulations focus on the energy efficiency of building systems. Also, regulations address all other technologies and the forms of energy saving.

Most energy efficient systems in buildings are first standards for the construction industry so they are taken into account through the various stages of construction. But others focus on the use of appliances and equipment that consumes less energy, which is the most efficient and the other systems don't take it into consideration. This explains the obvious difference between the aspects of these systems, especially when high specifications are required for the building so as to get high requirements.

There are many different ways to set energy efficiency requirements and each has its various own advantages and disadvantages. In particular, for the prescriptive of efficiency on the basis of a guideline, but in general, it is easier to understand contractors, where they are given values in detail. Energy efficiency requirements can also be mapped in ways that trade-off, build the model, and the framework of energy or energy performance. It is basically a set requirement either on the part or component or building level as both a maximum value calculated.

There are a number of developing energy efficiency methods to reduce costs, some of them are avoiding over enhanced some parts of buildings, and thus could decrease the cost of energy efficiency consumption. Also, some methods are prioritised to fulfil the energy efficiency requirements.

Some designers focused on interest of improving the performance of energy efficiency in buildings without putting into account the completion of the selection process for how to use

energy and without reference to estimate the amount of energy used. There are a number of possibilities which are based on the performance of energy and attention to get the best effective costs at the cheapest solutions.

It is not easy to distinguish between each type of energy efficiency requirements and whether it is existing in the comparison of different methods of saving energy in the development of the construction industry. As a consequence, these methods are quite surprising and reasonable considering the individual, performance and the method frame.

The longer term energy efficiency in buildings will be the only workable solution. Using the integrated design to achieve energy efficiency in buildings should be arranged as the goal for future building policies or energy efficiency standards to ensure the development of optimized solution. Any financial restrains for new and existing buildings may prevent the integrated design from delivering the energy efficiency to ensure that buildings can be cost the least over the next years. One of the most expanding points in the concept of energy efficiency is the energy embodied in construction and demolition.

Some of researchers think that the potentials of efficient costs will continue increase also year after year because there will still be need for renovation of existing buildings and because new buildings will continue to be constructed. In same way, to improve the efficiency in buildings there is a real demand to introduce policies that demonstrate the energy efficiency in buildings and overcome all barriers by emphasising the effective strategies. Policies and initiatives can be the limits for continue effective development, which would result in increasing the energy efficiency in buildings. Also, with a least cost, the role of new technologies can improve the solutions that allows for full use of process of optimizing energy efficiency in buildings.

5.4 Conclusion on potentials in new buildings

The possibilities for savings in new buildings are calculated based on the figures and forecast. This research explores the integrated design and the cost impacts to deliver energy efficiency in buildings. The objectives of this study are: to define the integrated design as a concept, system that can be differentiated from other systems in delivering the energy efficiency in buildings; to investigate the current situation of integrated design in order to identify and explain the barriers facing its adoption and implementation; to identify and explain the institutional barriers related to key players in this sector of industry, and evaluate their effects on the energy efficiency in buildings and be able to overcome the barriers and problems facing the sector of industry.

5.5 Conclusion related Methodology

In this methodology, the combined quantitative and qualitative methodology is set out. The chapter explores the analytical techniques that engaged in the study and clarifies the reasons behind selecting these methodologies. Maxwelland Loomis (2003), illustrates that the quantitative approach was selected to highlight the impact of groups of variables, namely, basic variables, institutional variables, variables related to research three elements (integrated design, energy efficiency and cost) adopted and problems facing industry. The qualitative approach was selected to conduct the based data collection and to examine the generated propositions and questions, which were based on the literature review and the based discussion. Teddlieet al. (2008), explain that the mixture of both the quantitative and qualitative approaches facilitated the crosschecking of the results of the one method against those of the other. The two approaches are jointly on balancing. Also the research methodology defined the justifications and the participant as units of analysis.

For the purpose of expand the understanding process to explain the fact; (Holstein, and Gubrium, 2000) illustrate the use of the qualitative approach widely and intensely will be the right path to focus in a close understanding perspective. Also, to recruit the quantitative approach adequately to answer questions that need the description of the used methods, as

well as in the use of survey, that's because the quantitative approach seeks to highlight the facts that could have seen by the largest number of individuals.

Heyvaret (2016) explains that the research could recognize the questionnaire items related to literature review lack data, all kinds of barriers, and the problems facing this sector of construction industry. The key assumptions that the research is consist of are
integrated design, energy efficiency in buildings, cost, and the problems facing construction industry.

One of the key assumptions in the research is that the integrated design needs to be applied properly because the barriers are not receptive to adopt it. The initial assumption and questions could create the barriers that impede to achieve the design of energy efficiency in buildings with low cost. This research's methodology outlined the analysis process for both the quantitative and qualitative approaches to the questionnaire's results. This is statistically assessed a level of confidence. As will be seen a statistical regression technique was also used to analyse the relations between the variables (Chilisa, 2011).

Participants are often chosen with the anticipation that they were meeting firm requirements. Chosen the model in qualitative research is always about a few of non- typical situations. Though, it is crucial in improving a real considerate for further choice could be formulating it. Qualitative approach generally is defined by the examining and the analytical. The outcomes are not usually to be employed and apply them in all situations (Denzin, and Lincoln, 2005). This examination was carried out to evaluate the impact of the variables on the take-up of whole process. Further analyses were carried out to give more evidence on different groups of variables.

The explanation of the qualitative approach, adopted by means of leading analysis to literature and questionnaire and interviews. For the purpose of expanding the understanding process to explain the fact; Gubrium, and Holstein, (2000) illustrate the use of the qualitative approach widely and intensely will be the right path to focus in a close understanding

perspective. Also, to recruit the quantitative approach adequately to answer questions that need the description of the used methods, as well as in the use of survey, that's because the quantitative approach seeks to highlight the facts that could have seen by the largest number of individuals. Selecting interviewees and participants in questionnaire from different projects was based on criteria (Dale et al*.,* 2015):

a. the process,
b. the type of projects,
c. the availability of staff,
d. the value and size of the project and
e. the availability of resources.

The research similarly clarified the propositions and questions for the questionnaire and defined the type of the relevant data and observations to be collected while leading the interviews with the professionals who play role in the accomplish of a number of projects. Hammersley (2008) explains that outcomes of the interviews were drawn up to adopt a manual form of analysing these findings, which is the result of extraction and classifying the information collected from the interviews. This includes a long-term government strategy for a decarbonized system, which works towards the integration of electricity, heat, and transportation systems.

The integration of the systems of efficient energy in construction industry, the government's strategies should work towards that integration. There is a significant lack of implementing energy efficiency in traditional buildings, which affect the performance and possibility of achieving the targets realistically; while the calls for the consideration of cost effectiveness ((Irani, et al., 2003). Lastly, this explored strength and criticism of the methodology and underlined the problems encountered in this research.

This study comprises two empirical approaches: a quantitative approach by means of structured questionnaire and a qualitative approach focusing on interviews. A questionnaire

was sent to one hundred and fifty professional persons from different construction firms in the UK. Of these active professionals, only one hundred and eight percent responded. Data analysis of the only one hundred and eight completed questionnaires employed a combination of approach ranging from simple approaches such as analysis of individual questions, to regression analysis, and maximum likelihood factor and variables analysis.

The qualitative approach was based on theoretical propositions and questions that were explored through the survey that based projects in the UK. Data and observations related the integrated design and institutional variables were collected by means of in-depth. The study analysed the interview texts by employing a manual from of content analysis to obtain reliable results. It organised the interviews' findings in tabulated framework and extracted the object structure, the qualifying structure(s), and the abstract elements for the variables related to each of the propositions. Results of the quantitative and qualitative findings were analysed, compared and systematically combined to identify and define the impact of Integrated Design, Energy Efficiency in Buildings, and the Cost.

This research makes the following contributions to knowledge: it presents a review of using integrated design and energy efficiency in buildings in the construction industry in the UK. And the underlying institutional framework; it highlights the recent emergence of applying the integrated design to deliver the energy efficiency in buildings, provides insights into the potential problems and barriers facing implementation of integrated design and assess the impact of these barriers on this sector of construction industry. The research engages with construction industry at 4 – level: Integrated design, Energy Efficiency in Buildings, Cost and Participants' experiences.

The study also provides a blueprint for facilitating the advancement, offering recommendations to all actors of the construction industry and the institutions to overcome barriers and potential problems facing the industry. Finally, the study suggests lessons to be learned from the evaluation of applying the integrated design to deliver energy efficiency in

buildings with low cost by means of knowledge and technology transfer, especially as related to the development of the construction industry.

The survey and interviews highlighted the integrated design role in the energy efficiency in the building process and provide evidences that barriers and potential problems related to this implementation do indeed exist. In this research concluded that some stakeholders have a lack of the experience and qualification in a number of areas of this knowledge. This lack of knowledge, combined with a lack of fixed institutional policies to monitor and regulate the industrial profession, which cause the hinder to the implementation of energy efficiency in buildings.

5.6 Conclusion related Methodology Analysis

The methodology analysis chapter employed the manual content analysis technique to analyse the interview test and relate the results with the findings of qualitative survey. The use of each text allowed the extraction of the object structure, the qualifying structure(s), and abstract elements for the variables. The frequencies of occurrence for each abstract element were calculated and cross-referenced in order to determine the relative strength and influence of their related variables on the introduction and take-up of implement integrated design of energy efficiency in buildings.

The content analysis demonstrates that most of the interviews share the view that the project's stakeholders were in some projects behave with authoritarian, which affect the work of other roles. These actors seem to believe in their way of design the energy efficiency in buildings. This research concludes that design like these projects is characterised by a negative influence of old design methods and impedes the introduction and development of integrated design.

The interviews indicate that promotion is not based only on merits and skills of professionals to delegate strong effects to elementary variables in this sector of construction industry

considerations. Furthermore, the relationships between these variables are based mutual advantage. The interviews demonstrate that the participants are not reflecting a personal view but their opinions depend on collective general experiences in industry.

The interviews confirm that the professionals play the most important role in this sector of construction industry. Also, indicate they have a lack of strategy, co-operation, and co-ordination. This research concludes that some of the professionals' negative characteristics impede the development and implementation of such projects.

Energy efficient buildings projects are not certain operations and the interviews with professionals in this sector of construction industry disclosed a lack of strategy or frequent changes in strategy. They indicate that all actors in this sector of construction industry routinely exhibit a lack of precise strategy. This research concludes that the dimensions of uncertainty avoidance impede the implementation of integrated design to deliver energy efficiency in buildings.

5.7 Conclusions related to the Construction Industry

This sector of construction industry derives very significance simply from the magnitude of its activities, in terms of workforce, investment and intensive interaction with other economic and related sectors. At present, the industry lacks systematic approach to financial management, general administration and proper utilisation of advanced technology. This makes this study particularly interesting as important attempt to change the present approach in the context of saving energy in least cost by using the integrated design.

The integrated design ability is considered an essential contributor to the development process by delivering the energy efficiency in buildings. Therefore, improving construction capacity and capability is of a fundamental importance to a developing any country.

The work done by the construction industry sector, size of sharp variations has shown in both the private and public sectors, and can be attributed to main factors: the impact of limited funds available, it runs forward, and the lack of comprehensive government policies to encourage the use of integrated design in delivering the energy efficiency in buildings.

Integrated design emerged in energy efficient buildings only popular use recently and has mainly been implemented by designers, owners and investors in private and public sector those who discontented with performance of the traditional methods. All public and private firms have acquired only modest knowledge and the function in the absence of an official or private institution to regulate their profession. At present, Integrated Design in Energy Efficiency in buildings is implemented in an irregular manner and gives some negative results to all participants, especially to designers, owners and investors.

5.8 Conclusion related to the Variables

The variables, including the experiences of workforce in industry, the level of education of people who involving in this sector of construction industry. Though eighty-nine percent of the participants have or more than fifteen years of experience, they have the opportunities to gain more experience in this field of industry. Only a small percent of participants who don't have that much experience in this field based on their executed projects. The implementation of energy efficiency in buildings faced an important problem; because of the lack of experience and knowledge. The small volume of investment is another barrier and potential problem, it is not enough to enable the industry to work and expand. This potential problem impedes the implementation of energy efficiency in buildings.

Almost sixty-seven percent of the participants are holding of BA or BSc degrees. Among the respondents, thirty-nine percent have experience that exceed twenty-five years, indicating that the most participants currently involved in this sector who graduated just before the emergence of energy efficiency in buildings concept.

5.9 Conclusion related to the Financial Barriers

The process of determining the appropriate policies to overcome barriers at all levels, require more developments in any move to build a new building, whether new or a renovation of old buildings, and this is something that requires a deepening and broadening people's understanding about the nature of the use of energy efficiency in buildings.

Financial barriers and maximum expenses can be a barrier to increase designing the energy efficiency in buildings. Demands for energy efficiency in buildings should be defined by major renovation and refurbishment of all the buildings; even they are varying in the usage, size, and type. The renovation will increase the chance of buildings to improve the feasible energy efficiency especially the existing buildings.

5.10 Conclusion related Skills

In addition, a lack of profession is deeply ingrained in some players of the construction industry and at the different skills levels in different sectors in this type of industry. In light of this overriding concern, this study advances the following definition of integrated design, energy efficiency in buildings, and cost, which similar and differs from the definition offered by other researchers.

The energy efficiency in buildings industry also lacks from the constant supply of well-trained engineers, skilled technical workers, and managers who working towards the gain of financial skills and experience through training, education and the transfer of knowledge from other places. Some contractors' firms are not associated with research and development institutions, except for some specific and infrequent co-operation agreements.

This conducted study demonstrates that designing the energy efficient buildings is a collective team works. The process of hiring promotion is based on skills and rules. These features and characteristics can impede the implementation of energy efficiency in buildings.

The outcomes of the analyses reveal that skilled employees or unskilled are on the staff of any of the teams participating in the construction projects.

Sometimes if there is a lack of skills creates confusion and conflicts among the workforce in industry as the participants explained, which leads to overruns in cost and time. Also, sometimes the workforce faced lack knowledge of construction industry, and integrated design knowledge in particular, as well as the energy efficiency in buildings. The participating consultants in the energy efficient buildings projects demonstrated the hesitation among the competition firms involved in such projects and examine if this best way by applying the integrated design.

5.11 Conclusion related Policies

Integrated policies to regulate the energy efficiency of buildings play major roles in the process of energy performance in buildings, and from the perspective of coverage the requirements for the building of efficient energy hand and the process of dealing with cases of the use of this energy in all stages of construction and all equipment and devices used during the construction and beyond. Often these policies include both new and old buildings and focus on how to improve these buildings through the development of costumed performance of services in buildings.

The process of determining the appropriate policies to overcome barriers at all levels, require more developments in any move to build a new building, whether new or a renovation of old buildings, and this is something that requires a deepening and broadening people's understanding about the nature of the use of energy efficiency in buildings.

Policies and initiatives can be the limits for continue effective development, which would result in increasing the energy efficiency in buildings. Also, with a least cost, the role of new technologies can improve the solutions that allows for full use of process of optimizing energy efficiency in buildings.

5.12 Conclusion related Cost

There is a rising in cost of the new building in last recent years, because there is a sharp rise in energy prices, making them more expensive compared to conventional buildings; and that were the reasons for the high prices of the fact that the establishment of the modern buildings include the additional thermal insulation, ventilation and heating systems costs. It was found from the completed projects that the additional costs of the homes in average has been repaid in 20-21 years in a simple repay time, and interest were repaid over 25 years.

The process of determining the consequences of the choices made by the design at the initial stages is considered one of the tasks of decision-makers and through which possess the ability to calculate age of the building costs. Despite the fact that the decision-makers often do not devote part of their time to oversee the implementation of construction stages operating or even finance. But different people involved in the implementation of the construction of the building, as well as prepare the size required for the work of the budgets, which gives a clear picture of who governs the operation of the building, and often involve incentives for the development of the division of energy use as the best.

Some of researchers think that the potentials of efficient costs will continue increase also year after year because there will still be need for renovation of existing buildings and because new buildings will continue to be constructed. In same way, to improve the efficiency in buildings there is a real demand to introduce policies that demonstrate the energy efficiency in buildings and overcome all barriers by emphasising the effective strategies.

This sector of construction industry derives very significance simply from the magnitude of its activities, in terms of workforce, investment and intensive interaction with other economic and related sectors. At present, the industry lacks systematic approach to financial management, general administration and proper utilisation of advanced technology. This

makes this study particularly interesting as important attempt to change the present approach in the context of saving energy in least cost by using the integrated design.

The work done by the construction industry sector, size of sharp variations has shown in both the private and public sectors, and can be attributed to main factors: the impact of limited funds available, it runs forward, and the lack of comprehensive government policies to encourage the use of integrated design in delivering the energy efficiency in buildings.

Cost is considered as one of the most important assessment criteria for projects of buildings with energy efficient, and that the process of improving the cost in a consistent way is a means of measuring the efficiency of the projects. The concept of investing in buildings with energy efficiency may contribute to the process of the evolution of the use of integrated design to achieve energy efficiency in buildings.
Costs play a major role in achieving the traditional construction practice. As well as the costs analysis includes a number of methods and measures of calculating the cost of consumption of energy efficiency and energy saving.

5.13 Summary

The findings presented below are organised according to propositions that formed the core of the study. Integrated policies to regulate the energy efficiency of buildings play major roles in the process of energy performance in buildings, and from the perspective of coverage the requirements for the building of efficient energy hand and the process of dealing with cases of the use of this energy in all stages of construction and all equipment and devices used during the construction and beyond. Often these policies include both new and old buildings and focus on how to improve these buildings through the development of costumed performance of services in buildings.

Since long time ago, the focus of building on how to maintain the reduction of energy consumption sector as a result of the fact that the buildings remain existing for long lifespan compared to the rest of other remains. The factor of technology also plays as one of the factors that contribute to increased energy efficiency so screeds up to reduce consumption to nearly half in conjunction with other factors. These days there is a real need to take the necessary procedures to enhance the possibility of use of the integrated design in both new and existing buildings and apply it with the cheapest costs.

In conclusion of this study, the aim has been achieved in different levels of research sections as the following paragraphs show that. Integrated design users who are participating in energy efficiency in buildings projects in a better situation than conventional design users. Unqualified designers are sometimes put their impacts in wrong way. The research reveals that the role of integrated design to deliver energy efficiency in buildings at least cost; the designers can magnify this role to be used in finding the constructive design method that meet the objectives of this study to deliver the energy efficiency in buildings. In addition, the study concludes that participating unqualified designers who have a lack to expertise in team-work, and do not understand the real meaning of co-operation and co-ordination, do not value time, also, have a lack of financial knowledge.

The research demonstrates the important role of the integrated design in delivering the energy efficiency in buildings in the construction industry in general and in particular. The research revealed additional problems related to the institutional resources' negative attitude towards implementing of energy efficiency in buildings, the absence of an institutional body to regulate the technical professions, and the lack of support by the public sectors for research and development.

Furthermore, sometimes consultants misunderstand this kind of environment. Besides that, some of them face the lack of the technical capabilities, and professionalism. Moreover, the survey and interviews reveal that consultants demonstrate their dissatisfaction. Some of them

are believe they are more versed in their profession and show a dictatorial attitude towards other parties, especially the other professions. Also, through responds gathered from participants can evaluate the skills required to enable an effective the integrated design to influence a workable strategy in the process.

Lessons can be learned in all area of research that there is a substantial room for convergence and future improvement. Compared to other saving energy systems, there is still quite some room for improvement of building standards.

All these factors impede the progress and development of the energy efficiency in buildings. Training the labour force, including the managers, will increase the efficiency and will help develop and improve the interaction between construction industries as a whole. Such action would facilitate using the integrated design and implementation of energy efficiency in buildings. This study has established the way of its contribution to expand knowledge grounds, through connect the discussion of the findings of this study to previous existing studies.

The recommendations of the study are set out in accordance to following sections.

5.14 Recommendation

In this research there are a number of recommendations that have been addressed to the stakeholders, and which is placed to overawe the institutional and other barriers. The use of integrated design influences the energy efficiency in buildings which comprise the construction industry. Research has set out a number of recommendations in the next sections.

5.14.1 Recommendations to this sector of construction industry

The use of integrated design to design the buildings with the energy efficiency at least cost should be promoted. Also, the process of integrated design should be reformed to enhance the use of energy efficient buildings in construction industry.

The opportunity for continuity should be formed for all elements of the process of using the integrated design to deliver energy efficiency in buildings; which is encourage all different kinds of investments that will support and compromised the design process.

To ensure providing the construction industry with a constant stream of skilled and non-skilled labour who are qualified enough to improve the productivity through boosting the objectives of the design process's elements in this sector of construction industry. Therefore, that does will restructure this sector labour rules and policies validity.

Involve a large number of workers in training programmes to support the construction industry with qualified engineers with capability to overcome all barriers and transfer the technology comprehension.

The stakeholders should understand their role in the integrated design process, and improve the quality of their performance. All will need to adopt a more strategic and systematic approach to improve their business if they wish to progress, develop, and thrive in a dynamic environment. Design dimensions are considered to be main elements influencing a strategic approach, and implications for all aspects of implementing the integrated design process.

If the above-mentioned recommendations are implemented, it is likely that the prospects are reachable if investors engaged in a reform and enforce existing law. Major changes need to be made to enhance the apply energy efficiency in buildings. However, so substantial changes are expected in the short-term.

5.14.2 Recommendations related to barriers

The stakeholders should be assured of not expanding in employing a large number of labours who are not skilled in the way of implementing the process of applying the energy efficiency in buildings by using the integrated design.

The stakeholders should develop incentives to encourage the workforce in order to attract more qualified processionals to join this sector of construction industry and overcome negative characteristics. If challenges are blotted out, reform efforts can advance and the wheel of investment can begin to increase and roll. This will also address the fundamental need for further trust and team-building.

The stakeholders should work to ensure the influences of skilled people, which encourage other skilled people from other industries to join this sector. There should be complete integration between the different professions of the design. Also the research recommends limiting the influence of extended the application of integrated design in delivering energy efficiency in buildings.

Exerted the efforts to extend overcome the barriers and empower the policies and legislation to utmost efforts that should be exerted to tackle legislation.
Also, efforts should be exerted to come up with practical solutions to the particular obstacles facing integrated design empowerment to deliver energy efficiency in buildings. The research recommends that designers should be encouraged to participate in construction sector without underestimating their capabilities.

Uncertainty about the role of integrated design, designers should abide by the law and always be punctual. Designers and all other professional in this sector of construction industry must be adopt to develop a technical of precision and punctuality that does not tolerate deviations from the law or the use of laws and regulations.

5.14.3 Recommendations related to recognised barriers

Integrated design should appoint the effective techniques to develop clear strategies and to deal professionally with the other participate factors in the process. This will reduce the lack

of flexibility in this sector of the construction industry and generally in delivering the efficient energy buildings process in particular.

Stakeholders should retrain the services engineers of the integrated design from the first moment a project is conceived. This will reduce conflicts among teams in the integrated design process and overcome the barriers to the implementations of energy efficiency in buildings. Designers should co-operate, co-ordinate and facilitate the implementation of a proper design process.

To implement the integrated design process, special attention should be given to outlining and defining of the responsibility for each party. This is especially important for projects in this sector of construction industry.

5.14.4 Recommendations to stakeholders

The stakeholders that currently adopting the approach of energy efficiency in buildings should take immediate action with the help of all those concerned, especially the public sector, to regulate this process. This body would monitor and regulate the practitioners and protect their interests. It should also accredit the interests of the other parties involved in this process, as well as the general concepts about reducing of increasing the cost.

Stakeholders should enhance the capabilities of using the integrated design in the achievement of efficient energy buildings, expand the types of services for this kind of buildings can offer, and enrich the knowledge of public in the various areas of cost can play in this application. This would enable them overcome **the present lack of** knowledge using the integrated design in such kind of buildings or to employ these services when they are required.

To facilitate the widened of use the energy efficiency in buildings, stakeholders should hire experienced professionals who are qualified in this field and are capable of supporting the other new participants in this sector of construction industry.

References

Acharya, N. K.; Lee, Y. D.; Im H. M**., (**2006**).** Conflicting factors in construction projects: Korean perspective. South Korea: Emerald Group Publishing Limited.

Addis. B., (2007). Building: 3000 years of Design Engineering and Construction. US: Phaidon Publications.

ADEME (L'Agence De l'Environnement Et De la Maîtrisel' Énergie), (2007). Evaluation of Energy Efficiency in the EU-15*: Indicators and Measures*, Paris, France. [Online] available at <www.odyssee-indicators.org/Publication/chapters.php> [accessed 28th January 2013].

Aebischer**,** B., G. Henderson, and D. Catenazzi, (2006). Impact of climate change on energy demand in the Swiss service sector - and application to Europe. In Proceedings of the International Conference on (*Improving Energy Efficiency in Commercial Buildings*: IEECB '06), April 2006, Germany.

Alderfer**,** R. B., Eldridge, M. M.,. Starrs, T. J*,* (2000). *Making connections: Case studies of interconnection barriers and their impact on distributed power projects.* National Renewable Energy Laboratory, Golden, CO.

Attia, S., Beltrán, L., De Herde, A., and Hensen, J. (2009). Architect friendly: A comparison of ten different building performance simulation tools*.* Paper presented at the 11th International Building Performance Simulation Association Conference and Exhibition.

Amdurer, E. E., (2014). Positive transformation in The Face of Adversity: The Development of A Measure of Workplace Posttraumatic Growth. US: Ohio, Case Western Reserve University Publication.

Anderson T., (2012). Theory External and Validity. US: Journal of Academy of Marketing Science, Vol. 27, Issue 3, p. 367 – 376. Springer-Verlag Publication.

Aroul, R., and Hansz, J. (2011). Going Green – Impact on Residential Property Values: Thesis. US: USA Office, Energy Star, Journal of Real Estate Research, Vol. 39, Issue: 11, p.: 157-182.

Arvin, S. A. and House D. H. (2002). Modeling architectural design objectives in physically based space planning. US: Automation in Construction Journal. Vol.: 11, Issue: 2, p.: 213-225.

Atif, M.R. and Galasiu, A.D. (2003*)*. Energy performance of daylight-linked automatic lighting control systems in large atrium spaces: report on two field-monitored case studies. US; *Energy and Buildings Journal.* Issue: 35, p. 441-461.

Aurisicchio, M., Bracewell, R. H., & Wallace, K. M. (2006). Characterising in Detail the Information Requests of Engineering Designers Proceeding of IDETC'06. Canada: Quebec, ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference. ACM DL Digital Library online: [accessed 0n 04 March 2016].

Badescu, V. and B. Sicre, (2003). Renewable energy for passive house heating Part 1. Building description. Energy and Buildings magazine, issue: 35, p. 1077-1084.

Baker, N., Steemers, K., (2000). Energy and environment in architecture: a technical design guide. UK: E & FN Spon Ltd.

Balaras, C.A., (2001). Energy retrofit of a neoclassic office building - Social aspects and lessons learned. ASHRAE Transactions magazine, Vol.:107, Issue: 1, p. 191-197.

Banfi, S., M. Farsi, M. Filippini, and M. Jakob, (2006). Willingness to pay for energy-saving measures in residential buildings. Energy Economic. [Online] available at: <http://dx.doi.org/10.1016/j.eneco.2006.06.001>, accessed on 10 Feb. 2015.

Barnerjee, A. and B.D. Solomon, (2003). Eco-labelling for energy efficiency and sustainability. Energy Policy Magazine, Vol.: 22, p. 135-154.

Baumgartner, H., & Steenkamp, J. B. E. (2001). Response styles in marketing research: A cross-national investigation. US: Journal of Marketing Research, Vol.: 38, Issue: 2, p.: 127-136.

Bayazit, N., (2004). Investigating Design: A Review of Forty Years of Design Research. Massachusetts Institute of Technology Design Issues: Vol. 20, No. 1.

Bazjanac, V., (2008). Understanding the BIM in NBIMS. US: University of California, Lawerence Berkeley National Laboratory.

Becchi, A., Corradi, M., Foce, F., &Pedemonte, O., (2004). Construction History: Research Perspectives in Europe. Italy: Associazione Eduardo Benvenuto.

Bell**,** M. and R. Lowe, (2000). Energy efficient modernisation of housing: a UK case study. Energy and Buildings, No: 23, p. 144-157.

Bennett, F.L., (2012). The Management of Construction: a project lifecycle approach. UK: Oxford, Routledge.

Bentley (2009). Product Data Sheet: Bentley® Simulator V8iIndustry – Leading Building Energy Modelling and Simulation. Bentley. [Online]: ftp://ftp2.bentley.com/dist/collateral/Web/Building/BentleyTas/BentleyTA (accessed 06 April 2014).

Bergold, J., (2007). Participatory strategies in community psychology research - a short survey. In Proceedings from the 6th European Conference on Community Psychology. Poland: Opole, Opole University Press.

Bernstein**,** M.A. and Griffin, J. (2005). Regional differences in the price-elasticity of demand for energy. US: National Renewable Energy Laboratory.

Bertoldi, P., (2000). The European strategy for reducing standby losses in consumer electronics: status and results. US: Washington D.C. In Proceeding of the ACEEE 2000 Summer Study on Energy Efficiency in Buildings.

Bertoldi**,** P. and Starter O., (2003). Combining long term agreements with emissions trading: An overview of the current EU energy efficiency policies for the industrial sector and a proposal for a new industrial efficiency policy. US: Washington, D.C. In ACEEE 2003 Summer Study on Energy Efficiency in Industry.

Biesbroek. G.R, Termeer. C.J.A.M, Kabat. P, Klostermann.J.E.M, (2014). Institutional governance barriers for the development and implementation of climate adaptation strategies. Working paper for the International Human Dimensions Programme (IHDP) conference "*Earth System Governance: People, Places, and the Planet*". Netherlands: Amsterdam.

Billiet, J. B., & McClendon, M. McKee, J. (2000). Modelling acquiescence in measurement models for two balanced sets of items. Belgium*:* Structural Equation Modelling Journal. Vol.: 7, Issue: 4, p. 608- 628.

Binswanger, M., (2001). Technological progress and sustainable development: what about the rebound effect? US: Ecological Economics Journal. Vol.: 36, Issue: 1, p.: 122-135.

Birkeland, J. (2002). Design for Sustainability: A Sourcebook of Integrated Ecological Solutions. UK: Earthscan Publications.

Blessing, L. T. S.& Chakrabarti, A. (2009). DRM: a Design Research Methodology. London: Springer, Inc.

Blackwell, A. D; Eckert, C. M.; Bucciarelli, L. L and Earl, C. F. (2009). Witnesses to design: A phenomenology of comparative design. *e'Witnesses to design: A phenomenology of comparative design*. Design Issues, Vol.: 25, Issue: 1, p. 78–94.

Bloomberg, L. D., Volpe M. F., (2015). Completing Your Qualitative Dissertation: A Road Map from Beginning to End. CA, US: Sage Publications Inc.

Bordass**,** B., R. Cohen, M. Standeven, M., and Leaman, A. (2001). Assessing building performance in use 3: energy performance of the Probe buildings. Building Research and Information magazine, Vol.: 29, Issue: 2, p. 114-128.

Borg, Marit, Karlsson, Bengt; Kim; Hesook Suzie & McCormack, Brendan (2012). Opening up for many voices in knowledge construction. Germany: *Forum: Qualitative Social Research*, Vol.: 13, Issue:1, Art: 1, [Online] available on: http://nbn-resolving.de/urn:nbn:de:0114-fqs120117, [Date of access: 27th February, 2016].

Botta-Genoulaza, V., and Mille, P.-A., (2005). A Classification for Better Use of the Systems. Computer & Industrial Journal, Vol.: 56, Issue: 6, p.: 117-129.

Bourke, J., Kirby, A., Doran, J., (2016). SURVEY and QUESTIONNAIRE DESIGN: Collecting Primary Data to Answer Research Questions**.** Kindle Edition.

Bradburn, N., M., Sudman, S., Wansink, B., (2004). Asking Questions: The Definitive Guide to Questionnaire Design - For Market Research, Political Polls, and Social and Health Questionnaires**.** US: Jossey-Bass Publications**,** Kindle Edition.

Brauers, W. K. M., and Zavadskas, E. K., (2012). Multi-Objective Economic Evaluation of the European Union Member States. As Opposed to Credit Rating Agencies Opinions? Transformations in Business & Economics. Lithuania: University of Latvia, Vol.: 12, No.: 29 , p.: 234-256.

Braun, V., (2013). Successful Qualitative Research: A Practical Guide for Beginners. US: Sage Publications, Inc., Kindle Edition.

Braunoeller, B. F., Goertz C. (2000). The methodology of necessary conditions. American Journal of Political Science, Vol.: 44 Issue: 4, p.: 102-124.

Brinkmann, S., (2014). InterViews: Learning the Craft of Qualitative Research Interviews. UK: Sage Publications Inc., 3rd ed.

Brown, M.A., (2001). Market barriers to energy efficiency. *Energy Policy Journal*, Vol.: 31, Issue: 19, p. 791-802.

Brown, M., Wang, Y., (2015). Green Savings: How Policies and Markets Drive Energy Efficiency (Energy Resources, Technology, and Policy). Kindle Edition.

Bryman, A. (2006). Integrating quantitative and qualitative research: How is it done? Qualitative Research Journal, Vol.:6, Issue*:* 1, p. 97-113.

Burton, S., (2000). The Sociology of Energy, Buildings and the Environment: Constructing Knowledge, Designing Practice. US: NY, published by James &James.

CABE: Commission and Architecture and Built Environment, (2006). The Cost of Bad Design. UK: London. Printed by Ernest Bond Printing Ltd.

Campbell, J. with Holland, J. (eds). (2005). Methods in development research: Combining qualitative and quantitative approaches. UK: London: ITDG Publications.

CEC (California Energy Commission), (2005). Building Energy Efficiency Standards for Residential and Nonresidential Buildings. US: California, [Online]: available at <http: www.energy.ca.gov/title24>, [accessed on: 22nd March 2015].

Cheng, E., Li H., Love, P., and Irani, Z. (2001). Network communication in the construction of Complementary Methods Education Research. UK: Oxford: Routledge.

Chilisa, B., (2011). Indigenous Research Methodologies. US: Sage Publications, Inc., Kindle Edition.

Cheng, Z., Yao, S., Lin, J., Zeng, Y., & Eberlein, A. (2007). Formalization of Product Requirements: From Natural Language Descriptions to Formal Specifications. International Journal of *Manufacturing Research*. Vol.: 2, Issue*:* 3, p.: 404-427.

CITB, (2013). Altogether Stronger: Skills Needs Analysis for Construction: Executive Summary. UK: Construction Skills Publications.

Claire, E. & Ray, J. (2004). Engagement and empowerment, research and relevance: Comments on user-controlled research. UK: Research Policy and Planning Journal, Vol.: 22, Issue: 2, p. 5-13. [Online] available at: http://eprints.kingston.ac.uk/4049/ [Date of access: 7 January 2016].

Claridge**,** D.E., Liu, M., and Turner, W.D. (2003). Commissioning of existing buildings - state of the technology and its implementation. Japan: Kyoto. Proceedings of the International Short Symposium on HVAC Commissioning.

Claridge, D.E., M. Liu, S. Deng, W.D. Turner, J.S. Haberl, S.U. Lee, M. Abbas, H. Bruner, and B.V.S.U. Lee, (2001). Cutting heating and cooling use almost in half without capital expenditure in a previously retrofit building. European Council for an energy efficient economy, 2001 Summer Proceedings. ECEEE, No: 4, p. 62-71.

Clark, V. L. P., and Ivankova, N. V., (2015). Mixed Methods Research: A Guide to the Field. US: Mixed Methods Research Series. SAGE Publications Inc.

Cole, R.J., (2010). Environmental Assessment: shifting scales Chapter 18 in Ng, E. (ed.), Designing High-Density Cities: for social and environmental sustainability. London: Earthscan.

Collier, N., S., Collier, C., A., Halperin, D., A., (2007). Construction Funding: The Process of Real Estate Development, Appraisal, and Finance. US: New Jersey, John Wiley & Sons Publications, 4th ed.

Cooper, R., Evans, G., Boyko, C. (eds.), (2009). Designing Sustainable Cities. UK: Oxford, Blackwell Publishing.

Cosgrove, C. (2006). Energy Efficient Buildings a Top Priority. [Online] available at: <http:www.beehive.govt.nz>, accessed on 21st May 2014.

Creswell, J. W., (2002). Research Design Qualitative Quantitative and Mixed Method Approaches. London: Sage Publications Inc.; 2nd ed.

Creswell, J.W. (2011). Educational research. India: New Delhi: PHI Learning Private Limited.

Creswell, J. W., (2012). Qualitative Inquiry and Research Design: Choosing Among Five Approaches. UK: SAGE Publications Inc., Kindle Edition.

Creswell, J., (2013). Research Design: Qualitative, Quantitative, and Mixed Method Approaches. CA: Sage Publications Inc., 4th ed.

Cross, N., (2011). Design Thinking: Understanding How Designers Think and Work. UK: Published by Berg.

Dainty, A. D.; Moore, D.; Murray, M. (2006). Communication in Construction Theory and Practice. US: NY, Taylor & Francis Press, p. 272.

Danity, A., Moore, M., Muray, M., (2006). Communication in Construction: Theory and Practice. Kindle Edition.

Dale, L. D.; and Vope, M. F., (2015). Completing Your Qualitative Dissertation: A Road Map from Beginning to End. US: SAGE Publications, Inc. 3rd ed.

Darby S. (2003). Making sense of energy advice: Time to turn down energy demand. France: Saint-Raphaël, European Council for an Energy Efficient Economy, in eceee 2003 Summer Study.

Dasgupta, A., (2013). Proceedings of the 7th International Conference on Energy Efficiency in Commercial Buildings (IEECB). Luxembourg: Publications Office of the European Union.

Davies, M; and Hughes N., (2014). Doing A Successful RESEARCH PROJECT Using Qualitative OR Quantitative Methods. US: NY, Palgrave McMillan, 2nd ed.

De Dear**,** R.J. and Brager G.S., (2004). Developing an adaptive model of thermal comfort and preference. *ASHRAE Transactions*, No.: 104, (Part 1A), p. 145-167.

DEFRA/ UK: Department for Environment, Food and Rural Affairs (2004). Framework for sustainable development on the Government estate, Part E – Energy. UK: Sustainable Development Unit Department for Environment Food and Rural Affairs.

DEFRA **(**2006). Review and development of carbon abatement curves for available technologies as part of the Energy Efficiency Innovation Review. Final Report by ENVIROS Consulting Ltd. [Online] available at: <https://www.yumpu.com/en/document/view/8077342/**review**-and-development-of-carbon-abatement-curves-for-available-technologies-as-part-of-the-energy-efficiency-innovation-review> accessed on 22nd Sep.2015.

De Lit, P.; Delchambre, A. (2011). Integrated Design of a Product Family and its Assembly System. Belgium: Brussels. Springer Science & Business Media.

Del Monte, B. (2009). Integrated Design & Construction Teams Achieve Sustainability Goals. American Institute of Architects (AIA) journal, Vol. 8, p.118-123.

Deng, Y., Li, Z., Quigley, J. M., (2012). Economic returns to energy-efficiency investments in the housing market: Evidence from Singapore. Journal of Regional Science and Urban Economics. Vol. 42 (2012) p.: 506–515.

Dentith, A., Measor, M., OMalley, M. P., (2004). The Research Imagination Amid Dilemmas of Engaging Young People in Critical Participatory Work. UK: Research Policy and Planning Journal, Vol.: 22, Issue: 2, p.5-13. Publisher: Social Services Research Group.

Denzin, N. K., and Lincoln, Y. S. (2005). Qualitative research. New Delhi: Sage Publication.

Denzin, N. K. & Lincoln, Y. S. (2005). Introduction: The discipline and practice of qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), "*The Sage Handbook of Qualitative Research"*. US: CA, Sage, Thousand Oaks, (3rd ed.), p. 12-44.

Denzin, N. and Lincoln, K.; (2010). Grounded theory methodology and method. UK: Saga Publications Inc.

Department for Communities and Local Government (DCLG), (2010). Code for sustainable homes. London: Department for Communities and Local Government Publications.
Department of Energy and Climate Change (DECC), (2012)**.** Science and innovation strategy**.** London: Crown.

Deutsch, C.; Brix, H.; Ito, T.; Frenzel, H.; Thompson, L., (2011). Climate-Forced Variability of Ocean Hypoxia. US: Atlanta, Georgia Institute of Technology Press, Science Journal, Vol.: 331, Issue: 6039, p.: 236 -249

Deutsch, R., (2001). BIM and Integrated Design: Strategies for Architectural Practice. US: John Wiley & Sons, 1st ed.

Dietz, Tj. (2010). Narrowing the US energy efficiency gap. US: Proc Natl Acad Sci, No: 97, p.: 507-529.

Dobbelsteen, A., V. D., Dorest, M., V., Timmeren, A., V. (2009). Smart Building in a Changing Climate. Netherlands: Techne Press Publications; 2nd ed.

Don Kumaragamage, Y. (2011). Design Manual Vol. 1. US: Indiana University Press.

Dodoo A., Gustavsson L., and Sathre R., (2010). Life cycle primary energy implication of retrofitting a Swedish apartment building to passive house standard. Sweden: Mis Sweden University, Resources, Conservation and Recycling Journal, Vol.: 54, Issue: 12, p.: 1512-1516.

Domegan, C; and Fleming, D., (2007). Marketing Research in Ireland**:** Theory and Practice.

US: M. H. Gill & Company U. C. Marketing Research.

Dorst, K.& Cross, N. (2001). Creativity in the Design Process: Co-Evolution of Problem-Solution. Design Studies, Vol.: 22, Issue: 5, p.: 315-329.

Dreiseitl, H., Venhaus H. L., (2012). Designing the Sustainable Site: Integrated Design Strategies for Small Scale Site and Residential Landscapes. US: John Wiley & Sons.

Energy and Atmosphere Programme of United Nations Development Programme (EAP UNDP)**,** (2000). "*Sustainable energy strategies: materials for decision-makers*". US: Energy and Atmosphere Programme of United Nations Development Programme, Chapter 4, p.: 38.

Earl, C; Song, D. P. and Hicks, C. (2003). Planning Complex Engineer- to-order products. In: Gogu, Grigore; Coutellier, Daniel; Chedmail, Patrick and Ray, Pascal eds. "*Recent Advances in Integrated Design and Manufacturing in Mechanical Engineering"*. Netherlands: Dordecht, Kluwer, p. 463–472.

Edelson, D.C. (2002). Design Research: What We Learn, When. US: Journal of the Learning Sciences Vol. 11, Issue: 1, p.: :105-121.

Edwards, B., (2001). Green Architecture – An international Comparison. US: John Wiley & Sons.

Environment-Based Design (EBD), (2015). a Methodology for Transdisciplinary Design. US: Journal of Integrated Design and Process Science Vol.: 19, Issue: 1, p.: 41-47.

Environment and Energy Study Institute (EESI), (2006). Energy-Efficient Buildings: Using whole building design to reduce energy consumption in homes and offices. US: Washington DC, Eesi.org.

Emmitt, S.; and Gorse, C. A. (2003). Construction communication. UK: Wiley-Blackwell.

Environment and Energy Study Institute (EESI), (2006). Energy-Efficient Buildings: Using whole building design to reduce energy consumption in homes and offices. US: Washington DC. [Online] available at: <http//: Eesi.org>, accessed on 21st Oct. 2015.

Eris, O. (2004). Effective Inquiry for Innovative Engineering Design. US: Boston, Kluwer Academic Publishers.

Faulkner, A. (2004). The ethics of survivor research. Guidelines for the ethical conduct of research carried out by mental health service users and survivors. UK: Bristol, The Policy Press, [Online] available at : <http://www.jrf.org.uk/publications/browse/category/u/user-involvement> [Date of access: December 18, 2015].

Fawkes, S. (2013).**"***Energy Efficiency***".** UK: Gower Publishing Ltd.

Fellows. R. F. F.; Liu A. M. M., (2015). Research Methods for Construction. UK: Willey Blackwell Publications, 4th ed.

Filippini, M., & Hunt, L. C. (2011). Energy demand and energy efficiency in the OECD countries: a stochastic demand frontier approach. US: Energy Association, Energy Journal, Vol. 32, Issue: 2, p.: 203-228.

Fischer, C.T. (Ed.) (2005). Qualitative research methods for psychologists: Introduction through empirical studies. US: MA, Academic Press in an imprint of Elsevier.

Finnveden, G., Nilssonb M., Johanssona J., Perssonb A., Moberga A., Carlssond, T., (2003). Strategic environmental assessment methodologies—applications within the energy sector. US: Environmental Impact Assessment Review, Vol. 23, Issue 1, p. 91–123.

Flick, U. (2006). An introduction to qualitative research. UK: London: SAGE Publication.

Florides, G.A., S.A. Tassou, S.A. Kalogirou, and L.C. Wrobel, (2002). Measures used to lower building energy consumption and their cost effectiveness. Applied Energy, No.: 51, p. 204-232.

Floyd J., Fowler, (2003). Survey Research Methods (Applied Social Research Methods). US: SAGE Publications, Inc., 5th ed.

Floyd J., Fowler, J., (2014). Designing Questions to be Good Measures. US: CA, Survey Research Methods. Sage Publications Inc.

Flyvbjerg, B. (2006). Five Misunderstandings about Case Study Research. Qualitative Inquiry, Vol.: 12, No.: 2, p.: 427- 456.

Franklin, M. I. (2012). Understanding Research: Coping with the Quantitative - Qualitative Divide. UK: London: Routledge Publications.

Friedman, K. (2000). Creating design knowledge: from research into practice. IDATER 2000: International Conference on Design and Technology Educational Research and Development. UK: Loughborough, Loughborough University: 312-334.

Garcia, A., Alzate, J.M., Barrera, J., (2012). Regulatory design and incentives for renewable energy. US*:* Journal of *Regulatory Economics*, Vol**.:** 41, Issue: 6, p.: 315–336.

Gary, T. (2009). Your Research Project. US: CA, Thousand Oaks: Sage Publication Inc.

GEA: Guyana Energy Agency, (2014). Achieving Climate, Environmental and Economic Resilience through Sustainable Energy. Guyana: GEA Publications.

Geller**,** H., P. Harrington, Rosenfeld A.H., Tanishimad S. and Unander F., (2006). Polices for increasing energy efficiency: Thirty years of experience in OECD countries. *Energy Policy Journal*, Vol.: 34, Issue: 5, p.: 465-472.

Geller, H. and Attali S., (2005). The experience with energy efficiency policies and programmes in IEA countries: learning from the critics. France: Paris, IEA Learning from the critics. Paris: International Energy Agency Information Paper.

Georgiev, G. V., Taura, T., Chakrabarti, A., & Nagai, Y. (2008). Method of Design through Structuring of Meanings. Proceedings of the ASME 2008 International Design Engineering Technical Conferences & Computers and Technical Conferences & Computers and Information in Engineering Conference. Canada: Quebec.

Gero, J. S. and Kannengiesser, U., (2004). The Situated Function-Behaviour-Structure Framework. Design Studies. Integrated Design and Process Science Journal, Vol.: 25, Issue: 6, p.: 373-391.

Gero, J. S. and R. Sosa (2002). Creative design situations: artificial creativity in communities of design agents. US: New York, Prentice Hall.

Gillingham, k., K., Newell, R., G., Palmer, K., (2009). *Energy Efficiency Economics and Policy*. US: Annual Review of Resource Economics. Vol. 1, Issue: 1, p.: 487- 499.
Gillingham**,** K., Newell R., Palmer K., (2005). The effectiveness and cost of energy efficiency programmes. Resources. Resources for the Future, Technical paper. (PDF), researchgate.net.

Glaser, B. G., Strauss, A. L., (2008). The Discovery of Grounded Theory: Strategies for Qualitative Research. US: Aldine Publishing Company.

Golafshani, N., (2003). Understanding Reliability and Validity in Qualitative Research. Canada: University of Toronto Press. The Qualitative Report, Vol. 8, No: 4.

Goldman**,** C., Hopper N., and Osborn J., (2005). Review of US ESCO industry market trends: an empirical analysis of project data. Energy Policy, No: 33, p. 244-262.

Goldschmidt, G. and Tatsa, D. (2005). How good are good ideas? Correlates of design creativity. Design Studies Journal, Vol.: 26, Issue: 6, p. 365-383.

Grauch, V. J. S., Rodriguez, B. D., and Wooden, J. L., (2003). Geophysical and isotopic constraints on crustal structure related to mineral trends in north-central Nevada and implications for tectonic history: *Economic Geology*. Vol.: 91, p. 143-160.

Gray C. D. Kinnear, P. R, (2006). SPSS 14 Made Simple, UK: Oxford, Routledge Taylor & Francis Group Ltd.

Gorb, P., (2012). Design Management: Papers from the London Business School. IDBM papers Vol. 2. Finland: Finland, Published by IDBM Program, Aalto University Printed by Aldus Helsinki.

Great Britain: Parliament: House of Commons: Environmental Audit Committee, (2009). Green Jobs and Skills: Oral and Written Evidence v. 2: Second Report of Session 2009-10. UK: Publisher: Stationery Office Books.

Greening, L. A.; Greene, D. L.; Difiglio, C. (2000). Energy efficiency and consumption-the rebound effect-a survey. US: Energy Policy Journal: 23, Issue: 4, p 527–543.

Gubrium, J. F. and Holstein, J. A., (2000). The New Language of Qualitative Method. Kindle Edition.

Gustavsson L., and Joelsson A. (2010). Life cycle primary energy analysis of residential Buildings. Energy and Buildings Journal, Vol.: 42, Issue: 2, p.: 301-311.

Guy, S., Shove, E., (2000). Research in Global Environmental Change. Published by Routledge Inc.

Halpin**,** D. W., Senior, B. A. (2010). Construction Management. US: Hamilton Printing.

Hamel, J., Dufour, S., & Fortin, D., (2015). Case study methods. Kindle Edition.

Hammersley, M. (2008). Questioning Qualitative Inquiry. London: Sage Inc.

Hammersley, M. (2013). What is qualitative research? UK: London, Bloomsbury Publication.

Handford, M. and Petr M. (2015). Problem-Solving Discourse on an International Construction Site. Australia: Patterns and Practice for Specific Purposes, Vol.: 18, p. 85-98.

Hanson, W. E., Creswell J. W., Plano Clark V. L, Petska K. P., and Creswell J. D. (2005). Mixed methods research designs in counselling psychology. Journal of Counselling Psychology, Vol.: 25, Issue: 12, p.: 422-434.

Hardell. R. and Fors, J. (2005). How should energy efficiency be defined? Sweden: Stockholm University Press.

Hardy, T., (1983). Design Strategy. US: Auburn University Press.

Harding, C., (2015). Integrated Design & Construction - Single Responsibility: A Code of Practice. US: Wiley Inc.

Hardell. R. and Fors, J. (2005). How should energy efficiency be defined? US: Energy Research Journal, Vol.: 9, Issue: 3, p.: 382-410

Harris**,** J. and Johnson, F., (2000). Potential energy, cost, and CO_2 savings from energy-efficient government purchasing. US: CA, In Proceedings of the ACEEE Summer Study on Energy-efficient Buildings.

Harvey, L.D.D., (2006). A Handbook on low-energy buildings and district energy systems: fundamentals, techniques, and examples. UK: London, James and James Publications.

Hennie, B. R. (2009). Analysis in Qualitative Research. US: SAGE Publications.

Heine, S. J., Lehman, D. R., Peng, K., & Greenholtz, J. (2002). What's wrong with cross cultural comparisons of subjective Likert scales?: The reference-group effect. US: Journal of Personality and Social Psychology, Vol.: 82, Issue: 6, p. 903-918.

Heiselberg, P. (2009). Part 1 Responsive Building Concepts. Denmark: A Aalborg University.

Hermelink, A., Schimschar, S., Boermans, T. (Ecofys), Pagliano, L., Zangheri, P., Armani, R. (Politecnico di Milano / eERG), (University of Wuppertal), (2012). Towards nearly zero-energy buildings: Definition of Common Principles under the EPBD. Final report, *ECOFY ordered by the European Commission, EU Journal* Vol.: 14 February 2013.

Herring, H. and Robin, R. (2007). Technological innovation, energy efficient design and the rebound effect. UK: London, Open University, *Technovation Journal*, Vol.: 27, Issue: 4, p. 146-158.

Heyvaret M., Hannes K., Onghena P., (2016). Using Mixed Methods Research Synthesis for Literature Reviews (Mixed Methods Research Series. Sage Publications, Inc., Kindle Edition.

Higgin, J., Jessop, N., (2013). Communication in the Building Industry. Kindle Edition.

Hoffman, A. (2003). Research for Writers. UK: London: A&C Black Publishers Limited. p. 4–5.

Hofstede, G., Hofstede, G. J., Minkov, M., (2010). Cultures and Organizations: Software of the Mind. US: McGraw Hills Books, 3rd ed.

Holford, J.M. and Hunt, G.R. (2003). Fundamental atrium design for natural ventilation. *Building and Environment Journal*, No.: 26, p. 223-236.

Holliday, A. R. (2007). Doing and Writing Qualitative Research. UK: London: Sage Publications. *2nd ed*.

Holstein, J. A. and Gubrium J. F., eds. (2012). Varieties of Narrative Analysis. US: CA, Sage, Thousand Oaks.

Hong, S. H.; Oreszczyn, T.; Ridley, I., (2006). The impact of energy efficient refurbishment on the space heating fuel consumption in English dwellings. US: *Energy and Buildings Journal.* Vol.: 38, Issue: 10, p.: 361-379.

Horst, W. and Rittel, J., (2013). Thinking Design; Transdisciplinary Concepts for Planners and Designers. Germany: *Board of International Research in Design*.

Howell, K., E., (2012). An Introduction to the Philosophy of Methodology. UK: Saga Publication Ltd., 1st ed, Kindle Edition. [Online] available at: https://www.revolvy.com/main/index.php?s=Network%20communication%20in%20the%20construction%20industry.%20Within%20Construction,%20information%20is%20exceptionally%20diverse%20given%20the%20huge%20number%20of%20parties%20involved%20with%20the%20Construction%20Operations%20Corporate&stype=topics. [Date of access: March 11, 2016].

Huang, Y. (2012). Methodology of Climatic Urban Design for Buildings Energy Efficiency: Taking Urban Districts in Hot-summer And Cold-winter Area In China For Example. Lambert Academic Publications, GmbH.

Hueerl, E., (2001). The Shorter Logical Investigations (International Library of Philosophy). Published by Routledge, London, UK

Hunt, E. F., and Colander, D. C., (2013). Social Science: An Introduction to the Study of Science. US: Routledge Press, 15th ed.

Hunter, L., Emerald, E., Martin, G., (2013). Participatory Activist Research in Globalised World: Social Change Through the Cultural Professions. US: New York: Springer Science + Business Media Dordrecht.

IEA: International Energy Agency, (2008). Worldwide Trends in Energy Use and Efficiency: Key Insights. [Online] available at: <www.iea.org/publications/freepublications/.../Indicators_2008-**1**.pdf>[accessed 21st January 2013]. International Energy Agency, (2016). Performance Evaluation of Day lighting Systems. Task 21, Energy Conservation in Buildings & Community Systems, Annex 29, Subtask A. page 32 (integrated building design).

Irani, Z., Themistocleous, M., and Love, P. E., (2003). The Impact of Enterprise Application Integration on Information System Lifecycles. Inf. Manage., 41 (2), pp. 177–187.

(IWGEECE), (2000). Scenarios for a Clean Energy Future. Published by U.S. Department of Energy.

Jackson, A., Y., Mazzei, L. A., (2012). Thinking with Theory in Qualitative Research: Viewing Data Across Multiple Perspectives. US: Routledge Publishing, 1st ed.

Jakob**,** M., Jochem, E., Honegger, A., Baumgartner, Menti, U., Plüss, I., (2006). Marginal costs of Energy-efficiency measures and improved building technology for buildings of the commercial sector. Switzerland: Zurich, Amstein+Walthert, HTA Luzern on behalf of Swiss Federal Office of Energy (SFOE), Zürich/Bern.

Jeruchim, M. C., Balaban P., Shanmugan K. S., (2000). Simulation of Communication Systems: Modelling, Methodology and Techniques (Information Technology: Transmission, Processing and Storage). US: Springer Publications, 2nd ed.

Joel Ann, T., and Gail, L. (2013). Planning and Conducting Integrated Design (ID) Charrettes. Whole Building Design Guide. US: National Institute of Building Sciences.

Johnson, J., Eckert, C. M., and Earl, C. F. (2001). Complexity in Planning Design Process. In: Proceedings of the 13th International Conference on Engineering Design: Design Research – Theories, Methodologies and Product Modelling (ICED'01). UK: Glasgow, Open University, p. 161-174.

Kaming, K., Robinson, H., Symonds, B., Gilbertson, B., (2015). Design Economics for the Built Environment. UK: Published by John Wiley& Sons.

Keeler, M.; Vaidya, P. (2016). Fundamentals of Integrated Design for Sustainable Building. US: New Jersey, John Wiley & Sons. 2nd ed.

Keirstead J., (2006). Evaluating the applicability of integrated domestic energy consumption frameworks in the UK. Energy policy No.: 34, p.: 306-317.

Kelly, A. E., Lesh, R. A., Baek, J. Y., (2008*)*. Handbook of Design Research Methods in Education: Innovations in Science, Technology, Engineering, and Mathematics Learning and Teaching. UK: Routledge; 1ST ed.

Kemmelmeier, M., Burnstein, E., Krumov, K., Kanagawa, C., Hirshberg, M., Erb, H., et al. (2003). Individualism, collectivism, and authoritarianism in seven societies. US: *Journal of Cross-Cultural Psychology,* Vol.: 34, Issue: 3, p.: 287-302.

Keyson, D. V., Al Mahmud, A., Hoogh, M., Luxen, R., (2013). Designing a Portable Low Cost Home Energy Measurement Toolkit. US: *Procedia Computer Science Journal*, Vol.: 19, Issue: 3, p.: 234-253.

Kiel, M. (2008). Integrated Design in Contemporary Architecture. UK: London, Princeton Architectural Press.

King, N. and Horrocks, C., (2010). Interviews in Qualitative Research. US: Washington DC, SAGE Publications, 1st ed.

Kinnear, P. R, Gray, C. D., (2002): Practical Social Investigation: Qualitative and Quantitative Methods. UK: Pearson Education Limited.

Kinnear, P. R.; Gray, C. D., (2011). IBM SPSS Statistics 19 Made Simple. 1st ed. UK: Oxford, Routledge Taylor & Francis Group Ltd.

Knudstrup M. A. (2004). Integrated Design Process in PBL. Denmark: Aalborg University. The Aalborg University Journal, Vol.: 3, 2004, Aalborg University Press.

Krepchin, (2006). Integrated Building Design: Can Teamwork Lead to High-Performance, Cost-Effective Buildings? E SOURCE, [online] accessed on 05th April 2014.

Krippendorf. K. H. (2012). Content Analysis: An Introduction to its Methodology. UK: London: Sage Publications Ltd, 3rdedition.

Krishnaswamy, K. N., Sivakumar, A. I., Mathirajan, M., (2009). Management Research Methodology. India: Pearson India Publishing.

Dobbelsteen, A., V., D., Kristinsson, J., (2012). Integrated Sustainable Design. Netherlands: Publisher: Delft digital press, Vol.: 1; 1st ed.

Lalwani, A., Shavitt, S., & Johnson, T. (2006). What is the relation between cultural orientation and socially desirable responding? US: *Journal of Personality and Social Psychology*, Vol.: 90, Issue: 1, p.: 212-227.

Larsson, N. (2005). Integrated Design Process. [Online] available at: <www.iisbe.org/down/gbc2005/Other presentation/IDP overview.pdf> [accessed 12th December 2014].

Larsson, N. (2009). The Integrated Design Process; History and Analysis. iiSBE. [Online] available at: <http://www.iisbe.org/system/files/private/IDP%20development%20-%20Larsso> (accessed 27thMay 2013).

Lebjioui, S.; Eckert, C. M. and Earl, C. (2016). Understanding the relationship between design margins and trade-offs. In: Proceedings of the DESIGN 2016, 14th International Design Conference (Marjanovic, D.; Storga, M.; Pavkovic, N.; Bojcetic, N. and Skec, S. ,eds.), p. 417– 425.

Leither, J. A., (2013). An overview of the energy efficiency potential. US: *Environmental Innovation and Societal Transitions Journal*, Vol.: 9, p. 38-42.

Lesniewski, L. (2006). Report on Integrated Practice, American Institute of Architects. [Online] available at: <(http://www.aia.com/news/integrated-design-better-buildings-through-collaboration, [accessed 11th November 2013].

Levine M., Urge-Vorsatz D.; (2007). Residential and commercial buildings. UK: Cambridge, Cambridge University Press.

Lewis, M., (2004). Integrated Design. USA: *ASHRAE Journal*, Vol**.** September 2004.

Loseke, Donileen R. & Cahil, Spencer E. (2007). Qualitative manuscripts: Lessons learned. In Seale, C., Gobo, G., Gubrium, J. F., & Silverman D. (Eds.), *Qualitative Research Practice: Concise.* UK: London: Sage Publications, Inc., p. 491-506.

Lohnert, G., Dalkowski, A., Sutter, W. (2003). Integrated Design Process: A Guideline for Sustainable and Solar-Optimised Building Design. Germany: Berlin, International Energy Agency.

Lindlof, T. R., & Taylor, B. C. (2002). Qualitative communication research Methods. US: CA. Thousand Oaks, Sage Publications, Inc.

Linthicum, D. S., (2000). Enterprise Application Integration. US: Addison-Wesley, (Addison-Wesley information technology series).

Lombard, L. P., Ortiz, J., Pout, C., Termotecnia, G., Ingenieros, E., S., (2007). Energy-efficient Office Refurbishment: Designing for Comfort. Spain: Universidad de Sevilla, *Sustainable Energy Centre*, UK: London, Watford, BRE.

Lynne, P. (2005). How to Examine a Thesis? US: McGraw-Hill International, p. 79–85

Macaulay, D. R., (2008). Integrated Design. USA: WA, Seattle, Mithun, Ecotone Publishing. GEA, 2012

MacKenzie, F. (2010). Energy Efficiency in New and Existing Buildings: Comparative costs and CO2 savings. UK: HIS BRE Press.

Maher, M. and Tang, H.; (2003). Co-Evolution as a Computational and Cognitive Model of Design. Research in Engineering Design *Journal, number: 14*, 47-63.

Maher, M. L. (2000). A model of co-evolutionary design. US: *Journal of Engineering with Computers.* Vol.: 14, Issue: 7, p.: 95-102.

Mahoney, J; Goertz, G (2006). A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research. *Political Analysis magazine*. No.: 14, p.: 142–153.

Maier, H. R., (2013). What constitutes a good literature review and why does its quality. Australia: University of Aderlaide.

Maier, J. R. A. and Fadel, G. M. (2009). Affordance Based Design: A Relational Theory for Design. *Research in Engineering Design Journal*, Vol.: 20, Issue: 1, p.: 13-27.

Miles, M. B.; Huberman, A. M.; and Saldana, J., (2013). Qualitative Data Analysis A Methods Sourcebook. US: Washington D C, Arizona State University. SAGE Publication, 3rd ed.

Mangabeira, W. C., Lee, R., and Fielding M., (2004). Computer and Qualitative Research Adoption, Use and Representation. US: Sage Publications, Inc.

Marco, C. (2016). Smart Buildings: Advanced Materials and Nanotechnology to Improve Energy-Efficiency and Environmental Performance. UK: Oxford, Woodhead Publishing.

Margolin, V., (2002). Design As a Problem and Design As a Solution for Sustainability. Spain: Artículo escrito por Lantek.

Marshall, J. and Reason, P. (2007). Quality in research as taking an attitude of inquiry. *Management Research News Journal*, Vol.: 30, p. 368-380.

Marshall, C. and Rossman, G. B.,(2010). Designing Qualitative Research. US: CA, SAGE Publications, Inc. 5th ed.

Mason, J., (2002). Qualitative Researching. UK : Sage Publications Inc., 2nd ed.

McCartan, C.;Schubotz, D. & Murphy, J., (2012). The self-conscious researcher—Post-modern perspectives of participatory research with young people. Germany: *Forum: Qualitative Social Research Journal,* Vol.: 13, Issue: 1, Art. 9, p.: 305-321.

McCarthy, J. (2005). Individualism and collectivism: What do they have to do with counselling? US: Journal of Multicultural Counselling and Development, Vol. 33, Issue: 2, p.: 254-271.

McCloud, K., Hunt R., Suhr M., (2013). Old House Eco Handbook: A Practical Guide to Retrofitting for Energy- Efficiency & Sustainability. UK: Frances Lincoln Ltd.

McKim,R., H., (2007). Thinking Visually: A Strategy Manual for Problem Solving. US: New Jersey Published by John Wiley & Sons Inc. Hoboken.

McNeil, M. A., Letschert, V. E., Can de la Rue, S., Egan, C., (2009). Acting Globally: Potential Carbon Emissions Mitigation Impacts from an International Standards and Labelling Programme in Europe Council for an Energy Efficiency Economy. Belgium: European Council Publications.

Mitchell, M., L., Jolley, J., M., (2012). Research Design Explained. US: Cengage Learning Publishing; 8th ed.

Morgan, D.; Ataie, J.; Carder, P.; and Hoffman, K., (2013). Introducing Dyadic Interviews as a Method for Collecting Qualitative Data. US: SAGE Publication Inc.

Morse, J. M.; and Richards, L., (2002). ReadMe First for a User's Guide to Qualitative Methods. US: SAGE Publication, Inc.

Mumovic, D.; Santamouris, M. (2015). A Handbook of Sustainable Building Design and Engineering: An Integrated Approach to Energy, Health and Operational Performance

(BEST: Buildings Energy and Solar Technology). UK: Earthscan publisher, 1st ed., Kindle Edition.

Myers, M. D., (2008). Qualitative Research in Business and Management. UK: SAGE Publications Ltd.

Newson R.; King L.; Rychtnik L.; Bauman A. E.; Redman S.; Milat A. J.; Schroeder J.; Cohen, G.; Chapman S., (2015). A mixed methods study of the factors that influence whether intervention research has policy and practice impacts: perceptions of Australian researchers. Australia: *BMJ Journal*, No.: 5, p.: 288-301.

Onwuegbuzie A.; and Teddie C., (2003). A framework for analyzing data in mixed methods research. In *"Handbook on mixed methods in the behavioural and social science",* Tashakkori A. And Teddie C. US: CA, Sage Publications Inc., Thousand Oaks

Opie, C. (2004). Doing educational research. India: New Delhi: Vistaar Publications.

Oka T.; Yokoyama K.; Tamamoto M., (2016). Introduction of Annex 57- Evaluation of Embodied Energy/CO for Construction Worldwide and Measures to Reduce Them. Denmark: Aalborg. University of Aalborg. CLIMA2016.

Oppenheim, A. N., (2000). Questionnaire Design, Interviewing and Attitude Measurement. UK: London: Pinter Publications Ltd. 2nd ed.

Oxford Dictionaries.com. Integrated Design Definition. [Online] available at: <http://www.oxforddictionaries.com> [accessed on 21st April 2014].

Palmer M., (2011). Design the energy and environmental plan for Colorado's first green subdivision. US: USGBC Publishing, [Online] Available at

<http://www.usgbc.org/articles/us-green-building-council-announces-2013-class-leed-fellows> [accessed on 18th November 2013].

Patton, M. Q. (2002). Qualitative research and evaluation methods. US: CA, Thousand Oaks, Sage Publications. 3rd ed.

Pelletier C, Imbeault P, Tremblay A. (2003). Energy balance and pollution by organochlorines and polychlorinated biphenyls. Belgium: Copenhagen University Press. Obes Rev. No.: 4, p.: 17–24.

(Perkins B. + Will and Stantec Consulting), (2007). *Who's Green*? Canada Principles and Practice. UK: McGraw-Hill, Ecotone Publishing.

Plano Clark, V.; Creswell, J.W.; Gutmann, M.; and Hanson, W., (2003). Advanced mixed methods research designs. In A. Tashakkori and C Teddle (Eds.), (2003), *Handbook of mixed methods in social and behavioural research.* US: CA, Sage. Thousand Oaks. p. 297-324.

Polkinghorne, M. and Arnold, A., (2014). A Six Step Guide to Using Recursive Abstraction Applied to the Qualitative Analysis of Interview Data. UK: Poole, Bournemouth University.

Prindle, W.; Eldridge, M.; Eckhardt, M.; and Frederick, A. (2007). The Twin Pillars of Sustainable Energy: Energy Synergies between Energy Efficiency and Renewable Energy Technology and Policy. [Online] available at: Aceee.org. (PDF). access on 12th May 2014.

QG: Queensland Government, (2009). Climate Smart Home Services. Queensland Government Publications.

Ragin, C., C. (2014). The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies. US: CA, University of California Press. Kindle Edition.

PWaGSC: Public Works and Government Services Canada, (2011). Integrated Design Process (IDP). [Online] available at: http://www.tpsgc-pwgsc.ga.ca/biens-property/sngp-npms/conn-know/enviro/p. (accessed 25th July 2013).

Reed, B. (2004). Moving Towards Integrated Design in a Disintegrated World. [Online] available at: www.integrativedesign.net (accessed on: 12 Jan. 2015).

Remler, D. K., Ryzin, G. G. V., (2014). Research Methods in Practice: Strategies for Description and Causation. US: Sage Inc. Publication 2nd ed.

Rihoux, B. and Ragin, C. C. (2008). Configurational Comparative methods: Qualitative Comparative Analysis(QCA) and related techniques. US: CA, Thousand Oaks, Sage Publications Inc. Kindle Edition.

Rosenquist, G,. McNeil, M. A., Iyer, M. Meyers, S., and McMahon, J. E., (2004). Energy Efficiency Standards and Codes for Residential/Commercial Equipment and Buildings. US: CA, University of California: Lawrence Berkeley National Laboratory.

Roth, K., P. Llana, W. Detlef, and J. Brodrick, (2005). Automated whole building diagnostics. *ASHRAE Journal*, Vol.:**47,** Issue: 5, p.: 118-134.

Roth**,** K.W.; Goldstein F.; and Kleinman J., (2002). Energy consumption by office and communications equipment in commercial buildings. UK: Cambridge, In: Volume 1: Energy Consumption Baseline, Arthur D. Little Inc., Cambridge (MA), p.: 201 [Online] available at: <http://www.eere.energy.gov/buildings/info/documents/pdfs/office_telecom-vol1_final.pdf>, [accessed on 9 Jan., 2015].

Rowe, M.; Pease, W.; Cooper, M., (2007). Information and Communication Technologies for Economic and Regional Developments. US: Hershey, IGI Global Publications.

Ruane, J. M., (2016). Methods Essentials for Getting the Edge. UK: John Wiley & Sons Ltd.

Rudestam, K. E. and Newton, R. R., (2007). Surviving your dissertation. US: CA: Thousand Oaks: Sage Publications Inc.

Saladana, J., (2012). The Coding Manual for Qualitative Researchers. US: Sage Publications, Inc.

Saris, W. E.; Galhofer, I. N., (2014). Design, Evaluation, and Analysis of Questionnaires for Survey Research. US: Wiley Series in Survey Methodology, 2nd ed. Kindle Edition.

Savin-Baden, M. and Major, C. (2013). Qualitative research: The essential guide to theory and practice. UK: London, Rutledge Publications.

Schleich, J. and Gruber E., (2007). Beyond case studies: Barriers to energy efficiency in commerce and the services sectors. *Energy Economics Magazine*, Issue: 40, p. 187-208.

Saunders, R. (2002). Curious Design Agents and Artificial Creativity. Australia: Sydney University of Sydney. Department of Architectural and Design Science.

Saunders, H. D., (2005*)*. A Calculator for Energy Consumption Changes Arising from New Technologies. The B.E. *Journal of Economic Analysis & Policy*. Vol.: 5, Issue: 1, p.: 237-251.

Schlomann, B., Eichhammer, W., Gruber, E., Kling, N., Mannsbart, W., Stöckle, F., (2001): Evaluierung zur Umsetzung der Energieverbrauchskennzeichnungsverordung (EnVKV). Report on behalf of the Federal Ministry of Economics and Technology. Germany: Karlsruhe, Nuernberg.

Selkowitz S. (2005). Savings By Design Award Winners Integrate Energy Efficiency with Outstanding Design. US: CA: Berkeley. [Online] available at: www.savingsbydesign.com/awards-2003/index.html [accessed on 28/02/ 2016].

Seymour, E., and De Welde, K. (2016). Why doesn't knowing change anything? Constraints and resistance, leverage and sustainability. In G. C. Weaver, W. D. Burgess, A. L. Childress, & L. Slakey (eds.), *Transforming institutions: Undergraduate STEM education for the 21st century* (p. 462-484). US: Indiana, West Lafayette, Purdue University Press.

Shuttleworth, M., (2008). Definition of Research. [Online] available at: <http: www. Explorable.com>, accessed on 12th June 2014.

Silverman, D., (ed), (2011). Qualitative Research: Issues of Theory, Method and Practice. UK: London, Thousand Oaks; India: New Delhi, Sage Publications, 3rd ed.

Sincero, S. M., (2012). Advantages and Disadvantages of Surveys. [Online] available at: Explorable.com: https://explorable.com/advantages-and-disadvantages-of-surveys, [accessed on 19th March 2015].

Smithers, T. (2002). *"Synthesis in design. Artificial Intelligence in Design",* UK: Cambridge, Kluwer Publications.

Smith, J.; Flowers, P.; and Larkin, M., (2009). Interpretative Phenomenological Analysis: Theory, Method and Research. UK: SAGE Publications Ltd.

Snodgrass, A. and Coyne R. (2006). Interpretation in Architecture: Design as a Way of Thinking. UK: London, Routledge.

Sorrell S. (2007). The rebound effect: An assessment of the evidence for the economic-wide energy savings from improved energy efficiency. UK Energy Research Centre. [Online] available at: <www.ukerc.ac.uk/publications/the-rebound-effect-an-assessment-of-the-evidence-for-the-economic-wide-energy-saving-from-improved-energy-efficiency>. [accessed on: 18th August 2013].

Stansinoupolos P.; Smith M. H; Hargroves K.; Desha C., (2008). Whole System Design: An Integrated Approach to Sustainable Engineering. UK: Earthscan Publication.

Strauss, A.; and Corbin J., (2008). Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. CA: SAGE Publications Inc.; 3rd ed.

Stumpf, S. C.; and McDonnell, J. T., (2001). Talking about team framing: using argumentation to analyse and support experiential learning in early design episodes. *Design Studies Journal*, Vol.: 23, Issue: 1, p.: 25-41.

Suh, (2011), Malmqvist (2011). Requirements Management for the Design of Energy Efficient Buildings". Journal of *Information Technology in Construction, ITcon*, Vol.: 18, Issue: 5, p.: 108-131.
Sundramoorthy V, Cooper G, Linge N, (eds) (2011). Domesticating Energy-Monitoring Systems: Challenges and Design Concerns. IEEE Pervasive Computing No.:10, p.: 41-48.

Suresh, B. N., (2011). Integrated Design Aspects of Space Transportation System. India: John Wiley and Sons. 1st ed.

Syms, P., (2010). Land, Development and Design. UK: John Wiley and Sons.

Taskakkori, A.; and Teddie, C.; (eds). (2003). Handbook on mixed methods in the behavioural and social sciences. US: Sage Publications Inc.

Teddlie C.B.; Tashakkori A. M., (2008). Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioural Sciences. US: Sage Publications Inc.

Schmidt, D. (Fraunhofer Institute for Wind Energy Systems IWES), (2005-2010). Annex 49. IEA ECBCS Annex 49: Low Energy Systems for High Performance Buildings and Communities. [Online] Available at <www.annex49.com>, [accessed 05th November 2013].

Tichkiewitch, S.; Brissaud, D., (2003). Methods and Tools for Co-operative and Integrated Design. US: Kluwer Academic Publishers.

Trochim, W. M. K., (2002). What is The Research Knowledge Base? US: OH, Atonic Dog Publishing Cincinnati. 2nd ed.

UBC: University of British Columbia. (2000). A Beautiful Place to Inspire Sustainable Solutions. [Online] available at: http://www.sustain.ubc.ca/pdfs/liu (accesed on: 13 Apr. 2014).

UNEP DTIE: United Nations Environment Programme Division of Technology, Industry and Economics Sustainable Consumption & Production Branch; (2009). Buildings and Climate Change (Summary for Decision-Makers).

UN: United Nations, (2002). Global challenge global opportunity. Trends in sustainable development. Published by The United Nations Department of Economic and Social Affairs for the World Summit on Sustainable Development Johannesburg, 26th August – 4th September, 2002, [Online] available at: <http://www.un.org/esa/sustdev/publications/critical_trends_report_2002.pdf>, [accessed on 22 Feb. 2014].

Urge-Vorsatz, D.; and Miladinova G., (2005). Energy efficiency policy in an enlarged European Union: the Eastern perspective. In European Council for an energy efficient economy summer study, p. 223-235.

US Department of Energy Report/ Better Building, (2016). Moving Our Nation Forward, Fast Progress Report 2016. US: Department of Energy Publications.

Waterfield, P., (2011). The Energy Efficient Home: A Complete Guide. UK: The Crown Press Ltd. Publications.

Watson, D. and Labs, K. (2007). Climatic Building Design – Energy-Efficient Building Principles And Practice. [Online] available at: <*http//:www.jobexplorerbd.com/climatic-design-energy-efficient-building-principles-and-practice*> (PDF file), [accessed on 29th Apr. 2014].

Wengraf, T., (2001). Qualitative research interviewing. UK: London: Sage Publications, Inc.

White, T. L. and McBurney, D. H., (2012). *Research Method*. US: CA: Cengage Learning Publisher, 9th ed.

Wickens, T., D., (2004). Design and Analysis: A Researcher's Handbook. US: NJ, Pearson; 4th ed.

Wiid, J., and Diggines. C., (2010). Marketing Research. South Africa: Cape Town: Juta and Company.

World Energy Council. (2016). World Energy Resources, World Waste Energy 2016. UK.

Vajina, S. (2014). Integrated Design Engineering. Germany: Deutschland, University of Magdeburg Press.

Venhaus, H. L.; and Dreisitl, H., (2012). Designing the Sustainable Site: Integrated Design Strategies for Small Scale Sites and Residential Landscapes. US: New Jersey, John Wiley & Sons.

Vidar Lerum, (2007). High Building Performance. UK: Published by Wiley & Sons, Inc.

Viswanathan, M., (2005). What is Measurement? US: Measurement Error and Research Design, Sage Publications Inc.

Voss, k.; Musall, E. (2013). Understanding Net ZEB- Overview of existing definitions in EU/ Europe. Danmark: Bergische Universität, Wuppertal Publikation.

Yao, S. and Zeng, Y. (2007). Preliminary Study of Cognitive Model of Designer's Creativity by Using Formal Protocol Analysis. Germany: Berlin Springer Heidelberg.

Yan, B.& Zeng, Y. (2009). On the Structure of Design Conflicts. *The 12th World Conference on Integrated Design & Process Technology*, Germany, Karlsruhe.

Yin, R. K. (2006). Case study research: Design and methods. Canada: Newbury Park, SAGE Publications, Inc.

Yvonna S.; Lincoln, K,; Denzin, N., eds. (2005). The Sage Handbook of Qualitative Research. US: CA: Sage. Thousand Oaks, (3rd ed.).

Zamenopoulos, T. and Alexiou, K., (2007). Towards an anticipatory view of design. *Design Studies* Journal. Vol.: 28, Issue: 4, p.: 411- 436.

Zeng, Y., and Gu, P., (2001). An Environment Decomposition Based Approach to Design Concept Generation. Proceedings of 13th *International Conference on Engineering Design (ICED)*.

Zeng, Y., (2002). Axiomatic Theory of Design Modelling. US: Trans. SDPS. *Journal of Integration Design Process Science*, Vol.: 6, Issue: 3, p.:48-57.

Zeng, Y., (2004). Environment-Based Formulation of Design Problem. US: Trans. SDPS: *Journal of Integration Design Process Science*, Vol.: 8, Issue: (4), p: 122-137.

Zeng, Y. (2012). Editorial: Theories of and about Design. US: *Journal of Integrated Design and Process Science*, Vol.: 16, Issue: 3, p.: 147-161.

Zhu, S.; Yao, S. J.; and Zeng, Y. (2007). A Novel Approach to Quantifying Designer's Mental Stress in the Conceptual Design Process. US: Nevada, ASME International Design Engineering Technical Conferences 2007.

Bibliography

Alexander, C., (1978). A Pattern Language: Towns, Buildings. Construction (Centre for Environmental Structure Series). Printed in the US.

American National Standards Institute (ANSI), (2007). *MTS 1.0 WSIP Guide – 2007.* Whole Systems Integrated Process Guide for Sustainable Buildings. [Online] Available at <http://www.delvingdeeper.org/pdfs/wsip.pdf >, [accessed 05th November 2013].

Andersen, I. (2000). A Multi-Criteria Decision Making Method for Solar Building Design. US: Trondheim, Department of Architecture, History and Technology, NTNU Journal.

Anderson, J., and Narasimhan, R., (1979). Assessing Project Implementation Risk: A Methodological Approach. Management Science magazine, Vol. 25(6), pp. 512-521.

ASCE: Journal of American Society of Civil Engineering, (2004). Analysis of Owner's Design and Construction Quality Management Approaches in Design/ Build Projects. US: Journal of ASEC, Vol. 39, Issue: 4, pp 459-468.

Balcomb, D., Andresen, I., Hestnes, A. G., Aggerholm, S. (2002). Multi-Criteria Decision Making - A Method for Specifying and Prioritising Criteria and Goals in Design. Renewable and Sustainability Energy Journal, Vol.: 8, Issue: 5, p.401-431

Baskarada, S. (2014). Qualitative Case Study Guidelines. US: The Qualitative Report, Vol. 19, Issue: 40, pp 1-25. Sage Publications Inc., Kindle Edition.

Bastian, H.; Glasziou, P.; Chalmers, I., (2010). Seventy-five trials and eleven systematic reviews a day: how will we ever keep up? Poland: journal.pmed. Vol. 7, Issue: 3, p.: 177-192.

Beared, C. and C. Easingwood, (1980). Improving grounded theory: Methods and methodology. UK: Manchester, University of Manchester, Manchester Business School, Working paper 177.

Bjornholt, M; Farstad, G.R. (2012). Am I rambling? On the advantage of interviewing couples. US: Qualitative Research Journal, Sage Publications, Inc., , Vol. 14, Issue: 6, p.: 346-362.

Black, T. R., (1993). Evaluating Social Science Research: An Introduction. London Saga Publication, Inc.

Blaxer, L.; Hughes, C.; Tight, M., (2006). How to Research. UK: Maidenhead. Berkshire: McGraw-Hill International.

Boecker, J.; Green Building Certification Institute (GBCI), (2002). LEED Project Review. US: GBCI publications, Vol. 12, p.: 223-248.

Bouchard, T. J. Jr., (1976). Field Research Method. US: Chicago, *Handbook of Industrial and Organisational Psychology*. Rand McNally College Publishing Co.

Breuer, F. (2009). Reflexive Grounded Theory. GmbH: Wiesbaden: Springer Science + Business Media, p.115-141.

Breuer, F.; and Reichertz, J., (2001). Standards of social research. Germany: *FQS (Forum: Qualitative Social Research)*, Vol. 2 Issue: 3, Art. 24, [Online] available at: http://nbn-resolving.de/urn:nbn:de:0114-fqs0103245 [Date of access: February 27, 2016].

Building Technologies Office, (2013). "*Creating the Next Generation of Energy Efficiency Technology"*. [Online]. Available at <http://www1.eere.energy.gov/buildings/technologies/index.html> [accessed 9th January 2013].

Buchanan, R.; Margolin, V., (1995). Discovering Design: Explorations in Design Studies. US: Chicago, University of Chicago.

CABE: Commission and Architecture and Built Environment, D., Yeang, L., (2005). Better places to work. London: Thomas Telford Publishing.

Carnwell, R.; Daly, W., (2001). Strategies for the Construction of a critical review of the literature. USA: *Nurse Education Practical Journal*, Vol. 1, pp. 57-63.

Chartered Institution of Building Services Engineers: CIBSE/ UK, (1998). Energy efficiency in buildings. UK: CIBSE publications.

Chen, H. T.; Rossi, P. H., (1983). Evaluating with sense the theory driven approach. US: *American Journal of Evaluation*, Vol. June 2007, Issue: 28, p,: 199-202.

Cheng, W.L.; E., Heng, Li; Love, P. E. D.; and Irani, Z. (2004). Strategic alliances: a model for establishing long-term commitment to inter-organizational relations in Construction.

Cheung, W. M.; Cheng, Y. C. (1997). The strategies for implementing multilevel self-management. US: *International Journal of Educational Management*, Vol.: 11, Issue: 4, p.256-279.

Christopher P.; Lampard, R., (2002). Practical Social Investigation: Qualitative and Quantitative Methods. UK: Pearson Education Limited.

Cohen, J., (1998). Statistical power analysis in research. USA: *Journal of Management*, Vol.: 21, p.: 211–229. Conference, Lyon, France, Aalborg University Publications.

Cory, K.; Couture, T.; Kreycik, C., (2009). Feed-in –Tariffs: accelerating the deployment of renewable energy. London: Earthscan.

Darby, S. (1999). Energy advice – what is it worth? Proceedings, European Council for an Energy-Efficient. Economy Summer Study, Belgium: EU publications paper III.05

Department of Energy and Climate Change (DECC), (2012). Energy Consumption in the UK 2012. [Online]: Available at <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65950/2324-overall-energy-consumption-in-the-uk-since-1970.pdf>and <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65954/2323-domestic-energy-consumption-factsheet.pdf> [accessed 28th January 2013].

Ding, H.; Markandya, A.; Nunes, P.A.L.D., (2012). The Economic Impacts of Biodiversity

Policy for Improving the Climate Regulating Services Provided by EU Natura 2000 Habitats, BC3 Working Paper Series 2012-13. Spain: Bilbao, Basque Centre for Climate Change (BC3).

Doblin, J. (1956). Perspective: A New System for Designers. US: New York published by Whitney Publications.

Dokka, T. K.; and Rodsjo, A.; (2005), Lysen, E. H., (1996). "*IEA SHC Task 23 Optimization of Energy Use in Large Buildings".* [Online] Available at <http://www.iea-shc.org/task23/>, [accessed 05th November 2013].

EDP: Directive of the European Parliament and of the Council on the energy performance of buildings. EU Publication 2002. [Online]. Available at: <www.buildup.eu/publications/1157>33.

Eisenhardt, K. M. (1989). Building theories from case study research. US: Academy of Management Review, Vol.: 14, Issue: 4, p. 352-550.

Ellison, L.; and Sayce, S., (2006). The Sustainable Property Analysis Project. [Online]. Available at <http://eprints.kingston.ac.uk/1435/1/Sustainable_Property_ Appraisal_Project.pdf> [accessed 1st January 2013].

Emory, C. W.; and Cooper, D. R. (1991). Business research methods. US: Boston, MA, Irvin Press. 4th ed.

Fals-Borda, O. and Rahman, M. A., (1991). Action and knowledge: Breaking the monopoly with participatory action research. N Y, US: Doubleday Publishing Co. p. vii-viii.

Fotwe, E., F. T.; Price, A. D. F.; and Throp, A., (1996). Research Method Versus. US: ARCOM Conference, Vol.: 12, Shiffeild Hallam University Press.

Frederiks E. R.; Stemer, K.; Hobman, E. V., (2014). Household energy use: Applying behavioral economics to understand consumer decision-making and behaviour. Australia: Renewable and Sustainable Energy Reviews, Vol.: 41, p. 1385 -1394.

Gray; A.; Reytar; E.; Altamirano; K.; Carlos; J., Benjamin; H., (2016). Climate benefits, tenure costs: The economic case for securing indigenous land rights. US: Washington DC, World Resources Institute (WRI).

Gergen, J. K.; Gergen, M. K. J.; Guiney, M.; Yallop, J. J.; Lopez de Vallejo, Irene; R.; (2008). Performative social science. Germany: *Forum: Qualitative Social Research*, Vol.: 9, Issue:2, p.: 362-378.

Gergen, K. (1985). The social constructionist movement in modern psychology. *American Psychologist Journal*, Vol.: 40, Issue: 3, p. 246-255.

Glaser, B. G.; Strauss, A. L., (2009). The Discovery of Grounded Theory: Strategies for Qualitative Research. US: Aldine Transaction Publishing; 1st ed., Kindle Edition.

Glaser, B., G. (2001). The grounded theory perspective. Conceptualization contrasted with description. US: CA, Mill Valley, Sociology Press.

Gauch, Jr. H.G., (2003). Scientific method in practice. UK: Cambridge, Cambridge University Press.

GVA: Gross Value Added – Office for National Statistic, (2010). Emission Impossible. Can cities deliver on their emission reduction targets? [Online] Available at

<http://www.bpf.org.uk/en/files/reita/reita_org_documents/analysis/GVA_-_EmissionImpossibleWinter2011-11.pdf> [accessed 27th January 2013].

Hampton, S. E.; Parker, J.N., (2011). Collaboration and productivity in scientific synthesis. Vol. 61, p. 900-910.

Heiselberg, P. (2007). Integrated Building Design Motivation and benefits of integrated design. Denmark: Aalborg University, Aalborg University Press.

Heiselberg, P.; Andresen, I.; Perino. M.; Van der Aa, A., (2013). Integrating Environmentally Responsive Elements in Buildings. Proceedings of the 27th AIVC.

Heron, J. (1996). Co-operative inquiry: Research into the human condition. London: Sage Publishing, Inc.

Hoezen, M. E. L. (2011). The Problem of Communication in Construction. Netherland: University of Twente.

Hui, C. (1988). Measurement of individualism-collectivism. US: *Journal of Research in Personality*, Vol.: 22, Issue: 1, p. 17-36.

IEA-DSM (2005). Smaller customer energy saving by end-use monitoring and feedback. International Energy Agency Demand-side Management Programme Task XI, Subtask 1. UK: Chester, Richard Formby, EA Technology.

IEA, (1997). IEA SHC Task 23 Optimization of Solar Energy Use in Large Buildings. [Online] available at: http://www.iea-shc.org/task23/, [accessed on 15th October 2015].

IEA, (2006). Energy Technology Perspectives. [Online], available at <www.**iea**.org/publications/freepublications/publication/etp**2006**.pdf> [accessed 21st January 2013].

JCCA, (1998). Association of Japanese Consulting Engineers. [Online) available at: dhttp://www.jcca.or.jp.

Johnson, T.; Kulesa, P.; Llc, I. Cho, Y.; and Shavitt, S. (2005). The relation between culture and response styles: Evidence from 19 countries. US: *Journal of Cross Cultural Psychology*, Vol.: 36, Issue: 2, p. 264-277.

Jones, J. C., (1992). Design Methods. UK: London, Published by David Fulton.

Kemmis, S. (2001). Exploring the relevance of critical theory for action research: Emancipatory action research in the footsteps of JurgenHabermas. In Handbook of: *Action Research: Participative Inquiry and Practice.* (p.:91-102). London: Sage Publishing, Inc.
Kemmis, S.; and McTaggart, R. (2005). Participatory action research. Communicative action and the public sphere. Handbook of *Qualitative Research.* US:CA, Thousand Oaks, Sage, Publications, Inc., p.559-603, 3rd ed.

Kent, R. (2008). Using fs QSA: A brief guide and workshop for fizzy-set qualitative comparative analysis. UK: University of Manchester, [Online] available at: *http://hummedia.manchester.ac.uk/institutes-/cmist/archive-publications/working-papers/2008/2008-10-teaching-paper-fsqca.pdf,* [accessed on 19th February 2016].

Kibert, C., J., (2008). The Whole Building Design Guide. [Online] available at : <www.wbdg,org> [accessed 27th January 2013].

Kenworthy, J. (1991). Language in Action: Introduction to Modern Linguistics. UK: Harlow, Longman Group Ltd.

Kibert, C., J., (2008). Sustainable Construction: Green Building design and delivery. UK: Chichester, John Wiley & Sons.

Knoblauch, H., Baer, A., Petschke, L., Sabine, E.&Schnettler, B., (2008). Visual methods. *Forum: Qualitative Social Research*, Vol.: 9, Issue: 3, http://www.qualitative-research.net/index.php/fqs/issue/view/11 [accessed: December 27, 2015].

Knowles, E. S., & Condon, C. A. (1999). "*Why people say "yes": A dual-process theory of acquiescence*". Journal of Personality and Social Psychology, 77(2), 379-386.

Knudstrup, M. A., (2000 & 2002). Architecture and Ecology – Energy and environment in Architecture. Denmark: Aalborg University. *The Aalborg University Journal*, Vol.: 11, 2002, Aalborg University Press.

Kristensen, P. E., and Esbensen, T., (1991). Passive solar energy and natural daylight in office buildings. *Proceedings of the ISES Solar World Congress*, US: ASES.

Krosnick, J. A., & Schuman, H. (1988). Attitude intensity, importance, and certainty and susceptibility to response effects. US: *Journal of Personality and Social Psychology*, Vol: 54, Issue: 6, p. 940-952.

Kurul, E.; Tah, J.; and Cheung, F., (2012). Does the UK built environment sector have the institutional capacity to deliver sustainable development? *Architectural Engineering and Design Management magazine*. 2012, Vol. 8, p. 42–54.

Larsson, N., Poel, B. (2003). Solar Low Energy Buildings and the Integrated Design Process – An Introduction. *IEA SHC Task 23 "Optimization of Solar Energy Use in Large Buildings"*. [Online] Available at: **Error! Hyperlink reference not valid.** [accessed on 12th June 2014].

Lawson, B. (2000). How Designers Think. The design process demystified. Architectural Press 2000. UK Letter of 23.06.05 to Aalborg University from the Ministry of Science,

Technology and Development concerning the Civil Engineer Education in Architecture and Design.

Lee, C.; and Green, R. T., (1991). Cross cultural examination of Fish be in behavioural intentions model. US: Journal of International Business Studies, Vol.: 22, p.: 289-305.

Legewie, N. (2013). An Introduction to Applied Data Analysis with Qualitative Comparative Analysis (QCA). Germany: Berlin, *FQS (Forum: Qualitative Social Research)*, Vol. 14 Issue: 3, p.: 249-271.

Lichun, D.; Shun'an, W.; Shiyiu, T.; and Hongjing, Z., (2008). GTL or LNG: Which is the best way to monetize "stranded" natural gas? US: Petroleum Science magazine, Vol. 5, p.: 388-394.

Lincoln, Y. S.; and Guba, E. G., (1985). Naturalistic inquiry. London: Sage Publishing, Inc.

Love, P.E.D.; Skitmore, M.; and Earl, G., (1998). Selecting a suitable procurement method for a building project. Construction Management and Economics *Journal,* Vol.: 16, Issue: 2, p. 221-233.

Lovins, A. (1992). Energy Efficient Buildings: Institutional Barriers and Opportunities. E-Source, [accessed on 20th Jan. 2015].

Lysen, E. H. (1996). The trias energetica: Solar energy strategies for Developing Countries. Germany: Eurosun Conference. *Journal of Building Appraisal* (2010), Vol. 5**,** pp. 293–310.

Markus, H. R.; and Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. US: *Psychological Review Journal*, Vol: 98, Issue: 2, p. 224-253.

Maslin, M., (2007). Global Warming: Causes, Effects and the future. London: MBI Publishing Company.

Mattesich, P. W.; Murray-Close, M.; and Monsey, B. R. (2001). Collaboration: What Makes it Work? US: St. Paul, MN: The Wilder Foundation 2nd ed.

Maxwell, J.; and Loomis, D. (2003). Mixed method design: An alternative approach. In A. Tashakkori and C. Teddle (Eds.), *Handbook of mixed methods in social and behavioural research.* US: CA: Sage. Thousand Oaks, p. 241-272.

McClintock, C., D.; Maynard-Moody S.; and Brannon, (1979). Applying Logic of Sample Surveys to Qualitative Case Studies: The Case Cluster Method. US: Administrative Science Quarterly, Vol.: 24, p.: 133-157.

McDonell, G., (2007). High Performance Buildings Through Integrated Design, HPAC Engineering. [Online] available at: <http://www.omnicronaec.com/resources /high_performance_buildings.pdf>, [accessed 05th November 2013].

Miles, M. B.; and Huberman, A. M., (1984). Qualitative data analysis: A sourcebook of new methods. US: CA, Beverly Hills, Sage Publications, Inc.

Miller, F. (1986). Use, appraisal, and research: A case study of social history. US: *The American Archivist*: Vol. 49, Issue: 4, p. 371-392.

Mok,C., (1996). Designing Business: Multiple Media, Multiple Disciplines. US: Publisher: Hayden Books.

Morgan S. L.; and Winship C. (2000). Counterfactuals and causal inference Methods and Principles for Social Research. UK: Cambridge: Cambridge University Press.

Morley, M., **(**2001). Building with Structural Insulated Panels (SIPS): Strength and Energy Efficiency: Through Structural Panel Construction. UK: Taunton Press, Inc.

Moselle, B., Padilla, J.; and Schmalensee, R., (2010). Toward a Low-Carbon Future in Electricity". US: Washington DC: RFF Press.

Mruck, K.; Wolff- Michael, R.; and Breuer, F., (2002). Subjectivity and reflexivity in qualitative research. Germany: Berlin: *Forum for Qualitative Research*, FreieUniversitat Vol.: 3, Issue: 3, p.: 422-439.

Narayaan, J. S.; Apte, P.; Haves, M.; Sohn, D.; and Elliott, J., (2010). ACEEE Summer Study on Energy Efficiency in Buildings. US: University of Pennsylvania.

Nicol, F.; and Pagliano, L. (2008). Allowing for thermal comfort in free-running buildings in the new standard EN15251. In Proceedings of the International Conference *Improving Energy Efficiency in Commercial Buildings (IEECB'08),* Frankfurt, Germany, 10-11 April 2008.

Olgyay, V. (1964). Design with Climate – a bioclimatic approach to architectural regionalism. US: Princeton University Press.

Orr, D., (2009). High Performance Guide: Triangle Region Public Facilities. Version 20, September 2001. [Online] available at: <www.tjcog.dst.nc.us/nyc.link/btml/ddc/home.html> [accessed on 28th January 2013].

Oyserman, D.; and Lee, S. (2008). Does culture influence what and how we think? Effects of priming individualism and collectivism. *Psychological Bulletin Journal*, Vol.: 134, Issue: 2, p. 311- 342.

Oyserman, D., Coon, H. M., and Kemmelmeier, M. (2002). Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analyses. *Psychological Bulletin Journal,* Vol.: 128, Issue: 1, p. 53-72.

Pautasso, M., (2013). Ten Simple Rules for Writing a Literature Review. US: CA, University of California San Diego, University of California Publications.

Rapple, C., (2011). The role of the critical review article in alleviating information overload. Annual Reviews White Paper. [Online] available at: <http://www.annualreviews.org/userimages/ContentEditor/1300384004941/Annual_Reviews_WhitePaper_Web_2011.pdf.>[accessed May 2013].

Rath, J. (2012). Poetry and participation: Scripting a meaningful research text with rape crisis workers. *Forum: Qualitative Social Research*, Vol.: 13, Issue: 1, Art. 22, <http://nbn-resolving.de/urn:nbn:de:0114-fqs1201224.

Reason, P.; and Bradbury, H., (2008). The Sage handbook of action research. Participative inquiry and practice. London: Sage Publishing Ltd; p.1-10, 2nd ed.

Ridley, D., (2008). The literature review: a step-by-step guide for students. London: SAGE, Inc.

Riecken, T.; Strong-Wilson, Teresa; Conibear, F.;, Corrine, M. &Riecken, J. (2004). Connecting, speaking, listening: Toward an ethics of voice with/in participatory action research. *Forum: Qualitative Social Research*, Vol.: 6, Issue: 1, Art. 25, [Online] available at: http://nbn-resolving.de/urn:nbn:de:0114-fqs0501260 [accessed: 27th Dec., 2011].

Roberts, S., Baker, W. (2003). Towards effective energy information: improving consumer feedback on energy consumption. UK: A report to Ofgem. Centre for Sustainable Energy.

Rosenberg, D., (2003). Early modern information overload. US: *Hist Ideas Journal*, Vol. 64, p. 1–9.

Saltelli, A.; Chan, K.; Scott, E. M., (2000). Sensitivity Analysis: Gauging the Worth of Scientific Models. US: John Wiley & Sons. Morris, M.D.

Schneide, C. Q.; and Wagemann, C. (2007). Set-theoretic methods for the social science: A guide to Qualitative Comparative Analysis (QCA). UK: Cambridge, Cambridge University Press.

Schwarz, N.; and Oyserman, D. (2001). Asking questions about behavior: Cognition, communication, and questionnaire construction. *American Journal of Evaluation*, Vol.: 22, Issue: 2, p.127-160.

Sedikides, C.; and Gaertner, L. (2005). Pancultural self-enhancement reloaded: A meta-analytic reply to Heine (2005). US: *Journal of Personality and Social Psychology*, Vol.: 89, Issue: 4, p. 539 -551.

Seefeldt, F., (2003). Energy Performance Contracting - success in Austria and Germany - dead end for Europe? In Proceedings of the European Council for Energy Efficient Economy 2003 Summer Study. Sweden: Stockholm. European Council for an Energy-Efficient Economy.

Shulruf, B.; Hattie, J.; and Dixon, R. (2007). Development of a new measurement tool for individualism and collectivism. US: *Journal of Psychoeducational Assessment*, Vol.: 25, Issue: 4, p. 385-401.

Shulruf, B.; Hattie, J.; and Dixon, R., (2008). Factors affecting responses to Likert type questionnaires: Introduction of the Imp Exp, a new comprehensive model. US: *Social Psychology of Education: An International Journal*, Vol.: 11, Issue: 1, p. 59-78.

Singh, Y. K., Bajpai, R. B. (2008). Research Methodology: Techniques and Trends. New Delhi, India: APH Publishing Corporation.

Slann, P., (1966). The cost and design methods. Canada: Ontario, University of Waterloo, *vads Design Journal*, Vol.: 16, Issue: 45, p.: 145-163.

Smith, P.L., (1992), Professionalism: Cornerstone of Engineering. *Journal Professional Issues in Engineering Education and Practice*, ASCE 118, *Reviews, Citations and Replications.*" Organisation Studies, No.: 15, Art.: 3.

Stake, R. E. (1995). The art of case study research. US: CA: Sage Publications, Inc.

Sutherland, W.J.; Fleishman, E.; Mascia, M. B.; Pretty, J.; and Rudd, M. A. (2011). Methods for collaboratively identifying research priorities and emerging issues in science and policy. Methods Eco lE. Denmark: Aalborg University Press, Vol. 2, p. 238–247.

Tester, J.W., Drake, E.M., Driscoll, M.J., Golay, M.W., & Peters, W.A., (2005). Sustainable energy: choosing among options. US: New York: MIT Press.

Todesco, G. (1998). Sustainable Construction – Energy Efficiency Design Integration. USA: *ASHRAE Journal*, June 1998, p. 52 –56.

Treloar, G.J., (1997). Extracting Embodied Energy Paths from Input-Output Tables: Towards an Input-Output-Based Hybrid Energy Analysis Method. Economic Systems.

Triandis, H., & Suh, E. M. (2002). Cultural influences on personality. US: Annual Review of Psychology, Vol.: 53, Issue: 1, p. 133-160, *Thomson Reuters Journal Citation Reports* (JCR).

Trianni, A., Cargo, E., De Donatis, A., (2013). A framework tocharacterize energy efficiency measures. Italy: Applied Energy, Vol.: 118, Issue:1, 2014, p. 207-220.

Tuluca, A. (1997). Energy Efficient Design and Construction for Commercial Buildings. US: NY, McGraw-Hill.

Uher, T.E.; Davenport, P., (2010). Fundamentals of Building Contract Management. New South Wales: UNSW Press.

Uwe, F. (2009). An Introduction to Qualitative Research. UK: London: Sage Publishing, Inc. 4th ed.

Van Herk, H.; Poortinga, Y. H.; and Verhallen, T. M. (2004). Response styles in rating scales: Evidence of method bias in data from six EU countries. Netherlands: *Journal of Cross Cultural Psychology*, Vol.: 35, Issue: 3, p. 346-360.

Voronov, M.; and Singer, J. A., (2002). The myth of individualism-collectivism: A critical review. US: *Journal of Social Psychology*, Vol.: 142, Issue: 4, p. 461-480.

Wagner, C.S.; Roessner, J.D.; Bobb, K.; Klein, J.T.; and Boyack, K.W., (2011). Approaches to understanding and measuring interdisciplinary scientific research (IDR): a review of the literature. *Informeter Journal*, Vol.5, p. 14–26.

Wahlström, Å.; and Henrik, B., (2005). An Eco-factor method for assessment of building performance. Proceeding of the 7th Symposium on Building Physics in the Nordic Countries, page 1110-1117.

Wahren, M.; Bauerharsel, S. T.; Dorr, S., (2003). Methodology for Energy Efficiency on Process. Forty-Six CIRP Conference on Manufacturing Systems. US: Science Direct, [Online] available at:< www.sciencedirect.com > [accessed on: 21st May 2015], Procedia CIRP 7 (2013), p.: 652-657.

Waterman, A. S. (1984). The psychology of individualism. US: NY: Praeger Publishing.

Watts A., (2016). Modern Construction Handbook. US: Birkhauser; 4th ed.

Weinert, N.; Chiotellis, S.; and Selige, G., (2011). Methodology for Planning and Operating Energy Efficiency. Germany: CIRP Annals, Volume: 60, Issue: 1, p.: 338-363.

Weiss, C.H.; and Bucuvala, M. J., (1980). Social science research and decision-making. US: New York, Columbia University Press.
White, B., (2002). Writing your Dissertation. UK: London: Thomson Learning.

Wicks, P. G.; and Reason, P., (2009). Initiating action research: Challenges and paradoxes of opening communicative space. US: Wiley & Sons, Inc., *Action Research* Journal, Volume: 7, Issue: 3, p. 243-263.

Wöhrer, V.; and Bernhard, H., (2012). Tricks of the trade—Negotiations and dealings between researchers, teachers and students. *Forum: Qualitative Social Research*, Vol.:131, Art. 16, p. 187-1.

Woodside, A.G., (2010). Case Study Research: Theory, Methods, Practice. UK: Yorkshire, Bingley, Emerald Group Publishing. [Online] available at: <www.eere.energy.gov/buildings/highperformance/lanl_sustainable_guide.html>[accessed on 19th Aug. 2014].

Yamagata-Lynch, L. C., (2010). Activity Systems Analysis Methods: Understanding Complex Learning Environments. US: Springer Science and Business Media.

Zangheri, P.; and Pagliano, L. (2010). Methodology for design and evaluation of zero energy buildings in Mediterranean climate. Application to a Passiv haus with Earth to Air Heat Exchanger. Greece: Palenc Conference 2010, Rode Island. *Advances in Building Energy Research (ABER)*, 2010, Vol. 4, p. 167-200.

Appendix 1

Survey Cover Sheet

Date:…… /……/…….

Dear Participant:

My name is (Saffa Gabber) and I am a Post-graduate student at the University of Westminster. For my dissertation project, I am investigating <How the Use of Integrated Design Can Deliver the Energy Efficiency in Buildings at Least Cost>. As you are <one of the professionals who can give available opinions in this area of research>, I am soliciting you to engage in this study by answering the chosen questions.

The approximate time to answer this survey is about ten minutes. Participation in this survey cannot be compromised anybody nor recompense with a reward; because it is a purely voluntary work and you have totally rights to withdraw from it at any time. Please give your possible responds to all survey parts in an honest manner, and sent back by attached stamped envelope provided. To ensure keeping confidentiality, we would like to ask you don't insert your name. In case you would like to know the results of this study, my University of Westminster and Supervisor will have copies of this dissertation; only you need to detach the Request Information Form and send back to me and I will be more than happy to provide you with any additional information you need or any enquiry. Please if you have any concern about any stage of the research or the conducting way of this research; you can inform my university and the supervisor. On this occasion, I am grateful and appreciable for your valuable time and agreeing to participate in this project that will offer my educational endeavours a real great help.

Sincerely,

Saffa Gabber (s.gabber@my.westminster.ac.uk)
(Instructor's Name: Dr.Junli Yang)
(Instructor's e-mail address: j.yang2@westminster.ac.uk)

Please detach here

……

(This request for information form is an optional part of the cover letter and is not required for IRB approved.)
Request for information

Please send me a copy of the study results to the address listed below.
Name:
Address:
Please do not return this form with your survey. Return to: <insert your name and address or e-mail address>

Appendix 2
Questionnaire and Reasons

Invitations : 150, Professional (88), Pre-professional (62), Reply: 108 (72%),
Missed: 42 (28%)

Part 1

Section 1 of 11

Q1

Answered: 106 Skipped: 2

Which of the following factors will have the GREATEST impact on energy efficient buildings in the near future in the UK? Which other factors will have a significant impact? Please choose one 'Greatest' and any 'Other' factors.

Answer Choices	**Responses**	
	Greatest impact	**Other factors**
– Needs levels in developed countries	**0**	**10%**
– Needs levels in developing countries	**0**	**9%**
– Economical instability	**59%**	**0**
– Actions / policies of saving energy	**0**	**8%**
– Action / measures due to climate concerns	**0**	**4%**
– Technological developments	**0**	**5%**
– Property trading	**0**	**5%**
Total Responses = 106		

The reason for asking this question because there is no sufficient literature about the factors that impact on energy efficient buildings in the near future in the UK.

Q2

Answered: 107 Skipped: 1

Which of the following factors will have the GREATEST impact on UK properties prices in the near future? Which other factors will have a significant impact? Please choose one 'greatest' and any 'other' factors.

Answer Choices	**Responses**	
	Greatest impact	**Other factors**
– Domestic capacity in the UK property	**0**	**15%**
– UK energy efficiency residential buildings demand	**0**	**35%**
– Taxation / duties	**39%**	**0**
– Construction industry trading	**0**	**11%**
Total Responses = 107		

The justifications for question two; that there is no mention to the obligations of the integrated design factors on UK properties prices in the near future.

Q3

Answered: 106 Skipped: 2

A wide ranges of housing types collectively is responsible for 32% of final energy use

in the UK, while the non-domestic premises in the UK are responsible for around 17% of total UK energy consumption. (Source: DECC, United Kingdom housing energy fact file, 2013) Relative to today, how do you expect UK properties prices to change in the near future?

Answer Choices	**Responses**	
	Greatest impact	**Other factors**
– Decrease more than 5%	**0**	**0**
– Decrease up to 5%	**0**	**5%**
– Stay about the same	**0**	**15%**
– Increase up to 5%	**49%**	**0**
–Increase more than 5%	**0**	**11%**
– Not sure	**0**	**20%**
Total Responses = 106		

The reason for sparking a debate like in this question because there is no enough literature about the dialectical relationship between the UK properties prices and the change effects.

Q4

Answered: 108 Skipped: 0

Which of the following factors will have the GREATEST impact on UK construction industry prices in the near future? Which other factors will have a significant impact?

Answer Choices	**Responses**	
	Greatest impact	**Other factors**
– Conventional design costs	**0**	**15%**
– Economic factors	**0**	**15%**
– Actions / measures due to sustainability / climate concerns	**0**	**5%**
– UK energy efficiency policies	**0**	**5%**
– Taxation / duties	**30%**	**0**
– Builders costs	**0**	**10%**
– Integrated design costs	**0**	**20%**
Total Responses = 108		

The cause for this question; there is no adequate information about the keys and factors that have significant impacts on the UK construction industry prices in the near future.

Part 2

Section 2 of 11 - Thanks for coming this far!

Q5

Answered: 105 Skipped: 3

In what order would you prioritise the elements of the Energy Efficiency in Buildings?

Answer Choices	**Responses**

	Greatest impact	Other factors
– Affordability	**28%**	**0**
– Security	**38%**	**0**
– Efficiency	**34%**	**0**
Total Responses = 105		

The justifications for this question because there is no evidence in literature about how to prioritise the elements of the energy efficiency in buildings.

Q6

Answered: 107 Skipped: 1

How do you expect UK policymakers to priorities the elements of the Energy Efficiency in Buildings?

Answer Choices	Responses	
	Greatest impact	Other factors
– Affordability	**0**	**28%**
– Security	**0**	**17%**
– Low cost energy in buildings	**55%**	**0**
Total Responses = 107		

There is a reason to generate this question because no appropriate specifics about how the policymakers are prioritise the elements of the energy efficiency in buildings.

Q7

Answered: 108 Skipped: 0

What effects do you think each of the following areas in the last years on the UK energy efficiency in buildings policy has had on?

Answer Choices	Responses					
	Very Positive Effects	Positive Effects	No Effects	Negative Effects	Very Negative Effects	Not Sure
Securing energy supplies	✓					
Climate change and efficiency development		✓				
Improving industrial energy efficiency in buildings		✓				
Supporting all		✓				

deployment types for the energy efficient buildings						
Regulating energy efficient buildings markets			✓			
Simplify taxation of energy efficiency in buildings						✓
Improving integrated design process in buildings	✓					
Improving energy efficiency performance in buildings		✓				
Total Responses = 108						

There is a cause to produce this question, which is the lack information about the effects of the UK energy efficient buildings standards in some areas.

Q8

Answered: 108 Skipped: 0

What effect do you think the following Energy Efficient buildings (EEB) mechanisms?

	Responses

Answer Choices	Very positive effect	Positive effect	No effect	Negative effect	Very negative effect	Not sure
Capacity Mechanism		✓				
Total Responses = 108						

In order to discuss this question there are few authors who have written about the effect that hinders Energy Efficient buildings (EEB) mechanisms.

Q9

Answered: 102 Skipped: 6

At what level should policy decisions be made for the following areas?

Answer Choices	Responses				
	UN	EU	UK	Devolved	Local

				administrations	**councils**
Energy efficient buildings markets	✓				
Climate change and energy efficiency in buildings development	✓				
Research and innovation			✓		
Saving low cost energy in buildings					✓
Energy efficiency security			✓		
Total Responses = 102					

The cause to produce this question is the lack information about what may constrain resources workability to align with the needs of implementing the integrated design in designing the energy efficient buildings.

Q10

Answered: 101 Skipped: 7

Which of the following statements describes your views on using integrated design for low cost energy efficient buildings development in the UK?

Answer Choices	Responses
This should be pursued	**31**
This should be pursued, but with stricter regulations than currently exist	**24**
This should be pursued, but with restrictions on siting	**20**
This should not be pursued	**12**
I am unsure if this should be pursued	**14**
Other Please enter an 'other' value for this selection	**0**
Total Responses = 101	

The reason for choosing this question lack of equality of energy efficiency and buildings in literature, which is a problem and barrier, needs to change.

Q11

Answered: 101 Skipped: 7

How knowledgeable are you regarding the subject matter in this section?

Answer Choices	Responses
5 - Very knowledgeable - I consider myself an expert on this subject matter	**31**
4 - Knowledgeable - I am confident discussing this area	**48**
3 - Fairly knowledgeable - I know enough to give an informed response	**14**
2 - Some knowledge - I have heard or read about this topic	**8**
1 - Not very knowledgeable - I know little or nothing of this subject matter	**0**
Total Responses = 101	

The reason for this question is to form a clear idea about the participants' experiences in this field.

Q12

Answered: 103 Skipped: 5

In the UK, what is the level of investment risk due to policy uncertainty for the following low cost energy efficient buildings?

Answer Choices	Responses					
	Very low	Low	Neither low nor high	High	Very high	Not sure
Domestic energy efficiency in buildings						**27**
Commercial energy efficiency in buildings			**8**			
Renovation traditional buildings		**16**				
Upgrading and expanding the low cost energy in buildings		**19**				
Expanding the using of integrated design in low cost energy buildings	**33**					
Total Responses = 103						

This question will give a full picture about the investment in the UK and the sectors that have benefit from that investment.

Q13

Answered: 108 Skipped: 0

In order to maintain designing low cost energy buildings and meet environmental goals affordably, what do you think should happen to UK investment levels (from all sources) for the following areas over the next 10 years?

Answer Choices	**Responses**			
	Increase	**Maintain**	**Decrease**	**Not sure**
Improving energy efficiency in traditional buildings		✓		
Total Responses = 138				

This question has been created because there is not a lot of literatures have been written about the inconsistency in applying rules that have negative impacts on the implementation and take-up of low cost energy efficient buildings, which needs more collection of information.

14%

Part 3

Section 3 of 11

Q14

Answered: 102 Skipped: 6

Where should the majority of funding for using large-scale of integrated design to achieve the energy efficiency in buildings come from?

Answer Choices	**Responses**
Government-Private partnerships	**14**
UK Government and devolved administrations (i.e. taxpayers)	**9**
Institutional investors (banks, hedge funds, etc.)	**26**
International (e.g. EU funding)	**8**
Private sector construction companies	**37**
Consumer bills	**8**
Other Please enter an 'other' value for this selection	**0**
Total Responses = 102	

This question due to the justifications for another very important potential problem and barrier missed in literature that could happened because of the shortage of precision in skills of professionals in the UK.

Q15

Answered: 104 Skipped: 4

How knowledgeable are you regarding the integrated design in this sector?

Answer Choices	**Responses**
5 - Very knowledgeable - I consider myself an expert on this subject matter	**49**
4 - Knowledgeable - I am confident discussing this area	**32**
3 - Fairly knowledgeable - I know enough to give an informed response	**16**
2 - Some knowledge - I have heard or read about this topic	**7**
1 - Not very knowledgeable - I know little or nothing of this subject matter	**0**
Total Responses = 104	

The reason for this question is to form a clear idea about the participants' experiences in this field.

22%

Part 4 Section 4 of 11

Q16

Answered: 103 Skipped: 5

Where is the greatest potential for future integrated design technologies in the UK construction industry? *Please this question is required.

Due to the UK construction industry has no clear perception around the future technologies used in the integrated design, this question has been asked.

Answer Choices	**Responses**
Government plans (national)	**30**
Individual buildings	**48**
Integrated design will not have a significant part in the UK energy efficient buildings industry	**22**
Not sure	**3**
Total Responses = 103	

Part 5 Section 5 of 11 - almost there!

Q17

Answered: 100 Skipped: 8

Can you identify any existing surplus or shortage in professionals in each of the following sectors? *Please this question is required.

Answer Choices	**Responses**			
	Surplus	**Neutral**	**Shortage**	**Not sure**
UK energy efficiency in buildings			✓	
UK conventional buildings design	✓			
Increased interconnection		✓		
Integrated design method		✓		
Upgrading and expanding the use of integrated design				✓
Improving domestic building's energy efficiency			✓	
Improving commercial building's energy efficiency		✓		
Improving industrial building's energy efficiency		✓		

Total Responses = 100

Q18

Answered: 104 Skipped: 4

In which sector do you think the GREATEST energy efficiency improvements can be made over the next 10 years?

Answer Choices	**Responses**
New integrated design in residential Buildings	**47**
Traditional design in residential Buildings	**31**
Design commercial buildings	**26**
Total Responses = 104	

43%

Part 6

Section 6 of 11

Q19

Answered: 101 Skipped: 7

Within the residential building sector, through what specific area do you think the greatest efficiency gains can be made?

Answer Choices	**Responses**
Controls and systems	**16**
Retrofitting existing building fabric	**35**
Renovate traditional buildings	**29**
Technology and equipment upgrades	**21**
Total Responses = 101	

This question has based on there is no enough literature about how the technology can influence the saving cost of energy efficient buildings.

50%

Part 7

Section 7 of 11 - You've done the hard work; later sections are shorter!

Q20

Answered: 103 Skipped: 5

Within the commercial buildings sector, through what specific area do you think the greatest energy efficiency gains can be made? Over the next 10 years

Answer Choices	Responses
Controls and systems	**29**
Retrofitting existing building fabric	**32**
Smart appliances	**17**
Technology and equipment upgrades	**25**
Total Responses = 103	

Q21

Answered: 105 Skipped: 3

How knowledgeable are you regarding the subject of gaining energy efficiency in commercial buildings?

Answer Choices	Responses
5 - Very knowledgeable - I consider myself an expert on this subject matter	**33**
4 - Knowledgeable - I am confident discussing this area	**39**
3 - Fairly knowledgeable - I know enough to give an informed response	**18**
2 - Some knowledge - I have heard or read about this topic	**12**
1 - Not very knowledgeable - I know little or nothing of this subject	**3**

matter	
Total Responses = 105	

The reason for this question is to form a clear idea about the participants' experiences in this field.

Q22

What do you see as the largest barrier preventing innovation in integrated design for the low cost energy buildings in the UK? (Optional 50 words limit)

Part 8

Section 8 of 11 – You're more than halfway!

Q23

Answered: 99 Skipped: 9

Where is the greatest potential for future integrated design technologies in the UK construction industry?

Answer Choices	Responses
Government plans (national)	**35**
Individual buildings	**48**
Integrated design will not be a significant part of the UK energy efficient buildings	**0**
Not sure	**16**
Total Responses = 99	

With the context of this research; the reason for this question to take place because in the UK, there is no enough literature about the perception around the future of low cost energy efficiency improvements in buildings can be made.

Q24

Answered: 108 Skipped: 0

How knowledgeable are you regarding the subject matter in this sector?

Answer Choices	Responses
5 - Very knowledgeable - I consider myself an expert on this subject matter	**68**
4 - Knowledgeable - I am confident discussing this area	**29**
3 - Fairly knowledgeable - I know enough to give an informed response	**9**
2 - Some knowledge - I have heard or read about this topic	**2**
1 - Not very knowledgeable - I know little or nothing of this subject matter	**0**
Total Responses = 108	**108**

Because there are no clear thoughts about which areas can gain greatest energy efficiency in building sector; this question has been introduced.

Q25

Answered: 108 Skipped: 0

Can you identify any existing surplus or shortage in qualified professionals in each of the following sectors?

Answer Choices	Responses			
	Surplus	**Neutral**	**Shortage**	**Not sure**
UK energy efficiency in buildings	✓			
UK conventional buildings design			✓	
Increased interconnection				✓
Total Responses = 108				

In same way, this question has been generated due to there is no clear thoughts about which areas in commercial buildings sector can gain the low cost energy efficiency.

Q26

Answered: 108 Skipped: 0

In the next 10 years, do you foresee surplus or shortage of qualified professionals in each of the following sectors?

Answer Choices	**Responses**			
	Surplus	**Neutral**	**Shortage**	**Not sure**
Expanding and installing new technologies energy efficiency in buildings	✓			
Upgrading and expanding the use of integrated design				✓
Improving domestic building energy efficiency		✓		
Improving commercial building energy efficiency	✓			
Upgrading and expanding the use of integrated design				✓
Behaviour change				✓
Improving domestic building energy efficiency		✓		
Total Responses = 108				

71%

Part 9

Section 9 of 11

Q27

Answered: 101 Skipped: 7

What single measure would be best taken by the current government to reach UK energy efficiency in buildings targets? (Optional 50 words limit)

76%

Part 10

Section 10 of 11

Q28

Answered: 96 Skipped: 12

The UK's 2013 primary energy demand comprised heat* (48%), transport* (39%), and electricity* (13%)(DECC, *Energy consumption in the UK [ECUK]*, 2015). What is the technology with the greatest potential for transforming the low cost energy efficient buildings by 2030? (Optional 50 words limit)

Q29

Answered: 128 Skipped: 10

What are the biggest barriers to the uptake the transformative technology you have identified? (Optional 50 words limit)

86%

Part 11

Section 11 of 11

Demographics

Please tell us about yourself

Q30

Answered: 108 Skipped: 0

What is your current level of seniority? *Please this question is required.

- Junior / Officer
- Manager / Senior Manager
- Director / Head of department / Vice President / Partner
- President / C-level executive / Owner
- Consultant

- Retired
- Other Please enter an 'other' value for this selection

Q31

Answered: 108 Skipped: 0

What is the size of your current organisation?

- Individual
- 2 - 49 employees
- 50 - 249 employees
- 250 – 5,000 employees
- 5,001+ employees

Q32

Answered: 108 Skipped: 0

In what discipline do you currently work?

If you are retired, please select the discipline(s) in which you formerly worked. (Please tick all that apply) *This question is required.

- Architecture and building
- Economics, business, management and commerce
- Energy management
- Engineering and related technologies
- Environment
- Health and safety
- HR and recruitment
- Information technology

- ☐ Inspection and maintenance
- ☐ Law and legal practice
- ☐ Measurement, testing and control
- ☐ Natural and physical sciences
- ☐ Planning and design
- ☐ Policy and governance
- ☐ Research and development
- ☐ Skills, education and training
- ☐ Other Please enter an 'other' value for this selection

Q33

Answered: 108 Skipped: 0

If you would you like to leave any additional comments, please do so here: (Optional - 50 words limit)

93%

Thank You!

Thank you for taking the time to complete this Survey. We realise it requires a significant amount of time, and we greatly

appreciate your effort. This activity depends upon your support; **thank you for making it possible**!

100%