REQUIREMENT ELICITATION USING KNOWLEDGE CAPTURING (KC) TECHNIQUES DURING THE CLIENT BRIEFING PROCESS FOR IMPROVED CLIENT SATISFACTION IN THE UK CONSTRUCTION INDUSTRY

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LIST OF ABBREVIATIONS

CB	**Client Briefing**
KC	**Knowledge Capturing**
KM	**Knowledge Management**
KS	**Knowledge Sharing**
KT	**Knowledge Transfer**
RE	**Requirement Elicitation**
RM	**Requirement management**
KE	**Knowledge Elicitation**
S&D	**Sketching and Diagrams**
INT	**Interviews**
COLL	**Collaboration**
OBS	**Observation**
RPF's	**Request for proposals**
BIM	**Building Information Modelling**
QST	**Questionnaires**
REQWKSP	**Requirement Workshops**
SA	**Scenario Analysis**
BS	**Brain Storming**
ST	**Storytelling**
IT	**information Technology**
FACWKSP	**Facilitated Workshop**
PRT	**Prototype**
FA	**Factor Analysis**

CSF's	**Critical Success Factors**
KPI's	**Key performance indicators**
ID	**Identification number**
BARR	**Barriers**
FAC	**Factors**
RBV	**Resource Based View**
KBV	**Knowledge Based View**
SECI	**Socialisation, Externalisation, Combination, Internalisation**
DIKW	**Data, Information, Knowledge and Wisdom**
AEC	**Architecture, Engineering and Construction**

To God Almighty and my Sweethearts,
Bukola and Tenni

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DECLARATION

This thesis is presented as an original contribution based on Doctorate of Philosophy research at the University of Salford, Salford, United Kingdom and has not been previously submitted to meet requirements for an award at any higher education institution under my name or that of any other individuals. To the best of my knowledge and belief, the thesis contains no previously published or written by another person except where due reference is made.

……………………………….. (Signed)

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ABSTRACT

Knowledge management in recent times has been considered a major source of competitive advantage in many business organisations in which the construction industry is a major player. Knowledge management includes the generation, capturing, sharing, transfer, re-use, storage, communication, of knowledge with the aim to improve organisational or project effectiveness. One important factor however that influence or impacts organisational effectiveness in relation to knowledge management is the ability to capture and codify knowledge that resides in the minds or sub-consciousness of individuals. Knowledge capturing involves the use of variety of techniques to elicit facets of an individual's technical knowledge such as insights, experiences, social networks and lessons learned which is then shared or stored to mitigate organisational knowledge loss. The knowledge capturing process is the first activity in the knowledge management framework which seeks to make tacit knowledge explicit and vice versa, thereby reinforcing the work of Nonaka and Takeuchi of the SECI model. Client Satisfaction with service received from professionals in the construction industry has witnessed a steady decline below 70% from initial 75% in 2009. Variations and Design changes which is as a result of change request or mistakes during requirement elicitation are the main reason for cost and time overruns. Statistics show that over 70% of construction projects suffer re-work and changes and this is largely caused by improper requirement capturing which results from clients finding it difficult to get across the knowledge in their minds (tacit knowledge) to professionals during the briefing process. The aim of this research however, is to develop a framework that would help construction professionals, architects to be precise, elicit client's requirements using knowledge capturing techniques for improved client satisfaction in the UK construction industry. The researchers underlying philosophies leans towards the interpretivist epistemological stance, the idealist ontological stance and a value laden axiological stance. In order to achieve the stated aim, a survey strategy was explored. Face to face interviews and questionnaires were administered to construction professionals (architects) within the UK construction industry. The interview was used to collect qualitative data from 6 architects with vast years of experience in client briefing in the UK construction industry. These professionals were from academia and industry, and they were selected based on their experiences and engagement in client briefing. A questionnaire was also designed to capture responses from over 250 architectural professionals and 100 responses was received and analysed alongside the interviewed respondents which were then used to refine the developed framework. From the findings in the research, several architects use different

knowledge capturing techniques to elicit requirements from their clients however, majority of the respondents admit that the use of graphical representations such as BIM can help elicit requirements in the mind of clients. Also, relationship building can help bring down the walls of misrepresentation and misunderstanding that exist during interview sessions with the client. From the analysis of the respondents, some factors have been identified which mitigate against effective client requirement such a culture that is not prone to change, not integrating IT with the briefing process, government policies and so on. In conclusion, paying adequate attention to the wealth of KC techniques available helps in overcoming issues such as cost and time overruns which strengthens the importance of KC to the client briefing process. In the course of the research, some effective KC techniques have been identified such as BIM technology, interviews, AutoCAD and so on. Certain barriers to KC have been identified and factors that influence proper client briefing has also been identified in the course of this research, as a result, this research offers a framework, with a guideline, on how to effectively elicit client's requirements using KC techniques for improved client satisfaction in the UK construction industry.

Chapter 1 – Introduction

1. 1 Background to Research

Rhodes (2015) in a briefing paper at the House of Commons asserts that the contribution of any industry to the UK economy is best measured by its Gross Value Added. He added that in 2014, the overall output of the construction industry was approximately £103 billion, which is approximately 6.5% of the total economy. In 2014, the output rose 9.5% which was the biggest increase since at least 1990. The industry accounts for approximately 2.1 million jobs as at 2015 which is approximately 6.2% of the total economy. In the last ten years, the number of jobs in the construction industry has been broadly steady (despite falling in 2009 and 2010), however, the number of construction jobs as a proportion of all jobs has experienced a decline from 7.0% compared to the current figure of 6.2%. Rhodes (2015) further added that the UK construction industry has experienced a considerable amount of returns in the performance of project related functions and as a result has been able to contribute to the overall economic state of the nation, making it one of the pioneering industries in the nation's economy. According to Construction 2025 report (2013), the construction industry accounts for nearly 7% of UK's gross domestic product (£92.4 billion gross value added), which is equivalent to about 10% of total UK employment.

The industry is dominated by Small and Medium Enterprises (SMEs), which constitute of the majority of organisations in the UK, with a small number of large organisations. The industry comprise largely of project related functions as its major operations and is subject to some measures of risk due to its complexities, knowledge intensive nature, high fragmentation and technological advancements in this field (Mok, 2015). Due to nature of this industry and its complexity, construction projects are subject to variations which leads to factors such as cost overruns, time delay, design changes and construction re-work (Pinto et al., 2011). These variations differ from project to project and from country to country depending on the many factors influencing the project. On time completions of projects to specified requirements and according to budget are the most important factors of project success (Abbasi et al., 2015; Masadeh et al., 2015). In order to complete construction projects on time and within budget, a proper strategic management process is required in terms of project schedules; project costing, project estimation, project documentation and project management (Tarhini et al., 2015).

There are a number of parties involved in construction processes ranging from the design team, consultants, architects, project managers and owners or clients of the project (Doloi, 2012). These parties especially the client which in some case is the owner of the project, have zero tolerance for delays and design mistakes in construction projects and want such projects to complete within the required time and estimated cost. Due to the highly knowledge-intensive nature and high fragmentation level of the construction industry, which makes it characterised by a high degree of tacit knowledge, there is a need for such factors responsible for variations such as time delays, design changes and cost overruns to be controlled and properly managed (Fathi et al., 2016; Hari *et al.,* 2005). One of the major success factors that have been noticed to contribute to the realization of these is the management and exploitation of knowledge within the construction industry (Ahmad and An, 2008). The concept behind managing knowledge mainly hinges on how well organisations can generate, capture, retrieve, store, transfer, share and re-use knowledge within the organisation, making sure that there exist no knowledge gap in the organisation.

In the 21 century, with increasing demands on the construction industry due to population growth, the need for fast economic development push construction industries to develop Knowledge Management (KM) strategies, which are considered as asset to an organization. Knowledge management is a discipline that involves the capture, storage, sharing, transfer and re-use of knowledge for organisational competitiveness and effectiveness. Organizational knowledge is a valuable, rare, inimitable and non-replaceable strategic asset (Alemu et al., 2016). This asset can be organized in a way that it creates value and make usable by the organization (Alemu et al., 2016). In the process of value creation in connection with KM in large and complex projects, knowledge capture, transfer, sharing, set-based thinking, proper iteration management and system integration are crucial (Bashouri and Duncan, 2014; Shokri-Ghasabeh and Chileshe, 2014).

Knowledge is considered as one of the most valuable asset that should be effectively managed for it to be able to create added wealth and competitive advantage to an organisation (Shokri-Ghasabeh and Chileshe, 2014). According to Latham (1994) and Egan (1998) report, UK construction industry has suffered from performance problems and client dissatisfaction and as a result have been in transition to overcome this issue. In order to improve overall performance in relation to client satisfaction in the construction industry, two core factors are essential, knowledge capturing and learning (Carrillo *et al.,* 2000; Hari *et al.,* 2005). KM has a vital role in

improving efficiency of project delivery and competitiveness of organisation (Egbu, 2001 & 2005; Sheehan *et al.,* 2005; Fong, 2005; Orange *et al.,* 2005). For projects to deliver these competitiveness and increased performance, attention needs to be given to the various Knowledge Capturing (KC) techniques available in capturing knowledge. Generally, knowledge has been described as either tacit or explicit. The concept of explicit and tacit knowledge was introduced by Polanyi (1966). The explicit knowledge is articulated, codified, stored and distributed in certain media, whilst the tacit knowledge is hard to codify and distributed because it is associated with experiences and skills of the individuals (Easterby-Smith and Jackson, 2008). Therefore, the importance of knowledge is more significant in knowledge-based industries in which the construction industry is a major actor. Due to the high knowledge intensity nature of the industry, several factors affect and influence the successful delivery of the project objectives in the long run. Example of such factors is interaction between the client and the design team or architect during the client briefing process. However, most construction errors identified during the construction phase under the traditional procurement route are problems due to inadequate capturing or elicitation of the client's requirement during the client briefing process which could be caused by lack of experiences of the architect or inadequate knowledge of the wealth of capturing techniques or requirement elicitation techniques available in construction practices (Love *et al.,* 2013).

In certain instances, some architects mainly rely on their knowledge (Heylighen and Neuckermans, 2000), which they have gathered through their involvement in construction projects (Heylighen *et al.*, 2007). Such knowledge is experience-based and ranges from technical to the specialist knowledge within the client and construction process (Bashouri and Duncan, 2014). However, relying on experiential knowledge can sometimes be detrimental to the successful delivery of a project because for a construction project to be effective and efficient, adequate attention needs to be given firstly, to identifying what knowledge is available for capturing and then giving adequate attention to the capturing of such knowledge (which can be in form of requirements) using effective KC techniques rather than relying solely on experiential knowledge (Alemu et al., 2016). Knowledge capturing involves the use of varieties of techniques to elicit requirements of an individual's tacit knowledge such that insights, experiences, social networks and lessons learned can be shared to mitigate organisational knowledge loss (Hari et al., 2005). A variety of methods are used and they vary according to each organisation's requirements but range from interviews, scenario analysis, communities of practice, workshops and mind mapping tools. The management of knowledge has led to the discovery of certain barriers and

enablers that can promote or inhibit the effective capturing of knowledge from construction clients and if such knowledge is not elicited effectively, could lead to reduced performance in construction output and lead to project variations such as cost and time overruns (Alemu et al., 2016, Ahmad and An, 2008, Hari et al., 2005).

Certain factors however, affect the interaction and communication process between the client and architect during the briefing process which can lead to variation such as increase cost of re-work as a result of errors and mistakes caused by inadequate capturing of clients requirement by the architects who may not have the right knowledge of the techniques available for capturing or eliciting clients requirements during the briefing process (Love *et al.,* 2011). Olatokun and Pathirage (2015) elucidated that capturing knowledge properly provide opportunities for organisations to innovate, reduce variations such as design changes, cost overruns, re-work and time delays. Capturing client's knowledge in form of requirements using KC techniques during the briefing process is vital for the competitiveness of an organisation as well as performance (Love *et al.,* 2011). The type of decisions made is based on the quality of information (knowledge) elicited from clients during the client briefing process (Bashouri and Duncan, 2014; Hari et al., 2005). The availability of accurate and timely knowledge captured during the client briefing process enables effective project management and the delivery of successful project which leads to increased client satisfaction (Love *et al.,* 2011). Salter and Gann, (2003) also mentioned that project knowledge and experiences held by project team members plays a key role in solving problems project related problems. Therefore, for organisations to have a successful competitive advantage and effective completion of a project, there needs to be adequate time and attention given to knowledge is managed and exploited during the construction project processes (Hari *et al.,* 2005).

KM plays a significant role in the survival and performance of organisations, specifically in project-based industries like the construction. This section has highlights the background of the research on which the whole research is underpinned. The management of knowledge in construction firms largely revolves around project knowledge. Construction organisations might not be able to attain the level of effectiveness and performance desired if knowledge is not adequately captured or elicited during the project initiation phase (client briefing process) which is vital to projects successfully delivering their objectives. The next section highlights some of the problems and justification for embarking on this research.

1.2 Research Problem/Justification

The research problem and justification section will be addressing problems of variations that occur in construction projects such as, cost overrun, time delay, design changes and re-work, client engagement, the client briefing process and knowledge capturing techniques in overcoming variations and improving client briefing process.

Variations in construction industry is a major problem that inhibits project progress and leads to client dissatisfaction, one of which is cost overrun which has the ability to reduce the contractor's profit leading to enormous losses, and making the client unhappy with the output and outcome of the project (Sindhu et al., 2016). Cost overruns occur almost in every construction project and the magnitude varies significantly from project to project. This leads to the severe need of addressing the acute issue of such variations in the construction industry and how to manage them. Cost overrun occurs when project objectives are not met within estimated budget (Laesen et al., 2016; Sindhu et al., 2016). Another terminology used to connote cost overrun is budget overrun which involves unforeseen costs incurred in excess of estimated amount due to an underestimation of the actual cost during budgeting or unforeseen situations that come up in the course of the project as well as not adequately capturing the clients requirement during the briefing process. Nine out of ten projects have experienced variations such as cost overrun at some point of the project (Flyvbjerg et al., 2002). Cost overrun affect both developed and developing countries and this is due to certain factors such as poor management of resources and improper clarification and elicitation of client's requirements which is addressed in due course of this research (Angelo and Reina 2002). Sindhu et al., (2016) in their study identified certain research carried out by some authors to identify the various factors that leads to project variations in relation to cost and time overruns. A study carried out by Jackson (2002) on construction projects in UK identified certain factors causing variations in construction projects which leads to cost and time overrun; these factors include poor project planning and management, unexpected ground conditions, lack of adequate information during the design briefing stages, estimating method, procurement route, commercial pressure, time limit and external factor.

Koushki et al, (2005) in addition investigated 450 projects in Kuwait randomly selecting private residential projects owners and developers, factors such as contractor- related problems, owner's financial constraints, and material-related problems were discovered to be the main factors

leading to project variations which increases cost and time delays. They recommended that to reduce these variations, allocation of sufficient time and money at the client briefing phase, requiring availability of adequate funds by project owners and selection of a competent consultants and reliable contractor to carry out the work will help reduce the chances of these variation factors. Ameh et al. (2010) and Kasimu M. A. (2012) revealed some of the major factors that lead to variations in relation to cost overruns as lack of experiences of contractors, lack of experience of the consultant, cost of materials, frequent design changes due to inadequate capturing of requirement, fluctuation in the price of the materials, economic stability, mode of financing, high interest rates charged by banks on loans received by contractors, insufficient time, and incomplete drawings due to improper capturing of requirements. Remon (2012) further added to factors causing variations in construction projects by carrying out research in construction of waste water projects in Egypt, the factors identified are availability of raw materials, allocation of sufficient time to gathering information from the client, cost of design phase, fraudulent prevention, bulk material purchase and by applying short term goals were marked as vital factors to be considered to overcome cost overrun.

Variation in construction project does not only lead to cost overruns but also leads to time delays in project completion or delivery. Raj (2016) elucidated that insufficient time allocated for the client briefing process could be a major cause of variation which could lead to increased cost of re-work, time or cost overrun. In this case, clients and architects are not given adequate time to properly engage in the client briefing process which aims to capture the client requirement before project implementation commences. In the first few minutes of the requirement elicitation meeting, participants may not remember all the requirements since they are in new environment or talking to new team. They may not be able to express the requirements appropriately but with time they will be relaxed and be able to articulate all their requirements (Jeffery et al., 2016). Several research have been undertaken to investigate and determine the causes of time delays in construction projects. Research into determining the causes of time delays has reached saturation point, however, construction projects are still suffering from variations in relation to time delays (Yang et al., 2013, Le-Hoai et al., 2008, Frimpong et al., 2003).

Authors such as Olawale and Sun (2010) and Love et al., (2005) posit that the building construction industry continues to be affected with time delays and cost overruns with design changes as the top inhibiting factor of time and cost control in construction projects. Therefore,

changes in client requirements which invariably leads to design changes will manifestly cause time delays and cost overruns if not adequately controlled or managed. Ramanathan *et al.* (2012) in addition to the previous authors carried out a research in the Malaysian construction industry and identified it is not uncommon to experience poor time performance in construction industry, but it has now become even more common given that most projects are reported as being late (Ting *et al.*, 2007). Four studies were carried out to identify some of the major factors affecting project performance which in turn leads to unsatisfied clients (Othman *et al.*, 2006; Alaghbari *et al.*, 2007; Sambasivan and Soon, 2007; Ramanathan *et al.*, 2012), all the studies carried out agree that variations such as time and cost overruns in construction projects is a central concern in the construction industry, and many stakeholders are not only aware but are also concerned about the problem and how to solve it. Other studies that have also investigated the causes of time delays include the Hong Kong projects by Chan and Kumaraswamy (1997); causes of project delays in Lebanon (Mezher and Tawil, 1998; Bordoli and Baldwin, 1998); delays in public utility projects in Saudi Arabia (Al-Khalil and Al-Ghafly, 1999); delays in Nigerian construction projects (Elinwa and Joshua, 2001; Aibinu and Jagboro, 2002), delays in ground water projects in Ghana (Frimpong *et al.*, 2003). They all indicate that project delays or time overruns are common, and costly; which is perhaps why understanding and analysing them has become an important aspect of construction project performance. One of the objective of this research however, is to increase attention and focus on how design (client) requirements are gathered which could reduce the chances of re-work due to improper documentation of requirements thereby leading to project delays.

Another aspect of variation in construction project as mentioned by Jeffrey et al., (2016), which affects client satisfaction and construction performance is design changes or changes in client requirements which invariably leads to cost overruns, time delays or increased cost and time of re-work. He added that almost 75% of the challenges confronting construction project are created at the design phase which could be a result of lack of communication between client and design team members which could lead to documentation errors and omissions. Sometimes, the design team often misinterpret the client's requirements of the project when adequate time and attention is not given to capturing of the clients requirement during the briefing stage (Love et al. 2004). They also suggest that communication and harmonious relationship between clients and their design team and the involvement of clients in the design process can appreciably cut design related re-work. In addition, Sun and Meng (2009), posit that design changes could include poor or incomplete drawings specifications, design changes due to poor client briefing, errors and

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omissions and inconsistent site condition. Mohamad et al. (2012) reported that improper documentation of the client brief, inconsistent information in drawings, discrepancy between contracts, lack of geotechnical investigation/ wrong interpretation of findings and insufficient detail of existing site condition are factors that could cause design changes in construction projects.

Kaming et al. (1997) in Jeffrey et al., (2016) describe that the magnitude of design changes depend upon consultant's inability or inadequate knowledge of the process, design omission as a result of inadequate time given to the briefing process, incomplete drawings, design errors and quality of design lead to variations of cost and time increases. Design errors due to improper capturing of clients requirements can significantly degrade project performance and affect business relationships by generating rework, requiring additional time and resource expenditure which will invariably lead to client dissatisfaction if the not caused by client (Hashim et al., 2016; Hamzah et al., 2011) which will inevitably degrade project performance leading to unsatisfied clients (Jeffrey et al., 2016). Mohamed et al., (2012) and Josephson et al., (2002) noted that the contributing factors of client to re-work in Swedish construction industry are client's changes, extra orders, bad choice of material/method and wrong information, modifications to the original design, addition of new work/scope and unclear initial design brief. Alnuaimi et al. (2010) in a study on public construction projects in Oman identifies clients having additional work as a major factor causing changer orders. According to Hwang et al., (2014) client-related factors include change of plans or scope by the client, inadequate/incomprehensive project objectives by the client change in specification by the client, financial problems faced by client, impediment in prompting the decision making by the client, replacement of materials by the client, change in specification by the client and obstinate nature of the client.

Heylighen *et al.,* (2007) in his report stated that some architects do not take the time in identifying and adopting the various KM techniques available for adequately documenting project knowledge, especially during the briefing process. There is a need for constant engagement and interaction between architects and clients in construction projects which helps to improve the capture and sharing of knowledge created during the client briefing process (Bashouri and Duncan, 2014). In addition to the many problems faced in the construction industry, (Kamara et al., 2002; Wapukha, 2013 and Salisbury, 2013) posits that one of the key factors that can positively influence a construction project outcome is having a good knowledge of the client's business and the ability to interpret and elicit client's requirements and turn them

into design and technical specifications. They added that some clients find it difficult to get across the knowledge in their minds which is tacit in nature to architectural professionals during the briefing process while other clients do not necessarily know what they want or what the output and outcome of the construction process would be like. As a result, professionals need to have the right knowledge, expertise and tool to elicit this tacit knowledge (requirements) from their clients. Another problem faced by the construction industry is failure to consider the perspectives of the client (Mohamed et al., 2012; Dorst & Cross, 2001). Professional team may come up with solutions that are based on their own understanding of the requirements rather than what the client really needs (Morledge & Smith, 2013, Kelly, et al., 2008).

The National Construction Contracts and Law survey (2015) carried out a survey in the summer of 2015 on the construction industry legal and contractual practice. The survey reported that attaining compliance with contractual and legal obligations, and addressing occurring disputes, are integral parts of the construction process. However, information about the happenings across the industry is not readily available in the construction industry. The report brings together the views of the three main groups involved in the construction process: clients, contractors and consultants. Often times, their views are very similar and at other times they diverge significantly. The survey was designed to gather views from these different groups within the construction industry.

Client	15%	
Contractor		
	25%	
Consultant or Advisor		
	61%	
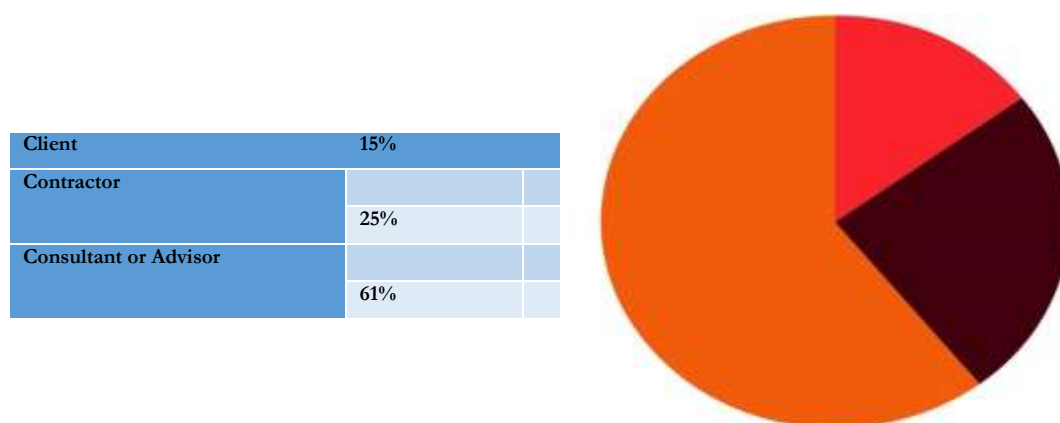
Figure 1.1: Responses of construction professionals involved in construction projects
(National Construction Contracts and Law survey 2015)

Results from the survey shows clients with the least percentage of responses based on the survey, however, one of the problems that has been identified to confront the construction industry is the quality of time and effort given to the involvement of client in construction

projects who in most cases under the traditional procurement route are the major sponsors of most projects.

Procurement is one of the five barriers to innovation identified within 'Construction 2025' strategy (NBS National construction contracts and law survey, 2015). The type of procurement method adopted creates the platform within which clients, consultants and contractors establish and legally describe their often complex relationship within a project. The type of procurement strategy adopted will most likely influence the contractual framework of a project, and may, to a large extent, determine it (NBS National construction contracts and law survey, 2015). It was discovered that the traditional procurement methods is often used in construction projects. Almost 50% of the respondent stated that the traditional procurement method was their preferred and most used method. On another hand, contractors tend to opt for the design and build procurement route most often while consultants and clients tend more towards traditional procurement, hence this research seeks to focus on the role of the client in the briefing process with emphasis on the traditional procurement route, and how the use of KC techniques can be used in eliciting client's requirements during the client briefing process with the aim of improving project outputs which invariably improves client satisfaction.
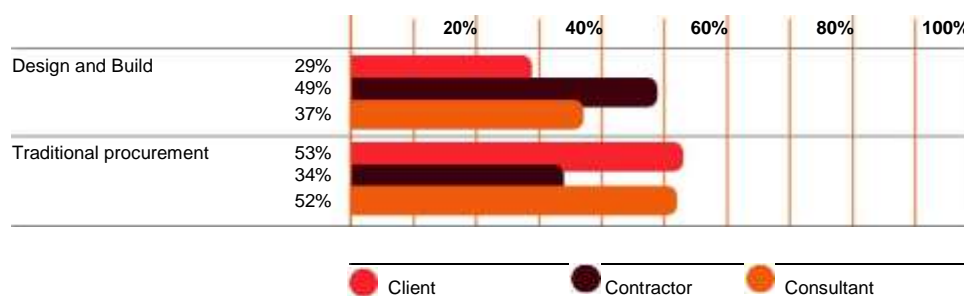
Figure 1.2: Most frequently used procurement method in construction projects
(National Construction Contracts and Law survey 2015)

Kasimu et al., (2013); Soon and Zainol, (2011), reported that according to Wernerfelt, (1995), KM is a technique that involves the capturing, sharing, distributing and creating of knowledge with the aim to improve an organisations performance and competitive advantage. Fong and Chu (2006) retort that KM is a method of making knowledge as a strategic asset to drive sustainable organizational benefit and also encourage an organisational approach to identify, capture, evaluate and share a firm's intellectual resource. Kasimu et al., (2013) posit that several

organisations face the difficulty of construction delays, cost overruns, disputes, poor planning and design, construction reworks, mistakes/errors as a result of not adequately managing the knowledge that occur in project processes. A lot of these problems occur as a result of ineffective and inadequate strategy/policy to manage these construction project problems. One of the pivotal and vital strategies in managing construction project performance is how knowledge is captured, documented, secured, stored, and shared. Khaksar, et al., (2011) added that for construction projects to deliver and improve performance, adequate attention needs to be given to the wealth of techniques that are available in capturing project knowledge which can also help in mitigating against variations in construction projects and documenting effective client requirements during briefing.

Variations in construction project have been seen to be a major challenge and problem facing construction project and the industry at large. Such variations include cost overruns, time delays, project re-work and design changes. One underlying factor that has been identified to cut across the major problems of variations investigated in this course of research is the issue related to client management. Under the traditional procurement route which this research is underpinned, clients are a major influence to the success of the project and this is dependent on how they are adequately managed. Adequately capturing or eliciting clients requirement at the briefing stage could be a potential solution to the causes of variation that occur in construction projects thereby reducing design change errors which occur at the client briefing stage which could lead to cost overruns, time delay and project re-work. The next section highlights the aims, objectives and research questions of this study.

1.3 Research Aim and Objectives

This research aims to develop a framework needed to support the effective capturing of clients requirements during the client briefing process in order to improve client satisfaction in the UK construction industry. Client briefing is the thorough and systematic process of evaluating and prioritizing the requirements of the client during the briefing process with the aim of proffering solution to the client problem. The major objective of this process involves the use of certain techniques in eliciting Client's Requirements (CR) during the client briefing process. The aim of this study is achieved through following objectives:

❖ To explore the importance of knowledge capturing to the client briefing process in UK construction industry.

- ❖ To document and explore the most effective and often used knowledge capturing techniques in client briefing in UK construction industry.

- ❖ To critically analyse barriers to knowledge capturing during client briefing in UK construction industry.

- ❖ To critically investigate factors that influence proper client briefing in the UK construction industry.

- ❖ To develop a framework that would help construction professionals capture and elicit knowledge-requirements effectively from clients during client briefing.

1.4 Research Questions

- ♦ How important is Knowledge capturing to the client briefing process for improved client satisfaction?

- ♦ What knowledge capturing techniques are most effective in helping professionals adequately capture client's requirements and to what extent would effectively capturing CR's have on client satisfaction?

- ♦ What key barriers impede the successful capturing of clients requirements during the briefing process.

- ♦ What important factors influence or impact the capturing of clients requirements during the briefing process.

1.5 Scope of Research

This research focuses on capturing client's requirement using knowledge capturing techniques in the UK construction industry for improved client satisfaction. Focus is given to the wealth of knowledge capturing techniques which are very effective in capturing or eliciting client's requirements during the client briefing process. This research will place emphasis on the traditional procurement route as the underlying philosophy under which the concept of KC techniques in eliciting client's requirements during the client briefing process is built. The national association of construction frameworks (2016) reported that the traditional procurement route under which this research is underpinned is probably the most commonly used method of procurement and it is suitable for all clients, including inexperienced clients, complex projects

and projects where functionality, time predictability and cost certainty is a prime objective. In some cases, the client is responsible for developing the business case for the project, provides a brief and budget and appoints a team of consultants to prepare a design and tender documents while in other cases, the client requires the expertise of a consultant (architect) to help capture and document their requirements accordingly before proceeding to the design phase of the project. The traditional procurement strategy focuses more on the functionality of the client and the communication between the client and the design team (constructing excellence, 2004). Since this research focuses on interaction between client and the design team (architect) and the use of knowledge capturing techniques in capturing or eliciting client's requirement during the client briefing process, the traditional procurement route is the most appropriate type of procurement route for this study.

This strategy is a low-risk option for clients who wish to minimise their exposure to the risks of cost overruns, time delays or design failure. This research will also identify the different KC techniques that exist in KM and analyse some of the KC techniques used in capturing or eliciting client's requirements during the briefing process with the aim of exploring which KC techniques are more effective. This research will also explore the importance of effectively capturing client's requirements using KC techniques during the client briefing process, the barriers to knowledge capturing during the briefing process and the various factors that affect the client briefing process in the UK construction industry. A framework is developed to help architects capture client's requirements effectively using effective KC techniques during the client briefing process for improved client satisfaction in UK construction industry. Although the findings and data collection strategy is carried out within the UK, knowledge capturing techniques and client briefing systems are more likely to be the same in all construction industry, hence the findings have the potential to be replicated elsewhere. The next section highlights the strategy, method and techniques that are used in addressing the aim and objectives of this research.

1.6 Research Methodology

To ensure that this research is conducted in a manner to satisfy its primary aim and objectives, several methodological steps have been developed and have been implemented throughout the course of this research. This research is divided into 3 distinctive phases namely; literature review phase, data collection and analysis phase, and finally the framework development stage. The first phase commencing this research is the literature review phase. This phase of the literature review study is designed to develop a comprehensive understanding and critical review of knowledge,

the history of knowledge, types of knowledge, knowledge management, schools of thought on KM, various KM models, KM processes and Knowledge capturing. The second part of the literature review critically investigates and explores the general construction industry, the UK construction industry, the various procurement routes in the UK construction industry, the client briefing (CB) process, requirement engineering, client satisfaction, and the various factors influencing the CB process and so on. The entire research process is shown in Figure 1.2.

The second phase of this research focuses on developing a sound methodology to achieve the aim and objectives of this research, as well as answering the research questions posed. Through justifications of research design and methodologies selected, both qualitative and quantitative data collection is conducted at this phase. The data collection revolves around 4 major themes namely;

- Importance of KC

- KC techniques

- Barriers to KC

- Factors influencing CB

The final phase of this research is the framework development, conclusion, recommendation and reporting stage. The findings from both qualitative and quantitative analyses are then tabulated according to the themes in answering the research questions. Findings from this research is taken on board and incorporated into the development of a framework using effective KC techniques in eliciting or capturing client's requirement during the client briefing process for improved client satisfaction in the UK construction industry. Recommendations are made based on the findings of this research and conclusions from this research are included in the thesis.

Figure 1.3: Research Methodological Framework
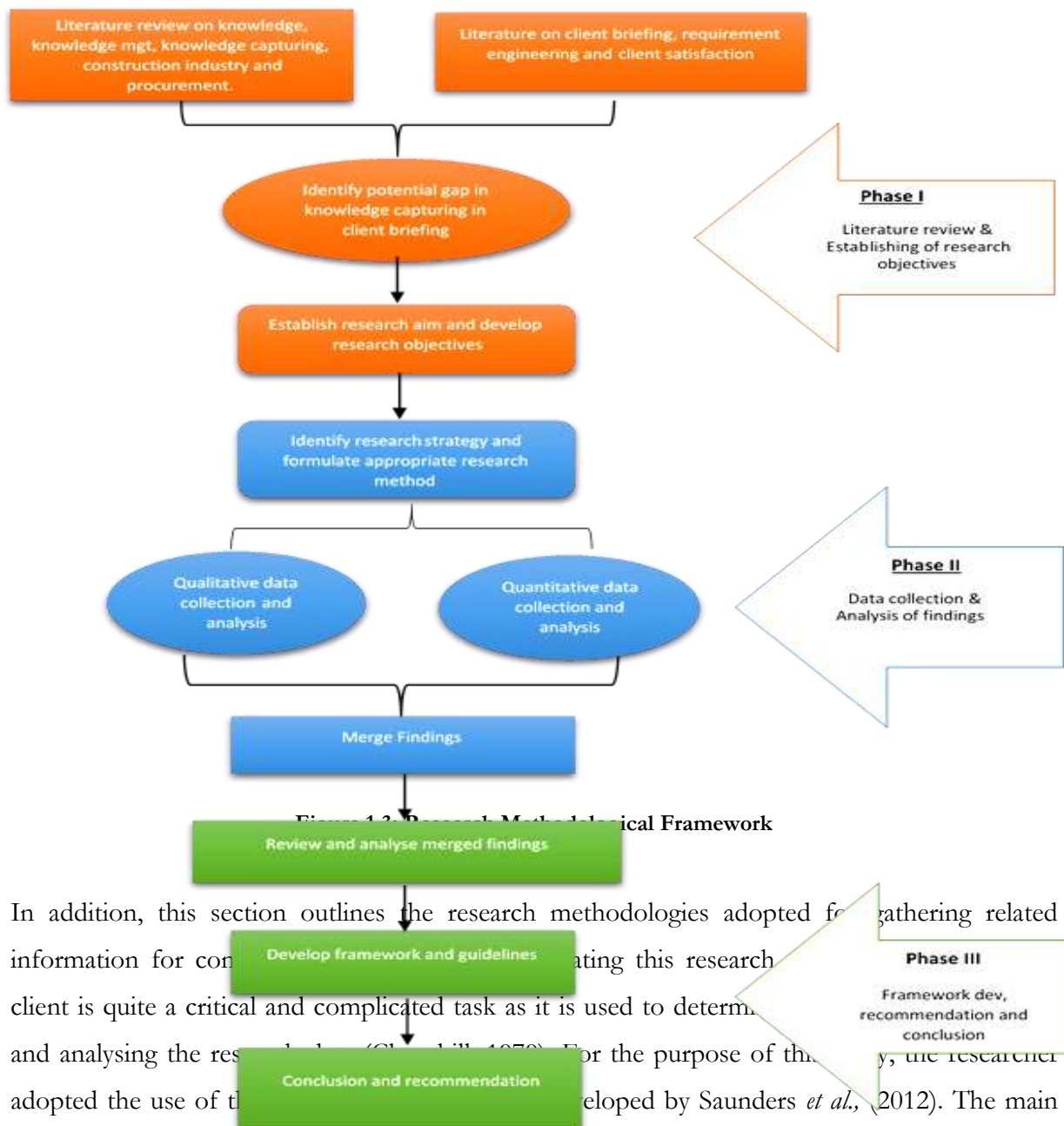
In addition, this section outlines the research methodologies adopted for gathering related

information for con[...] ating this research

client is quite a critical and complicated task as it is used to determ[...]

and analysing the res[...] (Churchill, 1979). For the purpose of th[...]y, the researcher

adopted the use of th[...]eloped by Saunders *et al.,* 2012). The main

feature of this model is its clear and detailed framework that enables researchers to select proper

strategies and approaches following the different layers of the model. The philosophical stance

for this research leans towards an idealist ontological assumption, an interpretivist

epistemological stance and a value laden axiological assumption. The survey research is adopted

as the research strategy for this study in order to deeply explore and investigate the techniques

used in capturing client's requirements during the client briefing process. The 'survey' research

strategy is required to find generic views on the perception of architects on the different KC

techniques used in client requirement elicitation during the client briefing process. Semi-

structured interviews were conducted with six architectural professionals in the UK construction

industry with over 15 years of experience spanning requirement gathering to briefing

documentation, and questionnaire survey was also administered to over 220 respondent with 100 responses generated from the survey responses. The techniques adopted to collect these data are both qualitative and quantitative data techniques. The content analysis technique (Nvivo23) was used as analysis tool for the qualitative data and statistical analysis software (SPSS 11) was used as analysis tool for the quantitative data for this research. The research structure is describe in the next section.

1.7 Structure of Thesis

The thesis is divided into seven chapters. A brief breakdown of the chapters and what the researcher seeks to address in each chapters are as follows:

- ***Chapter 1   Introduction***

This chapter provides the background of the research, the research problems, aim and objectives as well as the relevant research questions which is the foundation for all discussions in the following chapters. Accordingly, the achievements of this research are also briefly mentioned besides the scope of this research. Finally the structure of the thesis is presented at the end of the chapter.

- ***Chapter 2   Knowledge Management in the Construction Industry***

This chapter will address the definition and overall concept of knowledge, knowledge management, knowledge capturing, the construction industry and procurement route in construction industry. It includes a detailed exploration of current and past literature relating to knowledge management especially knowledge capturing in the construction industry. The various KC techniques, barriers to KC and factors influencing the CB process are explored extensively in this chapter. The chapter throws light into the concept of knowledge capturing and its ability to exploit and manage barriers and factors that influence the CB process helping to identify gap in knowledge with regards to the use of effective KC techniques. This chapter ends with a summary of key findings, which direct the decisions for the coming stages in this research.

- ***Chapter 3 Client Briefing in the Construction Industry***

This chapter discusses in detail who the client is, what the client brief is about, requirement engineering, factors influencing the client briefing process and client satisfaction in the UK construction industry. Apart from that, this chapter also highlights the importance of client briefing and how this can influence overall client satisfaction. The model selected is incorporated in the following data collection and data analysis stages in this research.

- ***Chapter 4   Research Design and Methodology***

This chapter discusses the design and methodology selected for this research. Firstly, the philosophical standpoint of the research, research approach, and techniques adopted in the research are discussed in this chapter. The second part of this chapter discusses the formulation and design of data collection methods employed in this research. The explanation and justification of decisions made pertaining to research design and methodology selected is also included in this research.

- **Chapter 5   Qualitative Data Analysis**

This chapter concentrates on the qualitative data analysis; specifically the participants in interview sessions and the rationale of sampling, the management of qualitative data, the coding process, methods chosen and the steps in analysing the qualitative data. The findings from qualitative data analysis are discussed in detail in this chapter.

- **Chapter 6   Quantitative Data Analysis**

This chapter includes the discussion of findings from quantitative data analysis. It will also include discussion on the sample included in the questionnaire survey, tests conducted in the analysis and the findings from each section of the questionnaire.

- **Chapter 7   Discussion**

This chapter will revisit the findings in accordance with the objectives first set out at the initial stage of this research. It outlines the proposed framework for partnering in Malaysian construction industry, which takes organisational culture into consideration for success of partnering. The reflection of the researcher on the applicability of the framework and the research process is also included. The final section of this chapter includes the limitations for this research, recommendations and suggestion for future research. The chapter ends with conclusions for this research.

- **Chapter 8   Framework Development**

This chapter discusses the development of the framework which is the core aim of this research. The chapter addresses the triangulation of literature, qualitative and quantitative analysis in a bid to develop a robust framework and set of guidelines that will enable architectural professionals capture clients knowledge-requirements with the aim to improve client satisfaction by reducing variations in design changes, cost and time of delivery.

- **Chapter 9   Limitation, Contribution and Conclusion**

This chapter will summarise the thesis in accordance with the objectives first set out at the initial stage of this research, while highlighting the limitations that confronted the research and the contribution of the research to the body of knowledge.

1.8 Summary

This chapter highlighted the background of the research, research problem and research aim and objectives. The chapter also outlined an overview of the scope of this research, followed by a brief overview of the research methodology and the overall structure of the report. The next chapter presents a comprehensive literature review on knowledge, knowledge management, KM in the construction industry, requirement management, client briefing, knowledge capturing techniques, factors and barriers associated with knowledge capturing in the client briefing process. All this is in line with the aim and objectives of this research. The next two chapters will review the current trends in literature in the areas of knowledge, knowledge management, construction industry and client briefing.

Chapter 2- Knowledge and Knowledge Management

2.1 Introduction

The first chapter of this thesis created the basic understanding of the use of KM most especially KC in addressing the various problems and challenges that confront construction project outputs. Accordingly, it is important to develop a thorough understanding of the overall concept of knowledge management and its benefits within current practices in the UK construction industry as it will form the basis for informed decision making in the progress of this research. Therefore, the main purpose of this chapter is to provide a review knowledge and knowledge management based on extensive search of existing literature published in academic and trade journals. The chapter begins by describing and exploring the history of knowledge and the various definitions of knowledge. The chapter progresses to identifying the different components of knowledge, how knowledge is explored hierarchically, the various schools of thought on knowledge, the different knowledge models and the characteristics and types of knowledge. The chapter then explores how knowledge can be properly managed, the various components of knowledge management and the different processes involved in KM. Emphasis is placed on KC which is one of the fundamental processes in KM. The chapter then proceeds to explore the various KC techniques, importance of capturing knowledge and the various barriers that occur during KC. Finally, a summary of key findings from the extensive literature review is provided at the end of this chapter.

2.2 History of Knowledge

The word "knowledge" has been discovered to mean different things to different people in different subject areas which means that the definition of knowledge is subject and peculiar to the individual's sector of operations and discipline. Knowledge has been identified with certain concepts such as data, information, intelligence, skill, experience, expertise, ideas, intuition, or insight, which all vary and depend on the context of usage (Gao et al., 2008). One of the core authors on knowledge in person of Plato's view knowledge as "justified true belief", and this was then further buttressed by Nonaka and Takeuchi (1995) to mean "a dynamic human process of

justifying personal belief toward the truth" at the organisational level. Bell (1973) in addition defined knowledge as "a set of organized statements of facts or ideas, presenting a reasoned judgment or an experimental result, which is transmitted to others through some communication medium in some systematic form" (Bell, 1973). Other authors such as Davenport and Prusak (1998), expanded on the definition of knowledge as a dynamic mix of experiences, values, data, information and insight". Boisot (1998) added to the pool of knowledge definition stating that knowledge is generated from a collection of information overtime derived from series of data or set of ideologies an observer hold with respect to an event.

Aidemark (2009), expands more on Drucker's definition of knowledge stating that knowledge is product of information that propels a desired and more effective action as a result of new knowledge obtained (specialized knowledge). Furthermore, in the work of Drucker, a study was carried out which identified a phenomenon known as knowledge work (Drucker, 1995). This phenomenon accentuates that systematic learning (formal schooling) is the most effective way that knowledge required for knowledge work is acquired. He explained further that such knowledge for knowledge work will most likely not be acquired through processes such as mentorship or apprenticeship (Drucker, 1994). Another aspect of knowledge discussed by Drucker is the utility of knowledge, which involves the application of knowledge to businesses. The work of Drucker and Nonaka believe that knowledge should cause or create a corresponding action. The contrasting feature of argument between Drucker and Nonaka lies in the fact that Drucker places emphasis on knowledge produced by the knowledge workers which in-turn leads to their productivity, while Nonaka argues that everyone in the organisation should be involved in knowledge-creating activities. The difference mainly comes from the different types of organisation they addressed when they discussed, knowledge management and knowledge creation.

Another notable author on the subject of knowledge is Michael Polanyi who carried out a study in 1966 defined knowledge as being a subjective or objective element which can be either explicit or tacit in nature. In his study, he divided human knowledge into two dimensions: explicit knowledge which is knowledge that is codified and documented which is expressed in the form of data, scientific formulae, graphs, specifications, manuals, textbooks and so on and tacit knowledge he defined as knowledge that is experience and action driven which is highly personal and hard to transfer (Polanyi, 1966). He added that knowledge is not a function of a series of events or the result of determined scientific endeavour, rather knowledge has its nature grounded

in human cognitive ability such as the ability to know what is beautiful and how we know if we have passion (Polanyi, 1962, 1966). Recognising and discovering new ways and processes to how things are done is fundamental to acquiring existing knowledge and generating new knowledge (Gao et al., 2009). Hayek's (1945) idea on knowledge centres on the contextual nature of knowledge which is widely distributed throughout communities and societies. He further explained that the use of circumstantial knowledge is never concentrated or integrated in its natural form but expresses itself as incomplete and frequently contradictory knowledge which is possessed by separate individuals which is the more reason why it is important to manage knowledge in an organisational context in order to identify features of contexts to enable the processes that can facilitate the flow of knowledge of individuals in organisations, communities and societies for a purposeful objective.

In Gao's et al., (2009) early work, it was reported that organisational knowledge can be considered at two levels: the first being the *individual knowledge level* and the second being the *organisational level*. Individual knowledge level corroborates the work of Drucker on specialised knowledge and that of Polanyi's on tacit knowledge. This knowledge also includes the values of an individual as well as their professional ethics and morals. This personal knowledge belongs to the person who possesses it as oppose to the organisation they works for and for such knowledge to be available for use by the organisation, it has to be codified or captured as it resides in the mind of the individual. At the organisational level, this knowledge is further divided into two types which are organisational static and organisational dynamic process knowledge. The organisational static knowledge is similar to explicit knowledge in terms of the codification of mission and vision statements, technology, management theory, and information and data upon which knowledge is based or drawn out. This static knowledge is further classified into two types' namely *visionary knowledge* such as organisational vision, mission, ethics, and morals and objective (or subjective) knowledge such as science, technology, and management. This knowledge exist in form of hard aspects such as technological equipment and products or soft aspects like research laboratories, qualified employees, patents, copyrights, services, and the ways of practicing management. The second type of static knowledge is the *generic knowledge* (information and data), which the organisation owns and have control over. The organisational dynamic process knowledge, the second type of organisational level knowledge deals with knowledge relating to human actions or the various organisational operations and activities, called the organisational human activity system (Mahdi et al., 2011). A brief history of the origin

of knowledge and how it came into existence helps to investigate in-depth on what the concept of knowledge really is.

2.3 What is Knowledge

A dictionary definition of knowledge defined knowledge as "facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject" (Oxford dictionary). Knowledge is a by-product of organised information which was developed from processed data but it's richer and carries more meaning than information (Fahey and Prusak, 1998). Such knowledge includes experiences and understanding gained through study, which results from making comparisons, identifying consequences, and making connections (Fahey and Prusak, 1998). Some authors have discussed that some of the product of applied knowledge is wisdom and insight (Servin and Brun, 2005). Organisations generally see knowledge as "know how" which involves the ability to know have the right knowledge at your disposal when the need arises (Servin and Brun, 2005). Some other authors see knowledge as neither data nor information, which might have an element of both, but however the difference between these terms is often a matter of degree. This has generated an on-going debate about the many differences that exists between knowledge, data and information; however, there might actually be a lack of correlation between data, information, and knowledge (Davenport and Prusak, 2000). For knowledge to be effective, the need to manage such knowledge is essential hence the concept of KM which will be discussed later in the course of this research. Orange *et al.* (2000) describe knowledge as the end-product of acquiring information through learning which is specific to an individual. In addition, they defined information as expressed knowledge, which can be stored, captured, accessed and shared. In addition to the previous know-how definition of knowledge, some other authors see knowledge as knowing the why, how and who and an intangible resource from which future revenues can be derived (Kamara et al., 2002). The lack of knowledge in a system implies that they system has a tendency to fail based on the outcome of the task performed. Consistency in the lack of application of knowledge in such system overtime can lead to the system ceasing to exist which enforces the importance in understanding knowledge and its management (Kamara et al., 2002). From the researcher's standpoint, the operational definition of knowledge is a dynamic mix of information and experiences which influences the way in which the custodian of such knowledge interpret situations and make decisions. Having defined what knowledge is in respect to different authors,

knowledge has different components under which it operates. These components are discussed in the next section.

2.4 Characteristics and Types of Knowledge

After studying and analysing different definition of knowledge and its frameworks, it is worth to highlight some key characteristics of knowledge. Blakeley *et al.,* (2005) consider six characteristics of knowledge from an economic standpoint. These characteristics are; *Non-rivalry*, *Non-excludability*, *Cumulative*, *Uncertainty* and *Lags*. Non-rivalry is seen as one of the most important characteristics of knowledge, which asserts that using an idea and knowledge by an individual does not prevent other individuals from using same simultaneously. The second characteristic implies the inability of knowledge to exclude individuals from using it, which depends on some factors like; the legal and environmental regulations, characteristics of both imitators and knowledge creators and the state of technology. The other characteristics of knowledge imply that knowledge is dependent on past knowledge, uncertainty and long lags before practical application. Generally, there are two common dichotomies of knowledge types that used by researchers which are tacit and explicit knowledge, and individual and collective or group knowledge (Hislop, 2013).
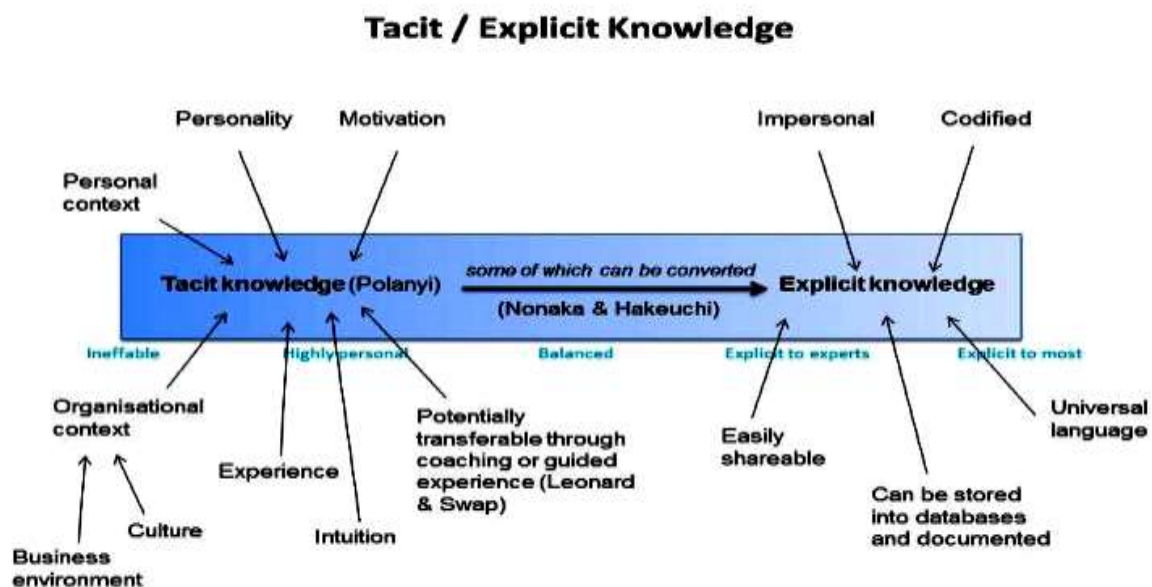
Figure 2.1: Tacit and Explicit continuum (Source: Hislop, 2013)

Despite various classification of knowledge, most scholars have consensus on using two types of knowledge, tacit and explicit, in their research (Gourlay, 2006; Nonaka & Takeuchi, 1995). This dichotomy is generally used for analysing organisational knowledge. According to Nonaka (1994), tacit knowledge is the kind of knowledge that can only be experienced and achieved in relevant context but cannot be easily articulated. In other words, it consists of individual's values, beliefs and mental models that ingrained in their minds and skills. Nonaka *et al.,* (2000) define tacit knowledge as knowledge based on past experiences of individuals in the form of attitudes, commitment, evaluation, points of view and motivation. In contrast, explicit knowledge is the knowledge that can be articulated, codified and stored in certain media. It can easily be understood and transferred to another person by verbalising it and appropriate without knowing subject. However, transferring tacit knowledge requires full potential of personal interaction in order to build trust and share understandings between knowledge holder and recipient (Nonaka & Takeuchi, 1995). According to Cook & Brown (1999), Nonaka & Takeuchi (1995), and Alavi and Leidner (2001), there are three main areas that tacit knowledge differs from explicit knowledge;

- Codifying and methods of transferring knowledge

- Methods of accumulation and acquisition of knowledge

- Modes of appropriation and aggregation of knowledge

Having discussed the characteristics of knowledge, the next section sheds more light on the different types of knowledge.

2.4.1 Tacit Knowledge

This is a type of knowledge that exists in the heads of people. This type of knowledge is less concrete compared to the explicit knowledge in that it can only be articulated verbally from the head and usually resides in the sub-conscious of the individual. This type of knowledge is difficult to codify (translated to documents or databases) as it might lose meaning within its original context. A very good example is knowing how to ride a bicycle, one might know how to ride a bicycle perfectly well but when it comes to documenting the process of riding a bicycle, that might prove very challenging, hence, tacit knowledge is basically transferred as a result of learning by doing (Nonaka and Takeuchi, 1998). Tacit knowledge can be difficult to access, as it is often not known to others, which in most case, many people are not aware of the knowledge

they themselves possess or of its value to others. Tacit knowledge is considered more valuable because it provides context for people, places, ideas and experiences. It generally requires extensive personal contact and trust to share effectively. Knowledge management tends to have a connecting and a collecting dimension (Nonaka and Takeuchi, 2003). The connecting dimension involves linking people with people specifically people who need to know with those who do know, and so enhancing tacit knowledge flow through better human interaction, so that knowledge is diffused around the organisation and not just held in the heads of a few. Connecting is necessary because knowledge is embodied in people, and in the relationships within and between organisations. Examples include collaborative working, communities of practice, brainstorming sessions, networks of people with a common interest, and various "socialisation" activities designed to support knowledge flows (Servin and Brun, 2005).

2.4.2 Explicit Knowledge

Explicit knowledge is more or less the mirrored version of tacit knowledge. This type of knowledge is easy to capture and write down in documents or databases (Nonaka and Takeuchi, 2003). Examples include, best practices, instruction manuals, diagrams, graphs, repositories, lesson learned just to mention a few. This type of knowledge is further divided into structured and un-structured knowledge (Nonaka and Takeuchi, 2003). Structured explicit knowledge as the name implies is information or knowledge that follows a particular structured pattern for the purpose of relating or presenting such documents in a more presentable way for easy retrieval in the future. Examples include documents, databases and spread sheets. Un-structured explicit knowledge is information or knowledge that does not follow a particular format. These information or knowledge are said to be un-structured in nature. Examples include emails, images, audio and video materials (Servin and Brun, 2005). From characteristic viewpoint; tacit knowledge is Inexpressible in a codifiable form, Subjective, Personal, Context-specific and Difficult to share. Explicit knowledge on the other hand is codifiable, Objective, Impersonal, Context independent and Easy to share.

2.4.3 Individual or Group Knowledge

Hislop (2013) argue that knowledge resides not only in individuals but also in social groups. Knowledge can be found in different forms of shared assumptions or perspectives, shared work practices and routines in social groups. Spender (1996) uses tacit and explicit dichotomy and Individual-group dichotomy together in order to produce generic types of knowledge. Table 2.1, consists of two-by-two matrix with four types of knowledge which are; *Conscious*, *Objectified*,

Automatic and *Collective*. Objectified and Collective types are more important because they exist in social groups. For example, formalised organisational routines or documented rules are objectified knowledge, which are both explicit and reside in social group. An example of collective knowledge on the other hand is informal organisational routines and ways of accomplishing task and working. This type of knowledge is the most important one because it is not only exists in social group but also it is form of tacit knowledge that cannot be codified.

Collective knowledge is not limited to specific type, size or characteristics of community. It exists and develops in different types of communities from small-scale level, like teams or communities, to large-scale level like departments, business units, sites and organisations. Hecker (2012) did a deep analysis and distinguished three types of collective knowledge which is worth to be highlighted. According to his analysis collective knowledge consists of *Shared Knowledge*, *Complementary Knowledge* and *Artefact-Embedded Knowledge*. The first type is located in individuals, for example the way of managing customer interactions within a sales team is a type of shared knowledge. The complementary knowledge focuses on the importance of the distribution of expertise within a group or the community. Group members could benefit from this type of knowledge to effectively coordinate their work activities, because sum of individual (expertise) knowledge and their collective effort is greater than individual's effort and knowledge. The last type of collective knowledge is about knowledge that embedded in artefacts which are used by group members like shared presentation or database, or collectively developed products which is an example of technological artefacts. Table 2.5 represents different types of collective knowledge.

Table 2.1: Generic Knowledge Types (Source: Hislop 2013)

	Individual	Social
Explicit	Conscious	Objectified
Tacit	Automatic	Collective

This session creates the needed understanding on what knowledge is, its origin, how it came into existence, the different components and types of knowledge as well as the various models present developed. It is therefore appropriate to say that the subject of knowledge management, which is the main theory in which this research is based, does not come alive without first and foremost creating the necessary understanding of what the knowledge is and how such

knowledge is to be managed. The next section investigates critically the concept of KM with the aim to create the needed foundational understanding for this research.

2.4.4 Components of Knowledge

The work of Davenport and Prusak (2000) assert that organisation success depends on knowing what the organisation's needs, what is available to them and what they can and cannot do with each. They identified two basic component of knowledge which is data and information. *Data* is said to be a set of discrete and objective facts about events. In the context of organisational usage, data is described as set of structured records of transactions. An example of such is when a customer with a loyalty card goes shopping for groceries; such transaction carried out by the customer can be partly described by the store as data. Information such as how much was spent, how many point were received, the customers purchase history, what the customer buys more often and so on can be set of data generated on behalf of the customers. Such facts in themselves say nothing about whether the service station is well or badly run, whether it is failing or thriving. One of the founding brains behind the idea of management, Drucker (1993) discussed that information is "data endowed with relevance and purpose," this of course shows that data usage by itself is not relevant and does not serve any given purpose. Drucker (1993) further stated that data is a set of description of a process but does not provide adequate information or knowledge on which judgment or decisions can be made. While the raw material of decision making may include data, it cannot tell you what to do. All organisations need data to some extent to run their systems, some organisations such as Banks, insurance companies, utilities, and government agencies such as the IRS and the Social Security Administration use data and the management of these data in the effective and successful running of the organisation (Davenport and Prusak, 2000).

Information is defined as meaningful message which is usually in form of a written document, audio or visible communication (Davenport and Prusak, 2000). They further described information as having two basic qualities which is a sender and a receiver. The role of information is to create, change or alter an individual's perspective about something, which informs judgement and behaviour (Quintas et al, 1997). Every data needs to be properly informed to make meaning. The word "inform" originally meant "to give shape to" and information is meant to shape the person who gets it, to make some difference in his outlook or insight. For example, a memo to a line manager full of unconnected ramblings may be considered "information" by the writer but judged to be noise by the recipient (Davenport and

Prusak, 2000). Subsequent generations of scholars have emphasized the importance of information. Many writers over the last three decades have been arriving at some conclusion that information, as well as the traditional factors of land, labour and capital, have the potential to create wealth (Quintas et al, 1997). Bell (1973) relates information as being the "axial principle" of a post-industrial society in which the majority of employment is for "information workers" rather than for those engaged in manual tasks. Unlike data, information has meaning and not only does it affect the perspective or orientation of the receiver, it has a shape in itself which is organized for certain purposes. Data becomes information when its creator adds meaning to it. Information can be *contextualized,* meaning we know for what purpose the data was gathered, c*ategorized*, meaning we know the units of analysis or key components of the data, *calculated* meaning the data may have been analysed mathematically or statistically, *Corrected* meaning errors have been removed from the data and *Condensed* meaning the data may have been summarized in a more concise form.

Some have the idea of knowledge as something broader, deeper, and richer than data or information (Nonaka, 2005). People speak of the term "knowledgeable individual," which they mean someone with sound, informed, and reliable understanding of a particular subject, someone who is educated and intelligent. On the contrary, it is quite impossible to talk of a "knowledgeable" memo, handbook, or database, even though these items might be produced by knowledgeable individuals or groups (Quintas et al, 1997). The search for the true definition or the epistemological stance on what knowledge really is has been on for decades; however, arriving at a final solution at this point might be un-realistic. Whatever ideology or definition to knowledge arrived by would solely be based on already existing theories and literatures of other acclaimed researchers. One definition which describes the characteristic nature of knowledge and which also makes it difficult to manage as well is the fact that knowledge is collection of experience, values, contextual information, and expert insight which provides a framework for evaluating and incorporating new experiences and information which originates and is applied in the minds of the knower (Nonaka, 1991, Davenport and Prusak, 1998). In organisations, knowledge has often times become embedded not only in documents or repositories but also in organisational routines, processes, practices, and norms (Davenport and Prusak, 2000). Knowledge is not a simple element, it involves the mixture of various elements which includes formal structures; it is intuitive in nature which makes it difficult to capture or codify in logical terms (Nonaka and Takeuchi, 1995). Chrysler, for example, stores knowledge for new car development in a series of repositories called "Engineering Books of Knowledge." The goal of

these "books," which are actually computer files, is to be an "electronic memory" for the knowledge gained by automobile platform teams (Bell 1973; Davenport and Prusak, 2000).

Knowledge has been described as having a slippery nature which requires reflection on certain components to better understand it (Nonaka and Takeuchi, 1995). Experiential Knowledge develops over time and includes what we absorb from courses, books, and mentors as well as informal learning (Nonaka, 2005). Nonaka (2005) further added that experience refers to what we have done and what has happened to us in the past. Experience and expert knowledge can be used interchangeably as they are both derived from a Latin verb meaning "to put to the test." This goes on to show that expert's people with deep knowledge of a subject have been tested and trained as a result of experience. It may be as easy as being able to produce a good report due to consistent reporting and may also be as complex as forecasting construction project trends in the nearest future, this has made organisations wake up to the reality of knowledge as corporate asset (Davenport and Prusak, 2000). People in organisations have always sought, used, and valued knowledge, at least implicitly. Companies hire for experience more often than for intelligence or education because they understand the value of knowledge that has been developed and proven over time (Nonaka, 2005). Managers who are saddled with the responsibility of making difficult decisions are much likely to approach those who have the know-how rather than look for such information in databases (Leung and Fong, 2011). Studies have shown that managers get two-thirds of their information and knowledge from face-to-face meetings or phone conversations, however; only one-third comes from documents (Davenport and Prusak, 2000, Leung and Fong, 2011). Having identified the various components that make up the concept of knowledge, it is apropos that we arrange them in order of importance and how their properties influence the development of knowledge.

2.4.5 Hierarchy of Knowledge

Levy (2011) study on data, information, knowledge and wisdom described data as a series of unconnected facts and observations. He added that unrefined data which could be sometimes referred to as source data is a form of data that is yet to be processed or refined for a given use. He further discussed that the term unrefined or unprocessed connotes data which effort has not been made in interpreting or understanding its use. Such unprocessed data is classed as facts which could have arisen as a result of some observation or measurement process, or the output of some previous data generating process for example computer input data. The word "data" is the plural of Latin "datum", "something given", which could also be called "atomic facts" and

cannot be made any simpler (Swap, 2005). He added that data is a series of non-related facts and observations that can be converted to information by selecting, sorting, summarizing, or analysing the data in some way. Zin (2007) collated several information scientists' definition of data, information and knowledge. Some of the authors Landry et al., (2001) posit that data can be regarded as facts which are then developed on the basis of observation or measurement. They define information on the other hand as data which has been organised to produce meaning and finally knowledge as the use of information available to make decisions. Another author in Zin (2007) defined data as statistical facts that are quantifiable and measurable and information as data that is organised, categorized, and arranged which gives meaning and relevance or purpose and finally knowledge as information that is organised to give a higher level of meaning. Figure 2.1 gives a diagrammatic representation of these components of knowledge in a hierarchical manner.
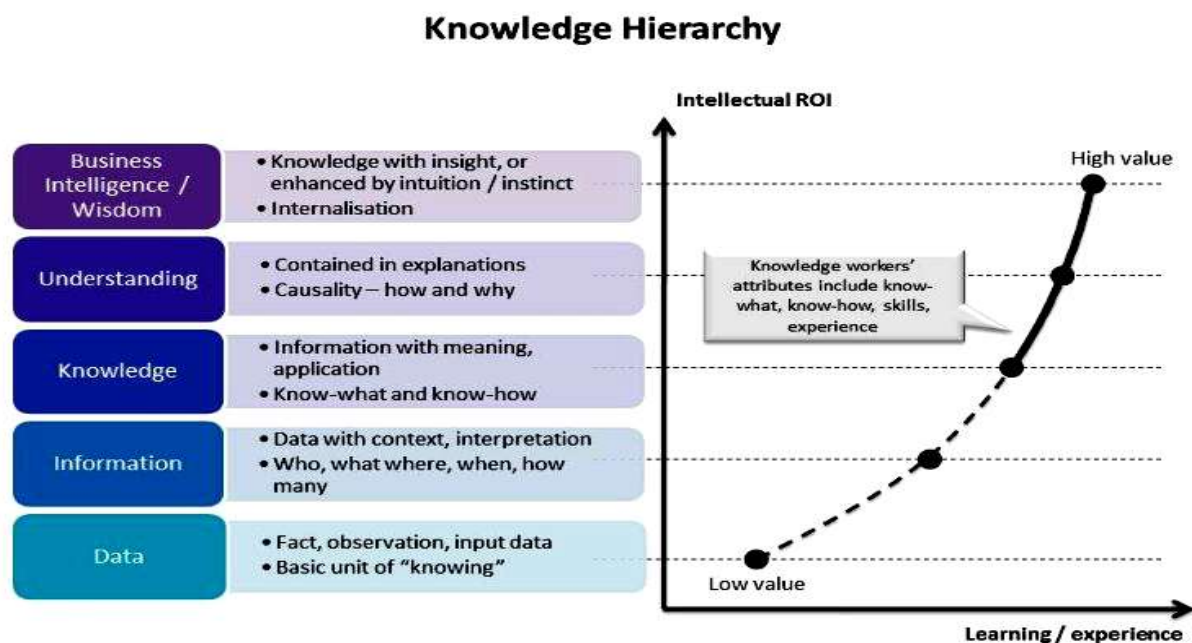
Figure 2.2: Hierarchy of Knowledge (Source: Swap et al., 2005)

From the various definition of data, information and knowledge, it is clearly evident that there is a connection and relationship between the three elements. Information is seen as an element that can be communicated and knowledge is seen set of conceptual ideologies or believes held in the human brain which is imperfectly represented by information that can be communicated (Pillania, 2008). The concept of knowledge has long been considered a controversial and challenging topic amongst many researchers as it does not have a particular definition to it which

makes it an unending task (Bhatt, 2000). Plat (427-347 B.C.) defines knowledge as "justified true belief" (Crane, 1960). According to Plat definition, knowledge cannot be generated by merely believing something even such belief is not true. This means that an individual must not only have a valid justification for a certain course of action, but must also know the relevant true proposition. An example of this is a lawyer who employs the use of true evidence to convince a judge into accepting a particular belief that turns out to be true, this belief can be said to constitute knowledge (White, 1976). Figure 2.2, illustrates the philosophical view of knowledge.
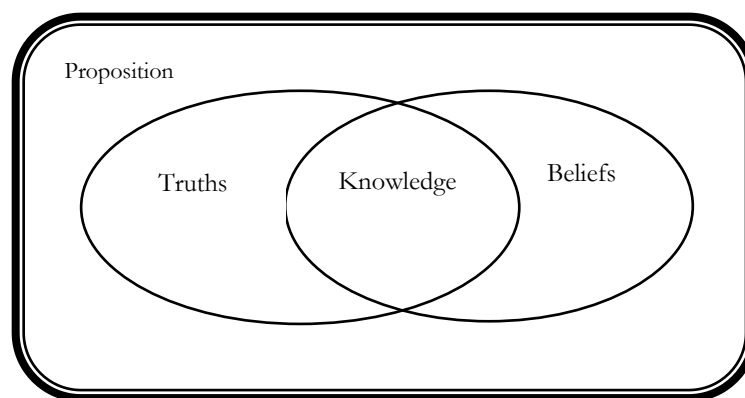
Figure 2.3: A Philosophical view of Knowledge by Plat, 427-347 B.C. (Crane, 1960).

Another definition of knowledge by Propp (1999) is "content plus structure of the individual's cognitive system". Swap (2001) also described knowledge as the end product of information processing. He added that since unrefined data can be used as input which is then processed to get information, the information generated can also be used as input for knowledge creation. Knowledge content is usually unprocessed, disorganised and meaningless information but it is the cognitive system of individual that gives meaning to the information which transforms it to knowledge (Sun and Scott, 2005). According to Marakas, knowledge is defined as "meaning made by the mind" (Marakas, 1999). Pillania (2008) defines knowledge as a combination of experiences, insights and reasoning that are related to processes, technology, customers, products, etc. that enable effective action. As there are fewer consensuses about the definition of knowledge, different definitions from Hicks *et al.,* (2006) and other scholars are identified. Vance (1997) defined knowledge as "information that has been authenticated and thought to be true". Davenport & Prusak (1998) defined knowledge as a framework for evaluating and incorporating new experiences and information. Propp (1999) defined knowledge as content plus structure of

individual's cognitive system. Alavi and Leidner (1999) defined knowledge as "justified personal belief that increases and individual's capacity to take effective action". Vail (1999) said knowledge is "information made actionable in a way that adds value to the enterprise". Wilson (2002) says knowledge is what we know plus the mental structure used in learning, understanding and comprehension.

Distinguishing knowledge from 'data' and 'information' leads to have a better understanding on the nature and purpose of knowledge. Regarding this issue, the DIKW model, also known as DIKW Hierarchy, represents the structural relationship between Data, Information, Knowledge and Wisdom. This model was first deeply specified by Ackoff in 1988 address to the International Society for General Systems Research. Data are raw materials as signs or symbols in the world that can be sensed. Ackoff (1989) introduces data as any objective facts or observations that have no values until they are transformed into relevant and usable form. In other words, data will turn into information when they assigned meaning. According to Choo *et al.* (2000), data are simple messages, facts and figures that are not organised and do not have any meaning, whilst information is defined as processed data that has values and meanings. During data processing to produce information, some irrelevant data reduces. In other words, information is the result of inference from relevant data. It could be concluded that the distinction between 'data' and 'information' is functional rather than structural. Knowledge, what we know, construe as what we build from our understanding from world in our mind, which includes our expectations and beliefs. It originates and applied by analysing and synthesising expectation, beliefs, values and information.

Davenport and Prusak (1998) claim when new information compares and connects with existing, it becomes knowledge. In addition, it is also required that new information evaluates by humans in order to find out its consequences on future actions and decisions. On the other hand, Wisdom is the ability of making decision and using judgement by employing integrated knowledge and information, apparently without thought (Wallace, P. 2007, Gamble & Blackwell, 2001). This ability is used to increase effectiveness and add values, which are unique and personal for each individual. In the previous sections, we have discussed the origin and existence of knowledge, the many components that make up knowledge and how this components function in hierarchy. However, different authors have researched the various schools of thought on the concept of knowledge. The next section identifies some of these schools of thought on knowledge.

2.5 Schools of Thought on Knowledge

A school of thought is a socially constructed and informal community of researchers building on each other's ideas and sharing similar interests and who consequentially share patterns of citation in their work (Phin et al., 2005). Schools of thought represent philosophies and ideologies that govern a particular subject area. Generally, schools of thought can be powerful in influencing the process of individual knowledge creation. It is based on conversations with well-regarded scholars, which influence how developers of new knowledge explicitly think about and position themselves within their field and which also represent mental paradigms which unconsciously influence an author's view of the boundaries of their intellectual world (Crane 1980; Pfeffer 1993). This section looks at schools of thought such as the knowledge based view and the resource based view, knowledge as a core competence which then has become a dynamic capability and the different knowledge production type.

2.5.1 Knowledge Based View and Resource Based View (KBV And RBV)

The origin of the resource-based view (RBV) of an organisation can be traced to the work of Penrose (1959) in the middle of the nineteenth century, which viewed the organisation as an administrative organisation, and a collection of productive resources, both physical and human (Curado and Bontis 2006). Resources such as material and human resources have the potential to provide the organisation with a variety of services. The RBV of an organisation allows the organisation to look inward at the resources and capabilities available to them in order to explain and predict the organisations profit and value. This theory is used to explain differences in performance within an industry (Curado ans Bontis, 2006). In this new era of information and resource management, the knowledge-based (KBV) of an organisation is seen to be a recent development or extension of the RBV. The KBV considers knowledge as the most important strategic resource necessary for profit maximization within an organisation (De Carolis, 2002). The RBV of the organisation justifies the existence of differences in performance between organisations as a consequence of knowledge asymmetries (capabilities and competences). As a result, an important proposition of an organisation KBV states that the organisation exists to create, transfer and transform knowledge into competitive advantage (Kogut and Zander, 1992). Nevertheless, transferring knowledge through the organisation can be difficult, which accounts for the so-called "*stickiness*". *Stickiness* reflects the presence of internal factors that enable the true achievement of competitive advantage. *Stickiness* also hinders the appropriation of rents from existing knowledge assets (Szulanski, 2004).

Another perspective known as the *Ricardian* perspective of rent creation adopted by the RBV of an organisation states that the choice of the resources is the main mechanism influencing the generation of the economic rent (Makadok, 2001). This was challenged by the *Shumpeterian* perspective which states that organisations capabilities are dynamic and not fixed (Curado and Bontis 2006). This idea of dynamic capabilities enlightens the importance of an alternative rent creation mechanism capability building, which is different from selecting from a pool of resource within the organisation (Makadok, 2001). Furthermore, there is a connection between the economic history and the classical factors of production which are Land, Labour and Capital and which have been put to use over the years. However, there is a new world order in the new millennium that economic behaviour is being attributed to and that is "knowledge". Knowledge however is a critical dimension in the sustainability of competitive advantage in an economy as well as an organisation (Carneiro, 2003). We are living in a knowledge century where the amount of knowledge possessed by an organisation determines their competitive edge and as a result has made competitive advantage not to arise from those possessing huge dimensions or those blessed with abundant natural resources but those with armed capacity in exploiting their knowledge economy (Martin de Castro et al., 2006). In this global economy, knowledge has become major force and the biggest competitive advantage of them all (Davenport and Prusak, 2000). Curado and Bontis (2006) went on to include that the "new economy" is driven by knowledge, is based upon knowledge, and it is moved by knowledge.

Organisational knowledge has great wealth creating potential. Contrary to the traditional factors of production, knowledge has the capacity to produce increasing returns, through its systematic use and application (Kim and Mauborgne, 1999). Knowledge has certain special characteristics that differentiate it from physical resources and contribute to the creation and sustainability of competitive advantage. It can be used simultaneously in several applications and still does not devalue its power (King and Zeithaml, 2003). Organisational knowledge is such a marvellous substance, contrary to other resources, its utilization, under different forms, increases it, instead of decreasing it (Adler, 2002; Spender, 1996). The knowledge patrimony of the firm has a strategic potential (Birchall and Tovstiga, 1999), as this asset becomes more valuable when is used, instead of depreciating (Stewart, 1998). This recent economic perspectives sees the firm as a recipient of individual and social capabilities, processing and transforming these capabilities into products valuable for economic exploitation and increased market value (Hoskisson *et al.*, 1999).

This economic approach has gained an increasing attention as recent research shows that firms that base their strategies on intangible resources are much more likely to outperform others that base their strategies exclusively on tangibles (Barney, 2001). These intangible resources have better tendencies to sustain a more competitive edge and produce higher probability compared to companies using tangible resources, hence, a very good example of this intangible resource is Knowledge (Hitt *et al.*, 2001). Curado and Bontis (2006) explain that organisational learning plays an important role in the sustainability of the competitive advantage considering the KBV of the firm. They added that the nature of the most important resources in the KBV of the firm is mainly intangible and dynamic. The idiosyncratic intangible assets developed through path dependency and causal ambiguity are the basis of the mechanism for economic rent creation in the KBV of the firm. The KBV of the firm considers a very special resource that does not depreciate, and can generate increasing returns knowledge. Having discussed the KBV as a fundamental resource in an organisation, the next section discusses knowledge as the core competence of an organisation.

2.5.2 Core Competence

In the work of Prahalad and Hamel (1990), core competence was defined as having specialized expertise in certain areas which is as a result of combining streams of technology and work activity. Mascarenhas et al (1998) also added that core competency takes various forms which includes technical and SME knowledge, a reliable process, and/or close relationships with customers and suppliers. When identifying core competencies, it is different from the traits of individuals or what human resource management literature refers to as "competencies". Core competence relates more to the skills, knowledge, experience and behaviour or individuals. In a strategic context, core competencies refer to the combined capabilities of the organisation (i.e. what the organisation is able to do, through the combined and integrated efforts of many.) providing it, sustainable value and broad applicability across the business. Fernando (2008) asserts that the core competency of an organisation is fundamental to its competitive advantage; however, organisations need to systematically identify and evaluate these core competencies to ensure that adequate leadership focus their resources and direct energy to its development to support growth and success in a dynamic market.

2.5.3 Dynamic Capabilities

Dynamic capabilities theory examines how firms integrate, build, and reconfigure their internal and external firm-specific competencies into new competencies that match their turbulent environment (Miles, 2012; Teece, Pisano, & Shuen, 1997). The theory assumes that firms with greater dynamic capabilities will outperform firms with smaller dynamic capabilities. Capabilities are a collection of high-level, learned, patterned, repetitious behaviours that an organisation can perform better relative to its competition (Nelson & Winter, 1982; Winter, 2003). Organisational capabilities are called "zero-level" (or "zero-order") capabilities, as they refer to how an organisation earns a living by continuing to sell the same product, on the same scale, to the same customers (Winter, 2003, p. 991). Dynamic capabilities are called "first-order" capabilities because they refer to intentionally changing the product, the production process, the scale, or the markets served by a firm (Winter, 2003). An organisation has dynamic capabilities when it can integrate, build, and reconfigure its internal and external firm-specific capabilities in response to its changing environment. For example, whereas organisational capabilities have to do with efficient exploitation of existing resources, dynamic capabilities refer to efficient exploration and implementation of new opportunities (Miles, 2012). According to Helfat et al. (2007), a dynamic capability is "the capacity of an organisation to purposefully create, extend, and modify its resource base" which includes its physical, human, and organisational assets (Eisenhardt & Martin, 2000).

Macher & Mowery, (2009); Zollo & Winter (2002) further assert that dynamic capabilities are learned and stable patterns of behaviour through which a firm systematically generates and modifies its way of doing things, so that it can become more effective. For example, routinely operations develop from the accumulation of experience through the repeated execution of similar tasks over time (Argote, 1999). According to Teece (2007), a firm's history and prior paths help determine its current tangible and intangible positions and asset bases, which lead to organisational processes. The firm uses its sensing capabilities to identify opportunities. Once they are identified, the firm invests in ("seizes") these opportunities to improve its organisational capabilities. Parayitam and Guru (2010) have argued that dynamic capabilities can lead to both Ricardian and Schumpeterian rents for a firm. According to Schumpeter (1934), an entrepreneur will make profits (rents) because of innovations (strategies) as long as other entrepreneurs are not able to copy those innovations. In other words, profits emerge when innovations are new, and profits disappear when innovations are copied; profits can reappear if new innovations are created. According to Ricardo (1817), profits (rents) occur because of scarcity of resources or

capabilities, such as land, that are available to the entrepreneur but not available to his or her competitors. Thus the entrepreneur will have lower operating costs compared to those of other entrepreneurs, which will result, simply speaking, in a competitive advantage for the entrepreneur.

2.5.4 Knowledge Production

Gibbons et al., (1994) in his study investigated two different types of knowledge. The Mode-1 knowledge is structured, single minded and slow to change, which can be seen, in traditional occupations such as classical music or art history. Mode-2 takes a different approach and breaks down the traditional ways of thinking. Mode-2 knowledge is involved in a lot of group work, discarding the principal that ideas can be generated from one individual. A good example of the Mode-2 knowledge is the "Google Reader." This brief was designed to help users reduce the need to constantly surf the web by sending updates to user instead of searching for recent additions of updates on your favourite websites. Gibbons and his fellow researchers in 1994 drew the attention of readers toward this new form of knowledge production, the Mode-2 knowledge which was a derivation from the existing Mode-1 knowledge production. Gibbons view was that while Mode 2 may not be replacing Mode 1, Mode 2 is different from Mode 1 in almost every respect. It is not being institutionalised primarily within university structures and it involves the close interaction of many actors throughout the process of knowledge production. It also makes use of a wider range of criteria in judging quality control. Overall, the process of knowledge production is becoming more reflexive and affects at the deepest levels what shall count as "good science". The problems associated with Mode-1 are set and solved in a context governed by the, largely academic, interests of a specific community. By contrast Mode 2 is carried out in the context of application. Mode 1 is disciplinary while Mode 2 is trans-disciplinary. Mode 1 is characterised by homogeneity, Mode 2 by heterogeneity. Organisationally, Mode 1 is hierarchical and tends to preserve its form, while Mode 2 is more hierarchical and transient. In comparison with Mode 1, Mode 2 is socially accountable and reflexive Gibbons et al., (1994). Maclean et al., (2002) proposed 5 features of the mode 2 knowledge production which is called the 5mode 2. These include knowledge produced in the context of application, trans-disciplinarily, heterogeneity and organisation diversity, social accountability and reflexivity and diverse range of quality control. The next section identifies and explains some of the different models of knowledge.

2.6 Different Knowledge Models

Knowledge model presents a general theoretical framework, as well as specific guidelines for implementation of knowledge and it also sets a platform on which other guidelines are developed. This section discusses three knowledge models which are the DIKW model, the E2E model and SECI model by Nonaka and Takeuchi.

2.6.1 DIKW Model

The DIKW hierarchy represents the chain from 'Know-Nothing' (data) to 'Know-What' (information) to 'Know-How' (knowledge) to 'Know-Best' (wisdom). This model was offered by Ackoff (1989) and has received a good attention and citation amongst information scientist researchers. Many researchers found it challenging to describe the transformation process between data and wisdom, Rowley (2007) in the DIKW model developed a model that could represent this process. Figure 2.4 describes the transitions from the lowest element 'data' to the highest element 'wisdom'. This model is called 'The understanding hierarchy model of DIKW'.
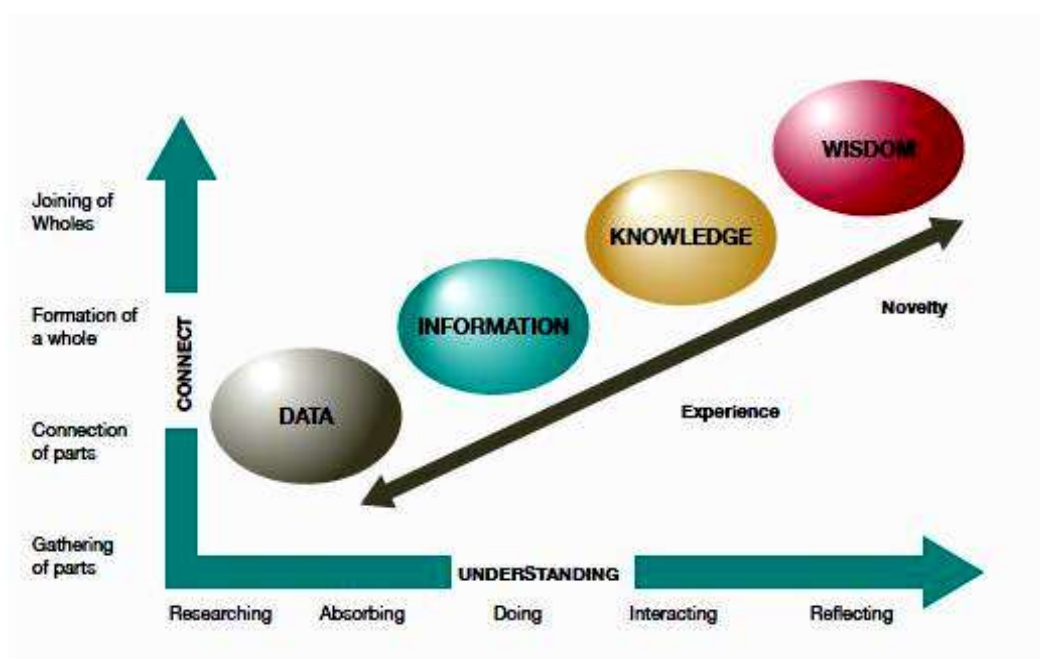
Figure 2.4: The DIKW model (Source: Rowley, 2007)

Rowley (2007) used this model to illustrate a better understanding of transforming data to wisdom. Carrying out research or gathering of random facts and figures without meaning forms data. Information is formed by both connecting different parts of data and understanding

relations between them. Then gathering of appropriate information and understanding patterns between them, in other words application of such information, will create the desired knowledge. Wisdom, know-best, is created by integrating knowledge and understanding principles, which will inform the nature of decisions made. Another important point explained by Rowley (2007) is that data, information and knowledge are based on experience and past occurrences, whilst wisdom is future based and used to create new ideas. Although the DIKW model was developed by many researchers like Nonaka (1991) and Rowley (2007), but it was also criticised by Fricke (2009). He argues that the hierarchy model (DIKW) is methodologically undesirable, unsound and has a theoretical and intellectual gap over the interrelationship and nature of its components. He introduced data as "anything recordable in a semantically and pragmatically sound way", information and knowledge as "weak knowledge", and wisdom as "the possession and use of wide practical knowledge if required by an agent who appreciates the fallible nature of that knowledge".

2.6.2 E2E Model

Faucher *et al.,* (2010) adopted a complex-based perspective to the analysis of the DIKW model. A new model was developed which incorporated the addition of two new components namely 'Existence' and 'Enlightenment', which is called E2E model. They asserted that the relationship between the new component and the existing ones are non-pyramidal and non-linear (Existence, Data, Information, Knowledge, Wisdom and Enlightenment), meaning that each component can be used in no specific order. Faucher *et al.* (2010), shed more light on this model using a real life example. A new receptionist may have the wisdom of knowing how to manage customer effectively without any prior relationship or data about customers. This wisdom might have been developed as a result of experience gained from his/her formative years. The DIKW model lies in between existence and enlightenment, which provide the boundaries for the cognitive system of knowledge. In other words, the DIKW is the abstraction of the existence and the enlightenment is the highest level of abstraction, which leads to understanding. According to Faucher *et al.,* (2008), the elements of DIKW model are based upon the abstraction of existence and could be either tacit or explicit. The level of understanding these elements is the basis of both differentiating them and conversion process among them. Figure 2.4 illustrates the E2E model based on Faucher *et al.* (2008).

E2E knowledge model
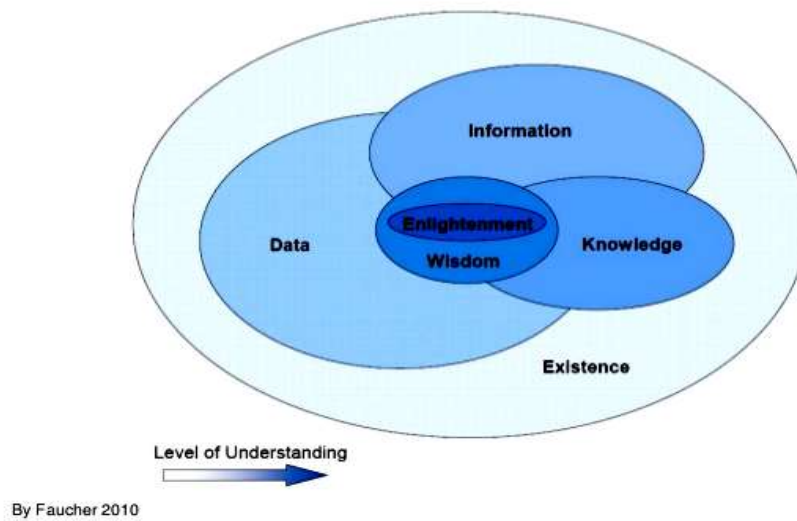
Figure 2.5: Knowledge System (Source: Faucher et al., 2008)

Based on foregoing discussion on knowledge and its related concepts, Faucher *et al.,* (2008) also reviewed literature on components of knowledge system. Few authors made their contributions to the subject of wisdom. Ackoff (1989) defined wisdom as an evaluated understanding". Awad and Ghaziri (2004) defined wisdom as the highest level of abstraction, with vision, foresight, and the ability to see beyond the horizon. Faucher et al., (2008) said wisdom is understood as a meaningful, procedural, and justified abstraction of existence based on experience. Thierauf and Hoctor (2006) defined wisdom as the ability to judge soundly over time. After listing the many different definitions identified, a conclusion has been reached that there is no universally accepted definition for the concept of knowledge. Eysenck (1979) suggests that when there is no consensus on an accepted definition, it is better to share the personal understanding applicable in the context.

2.6.3 SECI Model

Generally, KM approaches is classified into two categories: process and object approach (Alavi and Leidner, 2001). The former views knowledge as a process of applying expertise and focuses on tacit aspect, whilst the latter views knowledge as an object or product that can be stored and manipulated (explicit aspect). However, the researcher considers the SECI model, introduced by Nonaka and Takeuchi (1995), as an approach in this research. The actions of individuals,

construction organisations and project teams along with the interaction of different types of knowledge (tacit and explicit) between client phase and construction phase will lead to create construction project knowledge. Nonaka and Takeuchi (1995) introduced four modes of interaction that result in creation of knowledge. This theory of knowledge creation is known as SECI model.
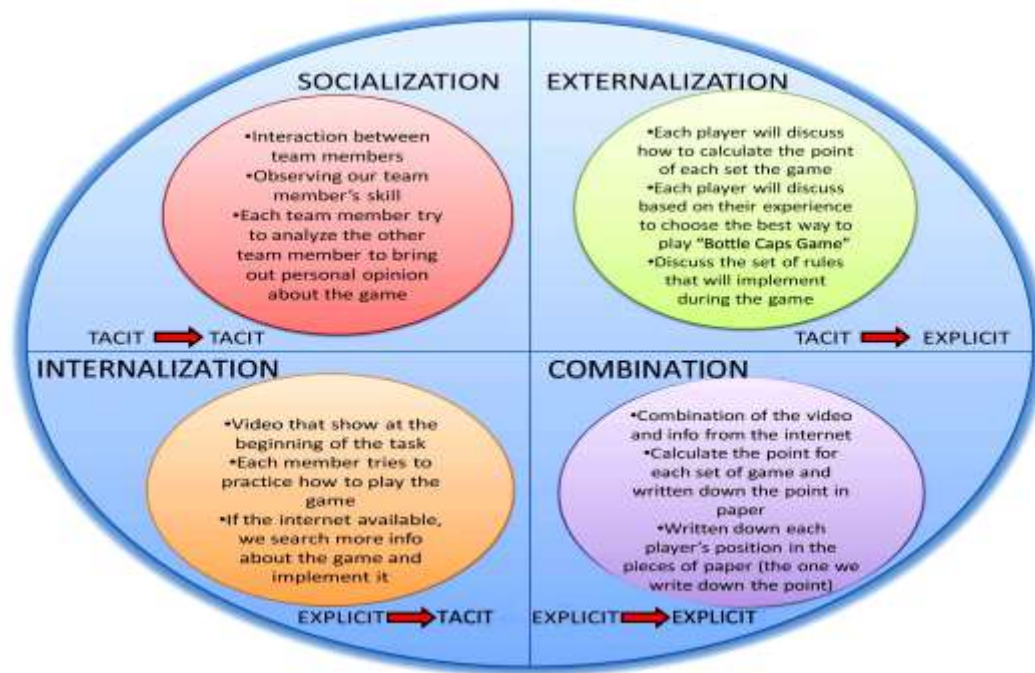
Figure 2.6: SECI Model (Source: Nonaka and Takeuchi, 1995)

Socialisation is the process of tacit to tacit knowledge interaction that involves capturing, transferring and sharing tacit knowledge through social interaction like face-to-face or experiences. In construction context, an example of this type of interaction is when an architect gives an explanation of a client concept to a client or other project members during a meeting. However, continues interaction leads to reinforce and develop experiential knowledge through sharing experiences. *Externalisation* is the process where tacit knowledge transformed to explicit. For example, architects provide a written instruction or translate a client concept into sketches to explain to engineers and quantity surveyors. *Internalisation* is the reverse process where individuals through recognising patterns, connection and making sense between fields, concepts and ideas transform explicit knowledge to tacit. In construction context, an architect could interpret explicit documents (books, manual on client standard) to create a mental model of a unique client. *Combination* is the process of explicit to explicit knowledge interaction through the process of gathering, integrating, transferring, diffusing and editing knowledge. For example, explicit knowledge in the form of project documents (client brief, engineering documents, contracts,

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performance specification) is integrated and processed by technologies like; databased, emails, CAD systems in order to be converted and create explicit knowledge.

Two of the three different knowledge models presented in the course of this literature review identify core variables such as data, information, knowledge and wisdom as the core factors which are essential in the implementation of knowledge; these factors undergo a progressive conversion from one form to the other in a hierarchical format. Rowley (2007) DIKW model shows a pattern of understanding suggesting how knowledge is created from data. The E2E is an upgraded version of the DIKW introducing two extra components which are the Existence and Enlightenment. Faucher *et al.,* (2010) believes that before the introduction of Data to Wisdom as seen in the DIKW model, there is a cognitive understanding of Existence which leads to Enlightenment. Both the DIKW and E2E have a lot in common. The SECI model on the other hand uses the two basic knowledge types, tacit and explicit knowledge in the creation and development of knowledge. For knowledge to be created, it has to firstly be captured and then codified which is the basis of the SECI model. Of all the different knowledge models, the SECI model is seems to be more relevant to this research in the sense that knowledge is firstly created by being captured and codified and then converted. Having discussed some of the models of knowledge, there are certain types and characteristics of knowledge that make it valuable to organisations and individuals. The next section discussed the different types of knowledge and their various characteristics.

2.7 Knowledge Management (KM)

Before delving into the full details and discussion on the concept of knowledge management, an understanding of the fundamental discovery and history of knowledge management will help create a solid foundation under which this research is based.

2.7.1 History of Knowledge Management

KM in recent times has been considered a major source of competitive advantage in business organisations. This idea has helped many organisations enjoy cutting edge competitive advantage over other competitors in a bid to expand, transfer and exploit their knowledge internally while protecting their knowledge source from external imitators and competitors (Winters, 1987; Hedlund and Nonaka, 1993; Prusak, 1996). Although research in this area is still expanding, organisations are steadily developing strategies necessary to help manage their

knowledge more effectively (Bierly and Chakrabarti, 1996; Szulanski, 1996, Spender, 1994). Davenport and Prusak (1998) defined knowledge as a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. Knowledge management appeared to exist somewhere between five and fifteen years ago. It evolved from the thinking of academics and pioneers such as Drucker (1970), Sveiby (1980) and Nonaka and Takeuchi (1990).

In the late 1990's, economic, social and technological changes were transforming companies approach to work. The emergence of globalisation brought new opportunities and increased competition. This made companies respond by downsizing, merging, acquiring, reengineering and outsourcing. This resulted in many companies losing valuable company knowledge as they grew smaller while many lost company knowledge as they grew bigger, resulting in companies no longer "knowing what they knew" (Wiig, 1994). By the early 1990s a growing body of academics and consultants started researching on knowledge management as "the" new business practice, and it began to appear in more and more business journals and on conference agendas. By the mid-1990s, it became apparent and widely acknowledged that the competitive advantage of some of the world's leading companies was being generated from those companies' knowledge assets such as competencies, customer relationships and innovations (Wiig, 1994). Many of these companies moved in this direction by implementing "knowledge management solutions", focusing almost entirely on knowledge management approaches, techniques and the technologies that enhance them. However they met with limited success and so questions began to be asked about whether knowledge management wasn't simply another fad that looked great on paper, but in reality did not deliver (Servin and Brun, 2005). Many of these organisations started experiencing limitations in their approach to knowledge management success practices, some of which laid more emphasis on   technology rather than the business and its people (Nonaka and Takeuchi, 1990). Research has shown that some companies spend a lot on state of the art technologies with little or no return on their investments. Most knowledge management literature is very conceptual and lacking in practical advice, which led to frustration at the inability to translate the theories into practice. It was discovered that knowledge management was not tied into business processes and ways of working, rather it was seen as another laborious overhead activity or yet another new initiative (Servin and Brun, 2005).

To better understand the concept of knowledge management, defining certain concepts that make up this body of knowledge would be vital.   As discussed in the previous section,

knowledge is often defined as a "justified personal belief." The most fundamental distinction is between "tacit" and "explicit" knowledge (Polanyi, 1966), which would be properly addressed in the coming chapters. In the 1960's, the United States accounted for about 53% of the world GDP. The demand for American goods at home and abroad was so great that almost any product could find a market. Today, the U.S. share of the world GDP is approximately 18%. Although the "pie" is much bigger than it was, American companies no longer dominate the world market as a result of fierce international competition for every marginal dollar of profit. Companies no longer expect that their products and practices, which made them successful in the past, will keep them viable in the future. Increasingly, companies are beginning to come to terms with the fact that what stands them out and differentiates them from other competitors is solely based on the amount of what they know. Clearly, the knowledge-based activities of developing products and processes are becoming the primary internal functions of firms and the ones with the greatest potential for providing competitive advantage (Davenport and Prusak, 2000). Knowledge management (KM), as stated by Zou and Lim (2002), is the management processes of creating, capturing, transferring, sharing, retrieving, and storing of data, information, knowledge experiences, and skills by using appropriate information and network technology, with the endorsement of total involvement, in organisational learning to enable knowledge acquisition throughout the processes.

For centuries, scientists, philosophers and researchers have been concerned about the creation, acquiring, communication and improving the re-utilization of knowledge. However, it is only in the last 15 to 20 years or so that a distinct field called "knowledge management" (KM) has emerged. KM is based on the premise that, just as human beings are unable to draw on the full potential of their brains, organisations are generally not able to fully utilize the knowledge that they possess. Through KM, organisations seek to acquire or create potentially useful knowledge and to make it available to those who can use it at a time and place that is appropriate for them to achieve maximum effective usage in order to positively influence organisational performance. It is generally believed that if an organisation can increase its effective knowledge utilization by only a small percentage, great benefits will result. Knowledge management is the planning, organizing, motivating, and controlling of people, processes and systems in the organisation to ensure that its knowledge-related assets are improved and effectively employed. The process involves knowledge creation, storage, transfer, sharing, and utilization (King, 2009).

Organisations are coming to terms with the fundamental reality that most of the knowledge impacted or developed by some individuals either through experience, trainings and other modes of knowledge transfer mechanisms has been lost as a result of turnovers, which has created a gap in knowledge storage and exploitation. Some of these professionals move to different organisations having ingrained themselves with tacit knowledge as a result of years of experience, and this has widened the knowledge gap and created high level shortage in knowledge storage and exploitation hence the idea of knowledge management. The management of knowledge has received tremendous attention and interest as it reflects that academia recognizes the fundamental economic changes resulting from the availability of knowledge and how it affects an organisation's performance strategy (Carneiro, 2003). However, since knowledge management is an important part of an organisation's strategy in staying ahead of others and maximizing performance, it is prerogative to lay a foundational understanding of what it means. Quintas et al., (1997) and Davenport et al., (1998) defined knowledge management as " set of business policies and actions undertaken for the purpose of favouring the creation of knowledge, its transfer to all the organisations members and its subsequent application, all of this with the motive of achieving distinctive competencies which can give the company a long-term competitive advantage". Since knowledge management involves the creation, storage, transfer and sharing of knowledge to achieve this long-term competitive edge and productive performance measure, certain knowledge management tools would be considered to effectively communicate this knowledge.

In the construction environment, knowledge management (KM) is a discipline that promotes an integrated approach to the creation and generation, capture and storing, sharing and communication, transfer and reuse of knowledge of a particular field obtained from projects experiences which has been previously undertaken. Other authors define KM with collection, modelling, storing, reusing, evaluating, analysing and maintenance of knowledge while others refer to it as the collection of processes controlling the creation, storage, reuse, evaluation, and usage of experience in a particular situation or problem solving context. Knowledge management within the construction industry aims to efficiently and systematically transfer and share knowledge derived from the many experiences of engineers. However, many Knowledge management systems are good at generating, collecting and storing knowledge in explicit form, while less focus is on tacit knowledge retrieval and sharing (Lin and Lee, 2011).

Knowledge can be seen as a key source of advantage. Its importance has been recognized for a long time. Some scholars have realized that information can create wealth. Knowledge can be seen as a product of power relations. Knowledge management comprises information, communication, human resources, intellectual capital, brands etc. It involves facing a number of challenges such as its usefulness, its transfer to others and its quantity. The role of knowledge as the key source of potential advantage for organisations and indeed whole economies has become hotly debated. Drucker (1995) recently wrote, "Knowledge is the only meaningful economic resource". It follows that for organisations, individuals and society; the processes by which knowledge is created or acquired, communicated, applied and utilized must be effectively managed. Knowledge acquisition is an active process, which requires organisations to invest resources to its management thereof. A good example is investing in research and development for tracking and assimilating knowledge from outside the firm boundary (Quintas et al, 1997).

In organisations, knowledge is often times embedded not only in documents or repositories but also in organisational routines, processes, practice and norms which brings us to the idea of tacit and explicit knowledge. Tacit knowledge, as stated by Polanyi (1966) is the fact that people tend to know more than they can usually tell. This type of knowledge resides within people and may be embedded in organisational and social processes, building cumulatively within the organisation and it is however difficult to unravel and transfer between organisations. This body of knowledge further gained traction through the work of Nonaka and Takeuchi (1995) in The Knowledge-Creating Company which described tacit knowledge as a highly personal and hard to formalize knowledge which makes it difficult to communicate and share with others. Subjective insights, intuitions, and hunches fall into this category of knowledge and it is often times embedded within individuals cognitive processes or is deeply ingrained in the routine and non-routine processes of an organisation's unique culture and values (Daft and Lengel, 1986) which has considerable causal ambiguities surrounding it (Szulanski et al., 2004).

Explicit knowledge on the other hand is a type of knowledge, which is codified, transferable and relieved with ease (Polanyi, 1958). This medium for communicating such knowledge includes documents, repositories, graphs, diagrams just to mention a few (Bhagat, et al., 2002). In transferring knowledge across organisational boundaries, organisations must solve issues relating to knowledge boundaries and barriers which allows their borders to be opened to flows of information and knowledge from the networks and markets in which they operate (markets which increasingly blur traditional boundaries), on both formal and informal bases, whilst

protecting and nurturing its own knowledge base and intellectual capital at the same time. If this is not properly managed, it could lead to knowledge loss which could affect the survival of such organisation. Knowledge management however, has been discovered to have certain components which will be discussed in the next section.

2.7.2 Components of Knowledge Management

There are major component that exist in knowledge management which are fundamental to the successful management of knowledge, they include people, processes and technology. Servin and Brun (2005) explores these different components in table 2.2.

Table 2.2: Components of Knowledge management (Servin and Brun, 2005)

People (Servin and Brun, 2005)	Getting an organisation's culture (including values and behaviours) "right" for knowledge management is typically the most important and yet often the most difficult challenge. Knowledge management is first and foremost a people issue. The type of culture developed within an organisation has tremendous effect on the knowledge sharing ability of the employees.
Processes (Servin and Brun, 2005)	In order to improve knowledge sharing, organisations often need to make changes to the way their internal processes are structured, and sometimes even the organisational structure itself. Processes are meant to allow free flow of knowledge and not constitute a barrier to it and these processes must allow adaptability and opportunity for developing new ones to enhance knowledge sharing, creation and usage.
Technology (Servin and Brun, 2005)	A common misconception is that knowledge management is mainly about technology, getting an intranet, linking people by e-mail, compiling information databases and so on. Technology is often a crucial enabler of knowledge management and can help connect people with information, and people with each other, but it is not the solution, however, whatever technology is adopted, it must fit the organisations people and process.

Having discussed what KM is and the components that constitute KM, it is necessary to highlight some of the many definitions of KM researched by several authors.

2.7.3 Various Definitions of Knowledge Management

More work has been invested in trying to create a clear-cut one size fit all definition to the subject of knowledge management but this has proven to be of great challenge, however, some authors have been able to come up with some basic definitions as a result of experiences derived from their work environments (Servin and Brun, 2005).

Table 2.3: Definition on Knowledge Management

AUTHORS	DEFINITION
Jeremy Wyatt (2001)	Clinical knowledge management means improving how knowledge is identified, shared and applied to results of research relevant to clinical practice in health and social care.
Abell and Oxbrow, 2001	Creating a management environment, which encourages knowledge to be created, shared, learnt, enhanced, applied, organised and used for the benefit of the organisation and its customers.
Maggie Haines, NHS Acting Director of KM (2003)	Knowledge management is a process that places emphasis on generating, capturing and sharing knowledge and integrating these into business practices and decision making for greater organisational benefit.
BSI's A Guide to Good Practice in KM (2001)	The ability of teams within an organisation to capture the knowledge that is vital to them, consistently improve it, and share it in the most effective manner to those in need of it, so that they can exploit it creatively to add value as a normal part of their work.
Peter Drucker (1998)	"Knowledge is power, which is why people who had it in the past often tried to make a secret of it. In post-capitalism, power comes from transmitting information to make it productive, not from hiding it!"
Yankee Group (1997)	Knowledge management involves rightly networking those with the knowledge with those who need to have the knowledge thereby converting personal knowledge into organisational knowledge.
IBM (as cited in Servin and Brun, 2005)	Knowledge management is not about data, but about getting the right amount of information to the right people at the right time in order to impact the overall bottom line.
Nonaka& Takeuchi, (1995)	The ability of an organisation to generate new knowledge, share it throughout the organisation and incorporate it in products, services and systems.
Office of thee-Envoy, (2002)	Knowledge management is a relatively young corporate discipline and a new approach to the identification, harnessing and exploitation of collective organisational knowledge, experiences, talents, expertise and know-how.

David J Skyrme, (1997)	"Knowledge management is the explicit and systematic management of vital knowledge and its associated processes of creating, gathering, organizing, diffusion, use and exploitation. It requires turning personal knowledge into corporate knowledge that can be widely shared throughout an organisation and appropriately applied."
Davenport (1994)	"is the process of capturing, distributing and effectively using knowledge"
Quintas *et al,(*1997)	"is the process of critically managing knowledge to meet existing needs, to identify and exploit existing and acquired knowledge assets and to develop new opportunities"
Brooking (1997)	"is the activity which is concerned with strategy and tactics to manage human centred assets "
Wiig (1997)	"is to understand, focus on, and manage systematic, explicit, and deliberate knowledge building, renewal, and application--that is, manage effective knowledge processes"
Gartner Group (1999)	"Promotes an integrated approach to identifying, capturing, retrieving, sharing, transferring and evaluating an enterprise's information assets. These information assets may include databases, documents, policies and procedures, as well as the un-captured tacit expertise and experience stored in individual worker's heads"
Alavi and Leidner (1999)	"refers to a systemic and organisationally specified process for acquiring, organizing and communicating both tacit and explicit knowledge of employees so that other employees may make use of it to be more effective and productive in their work"
Tserng and Lin (2005)	"is creating, securing, capturing, coordinating, combining, retrieving, and distributing knowledge"
Greiner et al. (2007)	"includes all the activities that utilize knowledge to accomplish the organisational objectives in order to face the environmental challenges and stay competitive in the market place"
Armstrong, (2009)	"any process or practice of creating, acquiring, capturing, sharing, and using knowledge, wherever it resides, to enhance learning and performance in organisations"

Ma and Yu (2010)	"is defined as a systematic process of gathering, organizing, sharing, and analyzing knowledge in terms of resources, documents, and people skills within and across an organisation"

Knowledge management is seen to be a fundamental tool to organisations competitiveness and effectiveness. No matter the pool of knowledge gained or created by an organisation, if it's not properly managed could yield wasted efforts and resources. One of the key fundamental definitions of knowledge management is the capturing, creation, sharing and transfer of knowledge for improved competitiveness. However, for knowledge to be adequately managed, it needs to first and foremost be captured. Knowledge on how to implement knowledge capturing initiatives in projects, the question of why we need to manage captured knowledge and where such knowledge resides will create the right perspective needed to embarking on this study. One aspect of KM that is central and core to the successful delivery of KM initiatives is the codification of knowledge which is discussed in the next section.

2.7.4 Knowledge Codification

Falqi (2011) asserts that one of the fundamental areas of KM is knowledge codification which also has with it several challenges in its usage and understanding. Knowledge codification as defined by April *et al.* (2004) is the process of turning knowledge from one dimension into another in order to make it easily accessible. It is also defined as the process of organising knowledge in in order to be accessed and shared (Ruggles 1997). Falqi (2011) further discussed that certain information needed to carry out certain tasks or projects already exist in an organisations, but most times are in forms that are not easily accessible. Employees of organisations possess this knowledge but are mostly embedded in the minds of the individuals (Davenport and Prusak 1997). The aim of knowledge codification especially in the client briefing process during construction projects, is to be able to capture or elicit tacit knowledge inform of requirements which resides in the mind of the client who sponsors the project, and turn such knowledge into documented requirement brief to enable the design team develop quality designs before construction work commences. In as much as the responsibility of the architect is to capture the clients knowledge in form of requirement, this research proposes the use of KC techniques in capturing or eliciting clients requirement during the briefing phase, however, not all types of knowledge can be captured or codified, which can make it difficult to retrieve the right knowledge (Falqi, 2011). Just as we have discussed in earlier section the different

component of KM, there are certain processes also that help in the actualisation of KM initiatives. These processes are discussed in the next section.

2.8 Knowledge Management Processes

King (2009) describes the processes of KM as involving the capturing of knowledge, acquisition of knowledge, creation of knowledge, storage of knowledge, transfer of knowledge, sharing of knowledge and re-use of knowledge. He further added that the functions of these KM processes in the organization centres on developing methodologies and systems to support them, and motivates people to participate in them. King (2009) further asserts that the goals of KM in an organisations is primarily to leverage and improve the organisations knowledge assets with the aim to make better and effective practices, improved organizational behaviours, more informed decision making and improved performance. Omotayo, (2015) also views KM processes as the organisation of several activities aimed at carrying out key elements of an organisation's KM strategy and operations. For this to be sustainable and effective, an organisation must firstly be able to identify what knowledge is available and then capture such knowledge which then needs to be organised it in order to effective within the organisational boundaries. Omotayo (2015) further asserts that knowledge when captured, needs to be shared and transferred amongst the staffs of an organisation via both human and technological means, and as a result, the members of the organisation can apply the new knowledge to their tasks/work activities, which can include the use of KM systems or developing the business case for an organisation's KM projects. KM processes are quite people-intensive, and less technology-intensive than most people might believe, although a modern knowledge-enabled enterprise must support KM with appropriate information and communications technology (King, 2008). The next section starts the discussion with knowledge creation which is one of the processes of KM.

2.8.1 Knowledge Creation

The creation and development of knowledge is a fundamental element in the KM process (Dul et al., 2011; Nonaka and Takeuchi 1995; Pan and Scarbrough, 1999). For any organisation to survive, knowledge creation must be given attention Adi et al., 2016). Knowledge creation is not only limited to organisations alone but also occurs throughout daily activities which includes the work place as well as social settings. The creation of knowledge is dynamic in nature, and expresses itself in different forms such as formal training or talking with people who share similar interests or technological means such as data mining activities (Omotayo, 2015). She

further posits that knowledge creation is majorly a process driven by people more than technology; technology is mostly used as an enhancer but cannot replace human ability to create knowledge. Organisations leverage on their ability to create knowledge, innovate, and generate value with new knowledge (Omotayo, 2015). This is knowledge that leads to new and innovative products, improves internal processes and operations, and improves the strategic decision-making capabilities and direction of the organisation (Nonaka 1994; Nonaka and Takeuchi 1995). Knowledge creation as described by Nonaka et al., (2006) is the conversion of tacit to explicit or explicit to tacit as seen in the SECI model which is embedded in the organization's staffs minds and its vision and culture.

Hislop (2013); Adi Sapir et al., (2016); Nonaka et al., (2006) posit that the ability to create knowledge and generate a competitive advantage is now essential for any organisation that plans to remain ahead of the competition in the marketplace. The need to create knowledge in organisation has been identified above. It is equally important to point out that, for knowledge activities to be effective, knowledge held by organisations must be easily accessible and retrievable (Omotayo, 2015). This means that organisations must plan and organise their knowledge in such a way that it is easily assessable by the appropriate individuals in order to avoid or mitigate against any consequence this might leads to. It is therefore important for organisations to spend resources and efforts in managing and organizing the knowledge that exists within the boundaries of the organisation (Adi Sapir et al., 2016). When an employee leaves an organisation on the basis of turnover or retirement, their knowledge, ideas, experiences, relationships and insights leave with them and if strategies are not put in place capture, transfer, and share this knowledge in the organisation, this could lead to major knowledge loss within the organisation, to prevent this, the next section discusses how to share knowledge that was initially created.

2.8.2 Knowledge Sharing

The effectiveness of KM lies in the ability to share quality knowledge between and within an organisation (Paquette and Desousa, 2011; Olatokun and Nwafor, 2012; Amayah, 2013). The benefit of knowledge usage hinges on the ability to share such knowledge with colleagues, teammates and co-workers such knowledge once it is created. Ziva and Katarina, (2015) explain that the sharing of knowledge is a vital process in KM because it helps organisations leverage on the knowledge of employees which could be lost as a result of employee turnover or retirement.

Another form of knowledge loss in organisations involves employees transferring to another organisation, mobility and alternative work arrangements. It is however, the responsibility of organisational staffs to create and share knowledge by making knowledge a personal responsibility and one that requires personal commitment (Pauline and Suneson, 2012). They added that an organisational goal for managing knowledge is to increase profit by improving the efficiency of their operations, improve innovation and enhance competitiveness. However, this desired benefit cannot be achieved without the effective sharing of knowledge within the organisation. These shared knowledge needs to be exploited in order to help employees make informed decisions. The application of knowledge by organisations is critical to the success of the KM goals against actual realized benefits (Hislop, 2013; Dul et al., 2011).

Knowledge Sharing (KS) is one of the fundamental aspects of the KM process, which is pivotal to the functioning of other KM processes (Wang and Noe, 2010). KS can be described as either "push or pull". The push system typifies the ability of the knowledge worker to seek knowledge sources such as library search, seeking out an expert, internet search and collaborating with a colleague, while push system is exemplified in pushing knowledge onto a user, this includes items such as newsletters, unsolicited publications and so on (Frost, 2013). The goal of KS involves the creation of new knowledge through the combination of differently existing knowledge or to become more effective at using existing knowledge (Milena et al., 2014). This also involves the processes through which knowledge is channelled between a source and a recipient. For KS to be successful, priority is given to the sharing of the specific knowledge which is focused on organising and implementing knowledge in a way that bridges both existing and potential relationship issues thereby examining the form and location of the knowledge to ensure its complete transfer (Cummings, 2003). Cummings (2003) added that for KS to work, the knowledge seeker needs an interaction with the knowledge provider, and the knowledge provider should be willing to share such knowledge with the knowledge seeker. Santos and Goldman, (2012) and Wang and Noe, (2010) posits that the facilitation of KS requires the understanding of owner or user requirements and the many challenges and potential problems that arise in the course of managing knowledge and knowledge sources. Different organisations perceive the idea of KS in different ways within different situations or contexts. One of those is the idea of KS and knowledge transfer (KT), which has generated several arguments amongst several authors as to the various similarities and difference between both. The next section discusses KT as one of the KM processes.

2.8.3 Knowledge Transfer

Prusak (2015) define KT as the process of relinquishing experience, know-how, insight, expertise and tacit knowledge of SME into the minds and hands of their co-workers. He added that in organisations, transfer of knowledge from one part to another poses a major challenge. Another definition of KT is the capture, organisation and distribution of know-how of professionals within a particular field (Kogut and Zander, 1992; Grant, 1996). Szulanski (1996) in his study regarded knowledge as an organisations core resource. During the early 2000s, focus on KT remains high on the minds of strategic leadership who seek to address the weakness associated with KT across organisations while others focus on intra-corporate knowledge flows within amongst multinationals and the study of business unit innovation and performance (Hansen, 2002; Gupta and Govindarajan, 2000; Tsai, 2001). Schlegelmilch and Chini (2003) present a literature review primarily in the area of certain empirical studies. The study shows that more recently published reviews on KT still align to the need of organisations focusing on the benefit of KT within and between employees.

Review carried out by Easterby-Smith, et al. (2008) and Van Wijk et al. (2008) focuses on both intra and inter-organizational knowledge transfer. Easterby-Smith, et al. (2008) then identified a number important questions relating to theoretical and practical significance to the current research area of inter-organizational knowledge transfer. Some of the questions generated in the process of this study include "How does the process of knowledge transfer unfold at different levels of analysis both at organisational and individual levels?" the work of Liyanage, et al. (2009), had a rather different perspective to the idea of KT and they state that it involves the dissemination of knowledge from point to point which could include a person, a place and so on. The next section discusses the knowledge capturing process and is the underlying KM process under which this research is underpinned.

2.9 Knowledge Capturing

One of the core KM process mentioned in section 2.8 of the literature is knowledge capturing. For knowledge to be created, shared, transferred, stored or re-used, there is a need to firstly identify the source of where the knowledge is coming from and how this knowledge can be properly captured. Knowledge capturing however, forms the basis for which all other KM processes derives their functionality. Before we delve into the nitty-gritty of KC, a brief definition of what KC is will be ideal.

2.9.1 What is Knowledge Capturing?

Hari et al. (2005) state that capturing knowledge is the process of turning personal knowledge into corporate knowledge in order to be shared among those involved in projects. Therefore, identifying the critical knowledge sources in project is prerequisite for capturing knowledge. Egbu et al., (2003) considered individuals in projects as the most important knowledge source. Kivrak et al. (2008) identified some knowledge sources in organisations that could help facilitate the knowledge capture process, these include; Colleagues, Company's experience, Personal experience, Company documentation, Current project documentation, Project team meetings, Intranet, Personal library, Clients, Internet, Knowledge brokers external to the firm, External events (conferences, seminars) and so on. Another school of thought discussed by Kivrak et al. (2008) identifies knowledge capturing as the acquisition and retrieval of quantitative data, using statistical computer packages, which is then used to assist in decision-making and strategic planning. Another fundamental element of KC is organisational learning. An example of this can be seen in the work of Yang (2004) where he did a case study of Ritz Carton Chain Hotels where knowledge was captured from customers by means of detecting and recording their guest special interests at the first-time visit and providing personalized treatment based on the records afterwards which in turn reinforces customer loyalty. In the work of Becerra-Fernandez, et al (2004), knowledge capture is defined as a combination of *knowledge elicitation and knowledge representation.*

Creation of knowledge occurs during construction project processes which is a highly knowledge-intensive environment (Woo et al. 2004; Hari et al. 2005). This newly generated knowledge resides and is impeded in the mind of staffs, managers, employees and so on. The realisation that members of staffs involved in construction project possess an adequate amount of new knowledge fuels the motivation, inspiration and encouragement to capture this knowledge. Unless this created knowledge is captured, the knowledge has the tendency to be lost since only a small amount of this information makes it into project documentation (Fruchter 2002). Falqi (2011) asserts that majority of such knowledge gained during the construction project is lost if adequate attention is not given to the wealth of techniques available in capturing such knowledge and if those involved in the projects are not motivated to feed it back into future projects (Barlow and Jashapara 1998; Fruchter and Demian 2005). Knowledge capture as defined by an author is the process of eliciting knowledge that resides within the minds of people, artefacts, or organisational entities, and then representing such knowledge in a format for later reuse or retrieval (Becerra-Fernandez and Sabherwal 2006; Schwartz 2006). For KC to be deemed

successful, it involves the conversion of personal knowledge into corporate knowledge that can be shared and applied throughout the organisation for improved competitive advantage (Hari et al. 2005). The author also stated that KC is not only limited to formal knowledge such as documents but can be informal in nature such as the morale behind certain, intuition, or interaction between team members. Falqi (2011) mentioned that for KC to be effective, the type of mechanism and technology adopted for the conversion of tacit to explicit knowledge or vice versa is very important. Some of these mechanisms include the development of frameworks and the articulation of best practices or lessons learned. Others include on-the-job type of learning, learning by observation, and face-to-face meetings (Becerra-Fernandez and Sabherwal 2006).

Research has revealed that most organisational knowledge resides in their processes and the heads of people and IT mechanisms have not been able to fully capture some tacit knowledge without losing its context (Robinson et al. 2005). Other author's discus that knowledge repositories can only capture the explicit side of knowledge and not necessarily the tacit side of knowledge, which makes project knowledge captured and in parts and not fully used, this makes a large part of the knowledge to remain in people's heads (Wenger 2002). In as much as some part of project knowledge which is tacit in nature can be converted to explicit knowledge, it is however important to also note that not all project knowledge can be captured, because not all tacit knowledge can be converted into explicit knowledge which buttress the work of Polanyi which says people can know more than they think they know (Nonaka and Takeuchi 1995; Polanyi 1966). Knowledge capture is most times not a one off endeavour; it requires some level of commitment and time investment over a substantial period of time (Hari et al. 2005). For KC in KM to be effective, Zack (1998) highlights four primary resources which are repositories of explicit knowledge; Refineries for accumulating knowledge which includes (refining, managing, and distribution of the refined knowledge); the role of organisations in executing and managing the refining process; and finally information technologies used in supporting those repositories and processes. A number of techniques for capturing knowledge during construction projects will be identified and discussed in due course. Some of the techniques that have been identified include CoP, Post project reviews, storytelling, and information systems tools (Anumba et al. 2005; Orange et al. 2000; Tan et al. 2010; Shapiro 1999). Another aspect of KC is knowledge elicitation as defined by Becerra-Fernandez, et al (2004).

Shadbolt and Smart (2015) define knowledge elicitation to consists of a set of techniques and methods that attempt to elicit the knowledge of a domain expert, typically through some form of

direct interaction with the expert. They added that knowledge elicitation is a sub-process of knowledge acquisition (which deals with the capture of knowledge from any source), and knowledge acquisition is, in turn, a sub-process of knowledge management. Knowledge elicitation is also defined as the techniques used in data collection for the purpose of gathering knowledge or information from human sources while knowledge representation is dedicated to representing information about the world in a form that a computer system can utilize to solve complex tasks such as diagnosing a medical condition or having a dialog in a natural language (Gaines, 2013; Becerra-Fernandez et al., 2004). A company's ability to exploit its collective knowledge can mean the difference between commercial success and failure (Nonaka and Takeuchi, 1995). Identifying and locating what knowledge is available for capture is usually the first step in the KM framework, however, if after identifying the knowledge and such knowledge is not adequately captured, it is as good as a wasted effort (Shadbolt and Smart, 2015). Garza and Ibbs (1992) outlined knowledge acquisition techniques, each suited to capturing different types of knowledge. One way this can be achieved is by analysing the public domain knowledge which then allows the knowledge capturer to familiarise with the current thoughts on that particular subject. Another technique discussed by Garza and Ibbs (1992) is the use of interviews. Interviews can either be unstructured or structured. The advantage of unstructured interviews is that they allow the knowledge holder (the person being interviewed) to explain freely what they feel are key elements in their work that if missed or not given attention, will affect the end result. Such information can then be refined and probed further with structured interviews.

The disadvantage of unstructured interviews is that the knowledge holder may digress from the problem being addressed. The opposite is the case for structured interviews; however, the disadvantage is that important points are not covered due to the way the interview is structured. The advantage is that the points that the knowledge capturer (the interviewer) wants to address are covered (Welbank, 1983). Another technique identified was induction which allows governing rules and gaps in existing rules to be identified by the analysis of case studies. By documenting the factors that result in different outcomes, governing rules can be developed. For example, if one house was built with foundations and a second without, if the house without foundation collapsed, the governing rule could be: houses with no foundations collapse. Furthermore, Rezgui et al. (2010) identified lessons learned as one of the main sources of knowledge capturing in construction industry, alongside recorded documents, experiences and interactions. Hinds et al. (2001) noted that organisations must consider how to capture knowledge from experts who have it to novices who need to know. Researchers such as Kazi and Koivuniemi (2006) believed that

knowledge is not transferred across the organisation for reuse in future projects and it unfortunately remains stored in the minds of project team members especially in construction industry. In the mid-1960s the Tavistock Institute (1966) embarked on a study stressing the need for the construction industry to concentrate on two aspects which are embracing socio-technical perspective and recognising the power of combing the application of techniques available to help revolutionize people's perspective in the release of their creative energies to their organisations. They assert that knowledge creation; capturing, storing, sharing and retaining knowledge play a major role in the management of organisational knowledge.

In today's knowledge economy, knowledge is increasingly being considered as an asset that needs to be effectively managed to create added wealth (TWI, 2015). Within the architecture, engineering and construction (AEC) industry, companies recognise they can no longer afford to reinvent the wheel, and thus must learn to better capture the knowledge accrued on projects to improve the quality and effectiveness of future projects (Egan, 1998; Matsumoto, 2005). According to TWI (2015), every construction project is unique with its own problems. Ideally, by carefully identifying potential problems at the planning and client stage of a project, preventive measures can be put in place. They defined knowledge capture as the use of variety of techniques to elicit facets of an individual's technical knowledge such that insights, experiences, social networks and lessons learned which is then shared to mitigate organisational knowledge loss. A variety of methods are used in KC and they vary according to each organisation's requirements but range from interviews and mind mapping to blogs and wikis (TWI, 2015). The knowledge capturing process is the first activity in the knowledge management framework which seeks to make tacit knowledge explicit and vice versa, thereby reinforcing the work of Nonaka and Takeuchi of the SECI model. Within the project-based architecture, engineering and construction (AEC) industry, knowledge capturing is also being recognized as a vehicle through which the industry can address its need for innovation and improved business performance (Egan, 1998; Egbu et al., 1999). The failure to capture and transfer project knowledge, especially within the context of temporary virtual organisations, leads to the increased risk of 'reinventing the wheel,' wasted activity, and impaired project performance (Siemieniuch and Sinclair, 1999).

For knowledge capturing to be deemed effective, it must be able to turn personal knowledge (tacit) into corporate knowledge (tacit and explicit) which can be widely shared and properly applied throughout the organisation so much so it gives the organisation added competitive advantage ((Kazi et al., 1999; McConalogue, 1999; Hari et al., 2005). Powers (2005) gave another

perspective to the concept of knowledge capturing; he explains that for knowledge to be captured rightly, we need to firstly identify the critical knowledge that might be at risk in the organisation as a result of downsizing or retirements. Collison and Parcell (2001) put forth their views that knowledge capture means capturing know-how in such a way that it can be reused. Ambrosio, (2000) stressed that there needs to be a link between capturing knowledge before, during and after a project or task has been executed. He described an instance that took place in BP Amoco, which saved up to $50 million in drilling costs at the Schiehallion oil field, off the coast of Scotland, UK, by leveraging on knowledge captured from developing prior oil fields (Ambrosio, 2000). In addition, Rezgui et al. (2010); and Hari et al., (2005) asserted that there are various reasons as to why SMEs need formal systems for knowledge capture. Some of the reasons include the fact that knowledge resides in the minds of owners/senior managers of SMEs which is the financial strength of the organisation.

Most SMEs feel that the knowledge capture return on investment (ROI) figures do not generally add up, so knowledge capture initiatives are relegated to the level of a "luxury item", and therefore something to be considered in the future. SMEs could adopt the policies and practices of the larger, more prosperous companies. Some other organisations adopt the "wait and see" position with regards to the uptake of knowledge capture initiative. It is often a case of "let the rich big boys (large organisation) test the waters, and when they have validated its worth to all businesses, then we will act". In the meantime, SMEs continue in the way they know best: losing vital knowledge capital and competitive advantage daily (Hylton, 2002). The rate of technology advancement in the present global economy is rapid. To maintain a competitive edge and remain valuable in the market place, organisations must devise means to adequately and quickly capture, assimilate and use effectively "just in time" knowledge of their organisation. Large companies have honed in on the fact that it takes a long time for employees to gain the level of experience of the company's key processes to be able to translate them into valuable explicit and tacit knowledge. They also realise that their employees no longer have the luxury of time to acquire the knowledge. Effective knowledge capturing affords organisations the opportunity to innovate, improve project methodologies, cut costs, save client time and reduce time to market and project deliveries (Becerra-Fernandez and Sabherwal 2006; Hari et al., 2005).

Greenes, (2006) described knowledge capture as a very common method of transferring knowledge. Knowledge capture is process that involves identification, elicitation, distillation, packaging and publishing of captured knowledge. It sometimes could be stressful and time

consuming, but under the right approach and management, it can enable the flow of knowledge from one to many regardless of time and space. Greenes provided some steps to help guide knowledge capturers through the main activities necessary to gather and capture knowledge;

❖ Collate any existing material upon which you can base your captured knowledge and look for general guidelines. Provide some context so that people can understand the purpose and relevance of the knowledge.

❖ Elicit or capture knowledge from individuals, teams and groups with relevant experience. This can be accomplished through retrospective interviews of individuals, or formal learning processes and meetings designed to glean and capture lessons learned, good practices and so on, from recent projects, activities or events.

❖ Publish the knowledge. Store and manage the knowledge in a space where it can be easily searched, found and accessed by its community or other potential users. Often this will be the company Intranet in the form of a digital knowledge asset.

❖ Initiate a feedback and ownership process. Encourage feedback from users, so that they pick up and eliminate any invalid recommendations. Instil a sense of obligation that 'if you use it, then you should add to it' (Greenes, 2006).

Olatokun and Pathirage (2015) define knowledge capture as the use of knowledge or requirement capturing techniques to capture client's tacit knowledge in the form of requirements during the client briefing process for improved client satisfaction in the UK construction industry". This definition will be adopted throughout this research. Knowledge exists in the mind of clients which are being captured as requirements. These requirements are captured with the use of certain KC techniques which are identified and discussed in the next sub-section.

2.9.2 Knowledge Capturing Techniques

Based on the operational definition of this research, the knowledge capturing techniques discussed in this section are the key instruments needed in capturing or eliciting the right knowledge or requirement depending on the sector under consideration. According to Shokri-Ghasabeh and Chileshe (2014), different techniques of capturing knowledge from projects have been proposed by researchers among which the following studies have been investigated. Von (2003), Carillo (2005), Williams (2007), Kululanga and Kuotcha (2008), Fuller *et al.,* (2011) and Henderson *et al.,* (2013) identified some KC techniques which include;

♦ **Interviews**

Shokri-Ghasabeh and Chileshe (2014) describe the interview technique as one of the most common and important technique used in capturing or eliciting client requirements. They added that one basic way this is achieved is by creating a meeting opportunity where the professional sits with the client and questions on what they need is asked. These planned meeting needs to be planned way ahead of time based on the type of requirements you're looking for. There are many good ways to plan the interview, but generally you want to ask open-ended questions to get the interviewee to start talking and then ask probing questions to uncover requirements (Shokri-Ghasabeh and Chileshe, 2014). Group interviews are similar to the one-on-one interview, except that more than one person is being interviewed usually two to four. These interviews work well when everyone is at the same level or has the same role. Group interviews require more preparation and more formality to get the information you want from all the participants. You can uncover a richer set of requirements in a shorter period of time if you can keep the group focused (Shokri-Ghasabeh and Chileshe, 2014).

♦ **Facilitated workshops**

In a facilitated session, you bring a larger group (five or more) together for a common purpose. In this case, you are trying to gather a set of common requirements from the group in a faster manner than if you were to interview each of them separately (Carillo, 2005).

♦ **Requirements Workshops**

In the work of (Carillo, 2005), requirements workshop is a generic term given to a number of different types of group meetings where the emphasis is on developing and discovering requirements for a software system. There are many different forms of requirements workshops including cross functional which involves different types of stakeholders from various areas of the business, Co -operative Requirements Capture where like JAD there is a defined set of activities and the development community is especially involved, and Creativity which encourages innovative thinking and expression. Another variation of requirements workshops often used in market analysis is the Focus Group.

♦ **Request for proposals (RFPs)**

If you are a vendor, you may receive requirements through a RFP. This list of requirements is there for you to compare against your own capabilities to determine how close a match you are to the client's needs (Williams, 2007, Carrilo, 2005).

♦ **Brainstorming**

In certain projects, knowledge is not captured or elicited as much as they should be. Some of these solutions are new concepts and needs to be created as a set of ideas that people can agree to. In this type of project, simple brainstorming may be the starting point. The appropriate subject matter experts get into a room and start creatively brainstorming what the solution might look like. After all the ideas are generated, the participants prioritize the ones they think are the best for this solution. The resulting consensus of best ideas is used for the initial requirements (Sheng-Tun and Fu-Ching, 2009).

♦ **Collaboration**

Some of the authors describe collaboration or Group work as a very common and often default technique for knowledge capturing or requirements elicitation. Collaboration is particularly effective because it involves and commits the stakeholders directly and promotes cooperation. These types of sessions can be difficult to organize due to the number of different stakeholders that may be involved in the project. Managing these sessions effectively requires both expertise and experience to ensure that individual personalities do not dominate the discussions. Key factors in the success of collaboration are the makeup of participants and the cohesion within the group. Stakeholders such as clients and users must feel comfortable and confident in speaking openly and honestly, and it is for this reason that group work is less effective in highly political situations (Kululanga and Kuotcha, 2008, Sheng-Tun and Fu-Ching, 2009).

♦ **Sketches and Diagrams**

Sketching is simply referred to as a simple and rough drawing with a lack of details Wang et al, (2012). The idea of sketching has been a tool used in supporting various kinds of creative works. In previous history, architecture design, industrial design and graphic design have seen sketching as a technique used in "capturing, developing, exploring, communicating and evaluate ideas" (Wang et al, 2012). Sketching has different characteristics in various fields of design, but it has three basic purposes: to structure thoughts and to form ideas, to externalize or elicit ideas (tacit in nature) and to communicate with oneself, and others by offering something to reflect upon. Sketching is a way to structure thoughts and to form ideas which are in form of tacit knowledge. Without such external representations, new possibilities and combinations of ideas can be difficult to see. Sketching is a way of externalizing an idea quickly (Tholander et al., 2008). Sketches "facilitate memory by externalizing the basic design elements" (Wang et al., 2012). This external representation allows architects to think about other properties of the elements, such as spatial arrangements and functions. The finding of the feature of sketches to represent spatial

information has its roots in human cognition – sketches have the attribute of representing three-dimensional visual experiences by using abbreviated two-dimensional lines. These lines can provoke visual experiences resembling that associated with the objects or scenes represented. Thus, sketches can be used to depict spatial scenes and convey the conceptions of reality (Wang et al., 2012).

♦ **Scenario Analysis**

Scenarios are widely used in requirements elicitation and as the name suggests are narrative and specific descriptions of current and future processes including actions and interactions between the users and the system (Mochal, 2008). Like use cases, scenarios do not typically consider the internal structure of the system, and require an incremental and interactive approach to their development. Naturally it is important when using scenarios to collect all the potential exceptions for each step. A substantial amount of work from both the research and practice communities has been dedicated to developing structured and rigorous approaches to requirements elicitation using scenarios. Scenarios are additionally very useful for understanding and validating requirements, as well as test case development (Cooke, 1994; Mochal, 2008).

♦ **Post-Project Reviews (PPR)**

The PPR technique aims to review both failed and successful projects to capture project knowledge by analysing the project, identifying the best practices and addressing the success and failure factors in a project (Kululanga and Kuotcha, 2008). This will lead to improve both the performance of organisations and their future projects as knowledge can be transferred to subsequent projects. Furthermore, they added this technique will enable involved individuals in projects to consult and learn from others who have done similar tasks in the past. The only drawback to this technique is that it does not consider how to capture knowledge during a project, which is the most important and valuable knowledge. PPR does not advice on how the captured knowledge should be disseminated and reused in future project; however, the beneficiaries of this technique are future projects, not current one, which makes the individuals reluctant to engage in activities (Kululanga and Kuotcha, 2008). The effectiveness of this technique is a function of the quality of time allocated for involved individuals in projects to participate in PPR meetings (Kululanga and Kuotcha, 2008).

♦ **Questionnaires**

Questionnaires are much more informal, and they are good tools to gather requirements from stakeholders in remote locations or those who will have only minor input into the overall

requirements (Zedtwitz, 2003). These questionnaires can also be used when you have to gather input from dozens, hundreds, or thousands of people.

♦ **Prototyping**

Prototyping is a relatively modern technique for gathering requirements. In this approach, you gather preliminary requirements that you use to build an initial version of the solution a prototype. You show this to the client, who then gives you additional requirements. You change the application and cycle around with the client again. This repetitive process continues until the product meets the critical mass of business needs or for an agreed number of iterations (Williams, 2007).

♦ **Observation**

This technique is especially helpful when gathering information on current processes. You may find, for instance, that some people have their work routine down to such a habit that they have a hard time explaining what they do or why. You may need to watch them perform their job before you can understand the entire picture. In some cases, you might also want to participate in the actual work process to get a hands-on feel for how the business function works today (Williams, 2007).

♦ **Building Information Modelling (BIM)**

The problem within the construction industry is the failure to deliver the client requirement due to inadequacy within the briefing process including among other issues, lack of systematic and structured methodology, less focus towards clients' real needs, ineffective usage of information technology (IT) and most importantly ;failure to provide clarity and traceability towards client requirement (Shahrin et al., 2010) . All these attributes provide vague and implicit client requirement which could be improve through an integrated process which clarified what the client values and delivering client requirements that reflects their needs. Client is the key to the whole construction process and understand their needs is paramount and it can be done by getting the brief right in order to meet client expectations and having an effective project delivery (Shahrin et al., 2010). Building information modelling can be acknowledged as a collaborative tool (Salmon, 2009; Singh *et al,* 2009) and it also allows the client and stakeholders of the project to link their requirements to live data (Salmon 2009). BIM is believed to offer opportunities for dealing with clients more effective in capturing, translating and delivering client requirement issues and particularly in its use to clarifying project objectives, assist collaborative working and the clarification of objectives. The benefit of BIM is also related to the level of commitment

given by the client (Howard & Bjork, 2007; Linderoth 2009) and training received by the architect (Kaner *et al*, 2008). The main point that needs to be established here is; BIM should be seen as a tool which needs both parties (the client and architect) to have the same vision of what they are getting (Shahrin *et al*, 2010). Bacerra-Fernandez et al., (2004) posit that knowledge capturing is a combination of knowledge elicitation and knowledge representation. In the context of this research however, elicitation and capturing are used interchangeably because they address the same purpose of extracting knowledge from a source. The following section looks at knowledge elicitation and the various wealth of techniques available in eliciting requirement knowledge.

2.9.3 Knowledge Elicitation (KE)

Knowledge elicitation involves the use of data collection techniques for certain disciplines such as cognitive science, counselling, education, knowledge engineering, management, philosophy, psychology and so on in gathering knowledge or information from people (Andersen and Taylor, 2010; Gavrilova and Andreeva, 2012). Knowledge elicitation adopts the use of certain techniques in eliciting knowledge or information from people and this knowledge is mostly tacit in nature. Many of the knowledge capturing techniques identified in the course of this study have a correlation with those of the knowledge elicitation techniques as the aim of both techniques is to capture or elicit certain requirements or knowledge from people (Rollnick et al., 2007; Hashem, 2008; Gavrilova and Andreeva, 2012). This research will use the term KE and KC interchangeably. Two distinct roles have been identified in knowledge elicitation processes and these are expert and analyst (Waterman, 2004; Kendal and Creen, 2006). An expert is someone who has valuable knowledge that is of interest to an organisation, and thus needs to be elicited. Knowledge management address employees with some sort of knowledge that is valuable to the organisation as "experts". The analyst on the other hand is someone who is responsible for eliciting knowledge from an expert. An analyst is an important characteristic from the knowledge engineering perspective, as they possess the skills and knowledge that enable then elicit knowledge from the expert. An analyst also has a mandate from an organisation to spend time and effort on knowledge elicitation, and holds responsibility for the success of this task. In relation to the traditional procurement route in the UK construction industry, the client is the one with the requirement knowledge which needs to be captured or elicited while the analyst is the architect using KC techniques or technologies in capturing the client's requirement (Gavrilova and Andreeva, 2012). A key difference between KE and KM however, is that the role of analyst does not exist in the latter, however, KC during the client briefing process assumes a

similarity with KE as it involves the use of certain techniques by the architect in capturing or eliciting the clients requirements during the briefing process in order to produce a quality brief document.

Several years ago, the interest of knowledge engineering researchers has been primarily the techniques and tools that help knowledge capture, not only for the development of intelligent systems but also for knowledge management practices. These tools are concerned with knowledge elicitation procedures that facilitate knowledge sharing and reuse (Burge, 1996; Gavrilova and Laird, 2005; Voinov and Gavrilova, 2008). One major question that arises from the many techniques available is the challenge of choosing the appropriate knowledge capturing or elicitation method that would fit a specific purpose and its requirements. The importance of this research however, is the interaction between the architect and the client during the briefing process hence some techniques that do not involve engagement and interaction between these parties will be excluded (Coffey and Hoffman, 2003; Kwong and Lee, 2009). The methods of KE were divided into three categories such as the level of involvement of an expert and an analyst, and type of interaction/collaboration between them. Two of these three categories can be labelled as "passive" and "active" methods respectively (from the perspective of the level of involvement of an analyst as compared to the efforts of an expert), and the third category implies more or less equal involvement of both parties. By "active" (analyst-leading) methods the authors mean the techniques that require the active position of an analyst, who "pulls" the knowledge from the expert with the help of specially prepared questions. By "passive" (expert-leading) methods the authors mean the techniques that imply that the analyst's interference into the process in which the expert is engaged is very limited (Gavrilova and Andreeva, 2012). This research leans towards the active (analyst-leading) category where the architect takes full responsibility of capturing or eliciting the client's requirement during the client briefing process. Nevertheless, one of the KC techniques identified and tested using the questionnaire analysis is observation which is a good example of a "passive" method, where the role of the analyst is just to observe/listen and then analyze, though this technique requires very little interaction between the client and the architect.

♦ **Analyst-leading methods.**

One specific form of communication between the analyst and the expert is Interview, where the analyst asks a number of questions prepared in advance in order to gain a better understanding of a specific knowledge area (Belanovsky, 2003; Bradburn et al., 2004; Rollnick et al., 2007; Hashem, 2008). There are different views on interviews in journalism, healthcare, sociology,

marketing and other sciences. The interview may have different levels of organisation (structured, unstructured, semi-structured) that gives the analyst different levels of freedom. Interview is the most popular technique because of its apparent simplicity of conducting. However, experience shows that best practices in interviewing need years of training and practical fieldwork. The main mistakes are based on the short and superficial stage of preparation to this method of knowledge elicitation (Gavrilova and Andreeva, 2012, Gavrilova, 1993). Due to their character, interviews are generally aimed at elicitation of tacit knowledge from individuals. Another technique is the use of questionnaire, which is a highly formalized method, targeted mainly at data collection. Andersen and Taylor, (2010) mention that questionnaires do not work at all for elicitation of tacit knowledge, as by their nature they address only already verbalized, formalized knowledge and do not allow for deeper probing. In such method, the analyst formulates a list of questions in advance and presents them to a number of experts who then responds by filling out the questionnaire.

- ♦ **Expert-leading methods.**

Expert-leading methods can be split into individual-focused and collective methods. Types of individual-focused methods are observation and storytelling, while collective methods include round-table and brainstorming. The observation method implies that the analyst is located in direct proximity to the expert, observing closely his professional activities or their imitation. A video recording can be helpful given that the expert has provided consent. The key precondition of this method is the avoidance of any intrusion by the analyst into the work of the expert. This makes the method perceived as the only "pure" method, because the observer is excluded from interventions or influence on the cognitive process, this may develop some accidental unfolding of pieces of tacit knowledge (Gavrilova and Andreeva, 2012). Storytelling on the other hand seems to be a rather simple method. Storytelling is probably one of the oldest forms of knowledge sharing or transfer which can also be a good form of knowledge capture based on how the story delivery is made interesting. In order to be efficient, storytelling requires not only the expert's ability to prepare and conduct lectures, but also the recipient's ability to listen, transcribe and understand the material (Gibbs, 1989). On the one hand, the experience of experts (architect) varies and they may or may not have the required expertise and talent to tell stories. If the expert has storytelling experience, the knowledge transfer or sharing in the form of a story could represent a concentrated and structured knowledge fragment.

On the other hand, potential knowledge recipients may also differ in their capacity to absorb knowledge, which could also be a function of the quality of the story delivered. Storytelling also

allows a significant degree of freedom; however, the topic and objectives of the story should be clearly formulated in advance (Gavrilova and Andreeva, 2012). The round-table method is used while engaging a discussion on a given topic by a number of experts, which have equal right in giving their opinions or suggestions. The number of participants can vary from three to seven. The analyst is required to make the additional effort of both an organisational (e.g. preparation of location, coordination of time, place, etc.) and a psychological kind (e.g. ability to input relevant comments, good memory for names, etc.). When transcribing and analyzing records of round-table discussions, the peer pressure effect, along with established relations between participants, should be carefully considered (Andersen and Taylor, 2010). The brainstorming method is aimed at facilitating new ideas void of any criticism. One rule of the brainstorming session is the prohibition of criticism as it is believed to impede creative thinking, so the essence of brainstorming is to divide the process of idea generation from critical analysis and valuation of the ideas that emerge. A valuation of ideas accumulated during the brainstorming session is usually done by a group of experts who have not participated in the session. The method is exciting but not very fruitful from the knowledge elicitation point-of-view, and also because the traditional procurement strategy is largely characterised by the major involvement of the architect and client (Gavrilova and Andreeva, 2012). The next section discusses on the importance of KC and why this KM process needs to be given adequate attention in the construction industry.

2.9.4 Importance of KC

As the global economy begins to recover and competition increases, companies are more stressed than ever due to increasing complexity and plant incidents and adding to the stress are the continuous departures of experts from the industry (Jallow et al., 2008). A strong majority of the existing workforce will be eligible for retirement in the next 10 years, predict experts, leaving a large vacuum of needed professionals in the energy industries where there are already shortages. As such, it has never been more important than now to capture the knowledge from these professionals and make it readily shareable before the expertise of their experience is lost forever. Not only is it important to preserve the knowledge, but the real value is derived from applying it in decision support applications to enhance the role of the organisation's personnel in the event of abnormal conditions (Jallow et al., 2008). In the construction industry, buildings are expensive and long-lasting acquisitions. For the organisations which occupy them, good buildings can result in high productivity, a positive working environment and high staff morale, with the reverse being true of poorly-performing buildings. However, the costs of disposing of a

poorly performing building and obtaining a satisfactory replacement can be high and sometimes prohibitive.

Good architects will do their best to give clients the buildings they want. However, if they are unable to determine what clients really need their task is difficult, if not impossible. This is where capturing client's requirements for a good briefing come in. It seeks to minimise the likelihood of a client receiving an unsatisfactory building by ensuring that project requirements are fully explored, captured and communicated as clearly as possible. Whilst good briefing cannot guarantee that a building will be perfectly suited to its occupants, it can help avoid serious mistakes (Constructing Excellence, 2004). According to KM online (2005), *Effective knowledge capturing has the capacity to reduce costs*. Most individuals, teams and organisations are today continually 'reinventing the wheel'. This is often because they simply do not know that what they are trying to do have already been done by elsewhere. They do not know what is already known, or they do not know where to access the knowledge. Continually reinventing the wheel is such a costly and inefficient activity, whereas a more systematic reuse of knowledge will show substantial cost benefits immediately.

Effective knowledge capturing can increase our speed of response as a direct result of better knowledge access and application. Effective knowledge management, using more collective and systematic processes, will also reduce our tendency to 'repeat the same mistakes'. This is, again, extremely costly and inefficient. *Effective knowledge capturing can improve quality of products and/or services*. Better knowledge of client's requirements, stakeholder needs, customer needs, employee needs, industry needs, can improve and strengthen relationship which will positively impact on the overall delivery of the project. The benefits of knowledge capturing for improved excellence, is simply 'one side of the coin', as there are more benefits and importance it generates for those who use it effectively. *Effective knowledge capturing, especially those used in creating knowledge, is the driver for innovation*. Increasingly, products and services are becoming 'smarter' and more knowledge based, hence our ability to better collaborate in physical and virtual teams, as knowledge workers, is driving the process of new knowledge creation. Ideas can now be turned into innovative products and services much faster. Organisations are learning faster, and that means that individuals are learning faster. People are developing their competencies and confidence faster in organisations that practice effective knowledge capture in their knowledge management processes (KM online, 2005).

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The operational definition of knowledge capturing for this research is "Knowledge capturing is the use of knowledge capturing techniques to accurately capture client's tacit knowledge in the form of requirements during the client briefing process for improved project performance in relation to client satisfaction. Some of the factors described in the operational definition have already been addressed in this session such as the various techniques used in KC, however, the subsequent sections sheds more light on the role of KM especially KC in the construction process and client/client briefing process (Jallow et al., 2008). Researchers have investigated theoretical findings to help overcome issues that exist in implementation of KM in construction industry. Having discussed the role of knowledge capturing in KM, the next section seeks to examine the barriers affect the use of these KC techniques in organisations. It is therefore good practice to identify what these barriers are in order to address them. The next section identifies some of the barriers that occur during knowledge capturing.

2.9.5 Barriers and Enablers to KC Process

Carillo et al. (2004) conducted a survey in the UK where 96.8 per cent of participants responded that *having no proper guideline or process for lessons learned documentation* was identified as the most important barrier to KM in the UK. Furthermore, more half of the participants in the survey conducted by Williams (2007) confirmed lack of guideline as a barrier to lessons learned documentation. Potential strategies for overcoming this barrier include having a better process of sharing knowledge as this would benefit the firm or organisation (Martensson, 2000). It is also suggested that appropriate interventions and mechanisms such as technological networking tools would facilitate knowledge capturing (Wong, 2005). Fuller et al. (2011), suggests that finding appropriate ways of capturing and embed learning emerging from projects is important to the success of any construction project (Shokri-Ghasabeh and Chileshe 2013). Without the *proper management support* knowledge capturing has been shown to be positively associated with employees' perceptions of a knowledge capturing culture and willingness to share same (Lin, 2007). Lack of senior management support which may directly cause or magnify the other capturing barriers, is one of the major barriers to organisations performing effectively as a result of inadequate capturing process (Carillo et al., 2004; Crosman, 2002; Pan and Flynn, 2003) (Shokri-Ghasabeh and Chileshe 2013).

Shokri-Ghasabeh and Chileshe (2013) carried out an investigation on some barriers that occur during knowledge capturing, some of the many barriers identified includes; *Lack of employee time.* According to Williams (2007), lack of time available to undertake capturing lessons learned is a

barrier that was identified by Keegan and Turner (2001) and Von Zedtwitz (2002). Similarly, in the survey conducted by Carillo et al., (2004), 67.9 per cent of the respondents identified "not enough time" as a main barrier to learning which is similar to Williams' (2007) statistics (67 per cent). The recommended strategy for overcoming this barrier involves the freeing up time for their employees to perform KM and organisation learning activities such as knowledge sharing (Wong, 2005). "Time" has also been identified as one of the critical elements in the creation and implementation of a KM strategy (Martensson, 2000) (Shokri-Ghasabeh and Chileshe 2013). Another barrier identified was *Lack of human resources.* Human resources are so critical in the learning process that Bresnen et al. (2002) considered them as one of the key factors enabling organisational learning.

Researchers have identified the following human resource related causes which result in not having eligible human resources to capture constructive lessons learned; Lack of attention, personal interest and ability (Von Zedtwitz, 2002), Insufficient willingness for learning from mistakes of the person involved (Schindler and Eppler, 2003), Lack of incentives (Bresnen et al., 2002) just to mention a few (Shokri-Ghasabeh and Chileshe 2013). Carrillo et al., 2012 elucidated that in the process of capturing clients requirements during the briefing process, there exist certain barriers that affect the successful capturing of clients requirements using KC techniques. Some of these barriers include; inadequate communication, inexperienced Clients, inadequate identification and representation of needs and requirements during the briefing process, unstructured approaches for knowledge capturing (Wang and Noe, 2010) and lack of process for knowledge capture is another essential protocol that needs to be addressed as many KC process does not take into consideration the process involved in knowledge capturing. This should include a pre-process and a post process review process and should be adequately documented for reuse in the future. Other factors as identified by (Shokri-Ghasabeh and Chileshe 2013, Greenes 2006, Carillo et al., 2012, Carillo et al., 2004) include;

- Misunderstanding and misinterpretation of client needs and requirements

- Communication gaps between client and architect

- Lack of proper documentation and or changes

- Lack of proper participation of client in the briefing process

- Inadequate attention given to the wealth of techniques available

- Lack of process knowledge for capturing knowledge

- Trust

- Knowledge of the architect

- Relationship

Greened (2006) further added that it's been observed in some organisations that certain barriers and problems occur during the implementation phase of knowledge capturing, some of these barriers include;

- Trying to capture too much - Knowledge capture efforts should focus on what customers for that knowledge need, and not attempt to capture everything that is known about a particular topic. The basics of how to do something or foundational knowledge are probably already documented somewhere in a manual, guide, etc. Emphasis should be on what isn't widely known, new learning, and other knowledge that isn't typically documented in the usual manner.

- Underestimating time and effort - It's a laborious process to harvest knowledge and present it in a manner that people can make sense of it for re-use and adoption. For example, it may take eight hours to distil a handful of powerful knowledge nuggets or insights from a one hour interview with an expert.

- Capturing knowledge that isn't used – unless you have identified what the potential customers for the captured knowledge are interested in, there's a good chance it's not what others will find useful.

- Assuming one size fits all - when it comes to methods for presenting captured knowledge it's important to understand people's preferences as receivers of knowledge. Some people find reading text a useful way to learn something. Others prefer to learn by listening and observing. In these cases, an audio version of the knowledge shared by the source and a video of someone speaking or performing an activity are often very effective (Greenes, 2006).

Collison and Parcell (2001) and Achammer, (2009) suggest that knowledge capture means capturing knowhow in such a way that it can be reused. A few challenges have been identified through a thorough review of literature from the social and technology perspective for knowledge capture.

- Lack of capturing of clients and (or) supply chain knowledge in an effective formal way. Most knowledge capturing processes are not given the adequate attention and formality required to make the process efficient

- Type of organisational culture encouraged for knowledge capture. If an organisation does not create a suitable culture that supports knowledge capturing, this could demean the potency and power of knowledge capturing in an organisation.

- Most knowledge capturing process does not consider wealth of techniques available to adequately capturing knowledge. During requirement elicitation in client briefing, several knowledge capturing techniques need to be identified and used in order to ascertain the effectiveness of such techniques.

The benefits of proper KC should also be identified and spelt out to encourage the organisation see the importance of properly capturing knowledge. Lack of time allocated to knowledge capturing process (William and Walter 2014). The more time allocated to the knowledge capturing process, the more quality document would be produced from the process. This can be made possible by the support of management. Lack of management support can also contribute to less effective knowledge capturing process (William and Walter 2014). Barriers to knowledge capturing in the construction industry shows that this could be a major deterrent to the progress of construction projects and delivery of quality output. Some organisations feel that the knowledge capture Return on Investment (ROI) figures do not add great value to the organisation hence are seen a "luxury item", and therefore something to be considered in the future (Lee et al., 2005). This has made other organisation adopt the "wait and see" approach with regards to the uptake of knowledge capture initiative. This approach has created a gap and a continued loss in vital knowledge capital and competitive advantage daily (Lee et al., 2005). Having discussed the various barriers that affect KC, the next section takes this further by highlighting and discussing the various challenges to KC.

2.9.6 Challenges Associated with Knowledge Capturing

Collison and Parcell (2001) identified a few challenges through a thorough review of literature from the social and technology perspective of knowledge capturing. Some of these challenges include;

♦ **_Social Issues_** which is related to issues such as culture, people, motivation, communication and network issues. Cultural challenge has been identified as one of the main challenges to knowledge capturing in the construction industry. Many experienced construction professionals see knowledge as power which makes them horde knowledge and unwilling to share.

♦ **_People Issues._** In small organisations, most knowledge capturing is done through informal networks, but as organisations grow, these networks cannot possibly be aware of the entire knowledge. They may result to getting some experts or contractors repeatedly which then affects them their fully responding to their duties. For example, some employees find it difficult to access key documents without the help of experts within each department, leaving the experts feeling overwhelmed by calls that make poor use of their time. It is however advantageous to capture the knowledge of experts to guide seekers to their appropriate documents and experts.

♦ **_Motivation Issues_**. Knowledge capture activities are to be rewarded in an appropriate and meaningful way. This has been a challenge for some organisations. Motivation has been identified as a major factor that helps construction personnel to exploit knowledge capture. However, organisation team leaders and those involved in job client and matching skills to jobs, need to devise means necessary to make organisational staffs interested in their jobs. They would also need to understand and accommodate the needs and expectations of these staffs. Training however, can be seen as a motivation tool for employees especially when the knowledge is highly needed in making their job successful.

♦ **_Communications and Networks Issues:_** The geographical separation of sites, both from one another and from the regional offices, would have a detrimental effect on the capture of knowledge because of the importance placed on social networks and contacts. The establishment of a network throughout the organisation (each with its own internal and external, networks and contacts) provides a base of knowledge and support that individual employees could draw upon to help them diffuse ideas and expertise within

their own context of work. This seemed to be a challenge for four organisations in the study that had regional offices spread across UK.

♦ ***Organisational structures***: Egbu's (2000) carried out a study which asserted that organisational structures were found to influence knowledge capturing. He added that the size and structure of the organisation enables the use of certain tools (techniques and technology) for knowledge capture that may encourage/discourage cross-regional and cross-project codification.

♦ ***Financial Issues:*** Cost may be in conflict with the pressures of a specific project, such as completion on time and within budget. If there are inappropriate or non-existing incentive structures to address this inherent conflict, knowledge capture policies would be inadequate. Capturing knowledge or requirements properly can reduce the risk of cost and time overrun in a project. In addition, the process of accumulating and documenting (i.e. capturing) 'lessons learned' is more tactical in nature, as it involves costs attributable to a specific project (for example employee time to document and compile reports).

♦ ***Process Issues:*** No single approach to knowledge capture can suit every organisation. It is good knowledge to know however, that knowledge codification also has its merits. In client briefing, the aim of the professional is to capture and codify the tacit knowledge of the clients in form of requirement. Without codification, the ability to allow explicit knowledge to disseminate is severely limited. From an organisational perspective, the capture and maintenance of knowledge can be time-consuming, labour intensive, and costly. It is a challenge to keep track of discussions, decisions, and their rationale when teams work on short term projects (Hari et al., 2004).

This research take into consideration the different barriers and challenges to KC which are essential in understanding the strategy to be used in reducing, avoiding or exploiting them. Since the overall aim of this research is the satisfaction of the client in the UK construction industry, the study aim to use effective KC techniques to capture client's knowledge in form of requirements during the briefing process in order to limit negative barriers and challenges and exploit positive ones.

2.10 Summary

This chapter has investigated and discussed the various perspectives on knowledge and KM, discussing number of fundamental elements such as KM processes which include KT, KS, KC and knowledge creation, Types of knowledge, the component of knowledge and KM, KC and the different KC techniques such as brainstorming, communities of practice, storytelling, mentoring and so on were emphasised in this chapter. In the course of exploring and reviewing literature, some authors believe knowledge can exist on its own and can be formed and exist without the input of the carrier why some others believe that knowledge cannot exist on its own, which means it requires a collection of social constructs for knowledge to be formed and sustained. The many views have propelled the researcher to consider definition of knowledge from various authors. In addition, without the proper management of knowledge, knowledge is at best a mere philosophy, however, managing knowledge has helped organisations exploit the benefits accrued to the management of knowledge which has led to increased competitive advantage of several organisations. A variety of tools and resources may help in managing project knowledge, such as mentoring, communities of practice, and workshops. This research places emphasis on KC as a vital process in the KM framework. For knowledge to be created, shared, transferred, communicated or re-used, it first and foremost needs to be captured. Knowledge capturing does not only occur amongst employees and staffs in an organisation, it also occurs at the various stages and phases of construction projects one of which is the client briefing stage which is the first phase of the RIBA construction projects, hence this research aims to use effective KC techniques in capturing clients knowledge (requirements) during the briefing process for improved client satisfaction.

Chapter 3 – The UK Construction-Client Briefing and Knowledge Capturing

3.1 The UK Construction Industry

According to a status report published by the South African Construction Industry in 2004, the construction industry accounts for more than 10% of the world's economy (CIDB, 2004). As a prime indicator of economic activity, the construction industry is often utilised by governments not only to stimulate growth but also to assist economic recoveries from recessions. Given the large capital amounts associated with construction projects, the performance in terms of cost and time are closely monitored, especially where tax payers' money is involved (Baloyi & Bekker, 2010). Compared to its European counterparts, the UK has suffered from a more pronounced decline in construction activity since the onset of the recession (UKCG, 2009). The impact on the construction sector is already apparent through sharp increases in company closures and individual bankruptcies and redundancies (UKCG, 2009). The industry majorly comprise of SMEs, which make up a majority of organisations. Different professionals and tradesmen make up the construction industry who offer their services and knowledge in the work they do. The construction industry today is facing several challenges such as greater demands from clients, the increasing level of awareness of clients, the complexities of projects in terms of size, cost, technology and the increasing nature of collaborative forms by which clients procure construction works (Hari et al., 2005). Since the Construction industry is a project-based industry, it utilizes a variety of separate forms in a temporary multidisciplinary organisation, to produce investment goods such as buildings, roads, bridges, factories etc., which are custom built to specific requirements and specifications. The Figure below shows a simplified model of the construction process. During project conception, the client establishes the need for a project and develops a set of requirements (the output), which are converted into an appropriate client. At the construction stage, the client is transformed into a facility for the use of the client (Kamara et al, 2002).

The construction industry operates a stage by stage project processes implementation strategy which involve the design and implementation of a building project right from the conception phase which is the mind of the client to it's the completion phase, which delivers the project output and outcome (Karhu et al. 1997). Falqi (2011) posits that successful projects are usually

projects constructed from a modelled process or method. This was expanded by Kerzner's (2009) who stated that the successful delivery of a construction project is based on the adoption of a project management methodology and which is used consistently. Frigenti and Comninos (2002) asserts that construction projects are more successful when management is consistent and routinely. A lot of projects are similar in operation and processes (Love et al., 1999 and Hughes, 1991) and also the structure of teams, processes, tools, and skills used (Kamara et al. 2003). Kamara et al. (2003) distinguished between the macro and macro perspectives and indicated that construction projects are usually unique in areas such as site, context and client requirements. The construction industry is a major contributor to UK gross domestic product (directly 8.5% in 2008, rising to 10% overall when the entire value chain is considered) and a driver of historical gross domestic product growth (UKCG, 2009). Its value chain consists of about 300,000 firms, including many small- and medium-sized family and local businesses. The sector employs well over 3 million people in a multitude of roles representing 8% of UK employment and a significant proportion of construction employees (>60%) are low-skilled labourers with relatively limited alternative employment opportunities (UKCG, 2009). Rhodes (2015) also reported that the UK construction industry is a pivotal and fundamental pillar of the total domestic economy. The industry approximately has an output of about £60 billion in 1998, equivalent to approximately 10% of the total UK gross domestic product and employs around 1.4 million people and for this reason, it is simply too important to be allowed to stagnate.

UK construction at its best is excellent; the industry is also eminently flexible, its labour force is willing, adaptable and able to work in the harshest conditions and its capability to deliver the most difficult and innovative projects which brings about client satisfaction matches that of any other construction industry in the world. Nevertheless, the industry recognises that it needs to modernise in order to tackle the severe problems facing it; not least that it has a low and unreliable rate of profitability. Margins are characteristically very low. The report shows that the margins of the industry are too low to sustain its future development and innovation and it wishes to see companies who serve their clients well making much better returns. Little investment has been made in research and development and in capital. In-house research and development has fallen by 80% since 1981 and capital investment is a third of what it was twenty years ago. This lack of investment is damaging the industry's ability to keep abreast of innovation in processes and technology as a result of lack of training given to its workforce (construction excellence, 1998). However, in the House of Commons library briefing paper, UK, statistics show that in 2014 the construction industry in the UK contributed about £103 billion in

economic output, almost double that of the 1998 output, 6.5% of the total. 2.1 million Jobs or 6.3% of the UK total were in the construction industry in 2014 (Rhodes, 2015).

The UK construction industry has been identified as a major driver of growth without which there would be a loss of domestic production capacity and skills. The proportion of trainees in the workforce appears to have declined by half since the 1970s and there is increasing concern about skill shortages in the industry. Too few people are being trained to replace the ageing skilled workforce, and too few are acquiring the technical and managerial skills required to get full value from new techniques and technologies. The industry also lacks a proper career structure to develop supervisory and management grades. Too many clients are undiscriminating and still equate price with cost, selecting architects and constructors almost exclusively on the basis of price, quality and experience. The public sector, because of its need to interpret accountability in a rather narrow sense, is often viewed as a major culprit in this respect. The industry needs to educate and help its clients to differentiate between best value and lowest price (Construction excellence, 1998; Rhodes 2015). The next few sections address some of the key areas within the UK construction industry which having the knowledge of are fundamental to the successful delivery of its projects.

3.1.1 Client Dissatisfaction

The notion of projects not achieving or meeting the required standards has been discovered to found amongst both private and public sector clients (Baloyi & Bekker, 2011). They added that the predictability of construction projects in relation to the triple project constraint of cost, time and quality delivering or achieving the desired objective is sometimes unpredictable. Investment in construction is seen as expensive, when compared to other goods and services and other sectors. One major challenge of the construction industry is that it too often falls short of the needs of modern businesses that must be competitive in international markets, and rarely provides best value for clients and taxpayers (constructing excellence, 2004). This under-achievement is graphically makes potential investors see the industry as a poor investment option (constructing excellence, 2004). With few exceptions, investors cannot identify brands among companies to which they can attach future value and as a result there are few loyal, strategic long-term shareholders in quoted construction companies (Baloyi & Bekker, 2011). Certain discussions carried out with analysts suggest that identification of effective barriers to entry in the construction industry, adequate stakeholder management especially clients, together with structural changes that differentiated brands and improved companies', could result in higher

share prices and improved performance (constructing excellence, 2004). The next section briefly discusses the importance and role of client in the UK construction industry.

3.1.2 Direction from Major Clients

In the UK construction industry, improvement is key and vital to the success of any organisation (Baloyi & Bekker, 2011). Clients, one of the most important stakeholders in the construction industry who a good return on investment from their projects, and the organisation itself, which also needs reasonable profits to assure their long-term future. Both points of view increasingly recognise that not only is there plenty of scope to improve, but they also have a powerful mutual interest in doing so (Baloyi & Bekker, 2011). They added that to achieve the performance improvements required, there is a pressing need to draw all the promising developments in construction together and give them direction. These directions are believed to stem from major clients who are the propelling factor for change in the construction industry. The next section discusses the fragmentation nature of construction projects which is one of the major challenges to knowledge management.

3.1.3 Fragmentation

Fragmentation is one of the major impediments to the successful performance improvement initiatives of the UK construction industry (Constructing excellence, 2004). One of the most striking things about the industry is the number of companies that exist; there are well over 250, 000 construction companies listed on the Department of the Environment, Transport and the Regions' (Egan, 2004) statistical register, most employing fewer than eight people. This level of fragmentation in construction industry is regarded as both strength and a weakness. On the positive side, it is likely that it has provided flexibility to deal with highly variable workloads. Economic cycles have affected the industry seriously over past decades and have meant that it has been forced to concentrate more on survival than on investing for the future and on the negative side, the extensive use of subcontracting has brought contractual relations to the fore and prevented the continuity of teams that is essential to efficient working.

Egan (2004) suggested that 'the industry as a whole is under-achieving', and called for 'dramatic improvements'. He proposed that this would be possible if focus is placed on delivering the value that the client needs, and if we are prepared to challenge the waste and poor quality arising from our existing structures and working practices'. Egan's (2004) report identified five drivers of change which are a focus on the customer, committed leadership, integrated processes and teams, a quality driven agenda and commitment to people. The report

set very ambitious targets of annual reductions of 10% in construction cost and construction time and a reduction in defects of 20% per year. A look at some of the factors that have driven the manufacturing and service industry to achieve these radical changes are discussed. These fundamentals are believed to be just as applicable to construction as to any other business concern. These are:

- A focus on the customer:

In the most successful companies, the customer is the brain behind most operations. These companies provide precisely what the end customer needs, when the customer needs it and at a price that reflects the products value to the customer. Activities, which do not add value from the customer's viewpoint, are classified as waste and eliminated.

- Committed leadership:

This involves leadership trusting and being fully committed to driving forward an agenda for improvement and communicating the required cultural and operational changes throughout the whole of the organisation.

- Integrate the process and the team around the product:

The most successful enterprises do not fragment their operations; rather they work back from the customer's needs and focus on the product and the value it delivers to the customer. The process and the production team are then integrated to deliver value to the customer efficiently and eliminate waste in all its forms.

- A quality driven agenda:

Quality means not only zero defects but right first time, delivery on time and to budget, innovating for the benefit of the client and stripping out waste, whether it be in design, materials or construction on site. It also means after-sales care and reduced cost in use. Quality means the total package exceeding customer expectations and providing real service. The industry rightly complains about the difficulty of providing quality when clients select architects and constructors on the basis of lowest cost and not overall value for money. We agree. But it must understand what clients mean by quality and break the vicious circle of poor service and low client expectations by delivering real quality.

- Commitment to people:

This means decent site conditions, fair wages and care for the health and safety of the work force. It means a commitment to training and development of committed and highly capable managers and supervisors. It also means respect for all participants in the process, involving everyone in sustained improvement and learning, and a no-blame culture based on mutual interdependence and trust. It is assumed that these fundamentals put together provide the model for the dramatic improvements in performance that UK construction must achieve if it is to succeed in the 21st century. Eagan (2004) added that in order to drive dramatic performance improvement, the construction industry needs to set itself clear and achievable objectives, and then give them focus by adopting quantified targets, milestones and performance indicators. If the construction industry must share in the benefits of improved performance the objectives and targets that it sets must be directly related to client's perceptions of performance which is related to cost, time and quality. Clients will then be able to recognise increased value and reward companies that deliver it.

3.1.4 UK Construction Industry KPI

The UK industry performance report (2015) posits that the economic KPIs point to an industry working hard to meet rising workloads whilst maintaining recent levels of performance and client satisfaction. Unfortunately in a number of areas the industry's KPIs have declined which had led to consecutive declining of client satisfaction over the years. Cost certainty overall was sustained after reaching a new survey high in 2013 and 2014; however there exist decline in performance when isolating either the design or construction phase. Time predictability has also declined markedly over the last 16 years. The UK industry report (2015) conducted an analysis of client satisfaction on 81% of surveyed project and client rating on the client's satisfaction with the project output and outcome, the result shows a decline in satisfaction rate compared to report generated in 2013/2014 of the survey. The satisfaction of clients with services received from contractors also received a decline in rating of little above 70%, from the initial 75% from previous years. Findings from 74% of the projects show that clients scored 'value for money' as eight out of ten. This is down 1% from the 2013/14 survey, to one of the lowest levels recorded by the KPI survey. The KPI for the clients' rating of the 'condition of the facility in respect to defects' might have received some measure of improvement, however, in line with other indicators client satisfaction remains off the peak level recorded in 2009. 73% of clients rated the impact of defects as a little better than previous year's survey in 2013/2014.
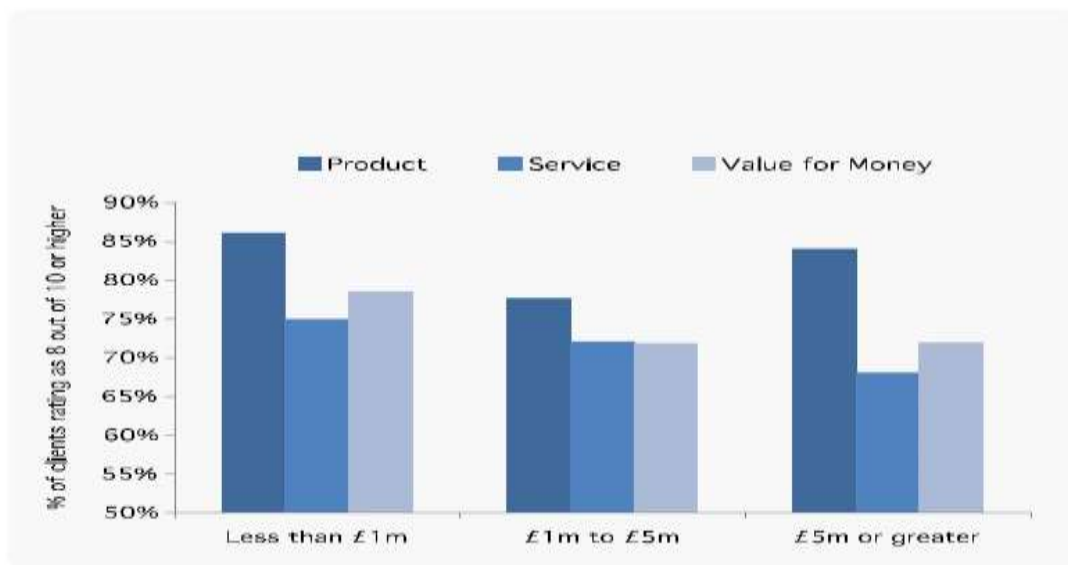
Figure 3.1: Client satisfaction by project size (The UK industry performance report 2015)

In terms of overall satisfaction with the finished product, clients on schemes valued at £5m or greater identified a decline in satisfaction rating compared to those of previous years. Lower levels of satisfaction with medium sized schemes, valued between £1m and £5m also experienced a decline in rating compared to previous surveys in 2013/2014. The proportion of clients rating satisfaction with the overall product is well below satisfaction levels seen over the previous 10 years; between 2003 and 2012, when this proportion varied from a low of 81% to a high of 88%. Despite the improvements, performance on both these measures was worse than in any year prior to 2013/2014. The overall cost predictability of housing projects deteriorated further after a sharp fall in the last survey, with less than half (43%) of clients reporting that their scheme had been completed on or below budget. This compares to 62% in 2012, which fell to 46% in the 2013/14 survey. Less encouragingly, the proportion of clients reporting that construction costs were on budget or better fell from 58% to 51%. This is the lowest reading since 2009. Though non-residential clients' overall satisfaction has held stable, almost all the other KPIs show a worsening in performance. Satisfaction with service fell to 74%, a mild drop from 77% in 2013/14.
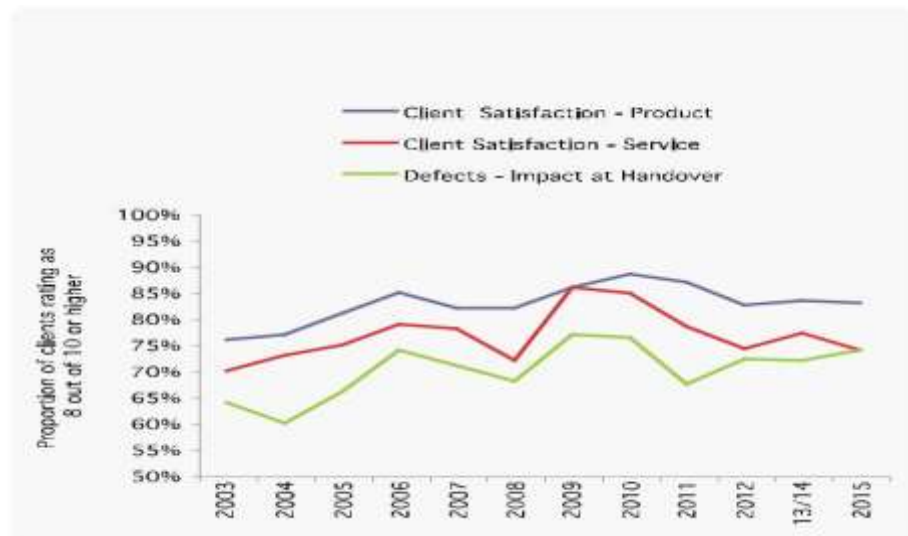
Figure 3.2: Client satisfactions against produce, service and handover

(The UK industry performance report 2015)

The UK industry performance report (2015) further reported that while there has been a worsening in overall cost predictability, a long-run improvement in performance has been sustained. The predictability of design costs also declined, with this phase being completed on time or better on 75% of projects. This follows previous steady performance with the preceding three surveys recording values of 80%, 79% and 81% for this KPI. Time predictability was poor for projects included in the latest survey. Just 38% of projects completed on time overall, with the design phase on schedule on just over half (52%) of projects and the construction phase coming in on time on just 45% of schemes. Performance on this measure dropped from 61% in 2010 to 52% in 2011 and has remained stable with little sign of improvement since. By contrast construction performance on the other two measures deteriorated sharply. The predictability of the construction phase has plummeted from a survey high of 67% in 2013/2014 to a new series low of 45% in 2015. The overall predictability of projects similarly fell sharply, from 46% to 38%. These falls in performance have reversed the gains recorded by the previous KPI survey. The levels of time predictability seen in 2015 and 2012 are significantly worse than in any other year between 2003 and 2015. The construction industry operates a project based system which has various stages and phases. The RIBA (2013) plan of work operates an eight stage process as shown in figure 3.4. These stages in the life cycle of the project have at various points' knowledge elements that exist in the course of project delivery. The next section discusses these various stages in construction project.

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3.2 The UK Construction Process

According to the RIBA (2013) plan of work, when a construction project is initiated, a building committee is formed to oversee the project development until completion. These phases are common to all new construction and renovation projects; but in smaller projects, the phases often become less formal, involve fewer individuals and may have a short schedule of only a few months. Large projects, on the other hand, take a longer time to complete compared to smaller projects. A building team of approximately six individuals is created to represent the stakeholder group(s) involved with the project. This team will be responsible for making the necessary client decisions based upon client and user requirements. In some cases especially in smaller projects, the client and the user are usually the same. Depending on the project, one member of the committee in most cases the architect will take up the responsibility of capturing, gathering and developing the specific requirements for the project. A Brief of Requirements (BOR) or brief is developed that details all objectives, spaces, equipment (new and existing), special finishes, furniture and spatial relationships (Kamara et al., 2002). The building team and various other groups involved in the project will review and contribute to the development of the brief prior to approval. In the case of technically complex projects, an outside consultant may be engaged to prepare the brief documents (Ryd, 2004).

Client (demand for facility)   Construction Industry (supply of facility)   Client (use of facility)
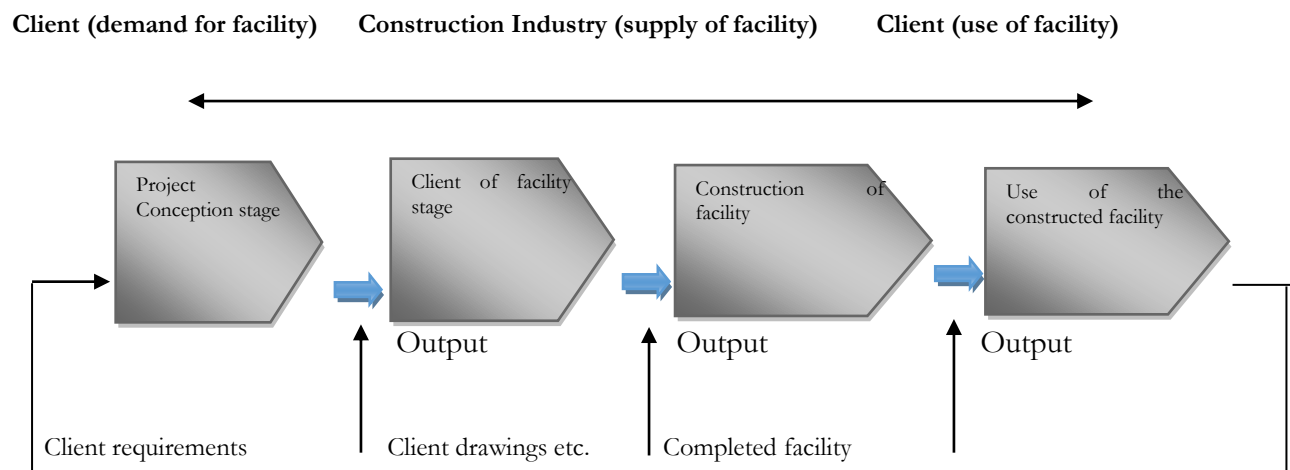
Figure 3.3: Simplified model of the construction process (Source: RIBA, 2013)

The construction process consists of all the processes that prepare for or result in a planned construction or renovation. The concept involves many different types of processes, core processes, administrative processes and public processes. For example, in traditional

construction process, the building process is divided into stages, concept, briefing, planning, production, and management of the finished building. The fundamental objective of creating these stages is to foster control, division of responsibility and cost management. In reality, the different phases have large overlapping areas during implementation and one of such fundamental and important tasks carried out at the initial stage of the construction process is the client (client) briefing process (Kamara et al, 2002). During the early phases of the building process, the briefing phase in the project conception stage extends into the client stage and construction stage; that is concept development phase/conceptualisation and even into the client and planning phase (Ryd, 2004). The Architecture Engineering and Construction (AEC) industry however, is a project-based industry, which utilizes a variety of separate firms in a temporary multidisciplinary organisation, to produce investment goods (buildings, roads, bridges, factories), which are custom built to unique specifications (Egan, 1998). During project conception, the client establishes the need for a project and develops a set of requirements (the output), which are converted into an appropriate client. At the construction stage, the client is transformed into a facility for the use of the client. The industry operates within a dynamic and changing environment. Clients are becoming more sophisticated, insisting on better value for money, and demanding more units of construction for fewer units of expenditure (Egan, 1998). The fragmented nature in which the industry is organized means that efficiency in project delivery is less than expected, resulting in dissatisfied clients, and low profitability for construction firms (Egbu et al., 1999; Carrillo et al., 2000).

This research is based on the RIBA (2013) plan of work client and focus is placed on the first stage of the RIBA process which is the Client briefing stage. This involves developing project objectives, including quality objectives and project outcomes, sustainability aspirations, project budget, other parameters or constraints and then developing the Initial project brief. The core objectives involve preparing project Roles, table and contractual tree and assembling of the project team. The brief team is assembled to review the project brief which may include pre-application discussions to determine the suitability of the feasibility studies carried out. Handover strategy and risk assessments notes are prepared in this stage including agreed schedule of services, client responsibility matrix and information exchanges. The project execution plan is prepared to include technology and communication strategies and consideration of common standards. The support tasks during this stage are focused on ensuring that the project team is properly assembled and that consideration is given to the handover of the project and the post-occupancy services that are required. Other factors needed to be noted include;

- Confirm that formal sustainability targets are stated in the Initial Project Brief.

- Confirm that environmental requirements, building lifespan and future climate parameters are stated in the Initial Project Brief.

- Have early stage consultations, surveys or monitoring been undertaken as necessary to meet sustainability criteria or assessment procedures?

- Check that the principles of the Handover Strategy and post-completion services are included in each party's Schedule of Services.

- Confirm that the Site Waste Management Plan has been implemented.

The diagram below shows that RIBA (2013) plan of work and in this case emphasis is placed on stage one of the process.
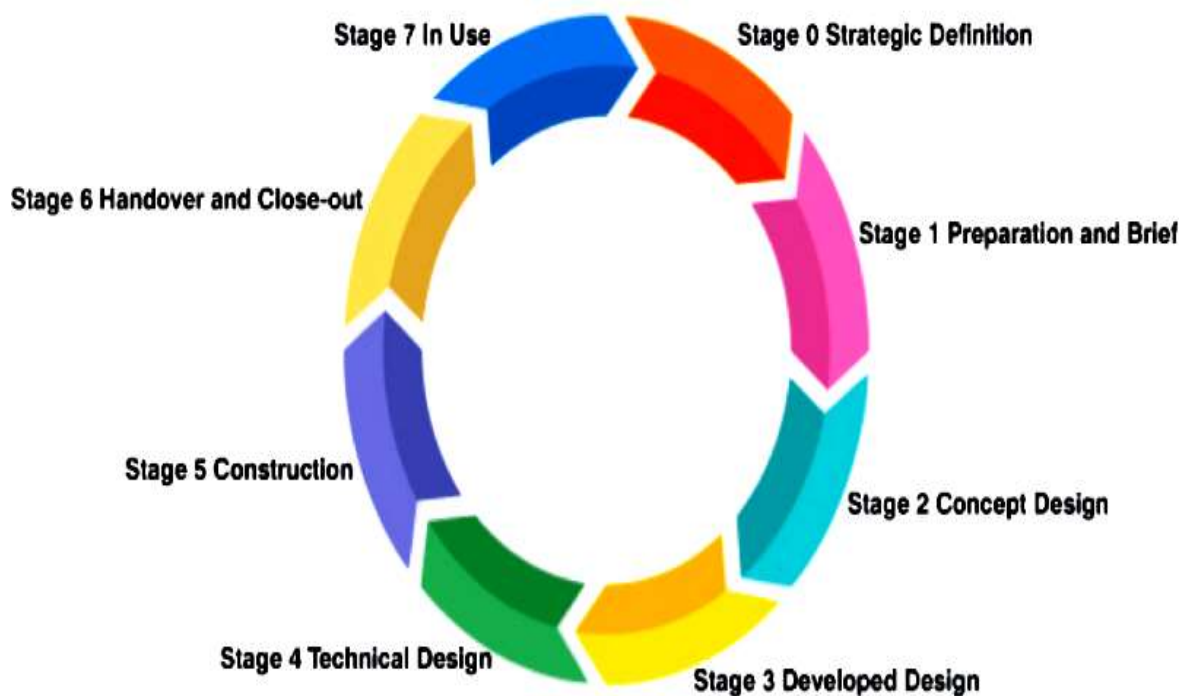
Figure 3.4: Detailed RIBA plan of Work (Source: RIBA 2013)

Several significant and parallel activities need to be carried out during Stage 1 Preparation of Brief to ensure that Stage 2 Concept Client is as productive as possible RIBA (2013). These split broadly into two categories:

- Developing the Initial Project Brief and any related Feasibility Studies

- Assembling the project team and defining each party's roles and responsibilities and the Information Exchanges.

The preparation of the Initial Project Brief is the most important task undertaken during Stage one. The time required to prepare it will depend on the complexity of the project. When preparing the Initial Project Brief, it is necessary to consider:

- The project's spatial requirements
- The desired Project Outcomes, which may be derived following Feedback from earlier and similar projects
- The site or context, by undertaking site appraisals and collating Site Information, including building surveys
- The budget.

A project Risk Assessment is required to determine the risks to each party. The development of the procurement strategy, Project Brief and, in some instances, a (town) planning strategy are all part of this early risk analysis. The importance of properly establishing the project team cannot be underestimated, given the increasing use of technology that enables remote communication and project development RIBA (2013). Having identified and highlighted the different stages that exist in the construction project life cycle, another fundamental aspect of the construction industry project is the procurement route. The type of procurement route adopted, informs the strategy adopted for implementing the project. The next section discusses the different procurement routes in the construction industry.

3.3 Building Procurement route.

A procurement system in construction is a system used in assigning specific responsibilities and roles to people and organisations, defining the various elements in the construction of a project (construction excellence, 2004). The different types of procurement systems are:

- Traditional (*separated*);
- Design and construct (*integrated*);
- Management (*packaged*); and
- Collaborative (*relational*)

Holt *et al.* (2000) posits that there are quite a number of variables to each of the commonly mentioned procurement strategies, notwithstanding the commonly adopted nomenclature; there

is a very wide range of strategies available. For example, the guidelines of the New South Wales Government (2005) in their procurement systems identify about eight variants of the design and constructs system. However, a range of commonly adopted procurement system and contract methods exists and each of these is described below. The decision regarding the choice of procurement strategy has to be made early in the course of the project and this has to be underpinned by the client's business case for the project. The risks associated with each procurement system and how they can affect the client should also be considered. Figure 3.5 provides an overview of the 'speculative risk' which can be identified in advance to a client and contractor for specific procurement methods.

Figure 3.5: Risk apportionments between client and contractor Holt et al. (2000)

In design and construct types of procurement the contractor predominately assumes the risk for design and construction of the project. Design and construct variations exist where the level of design risk can be apportioned more evenly, for example, novation. With traditional lump sum contracts the intention is that there should usually be a fair and balance of risk between parties. With management forms of procurement the balance of risk is most onerous for the client as the contractor is providing only 'management expertise' to a project. However, under a design and manage method a high of risk can be placed on the contractor for design integration (constructing excellence, 2004). The next section looks at the traditional procurement route which is the procurement method adopted for this research.

3.3.1 Traditional or Design-Bid-Build

This method of procurement is probably the most commonly used method in the construction industry and is suitable for:

- All clients, including inexperienced clients
- Complex projects and projects where functionality is a prime objective
- Time predictability
- Cost certainty.

In the traditional approach under which this research is underpinned, the design work is generally separate from the construction, consultants such as the architect are appointed for design and managing the project budget and the contractor is responsible for carrying out the works (Davis et al., 2008). They further mentioned that the responsibility of the consultant (architect) extends to all workmanship and materials, and includes all work by subcontractors and suppliers. The contractor is usually appointed by competitive tendering on complete information, but may if necessary be appointed earlier by negotiation on the basis of partial or notional information. Sometimes, consultants are also selected on the basis of referral (Morledge and Smith, 2013; Davis et al., 2008). The traditional method, using two-stage tendering or negotiated tendering, is sometimes referred to as the 'Accelerated Traditional Method' – this is where the design and construction can run in parallel to a limited extent. Whilst this allows an early start on site, it also entails less certainty about cost. This method however, is mostly not suitable for fast track projects. This method is characterised by the client sometimes developing the business case for the project, providing a brief and budget and then appointing a team of consultants (architects) to prepare a design, plus tender documents.

The client sometimes is involved in the process of appointing the building contractor to carry out the works to the design, by the contract completion date and for the agreed price. Usually much of the work is sub-contracted to specialist firms but the contractor remains liable (Davis et al., 2008). The consultants administer the contract on behalf of the client and carries out consultation practices on aspects associated with design, progress and stage payments, which must be paid by the client (Morledge and Smith, 2013). The separation of the contractor from the design can mean missed opportunities for contractor or specialist contractor to input. This strategy is a low-risk option for clients who wish to minimise their exposure to the risks of overspend, delays or design failure. However, exposure to risk will likely increase where the client briefing or design phase has not received adequate attention or time, where unachievable

time targets are set or where the brief documents are not fully completed as a result of improper capturing of clients requirements (Morledge and Smith, 2013). There is a refinement to this method, which involves a two-stage tender where contractor's tenders are based on a partially developed consultant's design (stage 1 tender). The contractor then assists with the final development of the design and tender documents, against which tenders for the construction works are prepared (stage 2 tender). Whoever put forward the first stage tender has the opportunity to tender or negotiate the second (construction) stage. This approach increases the risks of an increase in overall price and a less certain completion date but contractor involvement is likely to increase the likelihood that both these criteria are realistically established (Davies et al., 2008). Construction excellence (2004) identifies three types of contract under the traditional procurement method:

1. *Lump sum contracts* - where the contract sum is agreed and determined before the construction process starts, and the amount is entered in the agreement.

2. *Measurement contracts* – where the contract sum is accurately known on completion and after re-measurement to some agreed basis.

3. *Cost reimbursement* – where the contract sum is arrived at on the basis of the actual costs of labour, plant and materials, to which is added a fee to cover overheads and profit.
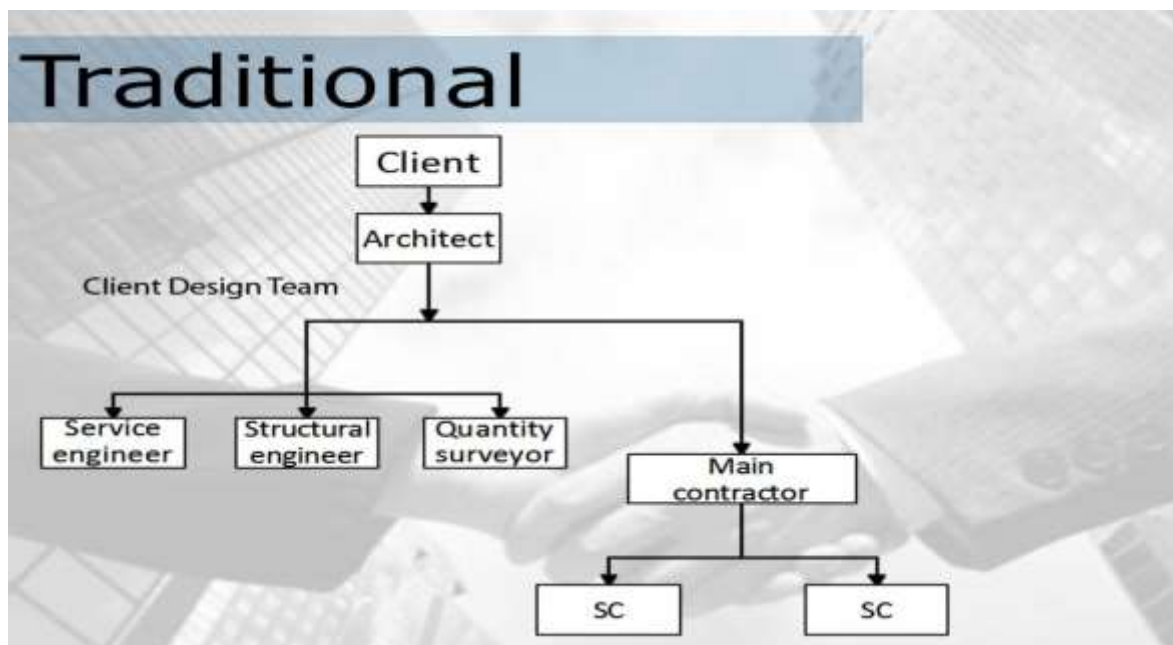
Figure 3.6: Traditional Procurement (construction excellence, 2004)

3.3.1.1 Key points to consider with traditional procurement

A traditional procurement strategy requires the production of a complete brief document before tenders are invited. This method assumes that the client is responsible for appointing architects to provide consultancy services in the development of the design brief. As the client appoints consultants to provide advice on all matters of design and cost, they thereby retain total control over the design and quality required. The contractor depends heavily upon the necessary information and instructions from the architect being issued on time, which also includes the client deciding which specialist firm; the contractor is to use (Gordon, 1994).

3.3.1.2 Advantages and disadvantages of traditional procurement

Constructing excellence (2004) highlights some of the main *advantages* and disadvantages of using a traditional procurement strategy are:

- ♦ Accountability due to a competitive selection;
- ♦ Competitive equity as all tendering contractors bid on the same basis;
    - ○ Designer and the client are able to have a direct influence with the project which can facilitate a high level of functionality and improve the quality in the overall design;
- ♦ Price certainty at the award of the contract;
- ♦ A tried and test method of procurement which the market is very familiar with.

The main *disadvantages* of using a traditional approach to procurement are:

- ♦ Can be a timely process to produce the full contract documentation. Tenders documents from an incomplete design can be produced but can lead to less cost and time certainty, and may lead to disputes;
- ♦ Overall project duration may be longer than other procurement methods as the strategy is sequential and construction cannot be commenced prior to the completion of the client brief; and
- ♦ No input into the design or planning of the project by the contractor as they are not appointed during the design stage.

3.4 The Role of KM in the Construction Industry.

The UK construction industry has in excess of 1.5 million employees and constitutes approximately 20 per cent of total enterprises in UK. This industry plays a significant role in

gross domestic product (GDP) of the UK that contributes around 8 per cent (Construction 2025 strategy, 2013). Furthermore, 99 per cent of organisations are SMEs in this industry and construction activities are highly knowledge-intensive which require an effective management (Hari *et al.,* 2005). According to Latham (1994) and Egan (1998) report, UK construction industry has suffered from performance problems which has affected the satisfaction of clients and has been in transition to overcome this issue. They further mentioned that in order to improve overall performance of construction industry, two core factors, have been identified which are knowledge and learning. The term 'knowledge management' and the way in which to achieve it are essential in knowledge-based industries like construction (Carrillo et al., 2000; Hari et al., 2005). KM has a vital role in improving efficiency of project delivery and competitiveness of organisation (Egbu, 2005; Sheehan et al., 2005; Fong, 2005), therefore, implementing KM in construction organisations confronts with challenges such as capturing, sharing and transferring such knowledge across projects, due to the fact that construction projects are mostly short-term, and have a definite beginning and end (project-based).

Furthermore, Egbu and Botterill (2002) elucidated that the rate of developing and generating new ideas and knowledge is very low because technical knowledge that was achieved from one project is usually lost or is not used in the next project. In essence, for organisations to be deemed competitive and effective in improving project performance, it is necessary to effectively put in place a strategy for capturing knowledge during construction projects (Lee and Egbu, 2005). Reviewing relevant literatures suggest that KM needs to be studied and explored more in construction industry, specifically more empirical research are required in project-based environments (Egbu, 2001; Chan *et al.,* 2006). Every construction project is triggered by a client, be it a private client, a business client, personal client or the government. Every construction project aims to deliver value to a client. The role of the client in the successful delivery of project success is very vital, hence the next section discusses on the role of the client.

3.5 Who is A Client?

In order to understand the role of the client in the construction industry and their impact on the successful delivery of a project, a brief understanding of who the client is, is required. Many authors have attempted to define who a client is. Morledge (1987) considers clients as primary and secondary developers whilst Flanagan and Norman (1993) classify clients as public and private. Clients are differentiated between public clients, individual clients and corporations Rougvie (1987). Hillebrandt (1984) refers to clients as 'continuing clients' and `one-off clients'

and also distinguishes between public and private sector clients. Kelly et al. (1992) suggest that clients can be broadly categorized in accordance with three parameters: size (small or large); sector (public or private); and project interest (developer or owner-occupier). Further, clients are grouped into 3 categories: on-going, on-off and one-off clients by Naoum and Mustapha (1994); and Masterman and Gameson (1994) categorises clients into 4 categories: secondary inexperienced, primary inexperienced, secondary experienced, primary experienced. Clients as defined by Kamara et al., (2002) is a person or organisation responsible for commissioning and paying for the project or facility (e.g. a building, road or bridge), and is usually (but not always) the owner of the facility being commissioned. They added that the clients can also be the users of a proposed facility, or they may be separate entities. The client may also be the owner, users and other identified persons, groups or organisations who influence, and are affected by, the acquisition, use, operation and demolition of the proposed facility. The client, in this research is seen as the owner or representative of owner of a building which could include personnel in the department within the organisation who has the authority to comment or make decision on the facilities affected by the project, the client can also be a public or private organisation who is responsible for commissioning a project and making sure the project delivers within the agreed budget, time and quality (Kamara et al., 2002). There are different types of client which will be discussed in the next section.

3.5.1 Client Types

Private

Private clients are sole traders or domestic clients who would like to have a house, a building altered, extended or maintained. They enter into private agreements with a builder to undertake the work. The private client may have an architect who has already produced the drawings or who needs to engage the client in producing the briefs for the project, as long as it is permitted by the planning or building regulations (Davies et al., 2008; Morledge *et al.*, 2006).

Commercial

A commercial client is a factory or business that needs to undertake building works in order to produce a product or process. For example, a fast food company needs an outlet which has to be built quickly and to be maintenance-free and adaptable (Davies et al., 2008; Morledge *et al.*, 2006).

Public limited companies

A public limited company, such as a bank, is one that trades on the stock exchange and is owned by its shareholders. A bank could have hundreds of branches that all need to be maintained and

looked after and upgraded by refurbishment from time to time. It is also likely to have a large headquarters in a major city, which will need similar work doing (Davies et al., 2008; Morledge *et al.*, 2006).

The Government

The Government can issue work at three different levels: through local councils, devolved administrations (Welsh Assembly and Scottish Parliament), and central government (Davies et al., 2008). Local councils have duties to construct and maintain services. They can issue work such as:

- Constructing schools
- Maintaining highways
- Replacing windows
- Maintaining houses
- Carrying out building works on council properties.

Central government departments, such as the Ministry of Defence (MoD), or bodies such as the Highways Agency or National Health Service can purchase a great deal of construction services, usually using intermediate companies who specialise in managing large building projects (Davies et al., 2008; Morledge *et al.*, 2006). Before a construction project is instigated under the traditional procurement route, the client initiates the need for the project to be initiated, however, for the project to commence, a brief has to be developed which forms the basis on which the project is initiated. The next section discusses the client brief in more detail.

3.5.2 The Client Brief (CB)

The need for KM in the Architecture, Engineering and Construction industries is fuelled by the need for innovation, improved business performance and client satisfaction (Yu and Chan, 2010). The industry operates within a dynamic and changing environment. Clients are becoming more sophisticated, insisting on better value for money, and demanding more units of construction for fewer units of expenditure (Egan, 1998). The demanded products are also becoming more complex, with increasing emphasis on environmentally friendly facilities. The fragmented nature in which the construction industry is organized means that efficiency in project delivery is less than expected, resulting in dissatisfied clients, and low profitability for construction firms (Egbu et al., 1999; Carrillo et al., 2000). This interest in capturing knowledge has been expressed in the development of products such as a knowledge based expert systems

(Anumba et al., 2000) and post project reviews in attempts to capture learning (Scott and Harris, 1998).

A set of definitions of the process of preparing client briefing and implementation of projects vary from project to project, however, one common correlation between all projects is that client want to be satisfied with the output and outcome of their project. Client briefing is the process whereby a client clarifies and informs a design team of their requirements, needs, aspirations and desires, formally or informally (CIB, 1997). It provides a channel to convey decisions and information between clients and consultants. Thus, a better understanding of their requirements and preferences at the project inception stage can be achieved (O'Reilly, 1987; Fisher, 1998). Blyth and Worthington (2001) describe briefing as a problem formulation and solving process, which identifies an organisation's needs and resources, and matches these to its objectives and mission. Example of such could be identifying housing needs and then providing proposing a solution by initiating a housing building project. In addition, briefing helps to balance the distinct interests of the users, client advisors, client founders and legislators from the demand side and those of the architects, consultants, contractors, property agents and facilities managers from the supply side (Shen and Chung, 2006).

Smith and Jackson (2000) explains that briefing is the process of capturing the purpose, intended use, requirements, objectives, and desired qualities of a construction project, resulting in an output document: the client's brief. Furthermore, the brief provides the client team with data to commence their design, without the preservation of their artistic expression. There are two general theories underpinning the function of the construction brief in construction projects. The first theory considers the brief as a static developed document, which serves as a set of client conditions. The second approach considers briefing as a dynamic process, which is developed throughout several stages in the process (Smith and Jackson, 2000). Yu et al (2006) posit that instead of an event; briefing should be seen as a social interactive procedure. Furthermore, it is a method of iterative learning about the client's organisation needs and requirements (MacPherson et al., 1992; CIB, 1997; Blyth and Worthington, 2010; Kamara and Anumba, 2001 and Kamara et al., 2002). Briefing concerns the identification and formulation of client requirements in construction processes (Blyth and Worthington, 2010). Moreover, client requirements generally are about issues like spatial dimensions, number of rooms, building aesthetics, flexibility, indoor climate, logistics, security and so on. In most projects, these requirements are captured in briefing documents which record them in documentary form.

These documented requirements are captured from the client and are assumed to be tacit in nature at the point of capturing. Briefing documents have been identified as means of communication in the interaction between client and architect (Kamara et al., 2002). For architects, and others involved in construction project, the brief should give a clear overview and understanding of the accommodation needs and ambitions of the client organisation which helps to structure the debate about the quality and value of client proposals between client and architect (Van der Voordt and van Wegen, 2005).

Due to the importance of the brief, it is expedient that clients and architects devout adequate time and effort to the successful delivery of the client brief (Bogers et al., 2008). In the traditional procurement route, the architect is responsible for developing the brief on the basis of interviews with the client and end-users, discussions with facility managers, and the expertise of external consultants (Bogers et al., 2008). Briefing generally starts with a statement of need, followed by different stages such as drawing up a functional brief, concept client and schematic client (Shen and Chung, 2006). Gould & Joyce, (2009) assert that at every first stage of a construction project, a brief is created. The brief is a document where the requirement of the building to be constructed is stated. Some of the properties of this document include the functions of the building, what particular spaces are needed and so on. Constructing excellence (2004) defined briefing as 'a process by which client requirements are investigated, developed, documented and communicated to the project board responsible for the construction'. These requirements need to be agreed and signed by the client before progress is made for client. Every project is preceded by a brief, though the quality can vary considerably. Good briefing is not easy to achieve, yet it has been suggested that improvements to briefing lead to clients getting better buildings Gould & Joyce, (2009).

According to Salisbury (2013), the briefing process is composed of elicitation and communication of the client requirements and exists in two types,

- **Strategic brief:** this is a document that communicates the overall project scope, aim and objectives; the key issues in this briefing are the success parameters, budget and brief.

- **Project (functional) brief:** this is the functional statement and operational needs for the construction of the project. The development of the brief is the process of clarifying the objectives and requirements of a project.

There are two schools of thought relating to construction project briefing as mentioned earlier;

♦ **Static briefing**

This approach considers the brief as an entity in itself, which should be frozen after a critical period; hence briefing becomes a stage or stages in the client process (Yu et al., 2007; RIBA 2013). The traditional approach to briefing views it as a separate activity that takes place before client starts (Jensen 2011), resulting in the production of a document, set of documents or collection of correspondence material containing the clients requirements (Barrett & Stanley 1999). This approach is driven by an emphasis on the importance of the early stages of development to a projects success (Smith et al. 1998; Shen et al. 2004) and the widely acknowledged impact that late changes can have on cost, time and quality, mainly due to the reworking of construction documents and the implementation of additional work. Changes made after the early stages of a construction project are a major source of dispute and litigation worldwide. This has led to a culture that generally views a change order as the failure of a party to fulfil their function in the construction process (Othman et al. 2004). The static briefing approach emphasises the need to freeze the brief. A commonly used process map for construction, the 'plan of work' developed by the RIBA (2008) takes this approach, pushing for the development of an explicit and detailed brief as early as possible in the project. The brief is then frozen at the end of the client development stage. Another popular map, the 'Process Protocol', developed from a manufacturing industry perspective, encourages fixing the brief before the construction phase (Kagioglou et al. 1998). Although it allows development of the brief until a later stage in the process, it can still be considered as leaning towards a static approach.

♦ **Dynamic briefing**

The second approach regards the brief as a live and dynamic document that develops iteratively in a series of stages from an initial global brief which is deemed an on-going activity that evolves during the client and construction process Yu et al., (2007). The limitations of the static briefing approach are based upon the inevitability of changes occurring throughout the project, most significantly when the client has been 'frozen', after the static briefing stage. This is well described by Nutt (1993) who suggested that the traditional (static) briefing process is challenged by the nature and pace of change, that future needs cannot be predicted with confidence and that there is a need for a dynamic process. Extensive research by Othman et al., (2004) supports this theory, identifying drivers for development of the brief during later stages, using an extensive sample of case study data. He suggests that this should be embraced using an approach called 'dynamic briefing'. The dynamic briefing approach has been defined in various ways. Jensen (2011) suggested that briefing should be 'a process of feedback to, and dialogue with,

all stakeholders' (Jensen 2011). It has also been defined as 'the process running through the construction project by which means the client's requirements are progressively captured and translated into effect' (Barrett & Stanley 1999).

'Exposing client values' involves the identification of the needs and requirements of the client, from the level of their mission statement or business outlook, down to their specific needs from the construction project. Green (2010) offers insight into the use of dynamic briefing to expose client values, drawing from the observation by various sources (Bennett 1985; Goodacre et al. 1982) that extensive collaboration over time is required between designer and client, as clients are often incapable of describing their own needs and objectives without being probed in depth. Other researchers also suggest that architects need to conduct a facilitated and guided learning process with the clients and users of a project (Green 2010; Jensen 2011). It is also noted by Barrett & Stanley (1999) that architects can easily misinterpret requirements expressed by the client, however this can be resolved through continuous follow-up and re-visiting of the issues through prolonged client-designer collaboration. The interpretation of the client's requirements and how they correspond to their real requirements greatly influences the efficiency of the client (Chatzi 2012). Barrett & Stanley (1999) offer further insights into how a dynamic briefing approach can be effective in exposing client values. Firstly they describe how, as the client's confidence, knowledge and feel for the issues increase throughout a project, their requirements may change from those first given during the early briefing. If these changes are not picked up, the client may become dissatisfied with the project. They describe how the identification of these changes in requirements is dependent on continued interaction with the client throughout the process. 'The briefing process must support the client through this journey from uncertainty to certainty in such a way that aspiration is turned to delight' (Barrett & Stanley 1999). Sustained interaction is likely to ensure the client's continued satisfaction with the developing scheme and enables them to highlight any potential problem areas before they develop further.

As well as the gradually developing exposure of client values, there are a number of other internal and external influences that can cause late development of the brief. Some of these drivers, which were identified as being highly influential by Othman (2004) included:

✓ Meeting new technology changes.

✓ Incorrect construction documents.

- ✓ Unavailability of materials.

- ✓ Changing of regulations.

- ✓ Response to market demand.

- ✓ Other unforeseen conditions.

Othman et al. (2004) asserts that the dynamic approach to briefing can enable innovative response to these drivers for the benefit of the project. Although dynamic briefing offers the potential to capture client value, techniques are then required to guide this approach as a client management strategy. Thyssen et al. (2011) described this process as an on-going value conversation or interpretation and suggested that one way of capturing client value is through the use of Value Management (VM). This involves maximising the value of the solution from the concept stage through to building use, by auditing decisions against value systems based on the client's exposed 'values'. There are however limitations to the use of dynamic briefing which must be taken into consideration. Feedback from the research by Othman (2004) suggested that if top management lack desire or willingness to use a dynamic briefing management strategy such as the Value and Risk Management Protocol, then its adoption will be limited. Therefore the benefits must be clearly presented to the top management of all parties to gain support. It is also noted that a dynamic brief approach such as this is time consuming and requires a large volumes of information. Having discussed what the client brief is, a quick look at its importance is discussed in the next section.

3.5.3 Importance of Client Briefing

Briefing is a process of developing a deep understanding about the client's needs and requirements and in some cases involves a continuous interaction and involvement of the client and in this process, the role of professional team is very important (Wapukha, 2013). Through good briefing and grasping what the real needs of the client are, a constructive and efficacious collaborative effort can lead to client and architects working more effectively and productively on project and make better decisions confidently knowing well that clients can potentially contribute to the success and failure of the project. In the briefing environment, effective communication between the client, the user of the building, the client team, the contractor, and specialist consultants, is critical (Shanmugam et al., 2006). The client can assume responsibility for initiating, directing and maintaining effective communication during the briefing process.

Clients, end-users, architects and contractors do not always have the knowledge, experience, skills and attitudes to enable them to interact as a team for the resolution of problems. In essence, unsatisfactory client solutions can result from ineffective communication between the client and the client team and one of the main factor behind communication difficulties is the nature of the relationship between the communicators (clients, professionals, users and procurement team) (Wapukha, 2013).
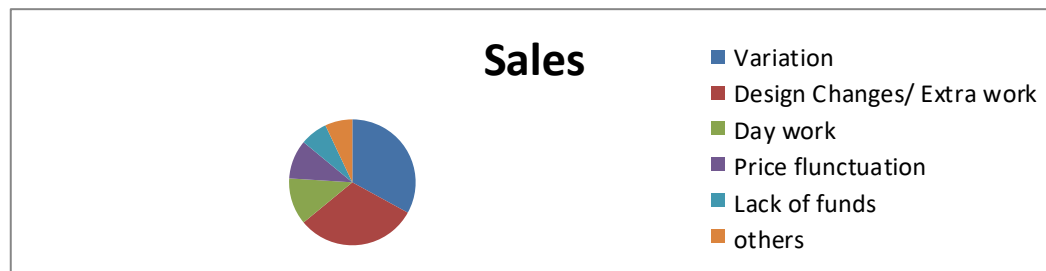
Figure 3.7: Breakdowns of Cost Overrun (Source: Shanmugam et al., 2006)

Shanmugam et al., (2006) identified two basic factors that contribute to cost and time overrun, these are; Variations in construction projects and Client changes (which is as a result of changes made due to mistakes or client request). Figure 3.7 identifies some of the factors that are responsible for cost and time overrun and shows a percentage break down of the cost overruns. It can be seen from the above analysis that the significant cost overruns are mainly due to Variation and client changes. The sources of variations and extra work can be classified into client initiated variations and unforeseeable variations. The main reasons behind the higher percentages in variation and client changes or extra work are identified as changes during the construction stage which could arise as a result of improper management, ineffective communication and incorrect assessment of the client brief. Wapukha (2013) in his research study stated that one of the major problems confronting the global construction industry is the briefing of the client whom a project may encounter. The main reason why there is a problem with the clients, stakeholders and the client team is because not much attention is given to the needs of the clients. The process of acquiring what the client needs is very important and must be taken seriously. The impact of decisions made will affect the client because they are the end consumers of a given products. They are also going to be affected financially since clients may be the major sponsors of the project (Kelly et al., 2008). Certain factors exists in the client briefing process which if properly addressed can be exploited or mitigated against, which invariably becomes an organisations strength and opportunity for better performance. The next session discusses the various factors that occur during the client briefing process.

3.5.4 Factors Affecting Client Briefing

Different factors affect the way briefing is developed and carried out and these factors relate to the type of information that is required which depends on the nature of the project such as size of client and the nature and skills of the client team (Morledge & Smith, 2013). Furthermore, effective client briefing is now regarded as fundamental to the production of buildings which satisfy not just functional needs but also reflect user preferences in relation to the environmental qualities they create. Moreover, briefing has become a more involved process due to the increasing complexity of both client organisations and buildings themselves. A primary and vital processes carried out during the briefing process is clients knowledge (requirement) capturing which involves the use of certain knowledge capturing techniques for the process to be effective (Morledge & Smith, 2013). Briefing is a critical process in construction and a considerable amount of research has been conducted into how to improve briefing since the Banwell Report was published in 1964 (Salisbury, 2013; MacPherson et al., 1992; Latham, 1994; Green, 1996; Fisher, 1997; Barrett and Stanley, 1999; Kamara et al., 2001; and Blyth and Worthington, 2001). However, as Salisbury, (2013); Blyth and Worthington, (2001) and Barrett and Stanley (1999) pointed out on the criticality and importance of the client brief, many people still overlook the importance of briefing in construction. These authors believe that a brief can be constructed quickly and efficiently merely by capturing and documenting the client's requirements at the start of the project. Consequently, the client's requirements may end up not being clearly defined. The Banwell Report (1964) stated that insufficient resources and time are devoted to the briefing process. After thirty years, the Latham (1994) report also concluded that effort is required to understand the needs of clients (Shen and Chung, 2006).

Bogers et al., in 2008 carried out a research interviewing 18 architects in Netherlands on their perception on client briefing and its impact on client satisfaction. The result analysed and gathered from the study shows that the briefing process is a major and fundamental process to the success of any construction work to be undergone. While recognizing the importance of the brief, the respondents express a considerable amount of dissatisfaction with the briefing documents they encounter in everyday practice. In their perception, briefing documents are often long lists with standard requirements that are based on building codes and generic standards they already know about. Other complaints are that briefing documents are not always complete; some say they are too detailed or not detailed enough. Inconsistencies and contradictions can also be a problem, especially in voluminous briefing documents for large scale projects. For this reason, many of the respondents would like to be actively involved and

participate in the development of the brief. According to many of the interviewed architects, the lack of proper structure is a major problem. In their perception, strategic requirements concerning, e.g. the ambitions of the client, are obscured by an overload of technical specifications. Another complaint concerns the absence of financial information in many briefs. Although almost all handbooks on briefing state that the brief should include information concerning the budget for the project, many briefing documents seem to lack this type of information. A topic of debate among the architects is the extent to which the brief has to be explicit about the client's preferences concerning Client style or aesthetics. Most architects, and experts on briefing, state that a client's ambitions on architecture should be an integral part of the brief. The architects were also asked about their preference in the phasing of the briefing process.

According to literature there are basically two different approaches. One approach is based on the idea that all briefing information should be complete before the client process starts (Pena and Parshall, 2001). The other approach is based on the idea that briefing is a continuous process, which interacts with the client process. Half of the interviewed architects said that they expect their clients to have done their "homework" before they start briefing. They feared, and have experienced, that an on-going briefing processes can result in new requirements and many changes along the way. In their opinion, it frustrates the efficiency of their client process. Over 40 percent of the respondents, however, question the extent in which clients are really able to formulate all their requirements beforehand. They stated that clients actually need the architect's sketches and drawings to find out what their accommodation needs really are. Regardless of which approach is pursued, the status of requirements should be clear (Bogers et al., 2008). However important the brief may be, all interviewed architects agree on the fact that briefing documents cannot replace face-to-face communication with the client. Many of the architects say that they always try to establish a direct dialogue with users and clients, even though they are not supposed to do so in some projects. Direct contact with users is seen as necessary to get a "feel" for the organisation and the ambitions and priorities of the clients. Architects see direct communication also as a means to test whether they have understood or interpreted the brief properly. The respondents indicate that written requirements do not always match the actual expectations of the clients and users.

Shen and Chung (2008) carried out a study in the Hong Kong construction industry with the aim to investigate the briefing process in the construction industry. Some of the findings discovered

shows that client briefing, which is comprised of initial brief and detailed project brief, has eight stages: strategic analysis, client analysis, facilities analysis, statement of needs, and confirmation of needs, functional brief, concept client, and scheme client (Latham, 1994; Atkin et al., 1995; Kamara et al., 2001). However, the findings revealed that these stages are not fully implemented in the industry. The procedures for briefing in the public and private sectors are quite similar, and they are normally comprised of three stages only. In the private sector, briefing is mainly undertaken by external consultancies and the brief is usually given either in a written format or through a combination of a written and verbal format. The briefing generally starts from the functional brief and is followed by the concept client and scheme client and all the process is highly informal. Other findings shows that most of the respondents agreed that public clients have their own planning divisions to formulate the statement of need through research on the user and by conducting studies; thus, client requirements are generally well defined in the public projects, however, this is not the case in private sectors. On the contrary, client requirements are usually loosely defined in the private projects.

Consequently, the criteria imposed by site location (which defines the orientation and standard of buildings), lease conditions (which define the usage, composition, plot ratio of land and project completion date) and building regulations (which define the maximum height and layout of buildings) become the major considerations in a briefing because most private clients are investors who will sell or rent the buildings to the public after the completion of the projects which makes them more focused on the development brief, financial flow, and completion date (Shen and Chung, 2008). Some of the reasons are because client requirements change from to time to meet changes in the market, such as the tastes and budgets of the customers, and there are no fixed requirements. No detailed description will be given in the brief to prevent any legal claims from being raised regarding modifications to the client. Most private clients are highly experienced in the industry. They know exactly what they want and are able to instruct the consultants to revise the requirements if necessary (Kamara et al., 2001).

Juaim and Hassanain (2011) present series of factors that affect the process of developing and implementing the Client brief. These factors are classified under several categories related to the owner and his representatives, the Client and architect, the client brief, the role of communication throughout the briefing process, the allocated time and budget and the management and control of the briefing process.

Factors related to the owner

- Involvement of the owner in the briefing process.

A Client briefing process requires the involvement of the owner who informs the design team of his objectives, organisational needs and requirements for the project (Hershberger, 1999). The owner may not entirely understand the criticality of their role within the building process, as well as the legal and financial implications of constructing a building (Juaim and Hassanain, 2011). The owner of the project may be an individual, an organisation or several stakeholders with different goals and project requirements. As the briefing process should sufficiently capture all the requirements of the stakeholders, the architect may experience difficulties in trying to satisfy their diverse goals which is one of the various factors which affects the effective capturing of clients requirements (Yu et al., 2005). Shen and Chung (2006) stress on the involvement of the stakeholders in the client briefing process, as their active involvement serves to ensure the reliability of the project. The added that prior to working through the briefing process for a project, the architect and the owner should identify the project participants who will be involved in contributing to the Client brief. Further, channels of communication as well as levels of authority are also identified. Commenting on the involvement of the owner and their representatives in the Client briefing process, Bogers et al. (2008) added that in order to improve the everyday practice of briefing, it is important to realize that architects cannot produce a good design, when clients fail to participate in the client briefing process.

- Involvement of owner and end user in the briefing process.

End users are considered to be a significant source of knowledge for specific requirements during the briefing process for the projects (Zwemmer and Otter, 2008). Users may constitute a diverse collection of individuals or groups with different interests and views. Moreover, these users might be part of the client organisation, external tenants, combination of both parties or they may be individuals or groups upon whom the organisation relies, such as its customers and visitors (Blyth and Worthington, 2001). Juaim and Hassanain, (2011) indicates that due to the fact that buildings may have different types of users, confusion about whom to seek requirements from or who has the authority to approve requirements may occur. When direct contact between the users and the designer is not feasible, the Client brief should contain as much information as possible about the requirements of the different types of users of the building (Bogers et al., 2008). Yu et al. (2007) emphasize the significance of involving adequate representation of all parties representing the client organisation to address their needs and requirements.

- The owner's level of experience with construction processes.

Some of the briefing problems associated with the project owners include inexperience of the owner with the building process, inadequate representation of the owner in the Client briefing process and partial identification of the owner's project requirements (Kelly et al., 2003). These problems may lead to the development of a vague Client brief for the project (Bowen et al., 1997). Yu et al. (2010) indicate that the breadth of the Client brief depends, to a large extent, on the experience of the owner of the project. Experienced owners tend to develop a detailed brief; while inexperienced owners might entirely neglect the project brief. A series of interviews confirmed that one of the major problems in the building industry is a lack of experience among owners with the building process. Owners may not be able to identify their requirements. In addition, owners may frequently change their requirements. Therefore, the architect has the responsibility of informing the owner about the importance and the expected benefits of the Client briefing process (Yu et al., 2010).

Factors related to the architect

- Familiarity of the architect with the project type.

Architects commissioned for developing the Client brief may not have enough experience in the requirements of the specific project type that they are involved in. Consequently, the outcome of the briefing process may be of an inferior quality (Shen and Chung, 2006). They further discussed that lack of experience on the project type may result in developing inaccurate assumptions pertaining to space types, space allocation criteria, relationships between spaces and proximities from one to another, costs of materials and construction methods, typical site requirements, technical, mechanical, electrical, security or other requirements unique to the type of the project. In addition to unfamiliarity with the project types, absence of information pertaining to the type of the end users may result in the development of an improper Client brief for the project (Pena and Parshall, 2001)

- Familiarity of the architect with various construction projects.

The architect usually assumes the responsibilities of developing the Client brief as well as developing the design solutions for the project. However, Shen and Chung (2006) indicate that not all architects are good architects. A specialist in one field may overlook essential information that are essential to other professionals. Architects tend to focus on the design of the facility, rather than on clearly establishing the organisational needs and requirements of clients in terms of building systems in the Client briefing process. As a result, the outcome generated from the Client briefing process may suffer from lack of details needed to reflect the requirements of the

client organisation (Shen and Chung, 2006). They added that architects may be unfamiliar with the construction process and as such may miss out some issues in the construction phase; however, since architects are responsible for developing the Client brief, they should possess adequate experience and knowledge in being able to provide solutions to the client.

- The architect's ability to comprehend the project requirements during the briefing phase.

Efficient briefing depends mainly on the involvement and the skill of two parties. These parties are the architect and the owner (Salisbury, 1998). Owners and their consultants normally focus on documenting their requirements in large reports. As a result, architects may not sufficiently comprehend the full extent of the documented requirements to commence work in the design phase (Bogers et al., 2008). The architect should be able to comprehend the project requirements.

- The architect's ability to conceptualise the client requirement.

The objective of the design phase is to produce a functional building that meets the actual needs and requirements of the clients (Van der Voordt and Van Wegen, 2005). The discussed further that the fulfilment of this objective is facilitated by the development of the Client brief that captures client and end users' goals and requirements. The architect should properly understand the prepared brief and carefully interpret it during the design process. Equally, it is important to be aware that when owners fail to determine and clarify their project requirements, architects are not expected to comprehend these requirements (Bogers et al., 2008).

Factors related to the client brief (requirement) document

- Clarity of project goals set by the owner.

The success of the briefing process depends on identifying and understanding the goals and objectives for the project by the owner or his representatives (Yu et al., 2007). Cherry (1999) describes that there exist several types of goals for consideration during the development of the Client brief. These types include organisational goals, such as, the owner's goals; form and image goals, such as, aesthetic and psychological impact; functional goals, such as, the number of people to be accommodated; economical goals, such as, the project budget; time goals, such as, the project delivery date and the expected changes and developments over the next 5, 10, 15 and 20 years; and finally management goals, such as, the set deadline for achieving the steps of the Client briefing process (Juaim and Hassanain, 2011).

- Clarity of project requirements (functional, technical and behavioural).

Owners should identify their project requirements clearly, systematically and comprehensively (Shen and Chung, 2006). Owners and their consultants usually identify and document their

organisational needs and requirements in large reports. Therefore, when owners fail to clarify the extent of their requirements, architects will find it challenging to develop effective design solutions (Bogers et al., 2008). Yu et al. (2005) indicates that while developing the Client brief, it is necessary to consider and maintain the proper balance of the interests of all parties in the client organisation. Further, the Client architect is expected to be keen on responding to the requirements of all parties of the client organisation.

- Establishing priority levels for the various requirements of the project.

The priority level set for each requirement in the project is an integral part of the data needed to develop and implement the Client brief (Kumlin, 1995). Established levels of priorities identify opportunities for developing design solutions and set constraints on the implementation of the solutions (Cherry, 1999). Kumlin (1995) indicates that these established levels of priorities provide a useful measure of control and assessment of the final design solution. In situations where the requirements cannot be implemented, due to time, budgetary or other constraints, the architect and the owner, should work toward establishing modified priority levels. An example for a modified level of priority is the allocation of one conference room to three departments rather than one for each department in the organisation (Cherry, 1999). Kumlin (1995) reveals that in cases where the significance of some of the brief requirements is not indicated, the brief may be subjected to a wide range of interpretations during the design phase.

- Effect of project scale on developing the brief.

In most projects, the client brief is developed based on discussions with the owner, end users, facility managers as well as external consultants (Bogers et al., 2008). A brief can vary considerably in length, content and format, depending on three main issues. The first relates to the professional experience of the owner. The second is associated with the type, scale and complexity of the project. The third pertains to the organisation of the construction process (Shen and Chung, 2006). In large and complex projects, briefing is more significant than in standardized and small projects (Bogers et al., 2008).

- Anticipation of changes in the future use of the building.

A well-documented set of user requirements provides for a building that is expected to meet the expectations of its users. However, as time passes, the range of activities and the users occupying the building may change. Due to such changes, the building may not be able to cope with the new requirements of its users (Brauer, 1992). Consequently, the building may suffer from functional obsolescence at an earlier stage of its service life (Langston and Lauge-Kristensen, 2002). They indicated that due to rapid changes in technology and organisational structures,

anticipated future developments and changes should be addressed during the briefing phase to ensure the development of long lasting design solutions.

Factors related to the role of communication throughout the briefing process. Utilization of face-to-face contact as a communication method

The success of the Client briefing process depends on effective communication between all participants in the project. Active listening throughout the briefing process facilitates a free and complete exchange of information. It also enables effective communication. Prepared or facilitated workshops could improve the communication among all project participants (Yu et al., 2007). Bogers et al. (2008) asserts that briefing documents cannot replace face-to-face communication with the project owner as written requirements do not always reflect the actual expectations of the owner and their representatives.

- Emphasizing the significance of face-to-face communication

Bogers et al. (2008) mentioned that a lot of architects have complained that they always try to establish a direct dialogue with users and clients, even though they are not supposed to do so in some projects. This was however disapproved by Juaim and Hassanain, (2011) who posit that direct contact with users is seen as necessary to get a 'feel' for the organisation and the ambitions and priorities of the clients.

- Frequent communication between the owner and the architect.

Frequent communication between the owner and their project representatives (end users and project manager) with the architect during and throughout the Client briefing process is essential for identifying, clarifying and representing the project requirements (Yu et al., 2007). Bowen et al. (1997) indicates that communication among the owner, the end users and the architect to identify their requirements significantly affects the level of satisfaction with the finished building project. Costa (2010) indicates that architects frequently need to interact with the project owner or their representatives to address their needs and requirements, especially when the owner lacks experience with the building process. Architects see face-to-face communication as a means to check their level of understanding and the correctness of their interpretation of the brief requirements (Bogers et al., 2008). Bowen et al. (1997) advocates that communication among members of the design team, during the design phase, could result in discovering the discrepancies made in the developed Client brief and developing means to resolve such inconsistencies. Lack of adequate communication may result in the development of unsatisfactory design solutions and owners sometime may not be aware of the significant role of the briefing phase, and as such, they may not be able to exactly define their organisational needs.

Therefore, face-to-face contact with owners is essential for identifying their needs and requirements.

- Utilization of different methods to document and effectively communicate the brief.

The adequacy of the documentation methods used to compile the Client brief is a significant factor toward the development of a satisfactorily design solution. Kumlin (1995) states that "most people are verbal thinkers, but architects, and engineers are visual thinkers. Briefing is the bridge between these thinking languages, and therefore the brief should incorporate as many graphics as the budget and time allows. The very best messages are those that contain both pictures and words." Shen and Chung (2006) indicate that the Client brief is typically expressed either in written format or verbal format, or through a combination of written and verbal formats. Zwemmer and Otter (2008) prefer that the Client brief, which states the Client values, is documented in business language as a common form of communication. Yu et al. (2007) explains that lack of common language usually provides for vague statements that could be misinterpreted as a result of the assumptions made.

Factors related to the allocated time and budget

- Allocating enough time for developing the brief.

An early start of the construction phase is a common objective for almost all project owners. Several owners allocate a short amount of time for the Client briefing process, which may result in poor definition of the owner's actual needs and requirements (Shen and Chung, 2006). The time allocated for developing the Client brief may also be affected by commercial pressures from owners. These commercial pressures in most cases require detailed design solutions to be prepared as soon as possible, as there is urgency to obtain an immediate and final design solution. These pressures reduce the time allocated to comprehend the actual needs and requirements of the owner and may affect the performance and the success of the project (Yu et al., 2005).

- Setting up measurable deadline for production and development of the brief.

The Client brief should be compiled, completed and agreed upon before commencing the design phase for the project. In essence, the Client brief should act as a reference document that is made available to all project parties (Yu et al., 2007). Othman et al. (2004) indicates that later changes to the Client brief constitute a major source for dispute and litigation throughout the construction industry. Once established, changes made to the Client brief at later stages could affect the cost, time and quality of the project.

- Allocation separate service budget for developing the brief.

Usually in small buildings projects, the Client brief is developed by the architect without an additional fee. On the other hand, in large buildings projects, the owner usually pays separately for commissioning, the architect to develop the Client brief (Cherry, 1999). Interviewed architects agreed that there is no fee allocated for preparing the Client brief separately in comparison to preparing the design documents for the project.

- Setting a clear budget for the whole project.

Information about the set budget for completing the project is an essential concern for the developer of the Client brief. The common absence of this type of information in many types of projects could result in the misinterpretation of some of the requirements. Lack of information on the set budget for the project makes it very challenging for architects to comprehend the contents of the Client brief. Expressions such as "high-quality" or "high-standards" may not in fact be understood when budget information is missing (Bogers et al., 2008).

Some other factors have been identified to relate with management and the control of the briefing process though commitment of all participants in the briefing process (Bogers et al., 2008), these include factors such as adequate planning and proper briefing, fluctuations in the cost of building materials, making sure specifications are not blown out of proportion, avoiding long waiting time for approval of drawings, preventing mistakes and discrepancies in requirement documents, economic factors, Project characteristics e.g. type, size, complexity, duration of the project all contribute to the successful delivery of the project (Zwemmer and Otter, 2008; Bogers et al., 2008). Timely and proper decision making at the various stages of the development and implementation of the brief are essential factors that affect the success of the overall project (Kumlin, 1995). The Client briefing process involves making decisions, on several brief requirements, during the development and implementation of the brief. Yu et al. (2005) indicates that decisions on changes, adjustments and corrections normally occur during the briefing phase. Blyth and Worthington (2001) advocate that it is crucial for the success of the project that right decisions are made at the right times by the right project participants. Decisions are guided throughout the project by the owner during the briefing phase; by the design team during the design phase; and by the contractor during the construction phase. Decisions are then exercised by the owner during the occupancy phase. Moreover, the owner usually assumes the dominant role throughout the project life cycle. During the design phase, architects develop a number of conceptual designs based on their interpretation of the compiled project brief (Shen and Chung, 2006). Since the Client briefing process is an iterative one, the developed brief will

take the form of a detailed document as it is subjected to multiple rounds of review and refinements during the design phase (Zwemmer and Otter, 2008). In practice, the brief continues to develop even further during the design phase as many questions and ideas arise (Van der Voordt and Van Wegen, 2005). The next section delves deeper into looking at specific barriers (which are also classed as factors) that affect the CB process

3.5.5 More Factors to the Client Briefing Process

One of the barriers that have been identified to affect the client briefing process is the lack of proper identification of the client's requirements (Barrett et al., 1999). One of the research problems identified in the course of this study is that the capturing and documentation of client requirements is not being done properly in the industry. This explains the reason why the private clients tend to overlook the identification of client requirements. Barrett et al. (1999) agreed that most clients do not set out a clear set of requirements for building. Contrary to what the client may believe this may create the potential for future disputes and result in the building of an unsatisfactory structure. Moreover, O'Reilly (1987) suggested that a written record of client requirements would be helpful in dealing with such matters as changes in personnel, ensuring the consistency of decisions throughout the project, and informing intended users of the building when the structure will be completed.

   ♦ Lack of contribution from clients.

A brief must be owned by the client at the highest level within the client organisations (Atkin et al., 1995). The study conducted also showed that most private clients do not appreciate the importance of briefing and usually rely heavily on professionals to interpret their needs in the process. In the UK however, it has been discovered that many large clients who embark on mega projects are most likely to have experiential knowledge of what they want thereby undertaking their own project requirement definition in-house. Conversely, smaller clients for example private clients wanting to build a house most times do not have a defined requirement and most times rely on the expertise of the professional to develop the client brief. In such cases, the responsibility that is shifted to professionals will eventually be transferred back to the clients. For example, the clients avoid providing any detailed information in the briefing. As a result, architects take extra time to anticipate what they really want. This will result in an increase in time and in consultancy fees. Moreover, the briefing process is a two-way one (Barrett and Stanley, 1999).

♦ Lack of involvement of stakeholders.

Some of the respondents agreed that the involvement of stakeholders who are able to identify the strengths and constraints of the projects from different viewpoints, is essential in drawing up the requirements of clients, and results in a more reliable project. It has been discovered that briefs are usually produced by a small group of people from the client organisation or by consultancies in the industry and that the briefs may not be comprehensive (Shen and Chung, 2006). It was suggested that the involvement of stakeholders, who can identify strengths and constraints of the projects is important in briefing, and their consensus could ensure the reliability of projects. Another view from a public clients reveals that stakeholders, in particular end-users, always have too many wants instead of needs, and finally their involvement will prolong the duration of briefing. This can lead to an ineffective brief because not all architects are good brief writers. Kamara et al., (2004) explained that an expert in one filed may miss out vital information that is related to other professionals. For example, architects may not be familiar with the construction process and may overlook some matter in the construction stage. There is a tendency for them to focus on client rather than on clearly establishing the requirements of clients in the briefing process. Thus, the briefing may suffer because of the bias of brief-takers.

♦ Conflicts between stakeholders and their requirements are common and almost inevitable.

Furthermore stakeholders may not want to compromise or prioritize their requirements when these conflicts occur. Sometimes stakeholders do not actually know what they want or what their real needs are, and are therefore limited in their ability to support the investigation of possible solutions. Likewise stakeholder can be adverse to the change a new system may introduce and therefore have varying levels of commitment and cooperation towards the project. Often stakeholders do not understand or appreciate the needs of the other stakeholders and might only be concerned with those factors that affect them directly. Like all humans, stakeholders can change their minds independently, or as a result of the elicitation process itself (Shen and Chung, 2006).

♦ Lack of time spending in briefing.

Investing time at the beginning of project to develop a complete definition taking into account all of the requirements will reduce the likelihood that changes will need to be made later (CIB, 1997). Some studies have revealed that the current practice of many clients is to shorten the time of the briefing to allow the work of construction to commence at an earlier time. An inadequate

amount of time is allocated for the definition of client requirements at an early stage of the briefing so that construction projects may end up suffering from poor definition (Shen and Chung, 2006).

- ♦ Communication and Understanding.

It is not uncommon that stakeholders may have difficulty articulating their requirements, however, in some cases this may be as a result of the analyst and stakeholders not sharing a common understanding of concepts and terms, or the analyst are unfamiliar with the problem (Zowghi and Coulin, 2005). Often stakeholders will have difficulty seeing new ways of doing things, or do not know the consequences of their requirements and as such may not know what is feasible or realistic. Stakeholders may understand the problem domain very well, but are unfamiliar with the available solutions and the way in which their needs could be met. Alternatively stakeholders sometimes suggest solutions rather than requirements. Things that are trivial or constantly repeated by stakeholders are often assumed and overlooked although they may not be apparent to the analyst and other stakeholders (Zowghi and Coulin, 2005).

- ♦ Quality of Requirements.

The requirements elicited may not be feasible, cost-effective, or easy to validate. In other cases they can be vague, lacking specifics, and not represented in such a way as can be measured or tested. Furthermore requirements may be defined at different and insufficient levels of detail. Because the process of elicitation is informal by nature, a set of requirements may be incorrect, incomplete, inconsistent, and not clear to all stakeholders. The context in which requirements are elicited and the process itself is inherently volatile. As the project develops and stakeholders become more familiar with the problem and solution domains, the goals of the system and the wants of the users are susceptible to change. In this way the process of elicitation can actually cause requirements volatility and therefore affect the quality of the requirements as a whole (Zowghi and Coulin, 2005).

In addition to the already identified barriers, Bowen et al., (1999) carried out a research to identify associated barriers that occur during the client briefing process; they were able to gather responses from different team members involved in the requirement elicitation process. They stated that often a lack of understanding on the part of clients about the client and construction processes could be a challenge. Clients are said to lack general experience; for example, being unfamiliar with local authority regulations and town planning issues. Clients frequently fail to provide a comprehensive listing of their project requirements (Bowen et al., 1999). Furthermore,

clients do not fully understand their own roles within the building process, as well as legal and financial considerations. Insufficient time is devoted to the briefing process and, in some cases, briefing is prematurely initiated before alternatives have been analysed by the client. Instances of personality clashes, the vagueness of the brief, and the inexperience of the client, were cited as exacerbating factors. Other barriers to effective briefing include vagueness on the part of the client in terms of requirements, insufficient time being devoted to the briefing process, briefing team members being under-qualified for their roles, and inadequate guidance being given by the principal agent. Some clients appear to be inflexible and reluctant to heed advice from their professional consultants. A lack of clarity with regard to communication networks between consultants is also perceived to be a barrier to effective briefing. A perceived lack of transparency in the briefing process was cited as a barrier to communication between professional and clients. Interesting further research might be indicated by this perception. Sometimes, clients do not participate in the briefing process due to their lack of knowledge regarding what they wanted, their lack of understanding of the briefing process itself and the roles and responsibilities of the professional team members. Barriers to effective communication between participants to the briefing process also appear to exist. The implication is that these barriers to effective briefing may impact negatively on levels of client satisfaction with their buildings (Bowen et al., 1999). All the above identified challenges that exist in the briefing process need to be addressed properly and if exploited rightly, will develop as a major strength and opportunity for the project.

Jenkins et al., (2012) explained that clients are often unclear as to their requirements and objectives in initiating the project, and that the project brief is most commonly communicated orally to the client briefing team. Furthermore, This question of whether or not the briefing team members hold similar views regarding the extent of the relationship between the quality of the briefing process and levels of client satisfaction with their resultant buildings. A good number of the respondents agreed that the quality of the brief has great impact on the resultant building which in turn informs the satisfaction of the client (Jenkins et al., 2012). However, literature may have been precipitate in placing such emphasis on a causal relationship between inadequate briefing and client dissatisfaction. Other factors may also be important. For example, little is known about the effect which lengthy time periods (e.g. from inception to completion) have upon client expectations, the effects of the transition from two-dimensional representation to three-dimensional reality or the potential for 'buyer's remorse' (the negative feeling experienced by many people after a major purchase) in construction projects. One major barrier identified in

this study was that clients often lack an understanding of the client and construction processes. Clients are said to lack general experience; for example, they are unfamiliar with local authority regulations and town planning issues. Clients frequently fail to provide a comprehensive listing of their project requirements. It was however agreed by the respondents that there needs to be a proper and better communication process between the client and briefing team which involves the team expending more time and effort in eliciting the client's requirements and objectives (Bowen et al., 1999).

This section has established the essence of the client briefing process which is majorly hinged on capturing or eliciting requirements from the client during the briefing process. The aim of the briefing process is to elicit tacit knowledge in the mind of the client which is documented in the form of requirements. A requirement is functionality that a system or process must perform before it is certified successful. In the context of the briefing process in construction, clients have certain requirements which are in form of tacit knowledge and it is the responsibility of the architect to use the right KC techniques in capturing and documenting these requirements during the briefing process accordingly. The next section, however discusses in-depth the concept of requirement engineering and requirement management and the various techniques available for requirement elicitation or capture.

3.6 Requirement Management

Fiksel and Dunkle (1992) define Requirements Management (RM) as the process of eliciting, documenting, organising, and tracking requirements and communicating this knowledge to the various groups of stakeholders in the project team. Furthermore, they defined requirements management as the process of creating, maintaining and testing requirements. Requirements are open to change and their documentation should enable such changes to be made. As such, a variable that discusses modification must be added. Nuseibeh and Eaterbrook (2000) recognise this, stating that "Requirements management is the process of identifying stakeholders and their needs, and documenting them in a form that is amendable to analysis, communication and subsequent implementation". One can observe that these definitions, despite coming from different industrial views have commonalities in them. It can be concluded that no matter what application industry, requirements management includes elicitation, documentation, communication, verification and managing change.

Requirements management is a broad activity which houses different sub-activities across a product or facility's life cycle of which communicating and maintaining changes to requirements are important (Yu and Chan, 2010). The mechanism of performing the management of requirements may be either manual, on an ad-hoc basis, or electronic. Traditionally this was done using manual forms but recent trends show increasing interest in electronic and automated tools and techniques to ease the difficulties associated with maintaining information across the project. Such tools help in understanding the relationship and traceability links between requirements and their associated processes and products. It is important to comprehend that requirements management is not an activity that needs to be performed only at the early stages of a project but should continue throughout a project (Jallow, 2008). Similar thoughts have been echoed by Ozkaya and Akin (2007) that "Requirements management is an inseparable part of client and has to be considered in correlation with form exploration, rather than as a front-end task. In any project, requirement elicitation and capture is among the front end activities between the client and architects. Once the requirements are captured, the brief document is used throughout the project. From a general construction point-of-view, Kamara and Anumba (2000) state that "Client requirements can be described in terms of the objectives, needs, wishes and expectations of the client (i.e., the person or firm responsible for commissioning the client and construction of a facility)". Kamara et al. (2002) further noted that "The 'voice of the client' (client requirements) includes the collective wishes, perspectives and expectations of the various components of the client body. These requirements describe the facility that will satisfy the client's objectives (or business needs)". The next section discusses the importance of RM.

3.6.1 The Need for Requirement Management (RM)

Yu and Shen (2013) carried out a study on four top construction companies in Hong Kong using a case study methodology alongside interviews; from the results of the study, misunderstanding and misinterpretation of client needs and requirements was the most significant problem of RM. Most of the respondents agreed that *misunderstandings could jeopardize the ultimate project success and client's satisfaction.* Understanding the client requirements is therefore the initial and essential step in the project development process. If this step is not carried out correctly, it is difficult for the following steps to be on the right track, not to say any success of the final outcome of the project. *Changing client needs and expectations produced incomplete and inconsistent requirements.* This was ranked second in significance of the associated problems of RM. While changes in every project are inevitable, owing to change of personnel, ideas, economic situation, market conditions, business growth and technology advancement; these are bound to induce changes in the

requirements of the development projects. If these changes of requirements are not dealt with properly, incomplete and inconsistent requirements would be produced. Late changes of the requirements during detail client and construction stages would create duplicated efforts in redesign and rework resulting in abortive works in the construction stage (Yu et al., 2005a). *Lack of well-documented updates of client requirements* was ranked as the third significant problem by respondents from the study. As mentioned earlier, since changes to requirements are inevitable during the development process, a robust system for updating the client requirements is necessary. *Ambiguity of client requirements* including needs and wants of the client coincide with findings of Arayici and Aouad (2005) which stated that one of the problems of RM is ambiguous and vague requirements.

The success of the project involves continuous communication between the clients, users and the client team, each of who have different expectations. Good client arises from well-informed clients who are able to communicate their needs to the client team. In turn, the client team should imaginatively communicate opportunities back to the client in a form that is understandable. The best requirements are succinct and can be tested against the original statement of need (Blyth and Worthington, 2001). *Lack of a thorough knowledge of RM.* One of the serious problems is the lack of a thorough knowledge of RM. Not only the architects and contractors but also the clients are lacking adequate knowledge and a systematic approach in managing client requirements for construction projects. Some attempts have been made to overcome the problem in the briefing process; however, the RM process is still inadequate. This may be attributed to the lack of knowledge in RM of the clients, architects and contractors.

No mechanism to record, manage and trace change in client requirements. Traceability is one of the main issues in requirement management. The original requirements are usually unrecorded and so they cannot be traced back afterwards, that is there is no notion of why a certain technical solution was originally chosen and which criteria were used as a basis for decisions (Huovila and Serene, 1998). Usually the only documentation left after the building completion is the drawings and specification documents. Normally, even the final built characteristics of the building are incomplete and even unrecorded. Another need for RM is the *Late involvement of end users in the project development process.* Arayici and Aouad (2005) identified that failure to manage end-user expectations is a major problems of RM. One of the reasons was attributed to the unavailability of the end users at the beginning of the project. In some cases, the end users are not known of identified while in other cases the end-users are identified but do not get involved in the

requirement capturing process at an early stage. According to Brauer (1992), users know the most about the four key aspects such as their people or personnel, equipment, activities and schedule. These four keys, called the PEAS (Brauer 1992) of user requirements method, form the basis of user requirements for a building or facility. By analysing the PEAS and deciding which will be part of a facility, users have a solid basis for defining the characteristic and features of a building that are needed to make the organisation successful. This user requirements method helps bridging the information gap between users and architects and ensures successful building solutions. There has arisen some form of confusion in the use of terminology regarding client requirements and client needs. The next section addresses these concerns.

3.6.2 Difference between Client Needs and Requirements

Very often the measurement of project success can be indicated by client's satisfaction. Clients are most likely to be satisfied when their perception of the services provided in a facility, which is may be different from that of construction professionals, matches or exceeds their expectations (Ahmed and Kangari, 1995). In order to satisfy the client, it is essential to fulfil the needs of the client. Very little literature has been written to differentiate requirements and needs of clients and often the words 'needs' and 'requirements' are used interchangeably. Kotler (1997) has indicated that a study of client satisfaction starts with the assessment of needs. Emery, (2004), has labelled requirements as wants and needs. Emery (2004) identifies the word 'want' as a condition that we desire and each "want" is a means to an end whilst 'needs' implies a necessity and it is a special 'want' that is necessary if we are to achieve the end. Based on this context, the authors will define 'wants' to mean 'requirements'. In the context of this research, client needs and requirements will be used interchangeably as requirements include functionality that a system or process must perform before it can be certified passed. During the client briefing process, certain requirements will be elicited or captured which means the project must perform those requirements before the project can be deemed successful.

Nkado and Mbachu (2001) have categorised client's needs into two ways: 'latent' needs which may not be directly observed by the use of the conventional briefing instruments and the 'stated' needs which are the client's perceived solution for realising the real latent needs. Such categorisation has been perceived by the authors that latent needs are 'needs' and stated needs are 'requirements'. Requirements as described by Kamara et al (2002) are described as the vivid description of the facility that satisfies the business need of the project initiator.

Kamara et al. (2002) further discusses clients' requirements within a project environment and discusses that these requirements can be classified as basic or expected needs, articulated or demanded needs, and exciting needs (Griffin and Houser, 1991; Mallon and Mulligan, 1993). Basic needs are those that are not voiced but are assumed to be present in a facility. The fulfilment of basic needs would not excite the client but their omission will reduce his or her satisfaction. Articulated needs are those that are voiced or demanded. Exciting needs are those which, although not voiced, will pleasantly surprise or delight the client if fulfilled. To fully satisfy the clients, all three categories of needs must be fulfilled (Lee and Egbu, 2005). In refurbishment projects, Nkado and Mbachu (2001), discuss that latent needs are the real needs in the mind of the client. These needs are usually consciously or unconsciously concealed by clients, and may not be easily observed by the use of the conventional needs assessment instruments.

Clients assess overall satisfaction with the procurement outcomes or the services provided, by the extent to which these needs are met (Salisbury, 1990; Turner, 1990; Green and Lenard, 1999). These needs and objectives may be concealed because they may have social, cultural, political or religious dimensions (Bennett, 1985). This point is supported by Runyon (1980) who sees that the existence of concealed needs and objectives is in the mind of the consumer and very often, a consumer's goals for making purchase decisions are complex, not easily inferred from direct observations primarily because the respondent may be unwillingly to release such information. Given the challenge to capture and maintain both expressed and unexpressed requirements, the elicitation of clients' needs should concentrate on what is expected from the building instead of describing the technical solution (Lee and Egbu, 2005). Table 3.1 describes the different aspects of requirements identified in the construction industry.

Table 3.1: Project requirements (Source: Kamara et al., 2002)

Client requirements	These are requirements for client, a transition of the client needs, site and environmental requirements. Describes the facility that satisfies his or her business need. Incorporates user requirements, those of other interest groups and the lifecycle requirements for operating, maintaining and disposing of the facility
Site requirements	Is the characteristics of the site on which the facility is to be built (e.g. ground conditions, existing services, history, etc)
Environmental requirements	Describe the immediate environment (climatic factors, neighbourhood, environmental conservation, etc.) surrounding the proposed site for the facility
Regulatory requirements	Describes building, planning, health and safety regulations and other legal requirements that influence the acquisition, existence, operation and demolition of the facility
Construction requirements	Are requirements for actual construction, which derive from client activity

Having discussed the meaning of requirements and the importance they attribute during the project client briefing process in the construction industry, it is essential that we discuss the need for capturing or eliciting such requirements and the benefit they give to the overall delivery of construction projects. The next section discusses the need to capture or elicit requirements.

3.6.3 Requirement Capture /Elicitation

Morledge & Smith (2013) posit that requirement elicitation (RE) is a process where professionals from the construction company meet with the clients in order to come up with the requirements. The professionals who may be involved in this process include; architects, development managers, engineers, project managers and quantity surveyors among other professionals. They used different methods of eliciting the requirements from the users such as interviews, workshops, evaluation of current facilities among others. The professionals will put together the requirements they have collected and come up with sketches and drawings. This drawings and clients are used to clarify the needs and requirements of the clients. If the clients are well experienced in the client process, they will come up with their clients and requirements for the project. This makes the process of collecting requirements easier to the construction company (Morledge & Smith, 2013). Requirements elicitation is all about learning and understanding the needs of users and client's with the ultimate aim of documenting the requirements and communicating these requirements to the client team. A substantial part of elicitation is dedicated to uncovering, extracting, and surfacing the wants of the potential client's. Effective elicitation/capture of requirements is arguably among the most important and highly recommended good client briefing practices (Morledge & Smith, 2013). Requirements elicitation itself is a very complex process involving many activities, with multiple techniques available to perform these activities. The multidisciplinary nature of requirements elicitation only adds to this complexity. Elicitation is subject to a large degree of error, influenced by key factors ingrained in communication problems. Despite the importance of requirements elicitation within the client briefing process, insufficient attention has been paid to this area in industry and software engineering research to date (Zowghi and Coulin, 2007).

Scope creep or requirement creep is a feature that occurs in the process of construction projects when proper attention is not given to the requirement capture process (Zowghi and Coulin, 2007). It is a progressive growth of project quantum and quality over that provided in the project cost budget and is a major cause of cost-overruns and client dissatisfaction with project

outcomes. Changes to the function, quantum or quality of the building have a direct impact on the project cost budget. To effectively control the project budget, requirements must be clearly defined at the outset and managed throughout the client and delivery stages. Cost risk is transferred from Client to Contractor at an earlier stage, when the definition of brief is open to a much wider interpretation by both parties. This has resulted in increased conflict of both cost and quality expectations as the project progresses. Effective management and interpretation of clients' requirements and scope definition are required to arrive at a good level of documentation.

Morledge & Smith, (2013) reported that there is widely reported evidence of substantial cost overruns in construction projects in both the public and private sectors. Ineffective client requirement capture which could lead to scope creep is a major contributing factor to cost overruns. There is also widespread concern and dissatisfaction among stakeholders with the ineffectiveness of current practices and failures in brief management practices. While the scale of the problem is difficult to accurately assess, as many are reluctant to admit to it and others can't keep track that there are abundant examples in parliamentary and media reports of projects sustaining cost overruns of from 20 to 50% and more. Ineffective client brief management is a major contributing factor to cost and time overruns. The problem is serious and one which the whole industry must confront and overcome. A recent construction industry forum on The Declining Standard of Documentation in the Construction Industry, hosted by Engineers Australia, was presented with evidence of 12% cost overruns across a series of public sector capital projects in Queensland. This 12% cost overrun figure related only to the impact of scope changes/variations from working drawings to completion. In the context of this study, knowledge capturing and requirement elicitation are used interchangeably.

A requirement is a function that a particular system must meet in order to be deemed effective. However, in the construction industry, clients have certain knowledge which is tacit in nature and resides in the mind of the client; this tacit knowledge is given expression in form of requirements when there is communication and conversation between the client and architect for delivery of a desired project. As a result, the architect engages the client with one goal in mind which is to capture or elicit the client's knowledge (requirements) which is then further developed into a client brief document. The next section discusses the important stakeholders under the traditional procurement route that are involved in the briefing process. Although many stakeholders are involved in the construction process such as project managers, quantity

surveyors, site engineers, structural engineers and so on. But this research focuses on the role of client and architects which is typical for the traditional procurement strategy.

3.6.5 Stakeholders Involvement in Requirement Elicitation

♦ **Clients**

The responsibilities of the client as reported by APUC (2009) are multifaceted and hence needs to be divided so that the appropriate management structure can be implemented and conflicts of interest avoided. Some of the responsibilities of the architect include making the decision to invest in the Project (Investment Decision Maker IDM), approval of the project and thereafter providing a sustained commitment to the project ownership of the project at High Level, providing the appropriate interface between the client team and the supply team. One major problem that arises as a result of lack of involvement of the client is scope creep which is preceded by poor project definition by the client and/or inadequate project budgeting processes (RIBA, 2013). Definition of project scope and cost is fundamental to project success and is the cornerstone of the business case for the project whether social or commercial. If the brief definition and the cost budget are inadequate, function is compromised. Issues such as ecological sustainability and energy rating become esoteric if the basic foundation of the project is unsound. Clients need a transparent process that locks in function, quality and cost, allowing them to see what they are getting for their money as the project proceeds. With this security of functional and cost outcome, decisions on ecological sustainability energy ratings and whole-of-life impacts can be made with greater confidence.

Figure 3.8: A typical Client-side structure

♦ **Architects**

The APUC (2009) describes the roles and responsibilities of the Architects as one who interpret and develop the Clients brief during the various stages of the project. The Architect will define the Client's requirements, identifying constraints, advise in terms of feasibility studies and option appraisals, arrange site investigations, establish the preferred solution, advise on sustainability, manage health and safety issues, develop the design, prepare room data sheets, obtain Client sign off of the design at appropriate stages, advise on materials selection, provide space planning services, advise on furniture/equipment selection, prepare construction drawings and specifications and so on and with due respect to the client's brief , prepare a design which meets all the clients requirements, including budget and timescale (RIBA, 2007). The Architect acts as the leader of the rest of the Design Team and co-ordinates their specialist input with their own. The Architect will prepare and lodge the Planning Application and Building Warrants in co-ordination with the rest of the Team. During the works on site, the Architect will assist the Clerk of Works in monitoring quality on site. At handover the Architect will assist in ensuring that the works are complete and that the client's needs have been met, and will continue their involvement through the Defects Liability period, and the final resolution of defects. The cost of re-design work necessitated by cost overruns resulting from scope creep has a major impact on client resources and prejudices good client outcomes (APUC, 2009). Client resources are being wasted re-designing buildings back to budget because 'scope creep' has not been adequately managed by the architects. The declining standard of documentation arises from the inappropriate documentation of the clients requirements during the briefing process. Certain barriers occur during requirement elicitation and these will be addressed in the next section.

3.6.6 Barriers to Requirement Elicitation

The problems and challenges in articulating and specifying requirements relies heavily on the ability to communicate clearly and effectively between groups of project stakeholders who may never meet, and who have quite different viewpoints (Alexander and Stevens, 2002).

♦ Inexperienced clients in RM – Kelly et al. (1992) pointed out that inexperienced clients often did not understand the structure of the building industry and the technicalities of buildings. This lack of understanding frequently led to the inappropriate selection of sites, unrealistic expectations of project costs, and a failure to appreciate the roles of various parties in the client and construction process.

- Inadequate identification and representation of needs and requirements during the development process – Inexperienced clients also did not identify and specify their requirements for the construction projects, thus relying on the architects to draw sketches to visualize what they expected. The "wish-list" syndrome aggravated the problem because they did not know their real needs (Kelly and Duerk, 2002).

- Unstructured approaches for RM – As identified by the authors in the previous research, there is a lack of a systematic approach for managing the requirements process in the construction industry. The application of value management methodologies may be one of the solutions to solve this problem (Yu, 2007).

- Misunderstanding and misinterpretation of client needs and requirements – Some clients could not even appreciate the 2-D drawings and misunderstood the intent of the architects. The emphasis of a solution-based system of the architects for communication may not create this problem. Therefore, using a common language for the client and architects to communicate the client problem may be a solution (Blyth and Worthington, 2001).

- Communication gaps between participants in RM – There are various groups of stakeholders who need to communicate well to make a new project a success. In the construction industry, there are bound to be gaps between developers and marketing managers, users and developers, project participants and clients, architects and contractors, contractors and sub-contractors. Not all relevant parties are involved to contribute at the right time of the projects (Kamara and Anumba, 2000; Yu, 2007; and Yu et al., 2010).

- Insufficient time to work out a good structure for RM – Getting the requirements structured correctly and precisely takes time because the structure depends on what kinds of users there are, on what each kind of user expects the project to fulfil, and on the nature of the constraints. Time must be allowed for gathering, organising and checking out the requirements both formally and informally (Kelly et al., 1992; Kamara and Anumba, 2000; Yu, 2007 and Yu et al., 2010). This is not something that can be rushed.

- Inadequate requirements effort throughout the life cycle – Some effort on requirements is needed throughout the project because compromise and change are inevitable. An essential element in any acceptable compromise knows how important each requirement

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is to its "owner". To put some numbers to all this, Alexander and Stevens (2002) suggested to spending about 5 percent of project effort on the requirements and also allow a generous chunk of schedule up to 25 percent of calendar time for requirements on shorter projects, but not more than three months on larger ones.

♦ Lack of documentation on changes, and feedback for RM – The lack of well-documented updates made it difficult to trace the changes in client requirements (Oberg et al., 2003). Changes from outside sources are also inevitable. Every project with a lifetime of more than a few months will experience pressures from competitors, market or operational changes, from new technologies, and from stakeholders to change the requirements and the client. The change of requirements should be able to be tracked back, updated and recorded properly for future use and feedback for subsequent projects.

♦ Lack of end users' participation and lack of a voice – The lack of adequate end-user's involvement caused failure to manage end-user's expectations (Kujala et al., 2005; Arayici et al., 2006). The users are the ultimate stakeholders that occupy and perform activities in the building. Their voice toward the requirements must be heard and should be paid attention to as early as possible during the project development process. Some users may be defensive about giving their opinions, especially if, for instance, they think their jobs may be affected by the project being developed. In that situation, it is essential to gain their trust before trying to start developing the project. It is necessary to consider who will really benefit from the use of the building and project managers should try to achieve a win-win situation between stakeholder groups if possible.

The next section will be focusing on the practice of documenting and communicating the client brief during construction projects.

3.6.7 Requirements Documentation and communication

Being the initiators and financiers of projects, clients are central to the construction process and the ultimate goal of all parties in a project is to satisfy fully the requirements of the client. Client requirements constitute the primary source of information for a construction project and therefore, are of vital importance to the successful planning and implementation of a project. Greater demands from clients for a better quality of building product delivered on time and

within budget are now part of the construction service ethos (Lee and Egbu, 2005). Client briefing is the process whereby the client's requirements are progressively captured throughout the construction project (Barrett and Stanley, 1999). It is the process of turning the client's desire for a built product into a clear brief (Winch, 2010). The briefing process has for some time been recognised as an important area in which the construction process can be improved. For a brief to be developed effectively, the construction professional will have to engage the client from an informed stand point for the sole purpose of capturing the client's requirements which is tacit knowledge in nature. Elicited and captured knowledge (requirements) need to be documented and stored for future use across all phases of a project and throughout the lifecycle of the construction project (Jallow et al., 2008). There is therefore a need to make sure that they are kept fully accessible. How requirements are to be communicated determines how they are represented and documented. Similarly, how they are captured depends on the technique adopted during the briefing.

Bouchlaghem et al. (2000) state that the type of technique used for capturing knowledge during the briefing process is largely dependent on the processes undertaken to communicate that knowledge. Traditionally within the construction industry, requirements are commonly documented in static form: sketches and hardcopy. As information technology has developed and its popularity emerged, electronic forms of documentation have taken centre stage and word processing, spreadsheet packages and databases may be used. With technological advancement, research shows that communicating requirements electronically has gained momentum with the common use of e-mail and project extranets. This follows the briefing process as discussed earlier and serves to inform those involved in both client and construction after translation by the Client architects into the specifications and drawings. It has been reported that requirements documents act as a carrier of information during client and production phases (Ryd, 2004). Different teams and stakeholders have an interest in specific requirements at different phases thus requiring information to be documented in a manner that is comprehensible to all concerned. Client requirements are detailed when the briefing process is completed (Jallow et al., 2008).

Client requirements are initially defined and elicited in the early stages of a project but clients constantly review and change their requirements of their facilities. The documented requirements therefore need to be modified and changed. It is generally accepted that lack of a capability to manage changing requirements is one of the major principal factors that contributes to delays

and budget overruns of construction projects which as a result causes client dissatisfaction. Such changes result in impacts to both the cost and duration of a project and inevitably, demand consideration of who is accountable for the changes. This causes the need to develop a strategy used in tracing and monitoring knowledge (requirements) when they are documented. Dick (2005) describes traceability from a software point of view as "documenting the relationships between systems requirements and software client. According to the IEEE (1984) "A software requirements specification is traceable if the origin of each of its requirements is clear and if it facilitates the referencing of each requirement in future development or enhancement". Requirements traceability is a process where the life cycle of the requirement is followed from the point of capture all though to delivery in both a forwards and backwards direction (Jallow et al., 2008). A change in client requirements should be traceable to the objectives of a project and be related to the lifecycle components of the building (Jallow et al., 2008). Chinyio et al. (1998) identified clients project needs in order of importance as shown in figure 3.9

QUALITY

SAFETY

FUNCTIONALITY

AESTHETICS

ECONOMY

LACK OF SURPRISES

GOOD RELATIONSHIP

TIMELY COMPLETION

Increasing order of importance

Figure 3.9: Client's project needs (Source: Chinyio, 1998)

In Chinyio et al., (1998) order of clients importance, quality has been seen as the most important need of a client, this could however be debatable on the grounds that some clients are not particularly after quality, as long as the project can be delivered according to cost and within time. This is not to say that quality is less important as oppose to other client needs but to stress

that client needs vary depending on the project to be embarked on in which case Chinyio et al (1998) looks at refurbished projects. The next section discusses the capturing or elicitation of knowledge in form of requirements during the client briefing process.

3.7 Knowledge (Requirement) Capturing/ Elicitation in Client Briefing

KM during the briefing process follows the established generic system (Ibrahim et al., 2006), summarised in six processes (Turban et al., 2011) i.e. capture knowledge, refine knowledge, store knowledge, manage knowledge, disseminate knowledge and create knowledge as depicted in the figure 3.10.
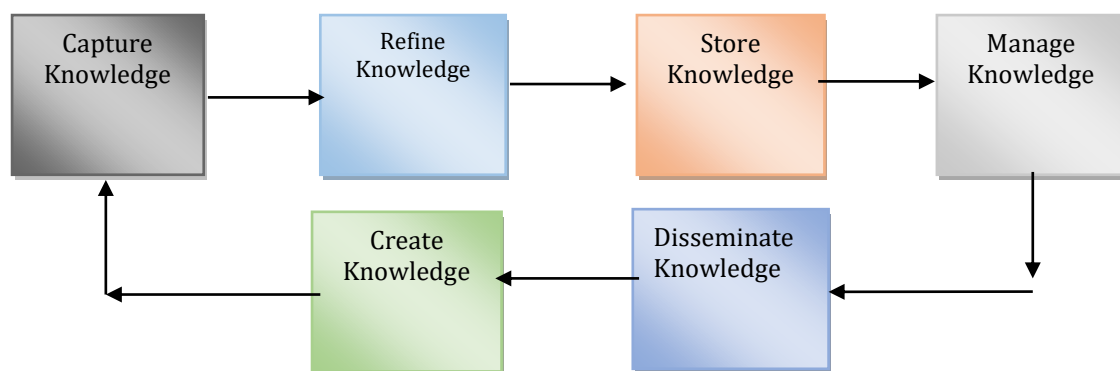
Figure 3.10: Cyclic Model of Knowledge Management System (adapted from Turban, 2011)

For the purpose of this paper, emphasis is placed on knowledge capturing during the client briefing process. This first stage of the briefing process is essential to the success of any project and figure 3.10 shows knowledge capturing as the first process in the KM system (Turban et al., 2011). Hari et al (2005) defined knowledge capture as a process through which knowledge is recognised from its source, examined and in accordance with the organisation's strategy. Appropriate techniques and technologies are implemented to retain the knowledge, which is filtered, banked, disseminated and updated. Powers (2005) suggests that one of the first steps in capturing knowledge is to identify the critical knowledge that might be at risk in the organisation as a result of downsizing or retirements. Collison and Parcell (2001) put forth their views that knowledge capture means capturing know-how in such a way that it can be reused. There needs to be a link between capturing knowledge before, during and after an event, project or task has

been executed; and in terms of accessing what has already been captured. Train et al., (2006) study focus on efficiency and effectiveness to drag the construction industry out of its perceived low productivity growth.

Clients are becoming more sophisticated, insisting on better value for money, and demanding more units of construction for fewer units of expenditure (Egan, 1998). The demanded products are also becoming more complex, with increasing emphasis on environmentally friendly facilities. The fragmented nature in which the industry is organized means that efficiency in project delivery is less than expected, resulting in dissatisfied clients, and low profitability for construction firms (Hari et al., 2005; Carrillo et al., 2004). In addition to the many initiatives that are being introduced to address these issues, the effective management of project knowledge is now seen as vital in enhancing project performance in construction projects. Becerra-Fernandez et al., (2004) defined knowledge capturing as the combination of knowledge elicitation and knowledge representation. During the client briefing process, knowledge (requirement) elicitation is carried out by capturing client's requirements which is useful and important information from the users and this process represents the starting base of a good client brief. Certain knowledge do exists during the client briefing process and these knowledge must be adequately captured, elicited and properly documented in order to allow the project to meet its desired objectives thereby leading to satisfied clients in the end. The next section addresses the benefits of KC as an important tool in the project client briefing process in the UK construction industry.

3.7.1 Importance of Knowledge (Requirement) capturing or Elicitation in Client Briefing

Olatokun and Pathirage (2015) reported that KC initiatives provide opportunities for organisations to innovate, improve project methodologies, cut costs, save client time and reduce time to market. Knowledge is a complex concept which consists of information and skills acquired through experience. Knowledge represents itself in truth and belief, perspective and judgments, expectations and methodologies and exists in individuals, groups and in organisations, in various forms. Capturing client's requirements using KC techniques during client briefing is vital for the competitiveness of an organisation as well as performance. The type of decisions made is based on the quality of information elicited from clients during the client briefing process (Hari et al., 2005). KC initiatives provide opportunities for organisations to innovate, improve project methodologies, cut costs, save client time and reduce time to market. Knowledge is a complex concept which consists of information and skills acquired through

experience. Knowledge represents itself in truth and belief, perspective and judgments, expectations and methodologies and exists in individuals, groups and in organisations, in various forms. Capturing client's requirements using KC techniques during client briefing is vital for the competitiveness of an organisation as well as performance. The type of decisions made is based on the quality of information elicited from clients during the client briefing process (Hari et al., 2005). The Information Technology Construction Best Practice (ITCBP, 2004) suggests that discussions about knowledge management usually refer to the need to capture one or both of the different types of knowledge which are the explicit and tacit knowledge. Explicit knowledge is the very factual information that is relatively easily to document, i.e. a list of experts; telephone numbers, and details of previous contracts for a particular client; methods of repairing a common fault, and so on. Tacit knowledge is much harder to address. It refers to the more subjective approaches people take in situations where there may be no single right or wrong answer. Tacit knowledge is seen as one of the keys to why a particular organisation is successful.

Knowledge capturing in the client briefing process involves use of both tacit and explicit knowledge. One of the key benefits of knowledge capturing in the client briefing process is the ability to elicit requirements from clients which is knowledge embedded in the mind of the clients in relation to the anticipated building they have in mind and these requirements needs to be properly documented (explicit) in such a manner that the client team can produce quality clients. It has been identified that one of the major reason behind defective clients can be traced to inadequate time given to the briefing process and this can account for the high level of increased cost and delay in project delivery. Quintas (2004) suggests that knowledge capture could lead to better problem solving and higher client satisfaction and improvement in the client briefing process in the pre-client stage of construction projects. As a result, giving adequate time to the client briefing process can reduce the level of client mistake that occur in the construction process and also improve the quality of output produced at the end of the project. However, no matter the amount of time given to the client briefing process without the right knowledge capturing tools and techniques, it could most likely lead to a frustrating activity which could impact on the overall objective of the briefing process. This goes to highlight the importance of knowledge capturing in the client briefing process and shows that no matter the quality of knowledgeable professionals and client present at a briefing meeting, the knowledge management strategy used to address the process has a major significance on the productivity of the process.

According to Achammer (2009), the costs of briefing cost about 1.5% of the total life cycle costs of the project. However, this relatively small amount immensely influences the performance of the overall costs, which can rise up to more than 80% of the total life cycle cost. When a project commences, the costs for changes are still minimal, but as the project progresses, there is an increase with the cost of changes that occur to the project. This is why it is very essential to capture the necessary knowledge available at the early phase of the project by properly eliciting requirements and documenting them properly. One of the underlying challenges discovered is the lacking willingness of today's clients and professionals to invest into the pre-design phase and this can be addressed by proper and adequate insistent communication between clients and professionals. The intention of every client is to build an excellent and unique building. However, the definition of excellence is subjective and varies within the different decision makers and the planners transforming the wishes into the build reality. "There can´t be an excellent building without knowing what´s excellent". The client briefing process uses several knowledge capturing methods to make these different pictures transparent and decreases the variety of diverse imaginations. The client briefing process provides the basic discussion and supports the development of clearly defined goals. Gould & Joyce, (2009) stressed the importance of involving the user (client) in the writing of the brief because they have unique and specific requirements for that particular project. Client's understanding may vary when it comes to building processes, as a result, those owners who seldom occupy themselves with building projects often need guidance and assistance from the professionals hired to produce the client brief (brief) and the client. In such cases, the professional may need to take more initiative in involving the owner in the client briefing process.

Conversely, owners that are more familiar with the building process do not need as much assistance since they are already familiar with other building projects. This does not, however, rule out the importance of client brief and effective requirement elicitation process. Once the decisions have been made in the pre-design stage, they cannot be easily changed in other stages. This means that early stages are very critical to the success of the project and it is vital that decisions are made cautiously. This is a stage that requires all the stakeholders' involvement, clients and expertise of the client team (Wapukha, 2013). The pre-client stage is the most critical phase in the construction decision making process, however, if the knowledge that exists between the professionals and the clients is not properly elicited and documented accurately, it may lead to deficiency in performance output and this can also lead to dissatisfied clients and a bad reputation for the organisation. Having discussed the importance of KC in the construction

project especially during the client briefing process, capturing client knowledge adequately during the briefing process can be one of the major differences between satisfied and unsatisfied clients. The next section discusses the importance of client satisfaction, the factors that affect client satisfaction and the need to invest time and energy to the satisfaction of clients in construction projects.

3.8 Client Satisfaction in the Construction Industry

Rahman and Alzubi (2015) stated that the subject on client satisfaction in the construction sector could be traced back to the 1980s. An investigation carried out by Ashley et al, (1987) on the determinants of the success of construction projects highlighted six criteria for measuring success which are budget, schedule, client satisfaction, functionality, contractor satisfaction, and project-manager/ team satisfaction. Ashley et al., (1987) added that the creation of a common client satisfaction measurement or approach is essential in to the success of projects in the construction industry and this will be carefully explored through this study. Client satisfaction has gained very much attention in the last few decades in all areas of production. In an increasingly competitive and dynamic environment, greater attention is continuously paid to client relationships and satisfied clients (Eriksson and Vaghukt, 2000). For many organisations, client satisfaction is an effective way to differentiate themselves from competitors and gain competitive advantage (Woodruff, 1997) but it is also one of the key issues in their efforts towards improving quality (Fornell et al., 1996). The importance of client/customer satisfaction has been investigated by many researchers in construction industry (Maloney 2002; Torbica and Stroh 2001). Therefore client satisfaction is a fundamental issue for construction participant who must constantly seek to improve their performance if they are to survive in the presence of the concept of globalization of construction services (Cheng et al., 2005).

Clients' satisfaction is regarded as a function of comparison between an individual's perception of an outcome and its expectation for that outcome. In the construction industry, client's satisfaction has remained an elusive and challenging issue for some considerable time. Dissatisfaction is widely experienced by clients of the construction sector and may be caused by many aspects but is largely attributable to overrunning project costs, delayed completion, inferior quality and incompetent service providers including contractors and consultants (Chan and Tam 2001). Ahmed and Kangari (1995) argued that knowing well the values and the requirements of the client will enable the service provider (contractor), through his managers and other staff, to

devise systems and approaches that uncover the root causes of their quality and service problems, and implement permanent changes to eliminate these problems.

Bowen et al. (1997) posit that, 'the construction industry potentially has a higher proportion of dissatisfied and critical clients than any other industry Mbachu and Nkado (2006). This agrees with an earlier observation by Kometa et al. (1994), that 'evidence abounds to suggest that clients are largely misunderstood and dissatisfied with the performance of their consultants and contractors' (p. 433). Previous studies have identified several factors responsible for client dissatisfaction in the construction industry. Another factor responsible for client dissatisfaction in the construction industry is the possibility of clients' stated requirements not sufficiently addressing their real (latent) needs. Owing to insufficient time for in-depth viability appraisal, clients usually adopt irrational approaches in making decisions concerning optimal solutions to their real needs. This results in divergence between clients' stated and real needs in the procurement process. On the basis of this, Goodacre et al. (1982) argue that listening to, and acting only upon, client's stated needs may not yield the desired benefits. That this has been the case in the construction industry could be responsible for the reported cases of client dissatisfaction.

Furthermore, the prevalence of client dissatisfaction in the global construction industry has been attributed to inadequate research into client needs and satisfaction. For instance, Liu and Walker (1998) submit that not much effort has been made to identify the needs of clients, which is crucial to ensuring client satisfaction. Green and Lenard (1999) corroborate this by noting that, as a recurring problem throughout the global construction industry, the industry has invested little time and attention in investigating the needs of its clients compared to other economic sectors. Perhaps the construction industry's service providers have been unable to fully grasp the issue of client satisfaction largely because of the absence or unawareness of a mechanism for measuring satisfaction in the procurement process.

Omonori and Lawal (2014) stated that in an increasingly competitive environment, companies must be customer oriented. Customer satisfaction represents a modern approach for quality in business life and serves the development of a truly customer oriented culture and management. Modern management science's philosophy considers customer satisfaction as a baseline standard of performance and a possible standard of excellence for any business organisation. To reinforce customer orientation on a day to day basis, a growing number of companies choose customer satisfaction as their main performance indicator (Nigel et.al, 2003). Construction can be

characterized as a specific type of project industry, with specific features concerning production, such as temporality, restricted location, and one-off products. Therefore, Construction can be defined to be a complete system industry, through which by-projects, temporary coalitions of firms and heavy customer involvement in the product life cycle are the norm (Bowen et. al, 1997). Due to the complex nature of construction and the special characteristics of project production, construction has had several problems in producing quality in a customer oriented manner (Sami, 2009). In construction, customer satisfaction has been considered as a dimension of quality. Therefore, in other to measure customer satisfaction in construction, the main subjects must be identified. A customer may be defined as the owner of the project and the one that needs the constructed facility. In simple terms, customers are those that buy the product or service. Satisfaction is defined as a customer's satisfaction with the end state resulting from having consuming a product or service. In other words, satisfaction can also be defined as a customer's process of perceiving and evaluating a consumption experience.

Client satisfaction plays an important role in the development of the construction process and client relationship. Due to competition in the construction world, a great share of attention has been shifted on Customer relationships and customer satisfaction (Sami, 2009). Clients are the reason that the construction industry exists; therefore, customers are always in the industry's thoughts. However, the relationship between customers and construction industry is not one of mutual enjoyment (Boyd & Chinyio, 2006). Many authors propose the importance of customer satisfaction and its use for evaluating quality from the customer's perspective (Sami et. al, 2008). In general, customer satisfaction is seen as an indicator of the future financial success of the company (Kotler 2000; Rust et al. 1994). Companies use customer satisfaction more and more as a criterion when assessing the quality of products and services. The benefits of customer satisfaction are often associated with high customer loyalty, future purchases, and positive verbal communication (Jones and Sasser 1995; Molinari et al. 2008). The more loyal the customers are, the more often they use the company's services or make purchases from the same supplier. High quality and high level of customer satisfaction can be observed to increase the profitability of the company due to increasing profit (Anderson et al. 1994).

The most commonly used model of customer satisfaction is the SERVQUAL model in which the service quality and thereby customer satisfaction is defined as differences between the customer's expectations and experiences (Parasuraman et al. 1985). In the model, the customer's expectations form a certain standard according to which the customer evaluates the experience

on the services received. The customer is satisfied when the experience exceeds the standard (positively disconfirmed) and dissatisfied when his or her experiences of the service quality are below standard (negatively disconfirmation). Client satisfaction is essential to business continuity, reputation and organisation sustainability. Without project to carry out on behalf of the client, a company can seize to exist. This shows that is project continually deliver increased variation leading to cost overruns, delay in completion of project, poor quality, increased design changes and so on, then client will have no choice but to consider better organisations that can deliver value. This places importance and value on client satisfaction and strengthens understanding on the correlation between increased competitive advantage, profit margin and client satisfaction. The next section discusses some of the factors that affect client satisfaction.

3.8.1 Factors Affecting Client Satisfaction

Subramani et al., (2014) assert that adequate importance should be given to projects meeting that focus on client satisfaction in the construction project. Client satisfaction is achieved when attention is given to managing variations in construction projects such as time delays, cost overruns, design changes and so on. Subramani et al., (2014) also added that for construction clients to attain some levels of satisfaction, cost, quality and time are three important factors that cannot be over looked. Maintaining a proper balance between the three elements is essential to the successful delivery of construction projects which invariably leads to client satisfaction. One major reason why this elements need to be properly managed is because overruns that's could arise in the course of project execution can be avoided and prevented if focus is given to the client needs early enough, however, there are some unavoidable costs such as those due to unanticipated events which cannot reasonably be prevented. Cost overrun of a project refers to increase that occur in cost or budget of a project which is accrued to the client in the course of the project (Kaming, *et al.*, 1997). This occurrence is due to overspending or over stretching the budget allowances as a result of making changes or encountering unforeseen problems. One major approach that can reduce cost overrun in projects is proper capturing of clients requirements in the client briefing stage (Subramani et al., 2014). Some factors have been identified to be responsible for cost and time variations in construction projects, factors such as (Kaming, *et al.*, 1997, Cox, *et al.*, 1999, and Radujkovic, 1999).

♦ Changes in client requirements

♦ Inadequate planning and proper briefing

♦ Unpredictable weather conditions; and

♦ Fluctuations in the cost of building materials.

Chimwaso (2008) in his study identified more critical factors that affect the successful delivery of project objectives which invariably leads to client dissatisfaction, some of these include; incomplete client documentation at the time of tender, additional work requested by client, changes in client's brief due to improper capturing of requirements or due to unforeseen changes, lack of cost planning/monitoring during pre-and- post contract stages, site/poor soil conditions, adjustment of prime cost and provisional sums, re-measurement of provisional works, logistics due to site location and lack of cost reports during construction stage. Chimwaso, (2008), further identifies three important factors that contribute to construction project variations, these include incomplete client briefs during knowledge (requirement) capturing phase (78%), clients request for additional work which might sometimes but not always arise from improper capturing of requirements at the briefing stage (57%) and changes in client's requirements during the briefing process (52%). Baloyi and Bekker (2011) agreed with the work of Chimwaso by highlighting factors affecting cost and time overrun in construction projects. These factors include additional work or changes to client's requirements, not giving adequate time to the requirement elicitation process in the client briefing stage. All this factors have been identified to affect project outcomes which eventually lead to client dissatisfaction if such factors are not triggered by the client.

Proverbs et al., (2000) posits that over-specification which means capturing requirements that are not necessary, has been one of the major problems in the UK construction industry. Reducing specification levels is not about cutting corners, but about cutting out waste and unnecessary cost. It has been suggested, that over-specification adds approximately fifteen per cent to the cost of construction work. They reported that many offices are designed to cope with sixty per cent more staff than actually occupy the building. In addition, buildings have been found to have an unnecessary number of lifts, toilets and escape routes for the number of people in occupation; as well as the over-specification of lighting, small power and heating and ventilating systems. A comparative study between UK and US building found that clearer requirements, lower specification, more prefabrication, and on standard components could lead to spectacular savings in the cost of construction (Proverbs et al., 2000). Kaming et al (1997) conducted a survey and identified factors influencing construction time and cost overruns on high-rise building projects in Indonesia through a questionnaire survey administered on 31 project

managers. A number of variables were identified first of which was client changes, inadequate briefing, inadequate planning, material shortages, inaccuracy of material estimate, skilled labour shortage, inadequate requirement capturing from clients, long waiting time for approval of drawings, poor site management and supervision, mistakes and discrepancies in client documents and so on. Al-Momani (2000) examined 130 public projects in Jordan and concluded that the main causes of delays include changes initiated by architects, client requirement, weather, site conditions, late deliveries, economic conditions, and so on. Hsieh et al (2004) conducted a statistical analysis in 90 metropolitan public work projects in Taiwan and identified problems in client brief and planning as main causes of change orders. Furthermore, based on analysis of 46 completed building projects in the UK, Akinsola et al (1997) identified and quantitatively examined factors influencing the magnitude and frequency of variations in building projects. These factors include: client characteristics, especially lack of prior experience and knowledge of construction project organisation and the production processes; project characteristics, such as type, size, complexity and duration of the project; and project organisation factors, such as; client duration, percentage of client completed before tender, procurement and contract type, adequacy of information provided, and number of sub-contractors. Some major limitations of this studies carried out reflect that some of these studies are over 10 years old. Also, most of the studies were carried out outside the UK. Although construction projects worldwide share some common characteristics, there are also some country specific conditions. For example, it is highly unlikely that "shortage of materials" and "import of materials" are major factors in the UK.

Olawale and Sun (2010) conducted a survey on cost and time variations in the UK construction industry, taking into considerations the aforementioned limitations, the administered 250 questionnaires to top construction companies and construction consultancies. The ranking of the factors affecting cost and time variation in the construction project industry shows client changes as the key factor responsible for time and cost overruns. This was overwhelmingly the top project cost and time control inhibiting factor from the questionnaire survey results analysis. This was also the case during the interviews as it was acknowledged by practitioners during the interviews as being a major obstacle to effective project cost and time control. The main issues revealed during the interviews include:

♦ The impact of a client change on project cost and brief is often underestimated.

♦ The client group is often not able to provide the information in time, which results in difficulty of client management.

♦ There is a general decline in the production of detailed client which is perceived as one of the greatest causes of client changes especially with the increased usage of the client and build procurement route.

♦ Lack of detailed client specification leads to contractor pricing the risk but also looks for every loop hole in the specification document to increase cost, reduce specification etc.

♦ There is a lack of clear distinction between client change and client development. As a result, project partners often argue whether a client change is actually a change or a development where there would not be the need for additional cost and time compensation.

Majority of the studies mentioned in this research identify changes to client requirements as a major factor to cost and time variation in the construction industry. Most of the factors discussed show correlation with factors affecting the client briefing process; this goes to show that if the factors affecting the CB process can be address, chances that it will lead to increased client satisfaction are higher. All the factors identified and discuss in this section can affect client satisfaction if adequate attention is not given to the knowledge (requirement) capturing or elicitation process during client briefing. One important point to note however, is that, the more the client is dissatisfied due to project not successfully meeting the client needs, the less chance there are for the business providing the construction services to have a productive profit margin, as this will affect business referrals and potential opportunities to carry out further business. The next section develops a conceptual framework that supports the use of KC techniques in effectively capturing client's requirement during the client briefing process for improved client satisfaction.

3.9 Conceptual Framework

Jabareen (2009) mentioned that the conceptual framework highlights the main issues to be studied in a research. He further defined conceptual framework as "a network, or set of interrelated concepts which when put together generates a comprehensive understanding of a concept or idea. Sokhanva et al., (2014) framework on KM processes as shown in figure 3.11 assumes that there are four processes to knowledge management which include knowledge creation; knowledge capturing; knowledge transfer and knowledge reuse. In addition, it is assumed that knowledge is generally created in PBOs but the first challenge is to capture current knowledge. He further discussed that knowledge capturing is one of the essential processes in

the KM framework which means without proper knowledge capturing, the re-use or transfer or sharing of such knowledge will be challenging. In other words, capturing knowledge should be given utmost priority in any KM process framework or implementation.
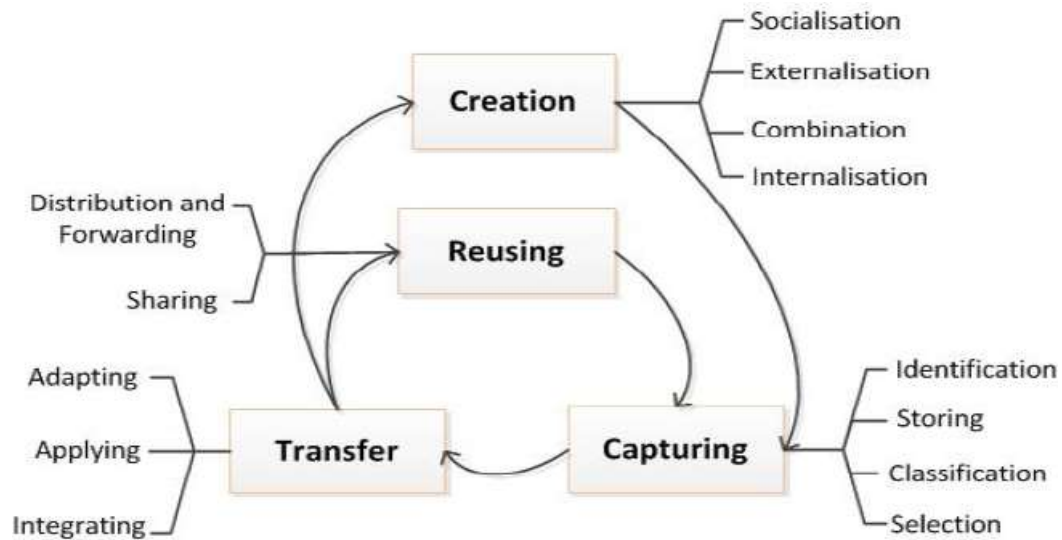
Figure 3.11: Framework for knowledge management processes and sub-processes (Sokhanva et al., 2014)

Kamara *et al*. (2003) developed a conceptual framework for knowledge capture as seen in figure 3.12. In he's approach, he explained that during the course of a construction project, certain learning occurs, some of which could be obvious while others may not be. This act of learning triggers and causes a flow of actions to capture by learning, the different knowledge that is generated at a particular point in time.
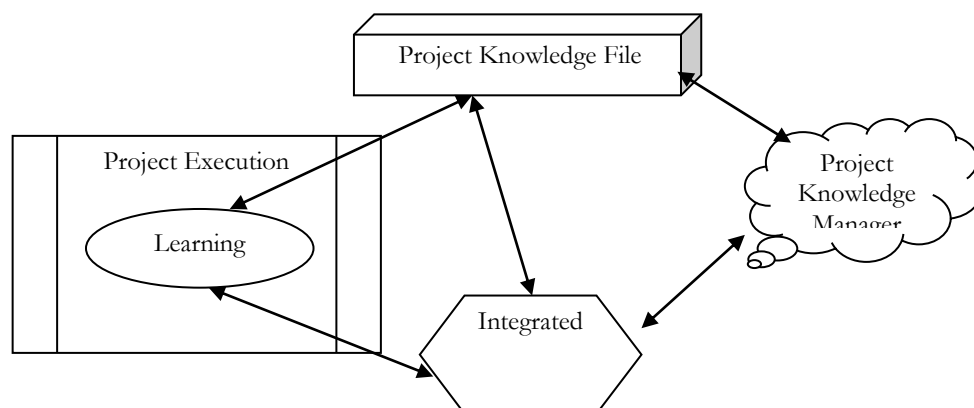
Figure 3.12: learning event-based knowledge capture system (Kamara et al. 2003)

The different frameworks discussed in this chapter see KC an important process in construction projects. However, knowledge capturing does not only occur between employees and their organisation, KC also occurs in the stages and processes on construction projects, one of which is the client briefing phase. However effective or important of KC might be, if the techniques available in the capturing of knowledge is not properly used or adopted, then the process of knowledge capture can end in total waste of time and effort. The conceptual framework developed for this research is presented in Figure 3.12 highlighting the use of KC techniques in capturing client's requirements for improved client satisfaction in UK construction projects. This conceptual framework has been developed based on literature review and the different KC frameworks analysed in the course of this research.

3.9.1 The Conceptual Framework Explained

The aim of this research is to reduce the amount of variations that occur in construction projects in relation to cost, time, design changes and re-work with the aim of improving client satisfaction. Section 1.2 highlights and identifies several problems and challenges in construction projects that invariably lead to client dissatisfaction as a result of variations, improper capturing of clients requirements and not paying attention to the wealth of KC techniques available in capturing client's knowledge (requirements) during the briefing process. As a result, this research aims to identify certain barriers and factors that affect the knowledge capturing and the client briefing process confronting the successful delivery of project objectives in the UK construction industry in relation to client satisfaction. The conceptual frame work Figure 3.13 has been developed to highlight the importance of knowledge capturing and the various techniques used in capturing knowledge (2.9.2, 2.9.3 and 2.9.4) in the client briefing process. Some of these techniques identified have great potential in helping to reduce variations in construction projects and improve client satisfaction but this will be further analysed in the course of this study. The conceptual framework is developed in 3 stages, the input stage, the process stage and the output or outcome stage. The first which is the input phase into the conceptual framework highlights the use of KC techniques during the client briefing process (section 2.9.2 and 2.9.3). The second which is the process phase which highlights the various barriers that affect KC process during the client briefing and the factors that influence the CB process (section 2.9.5, 2.9.6 and section 3.5.4, 3.5.5 respectively) and the final stage which is the output and outcome phase shows improved client satisfaction after the barriers and factors must have been managed and controlled using effective KC techniques. The conceptual framework is developed to use effective KC techniques in capturing or eliciting client's knowledge (requirements) effectively

during the client briefing process. It is assumed that if client's knowledge (requirements) is properly captured or elicited, using effective KC techniques, chances are that the factors responsible for variations and client dissatisfaction would reduce which means more business and increased profit margins for the organisation.

BARRIERS TO KC IN THE CLIENT BRIEFING
Inadequate identification and representation of needs and requirements during the briefing process
Unstructured approaches for knowledge capturing
Misunderstanding and misinterpretation of client needs and requirements
Communication gaps between client and architect
Insufficient time given to the briefing process
Lack of proper documentation and or changes
Lack of proper participation of client in the briefing process
Type of organisational culture
Inadequate attention given to the wealth of techniques available
Lack of process knowledge for capturing knowledge
Trust
Trying to capture too much
Capturing knowledge that is not used
Assuming one size fits all
Knowledge of the architect etc

CLIENT BRIEFING PROCESS

KC TECHNIQUES
e.g. Interview, Questionnaires, Scenario analysis, RFP's, Observation, Collaboration Brainstorming Storytelling Workshops Sketches and Diagrams

FACTORS AFFECTING THE CLIENT BRIEFING PROCESS
Involvement of the owner in the client briefing process
The architects level of experience with client briefing
The owner's level of experience with construction processes
How familiar the architect is with the design project
How familiar the architect is with other construction projects
Ability of the architect to comprehend the client requirements during briefing phase
Ability of the architect to conceptualize client's requirement
Clarity of client requirements
Establishing priority levels for various client requirements
Future changes anticipated in the design process
Signing off of the requirement document
Use of face to face communication method
Frequent communication between client and architect
Use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc.
Allocating enough time to the client briefing process etc

Improved Client Satisfaction

Figure 3.13: Conceptual frameworks for KC in client briefing

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3.10 Chapter summary

This section investigates literature on the UK construction industry and client briefing. The UK industry is described as one of the major sectors in the UK industries due to its contribution to the UK's gross domestic product. The industry has also been identified as a knowledge intensive environment due to its project related activities. One of the fundamental operations of this industry is the implementation of projects which is the core unit of operation of the UK construction industry. For projects to deliver within time, budget and quality, there need attention needs to be given to the many factors that affect the construction project processes one of which is the client briefing process. The client briefing process is the first stage of the construction project stages which is characterised by the capturing or elicitation of the client's knowledge which is in form of requirements. For this to happen, certain KC techniques have been identified in the previous chapter which are used to capture or elicit client's knowledge (requirements) during the briefing process. The chapter is concluded with a section on client satisfaction, which is the overall aim of this research. It is assumed that if effective KC techniques are adopted during the client briefing process, they might be able to help reduce variation that occur during construction projects and mitigate against the barriers mentioned in section 3.5.5, which in turn will lead to successful project delivery hence client satisfaction. A conceptual framework has been developed to show how the use of KC techniques during the client briefing process can be used to overcome barriers to the KC process and factors affecting the CB process thereby improving client satisfaction. The next chapter of this research discusses the research methodology and strategies for collecting and analysing data.

Chapter 4 – Research Methodology

4.1 Introduction to Research Methodology

The phrase "research" is coined from two word "re" and "search". "Re" is a Latin prefix which means again, once more, in return and with frequentative or intensive force. "Search" on the other hand is a verb meaning to try to find something by looking or otherwise seeking carefully and thoroughly. Research however, is the systematic investigation into and study of materials, sources, in order to establish facts and reach new conclusions. Also, it is an endeavour to discover new or collate old facts by the scientific study of a subject or by a course of critical investigation (Oxford Concise Dictionary). Methodology on the other hand is an integral part of any research, simply because it is the foundation upon which every researcher builds their research work. In determining the methodology for a research, layers of knowledge pertaining to that research must be explored via a philosophical stand point. The exploration of philosophical assumptions through the lenses of known paradigms will aid the researcher in deciding which approach is most applicable to the research topic and assist the researcher in choosing the research strategies to implement the research. Holden and Lynch (2004) implies that a philosophical review can have a dual effect on the researcher; (1) it may open their mind to other possibilities, therefore enriching their own research abilities, and (2) it can enhance their confidence in the appropriateness of their methodology to the research problem, which will in turn enhance their confidence in their research results. Table 4.1 gives more definition to what research is.

Table 4.1: Definition of research

Definition	Author
Research is a systematic process of collecting, gathering, analysing and interpreting information to answer specific questions but in order for such process to qualify as research, they must meet certain characteristic as far as possible, and these are controlled, rigorous, systematic, valid and verifiable, empirical and critical	Kumar (2005)
Research as a process followed by a researcher to systematically achieve the aims and objectives of a particular research. It is a process consisting of methods that are used in gathering data, making sense of such data to generate results and meaningful explanation of limitations that are related to them. Furthermore, achieving the aims and objectives is like having set of 'things' to find out which means set of activities that has to be finished in specific time in order to be	Becker (1998)

useful	
Research is a process of careful inquiry or examination to uncover new information or relationships and to expand, verify and test the existing knowledge with a specific intention in mind.	Smith and Dainty (1991)
Research is an organised, systematic, data-based and scientific investigation into particular problems, undertaken with aim of providing a solution to the underlined problem. Also, research methodology helps to provides set of required information and guidelines that equips the researcher into making the right decisions in order to successfully bridge the gap created by the research problem.	Smith and Dainty (1991)
Research can be classified as either basic or applied. It is better to say that research is a continuum between these two categories. The basic research is more about contribution to knowledge, but the applied research is more about practical.	Sekaran (2003)
Research methodology refers to the overall approach to the client process from the theoretical underpinnings to the collection and analysis of the data	Collis & Hussey (2003)
Methodology is the "overall approach to a problem which could be put into practice in a research process, from the theoretical underpinning to the collection and analysis of data".	Remenyi et al (2003)
Methodology is the "overall approach to the entire process of the research study".	Collis & Hussey (2009)

Saunders et al (2012) presented the overall research methodology in the form of an "onion" (Figure 4.1), in which the thoughts with regard to the research problem lie in the centre and thus several layers have to be "peeled away" before coming to this central position. These layers are the important aspects to be considered in determining the research methodology for a particular research study. Saunders et al (2009) defined research strategy as "the general plan of how the researcher will go about answering the research questions". On a similar note, Bryman (2008) identified research strategy as "a general orientation to the conduct of research". Identifying the research client is a critical and complicated task because it determines the process of collecting and analysing of research data (Churchill, 1979). It also requires consideration and analysis of different resources for providing a reasonable link between theory and argument (Bryman, 2008).
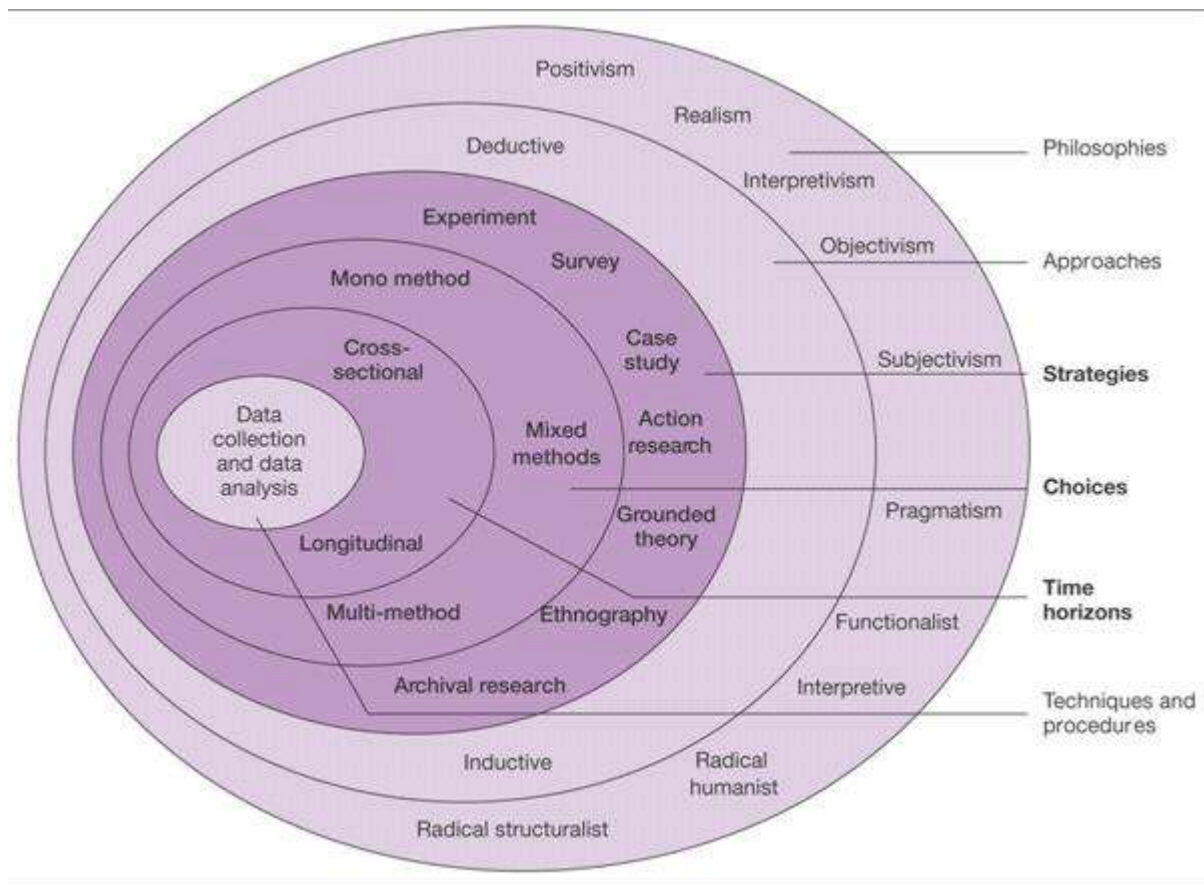
Figure 4.1: The Research Onion (Saunders et al., 2012)

According to research onion model, the research process should start from outer layer and peels away different layers of onion till it reaches to the centre of onion that identifies the techniques that should be used to collect data in order to answer research questions. The first layer identifies the research philosophy that should be adopted for the research. The second layer considers the research approach that flows from research philosophy. The next three layers: Methodological choice, research strategy or strategies and choosing time horizon for the research, are concentrating on the process of research client. The third layer considers different methodological choices that could be used for the research which is influenced by research philosophy and research approach. The fourth layer considers the most applicable research strategy. The fifth layer concentrates on the time horizon of the research which is dependent on the research questions. The last layer is about different data collection methods that could be used for the research. Choosing the best data collection methods is dependent on previous layers and research questions. In order to carry out this research, the proposed research process adopted will be the 'Research Onion' model which was developed by Saunders et al. (2012). The main feature of this model is its clear framework that enables researcher to select proper

strategies and approaches through its different layers. The next section will be discussing the different types of research.

4.1.1 Types of Research

According to Saunders *et al.* (2012), there are three main types of research which are; exploratory, descriptive and explanatory. Identifying the type of research, based on the aim and objectives of the research will enable the researcher to have a better understanding on structuring the research methodology.

Exploratory Research is defined as a valuable way to discover and gain in depth knowledge about a topic of interest by asking open ended questions (Saunders *et al*, 2012). This type of research could be conducted through interviewing 'experts' in their area of expertise, reviewing of literature critically and conducting focus group interviews. Furthermore, this type of research could help to clarify as well as give in depth understanding to an existing situation to ascertain the problems and create avenues for more accurate investigations in future. According to Collis and Hussey (2003), the exploratory research is likely adopted for qualitative measures. This type of research is also used to generate theories from a study or find and investigate hypotheses, ideas and patterns. The basic advantage of exploratory research is its flexibility and ability to adapt to change. Conversely, Descriptive Research seeks to answer questions on what, who and how many, and goes on to describe in full detail a situation or set of circumstances. This type of research provides an accurate profile of people, events or situations. It encompasses the study which informs about the status of a wide range of social indicators and initiates questions that may further necessitate the need to explore and explain why such phenomenon exists (Saunders et al., 2012). Statistical or quantitative techniques are frequently used in descriptive research to collect and summarise data with the aim to give an overview of the various characteristics that exists in a phenomenon and not necessarily the reasons why the phenomenon exists (De Vaus, 2001, Saunders et al., 2012).

Collis and Hussey (2003) state that the Explanatory Research may adopt qualitative and quantitative methods in order to investigate and explain why and how a phenomenon is happening or has happened. Saunders *et al.,* (2012) mention that the purpose of explanatory research is to explain the situation based on establishing "causal relationship between variables" by investigating into a phenomenon. However, it might be difficult to differentiate explanatory research with descriptive research as it seeks to answer the 'why' questions and any explanation

involves description. In order to clarify the difference DeVaus (2001) state that the explanation is used to find why phenomenon exists in order to suggest solutions, whilst the description only gives an overview of a phenomenon. In fact, the explanatory research is used to explain the relationships between variables in a situation or a problem. The purpose of this research is to investigate or explore the use of certain KC techniques or tools in adequately eliciting client's requirement during the client briefing process. As a result, this research will take an explorative dimension in analysing the various objectives and aim of this research. A framework is developed to aid construction professionals; architects in particular, capture client's requirements during the client briefing process with the aim of improving overall performance particularly client satisfaction. It is expected that this framework is able to give construction professional a better perspective on the advantages of effectively capturing client's requirement during client briefing. The next section of this study will be discussing the research philosophy which is the first layer in the research onion model as described by Saunders et al., (2012). The next section discusses the philosophies under which this research is underpinned.

4.2 Research Philosophy

According to Saunders *et al.,* (2012), the term 'Research Philosophy' is about the nature of knowledge and the development of that knowledge. They also stated that the research philosophy that the researchers adopt is related to their assumptions about how they view the world and the reality. Furthermore, these assumptions highlight the differences that affect the way in which the researcher thinks about the process of research and will support and justify the research strategy and the methods that were chosen by the researcher as part of that study. Esterby-Smith *et al.,* (2008) implicate that there are three main reasons that pinpoint the importance of understanding the research philosophy in research methodology which are: Research philosophy helps to clarify research client, which helps to simplify the research by which data is collected and analysed. Research philosophy enables the researcher to find out which research clients will work and which will not. Research philosophy enables the researcher to identify and create research clients even if he doesn't have any past experience. There are three underlying assumptions relevant to research philosophies which are; *Ontological, Epistemological* and *Axiological* assumptions. This philosophy concerns the nature and development of knowledge (Saunders et al., 2012). According to Easterby-Smith et al. (2002), an understanding of philosophical issues is essential to help researchers identify, clarify, and create appropriate research clients. Creswell (2009) said that examining different philosophical perspectives and assumptions is vital and must be carried out in the initial stage of the study and

the most known philosophical perspectives are ontology (what knowledge is), epistemology (how we know it) and axiology (what values go into it). The research approach and research technique should not operate in a philosophical vacuum, as this would render the methodology and the technique devoid of any philosophical context; indeed, "…..a methodology is more than merely a collection of these things, it is usually based on some philosophical view; otherwise it is merely a method, like a recipe" (Creswell (2009).

Research philosophy is principally concerned with the assumptions that a researcher brings to an investigation. Although there is considerable blurring, the two main traditions of philosophies can be labelled as positivism and social constructivism (Collis & Hussey, 2003; Easterby-Smith et al, 2003). While positivist argue that the world exists externally and its properties should be measured through objective methods, social constructionist hold the view that the reality is not objective and exterior but is socially constructed and given meaning by people (Easterby-Smith et al, 2003). Creswell (2009) posits that philosophical thinking majors around five assumptions which are ontological, epistemological, axiological, rhetorical and methodological assumptions. While ontological, epistemological and axiological assumptions positions the philosophical stance of a research, rhetorical and methodological assumptions are concerned with language and process of the research respectively.
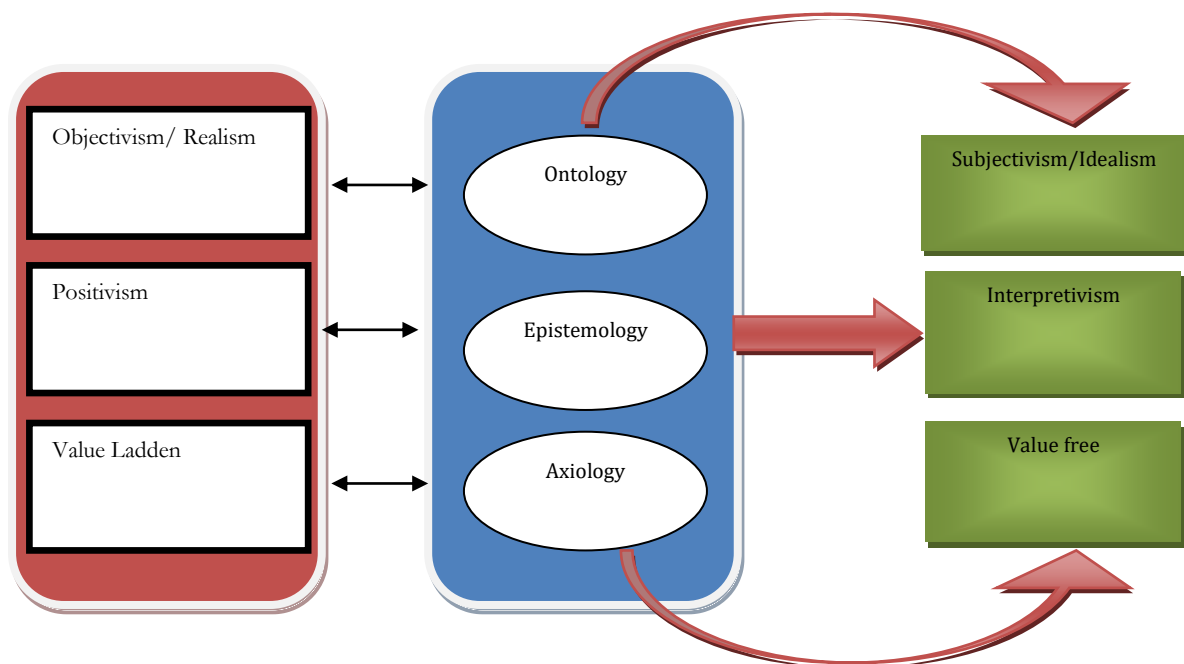
Figure 4.2: Philosophical stance of this research

4.2.1 Ontology

Blaikie (1993) describes the root definition of ontology as 'the science or study of being and develops this description for the social sciences to encompass 'claims about what exists, what it looks like, what units make it up and how these units interact with each other'. In short, ontology describes our view (whether claims or assumptions) on the nature of reality, and specifically, is this an objective reality that really exists, or only a subjective reality, created in our minds. Ontology concerns the nature of a phenomenon or reality that a researcher wishes to study (Mason, 2002). There are two divergent perspectives with regard to this ontological issue which are objectivism and subjectivism. Objectivism, on one hand, views social phenomena as external entities and therefore beyond our reach and influence (Bryman, 2008). Subjectivism on the other hand, views social phenomena as being continually influenced and socially constructed by social actors (Saunders et al., 2012). Hatch and Cunliffe (2006) use both an everyday example, and a social science example to illustrate the point. For the everyday example, they use the example of a workplace report asking one to question whether it describes what is really going on, or only what the author thinks is going on. They go on to highlight the complexity that is introduced when considering phenomena such as culture, power or control, and whether they really exist or are simply an illusion, further extending the discussion as to how individuals (and groups) determine these realities does the reality exist only through experience of it (subjectivism), or does it exist independently of those who live it (objectivism).

In ontological positioning the researcher is to decide whether the reality is objective and external to the researcher, or socially constructed and only understood by examining the perceptions of the human actors (Collis & Hussey, 2003). These two ontological assumptions are known as realist (Johnson and Duberly, 2000) and idealist/relativism (Gummesson, 1991). As a result, we all have a number of deeply embedded ontological assumptions which will affect our view on what is real and whether we attribute existence to one set of things over another. If these underlying assumptions are not identified and considered, the researcher may be blinded to certain aspects of the inquiry or certain phenomena, since they are implicitly assumed, taken for granted and therefore not opened to question, consideration or discussion.
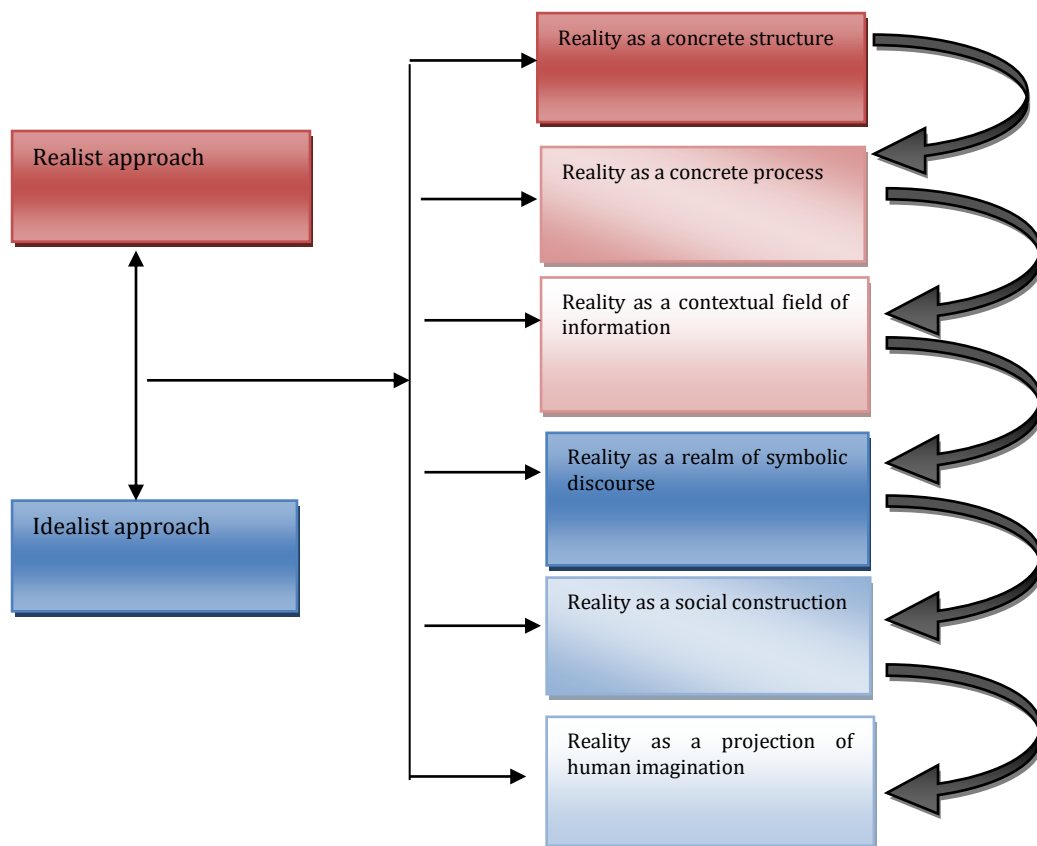
Figure 4.3: Continuum of core Ontological assumptions Source: Morgan and Smircich (Collis & Hussey, 2003)

4.2.2 Epistemology

Closely coupled with ontology and its consideration of what constitutes reality, epistemology considers views about the most appropriate ways of enquiring into the nature of the world (Easterby-Smith, et al., 2008) and 'what is knowledge and what are the sources and limits of knowledge' (Eriksson and Kovalainen, 2008). Eriksson and Kovalainen (2008) go on to discuss how epistemology defines how knowledge can be produced and argued for. Epistemology is a branch of philosophy concerning what constitutes acceptable knowledge in a field of study (Saunders et al, 2007). It is also described as a way of understanding and explaining how we know and what we know (Crotty, 1998). In simple words, epistemology is about the origin and the sources of knowledge, and more importantly from the researcher's point of view. Blaikie (1993) describes epistemology as 'the theory or science of the method or grounds of knowledge' expanding this into a set of claims or assumptions about the ways in which it is possible to gain knowledge of reality, how what exists may be known, what can be known, and what criteria must

be satisfied in order to be described as knowledge. Chia (2002) describes epistemology as 'how and what it is possible to know' and the need to reflect on methods and standards through which reliable and verifiable knowledge is produced and Hatch and Cunliffe (2006) summarise epistemology as 'knowing how you can know' and expand this by asking how is knowledge generated, what criteria discriminate good knowledge from bad knowledge, and how should reality be represented or described. They go on to highlight the inter-dependent relationship between epistemology and ontology, and how one both informs, and depends upon, the other.

Different epistemologies have different things to say about these issues and about what the status of knowledge can be (Mason, 2002). The idea that affirms these positions are frequently referred as positivism and interpretivism (Bryman and Bell, 2011; Saunders et al., 2007). The positivist perspective, on one hand, views acceptable knowledge as constituting only phenomena that has a direct observable variable, and can be quantifiable. In this view, the positivist perspective argues that the natural sciences approach needs to be adopted to gain knowledge of the social world. Thus, positivist studies are often designed as quantitative research that uses existing theory to develop hypotheses that are then tested with a large number of sample populations to confirm the statistical generalisation of the theory (Saunders et al., 2012; Bryman, 2008; Easterby-Smith et al., 2002). On the other hand, the interpretive perspective argues that the subject matters of the social sciences (i.e. People and organisations) are complex, unique and fundamentally differ from that of natural science. Interpretivism raises doubt about the usefulness of adopting a natural sciences approach to gain insight into the complex social world. It is argued that the study of the social world requires a different logic of research procedure (than the natural scientists) in an attempt to grasp the subjective meanings of social action (Bryman, 2008).

Generally, interpretive studies are often designed as qualitative research with the researcher being close to the studied phenomena to increase the general understanding of a complex situation. Saunders et al., (2007) discuss this further, highlighting that certain researchers therefore argue that data collected from objects that exist separate to the researcher (an external reality) is less open to bias and therefore more objective, and that if social phenomena are studied, these must be presented in a statistical, rather than narrative, form in order to hold any authority, a position of course that many researchers would challenge and Blaikie (1993) contends that since social research involves so many choices, the opportunity for researchers values and preferences to influence the process makes it difficult to ultimately achieve true objectivity.

4.2.3 Axiology

Axiology concerns the impact of the values of a researcher in the whole research process (Saunders, et al., 2012). Positivists believe that science and process of research is value free. At the other extreme social constructionist consider that researchers have values, and these values help to determine what are recognised as facts and the interpretations which are drawn from them (Collis & Hussey, 2003). This research however, moves in favour of a bias-laden or value laden approach because researcher cannot place himself free and outside any value that might be developed in the cause of this research, however, the researcher understands and honour the fact that input to this research is part and partial of understanding the deep research issues appropriately which makes my involvement in the research reflect the fact that the reality related to the subject matter is subjective. There is recognition that it is not feasible to expect that researchers investigating social phenomena can act in a value-free manner. According to Bryman (2008), "values can materialise at any point during the course of research. The researcher may develop an affection or sympathy, which was not necessarily present at the outset of an investigation". The next section discusses the philosophical stance of the researcher in relation to the aim and objectives of this research.

4.2.4 Philosophical stance of this study

In the context of this research, the research philosophy is the foundation to helping construction professional capture adequately clients requirements during the briefing process in order to improve performance through client satisfaction in the UK construction industry. The focus on this research anchors on the use of knowledge capturing techniques in eliciting requirements from clients in construction projects. This research involves a high level of interaction and communication between the researcher and actors involved in this research, therefore, the researchers reality can best be understood by examining the perceptions of the human actors involved in this research. The views of the researcher are being continually influenced and socially constructed by social actors and for this reason, the ontological assumption of this research leans toward subjectivism or idealism. Furthermore, participants (professionals) that would be involved in this survey will likely vary in demographic characteristics such as career level, gender, years of experience, qualification, age and so on.

These demographic differences will however, contribute to the many perspectives that each respondents will bring to the table in relation to the research topic and questions been asked.

The different perspectives of the many respondents are shaped by their demographics and experiences which might influence their responses to the questions asked. However, the focus of this research is on the perception of the respondents, what they think, feel, knows and their awareness regarding the use of KC techniques in capturing clients requirements for better client satisfaction and improved performance, the researcher is highly involved in engaging the professionals who are responsible for capturing client requirements in the briefing process therefore there is a possibility that the experiences and background of the researcher might influence his/her interpretations and analysis of the responses gathered from the survey process hence, the epistemological stance of this research leans more towards interpretivism. The axiological stance leans towards a value-laden approach as researcher cannot fully separate his/herself from bias and human interest/ belief. As a result of this, this research aims to develop a framework that would help construction professionals capture client's requirements properly during the client briefing process for better client satisfaction and improved performance. The next ring on the research onion identifies the approach to the research, this is discussed in the next section.
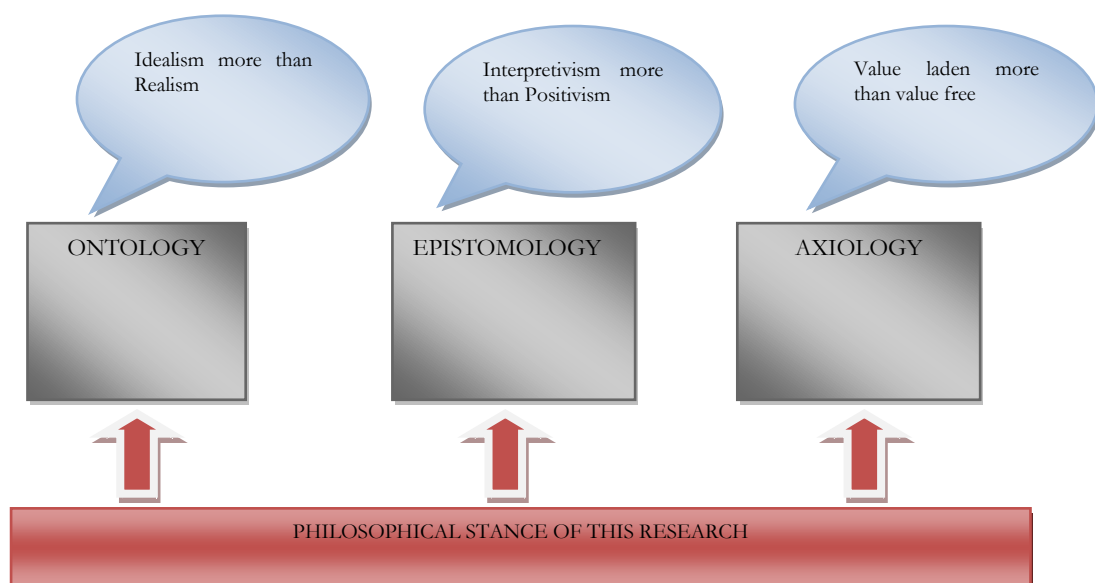
Figure 4.4: Philosophical stance of this research

4.3 Research Approach

Creswell (2003) assert that research approach plays a significant role in enabling the researcher to meet the stated objectives. According to Saunders *et al.* (2012), there are three main methodological approaches; deductive (theory testing), inductive (theory building) and abductive.

4.3.1 The Deductive Approach

The logic of *Deductive* approach is "when the premises are true, the conclusion must also be true" (Saunders *et al.,* 2012). The origins of this approach is exemplified in the natural sciences, where laws present the basis of explanation, allow the anticipation of phenomena, predict their occurrence and therefore permit them to be controlled (Saunders *et al.,* 2012). This approach allows the researcher to develop a hypothesis or set of hypotheses or theory, followed by a guided client strategy for testing the hypothesis. In other words, the collected data is used to evaluate the hypothesis (es) related to an existing theory (Saunders *et al.,* 2012). The profound difference between the deductive and inductive approach is that the deductive approach is from general to specific, whilst the inductive approach is vice versa.

4.3.2 The Inductive Approach

On the contrary, the Inductive approach guides the researcher to first and foremost collect data then from the data, explore phenomenon, identify patterns and themes and create a conceptual framework. Better put, inductive approach develops theories based on the analysis of data collected (Saunders *et al.,* 2012). The advantage of this approach is that it is particularly concerned with the nature and context in which such events took place in order to provide better understanding of that context. This is in contrast with the deductive approach which does not give attention to the way in which individuals interpret their social world and only considers the cause-effect link to be made between particular variables (Saunders *et al.,* 2012).

4.3.3 The Abduction Approach

The *Abduction* approach is the combination of the deductive and inductive approach and it is used to explore, examine and explain relationships between variables in a particular situation (Saunders *et al.,* 2012). In other words, this approach is about moving back and forth between deductive (theory to data) and inductive (data to theory).

4.3.4 Rationale for Choice of Research Approach

This research seeks to develop a framework that would help architects capture or elicit client's knowledge in form of requirements during client briefing process. For this to be achieved, existing literature was investigated in order to enable the researcher to develop and establish a conceptual framework which will then be used to further investigate and gather relevant information for improved client satisfaction in construction projects. For this reason, the abduction approach is adopted for this research which is a combination of both deductive and inductive approaches. In the abductive approach, the research process starts with certain facts that are not yet tested which then leads to the need of trying to explain these facts. Sometimes some facts or concepts might emerge which may be challenging for the researchers to explain by the existing range of theories. In adopting the abductive approach, the researcher seeks to choose the most relevant explanation among many alternative in order to explain the concept of knowledge capturing in the client briefing process in the UK construction industry, which was identified at the initial stage of the research process. In the course of addressing these emerging concepts, the researcher has combined both, numerical and cognitive reasoning in which case is adopting the mixed method choice of both qualitative and quantitative data collection techniques. This is used to test and review the conceptual framework where appropriate in order to answer the stated aim and objectives. The next ring in the research onion is the research strategy which is discussed in the next section.

4.4 Research Strategy

Once the philosophies and approach has been decided for a particular research, the next stage is to explore the various strategies available in order to proceed with the research. To ensure congruence within the foundation of research, the selection of research strategy should be inspired by the researcher's philosophical stance and approach. Essentially, research strategy (Yin, 2009; Saunders et al, 2009) or research client (Bryman and Bell, 2007; Sexton and Senaratne, 2003) provides the researcher a 'roadmap' or a 'plan of action' in order to translate the aims of the research into achievable results. Saunders et al (2009) indicated that research strategy is critical in enabling the researcher to answer research questions and achieve the research objectives. According to Remenyi *et al.* (1998) research strategy provides the overall direction of the research including the process by which the research is conducted. However, no research strategy is inherently superior of inferior to any other (Saunders *et al.*, 2009). Saunders *et al.* (2009) argues that choice of research strategy should be guided by research objectives and questions, the extent

of existing knowledge, the amount of time and other resources available, as well as the researcher's philosophical underpinnings.

Yin (2003) added that research strategy has distinctive characteristic; however, there are large overlaps among them. Yin (2003), point out that three conditions exist which determines when to use each of these strategies. These conditions consist of; the type of research question posed, the extent of control an investigator has over actual behavioural events and the degree of focus on contemporary as opposed to historical events. The justifications for the 8 research strategies introduced by Saunders et al., (2012) are discussed. The first which is the Experiment *research strategy* is not suggested for this study, as it requires the full control of the researcher over the phenomenon being researched. It is primarily suitable for quantitative research client and undertaken in a highly controlled context. Since the researcher does not have full control over the phenomenon being studied, the experimental research strategy is not appropriate for this research. The *Archival research* makes use of administrative record and documents as the principal source of data (Saunders *et al.,* 2012).

Bryman (1989) discusses that the term 'Archival' has historical connotations and may be misleading which may refer to recent as well as historical documents. Since this research seeks to understand a real-life context phenomenon within the UK construction industry, the archival strategy might be suggested partially but will not deliver the level of outcome needed for proper analysis unlike the case study strategy which makes use of document analysis as one of its data collection techniques. The *Ethnography strategy* usually used for group study is basically grounded in the inductive research approach (Saunders *et al.,* 2012). In this strategy, the researcher is required to be part of the group which is under his study to observe, talk and understand them in order to be familiar with their behaviours, shared believes, interactions and the events that shape the lives of the participants in order to enable the researcher to produce a detailed cultural accounts of the group (Saunders *et al.,* 2012). As a result of this, more time is needed on the part of the researcher to engage the use of this strategy. It is often times more appropriate for part-time researchers, which makes it not suitable for this research.

The *Action Research*, usually used in promoting organisational learning to produce practical outcomes through identifying issues, planning action, taking action and evaluating action (Saunders *et al.,* 2012). This research strategy is about 'research in action rather than research about action'. This type of strategy is best suited for part-time students who have more time and

can undertake the research in the organisation that they are working for. In addition, as the nature of action research strategy is longitudinal, it is more appropriate for medium or long-term research projects rather than short-term research projects. This makes it unsuitable for this research (Saunders *et al.,* 2012, Coghlan and Brannic, 2010). The *Grounded Theory* research methodology can be used to refer to a methodological approach, which is a method of inquiry resulting from a research process. Grounded theory strategy uses data collection techniques for collecting data and analytic procedures which will lead to develop a theory that explains social interactions and processes in a wide range of contexts (Bryant and Charmaz, 2007; Saunders *et al.,* 2012). The time frame within which this research is operating does not allow the luxury of time to carry out massive data collection with the aim to develop theories from them; hence the grounded theory strategy is not suitable for this particular research.

The *Narrative Inquiry* as described by Saunders *et al.,* (2012) and Musson (2004), state that the narrative inquiry will allow the researcher to analyse the linkages, relationships and socially constructed explanations that occur naturally within narrative accounts in order 'to understand the complex processes which people use in making sense of their organisational realities'. This research strategy is more suitable for interpretive and qualitative research; however the nature of this strategy is intensive and time-consuming. Since this research attempts to investigate in-depth the phenomenon in real-life context within the UK construction industry, the narrative inquiry strategy will not be used in collecting data for this research. According to the mentioned factors, research aim and objectives, the 'Survey' and 'Case study' research strategies are more appropriate and suggested for conducting this research. The following sections provide further discussion on case study client and case studies client protocol.

Table 4.2: A selection of Research Strategies that may be used for this research (Saunders et al., 2012)

RESEARCH STRATEGIES	CHARACTERISTICS	GENERAL PHILOSOPHICAL POSITIONS	APPROPRIATENESS FOR THE STUDY
Experiment	Suitable for laboratory research rather than the field Unlikely to be related to the real world of organisation	positivism/realism/ value-free	Experiments will have to be carried out in a controlled environment with a controlled group. This study will not make use of experiments because the researches objectives involve are a form of social science research.

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			Experiments are usually used for pure sciences.
Survey	Most frequently used to answer 'what', 'who', 'where', 'how much' and 'how many' questions Used for exploratory and descriptive research An easy to explain and to understand research strategy	Interpritivism, Positivism/Idealism/ Realism/ value-free/ value-laden	Surveys are used to collect data from a large population. Survey is not only a data collection technique but involves questionnaires and in-depth interviews, content analysis, observation and so on (Vaus, 2002). This is suitable for this study because of some objectives which will require gathering large amount of data which cut across various professions. The surveys will be quantitative and qualitative.
Archival research	This strategy makes use of administrative records and documents as the principal source of data Allows research questions which focus upon past and changes over time to be answered		
Case Study	It is suitable for research which wishes to gain rich understanding of the research context and processes Has considerable ability to generate answers to the question 'why', 'what', and 'how' Not suitable for collection data for generalisation	Intrepretivism/ Realism or idealism/value-laden	Case study research may be quantitative or qualitative in nature. This form of research seeks to generate answers to questions such as 'what', 'why' and 'how' (Yin, 2009). This research strategy will suitable for some of the research questions and objectives, however, this part is conducted using survey interviews for simplicity. Case study research may be longitudinal or cross sectional making using of interviews as research instruments.
Ethnography	It is used to study groups It requires a longer term of field work study		
Action Research	Provides in depth understanding to specific phenomena, but the literature advises using it in the education context	Subjective/idealism/value-laden	Action research involves experiments which are out of the laboratory or a controlled environment; they are practical forms of research will involve a lot of field work. Action research

			involves the use of controlled group for data collection (Saunders et al., 2012). This method will not suit any of the research objectives because the study has to be carried out with a group. This will be difficult to use in this research.
Grounded Theory	Has been used by many academic research studies in the building environment field Has been criticised widely due to its confusing process and time required to be completed Collecting data processes might require visiting the field several times		
Literature review (Content analysis)		Intrepretivism/ idealism/value-laden	Literature review as a form of research strategy could be content analysis, word, count, narrative analysis, taxonomy analysiss, qualitative comparative analysis and so on (2008) . Some of the research objectives will be resolved from the content of the literature review in this study.

These research strategies could be either used alone or combined together within mixed method (Yin, 2014). In selecting the best methodological approach for this research, the type of research question formulated at the beginning stage of this research should be revisited. These questions are:

♦ What knowledge capturing techniques are most effective in helping professionals adequately capture client's requirements?

♦ What barriers impede the successful capturing of clients requirements during the briefing process.

♦ What factors influence or impact the capturing of clients requirements during the briefing process.

♦ How important is Knowledge capturing to the client briefing process for improved client satisfaction?

The nature of this research facilitates social interaction between the researcher and the construction professionals in the UK construction industry and as a result, there is no control of behavioural events required, as this research values the richness of information provided from these social interactions. Considering no control of behavioural events is required, experiment and action research methodological approach is eliminated from selection. In parallel to this, the types of research question in this study are 'What' and 'How', thus eradicating the choice of action research, grounded theory, ethnography, and history research strategies which do not answer to 'What' research questions. The richness of information is gained from in-depth study involving construction professionals and thus archival research could not be the methodological approach adopted in this research as it requires research into archives and periodic documents. Henceforth, the strategies left to be considered are just case study and survey.

Yin (2009) defines case study as an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context especially when the boundaries between phenomenon and context are not clearly evident. Case study research is a qualitative approach in which the investigator explores a bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information such as; observations, interviews, audiovisual material, and documents, and reports a case description and case-based themes (Creswell, 2007). In a case study, the case is an object of interest in its own right and the researcher aims to provide an in-depth understanding of it (Creswell, 2007). A lot of consideration has gone into the use of case study as one of the research strategy of this study however, most of the research questions are heavily based on "What" questions which is typical of the survey strategy Yin (2003). Also, the target audience for data collection centres only on architects within the construction industry and since the bulk of information needed for this research sits with these professionals, the case study strategy is not necessarily required for this study.

The next section discusses the survey strategy as the adopted strategy for this research. This is because surveys are used to collect data from a large population in which case architects in the UK construction industry are part of. Survey is not limited to a data collection technique alone but also can be used for questionnaires and in-depth interviews, content analysis, observation

and so on (De Vaus, 2002). The survey strategy is also adopted for this study because the research aim and objectives require gathering large amount of data and also having a generalised view about the concepts of the use of KC techniques in eliciting client requirements during the client briefing process in the UK construction industry. The next section discusses in detail the survey strategy.

4.4.1 Survey

Surveys are the most commonly used method of quantitative or qualitative data collection in social science research and is most frequently used to answer who, what, where, how, how much and how many research questions (Saunders et al, 2009; Yin, 2009; Sarantakos, 2005). In this regard, *the survey strategy or research client is viewed as the best way to retrieve information in answering the research questions for this research* which are comprised of 'What' and 'How' questions. Considering the aim of this research which is to develop a framework for helping construction professionals capture client requirements using KC techniques during the briefing process, this research requires a comprehensive review of literatures serving as the secondary data, combined with primary data derived from investigations among the industry practitioners. Saunders et al., (2012) define Survey as a research strategy that is common in management and business research and mostly used to answer 'what', 'who', 'where', 'how much' and 'how many' questions. It is also used for descriptive and exploratory research. This strategy allows the researcher to easily compare the collected data from a sizeable population and have a control over the research process. This will enable the researcher to develop a model of relationships between variables and suggest possible reasons for those relationships. Since this research aims to improve performance in relation to clients satisfaction, this strategy is more appropriate, reason being that the researcher does not required to collect the data for the whole population and only needs to use the sampling, which enables the researcher to generate findings that are representative of the whole population (Saunders et al., 2012). As mentioned in the introductory chapter of this thesis, the aim of this research is to develop a framework that would help construction professionals capture client's requirements during the briefing process for improved client satisfaction. The phenomenon of this research requires both participation of professionals who are involved in construction briefing process and an understanding of the specific phenomenon of the various techniques used in knowledge capturing during the client briefing process, hence, the 'survey' research strategy is intended to find a generalised view and set of opinions about the different techniques of knowledge capturing that are currently used in construction projects. In addition, this will also be used to have an over view of the factors, barriers and importance of KC in the

client briefing process. Since the philosophical stance of this research leans towards subjectivism (idealism), interpretivism and value laden, and the research approach is abductive, all this support the use of 'survey' as a strategy for this research. In order to arrive at a more robust conclusion, this research will employ a mixed methodological survey strategy in collecting the primary data. A combination of methods in the form of qualitative and quantitative approaches is used in this research.

4.4.2 Literature review synthesis

Literature review is a very vital step in any research. This is the selection of available documents which may be published or unpublished materials, which are related to the topic. These documents contain data, evidence, facts and research carried out by various authors (Hart, 1998). The purpose of a literature review is to identify the gaps within a particular field of study. For empirical research, this assists in developing research questions and proffering appropriate solutions (Eisenhardt and Graebner, 2007). According to Saunders et al. (2009) the literature review aspect helps the researcher develop ideas from existing knowledge and research. This was used to create a strong aim and objective for the study. The concept of synthesizing literatures is to create a very robust argument about the justification for the research and identify basic challenges which might also influence the research problems based on other investigations by various academics. Gill and Johnson (2010) argued that the drawback of literature review is that the research may focus on the descriptive aspect of various articles rather than critique the narratives quality, strength and source of data. This investigation did a critique of existing knowledge capturing system and identified various gaps based on the use of KC techniques in creating improved client satisfaction during the briefing process.

In this study, literature was reviewed on existing KC techniques, factors that affect the briefing process, importance of the use of KC techniques in the briefing process the critical success factors required for effective client briefing document and the various barriers that exist in process capturing client's requirements during the briefing process for improved performance in relation to client satisfaction. Literature review synthesis also enables the researcher to client research instruments such as questionnaires and interview questions. The next ring after the research strategy in the research onion is the research choices which are discussed in the next section.

4.5 Research Choices

The term research choices refer to the combination of quantitative and qualitative techniques and procedures which are frequently used in business and management research to differentiate both data collection techniques and data analysis procedures (Saunders *et al.,* 2012). The research choices focus on collecting, analysing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone (Saunders et al, 2009). In reference to this research with the aim to effectively capture client's requirements at the client briefing stage using KC techniques, the mixed-method data collection and analysis techniques category will give a good insight into the issues being researched. Quantitative and qualitative techniques do not exist in isolation. Researchers can select from either a single data collection technique or corresponding analysis procedure, which is referred to as *mono method* or researchers can select from more than one data collection techniques and analysis procedures to answer research questions, which is known as *multiple methods* (Saunders *et al.,* 2009). Saunders *et al.* (2012) explained that mono-method represent single data collection technique and it corresponding analysis procedure. Mono-method combines either a single quantitative data collection technique, such as questionnaires, with quantitative data analysis procedures or a single qualitative data collection technique, such as in-depth interviews, with qualitative data analysis procedures. It is applicable for quantitative and qualitative techniques. Similarly the multiple-methods refer to combinations where more than one data techniques are used to answer research questions. This method is further broken down into two forms namely multi-method and mixed-methods. Multi-method refers to the combinations of more than one data collection technique with its associated analysis techniques, but restricted within either a quantitative or qualitative research environment. This means that the researcher can choose to use quantitative techniques by using questionnaires and quantitative analysis techniques, this approach is known as *multi-method quantitative study*. Alternatively, a researcher can choose to collect qualitative data using in-depth interviews and analyse these data using qualitative procedures, this process is known as *multi-method qualitative study*. Furthermore, if multi-methods is adopted, the researcher cannot mix quantitative and qualitative techniques and procedures (Saunders et al, 2012).

Incorporating the use of both qualitative and quantitative data collection techniques will help clarify the different aspects of phenomenon, reduce number of key reasonable alternative

conclusions that are gathered from the findings and also obtain verification of findings (Saunders *et al.,* 2012). Saunders *et al.,* (2012) highlighted some reasons for using mixed method clients in research and these are;

- Interpretation – one method (qualitative) may be used to help to explain relationships between variables emerging from the other (quantitative)
- Diversity – use of mixed methods may allow for a greater diversity of views to inform and be reflected in the study
- Triangulation – mixed methods may be used in order to combine data to ascertain if the findings from one method mutually corroborate the findings from the other method
- Confidence – findings may be affected by the method used. Use of a single method will make it impossible to ascertain the nature of that effect. To seek to cancel out this 'method effect', it is advisable to use mixed methods. This should lead to greater confidence in your conclusions

Table 4.3: Methodological Choice (Saunders et al., 2012)

Methodological Choice	Research Client	Example
Mono method	Single data collection technique and analytical procedure	Questionnaires (Quantitative) In-depth interviews (Qualitative)
Multi method	Use of multiple data collection techniques and analytical procedures	Questionnaires and observations (Quantitative) In-depth interviews and diary accounts (Qualitative)
Mixed method	Use of single and multiple data collection techniques and analytical procedures	Questionnaires and in depth interviews (Quantitative and Qualitative)

Moreover, this research aims to investigate the impact of using Knowledge capturing techniques in eliciting client requirements in the UK construction industry. In order to achieve this, semi-structured interviews and questionnaires are the suggested techniques that would be implored in collecting both qualitative and quantitative data. The analysed data from both qualitative and quantitative findings are contrasted and compared (triangulate) in order to validate the findings.

The figure below shows a sample frame of mixed method adopted Figure 4.5. The next ring in the research onion is the time horizon which is discussed in the next section.
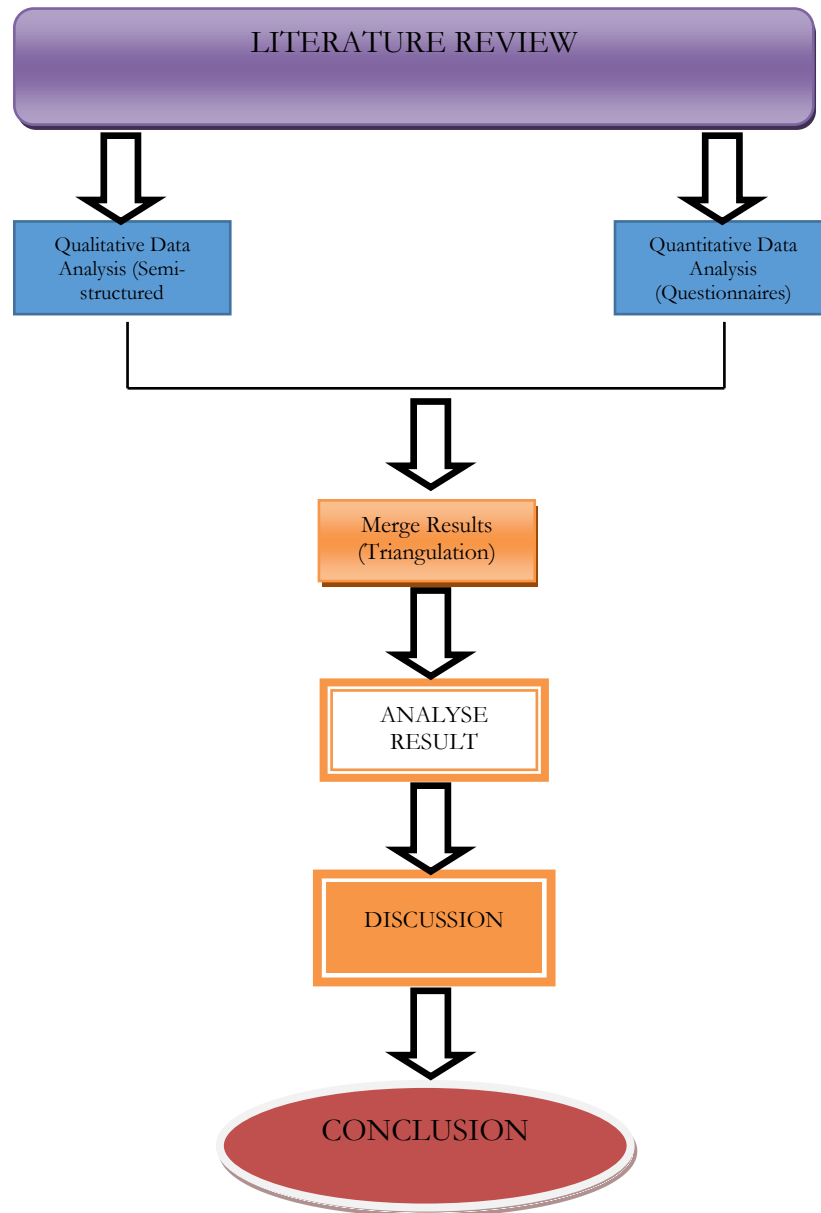
Table 4.4: Convergent Mixed Method Research Strategy (Creswell and Plano (Clark 2011)

4.6 Time Horizon

Saunders *et al.,* (2012) state that there are two types of time horizon in designing a research which are; *Cross-sectional* and *Longitudinal.* The cross-sectional time horizon is used to study a particular phenomenon within a particular time. In relation to this research, the researcher intends to

undertake this research work within the time allocated for the academic year because this study is carried out under an academic course brief. The researcher intends to develop a frame work that will help architects capture or elicit client's knowledge in form of requirements effectively using KC techniques during the client briefing process with the aim to improve customer satisfaction. Therefore, the time horizon stance of this research is cross-sectional. The longitudinal time horizon is adopted for the research that requires a long time period to provide high rich data and result. The next section discusses the research techniques adopted for this research.

4.7 Research Techniques

Research techniques are the last inner ring of the research onion ring framework which includes both data collection and data analysis methodology. Data collection and analysis are developed together in an iterative process in a case study (Hartley, 1994). Since this research leans toward the idealist ontological stance, as well as assuming the interpretivist epistemological position. The axiological standpoint of this research leans towards a value-laden stand point, thus reflected in the abductive approach where theory is generated from the richness of information obtained from the participants while some theories are tested in the process of achieving the desired aim and objective of this research. In order to arrive at a more robust conclusion, a mixed methodology is adopted gaining the advantages of both disciplines; in-depth reviews from semi structured interviews which are qualitative in nature, and questionnaires to capture the generic opinions of professionals within the industry which are more quantitative in nature. This research applies survey client, which mixed methodology primary data is supported by the secondary data derived from the literatures. This section will discuss in detail the research techniques employed in this research; the literature review, semi structured interviews and questionnaire surveys.

4.7.1 Data Collection

The research method for this study will include a combination of both qualitative and quantitative research methods in order to clarify the different aspects of the phenomenon being researched reduce number of key reasonable alternative conclusions that are obtained from the findings, and also obtain verification for the findings. Data collection varies in use and dynamics where the most frequently used and important ones are secondary data, interviews and questionnaires. These methods are further discussed in due course within the context of this research. Secondary data includes both qualitative and quantitative data which are used most

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frequently in case study and survey research strategy (Saunders *et al.,* 2012). Three main sub-groups of secondary data are documentary data, multiple sources data and survey-based data. According to Saunders *et al.* (2012), the documentary secondary data includes written materials such as; minutes of meetings, diaries, notices, transcripts of speeches, annual reports, administrative and public records. More examples include journals, newspapers, books and magazine articles. Documentary secondary data also include non-written materials like; drawings, video and voice recordings, films, pictures and television programs, organisations' databases, DVDs and CD-ROMs (Robson, 2002). These types of data can be analysed both quantitatively and qualitatively. The primary use of documentary secondary data is to triangulate findings based on other data that are collected through other data collection tools like interviews or questionnaires. In line with this study, the researcher engaged the use of documentary secondary data through articles, books, journals, conference papers and so on to form the necessary foundations and background information.

Yin (2003) identified six sources of data collection for case study research; documents, archival records, interviews, direct observation, participant-observation, and physical artefacts. Questionnaires are used in this research to gather initial relevant data which will then be quantitatively analysed. The questionnaires are distributed mainly to construction project professionals especially architect and project managers in different consulting firms. Yin (2003) observed that interview is one of the most important sources in case study research. Interview provides means of finding out from people what they do and what they think about any prevailing condition. As a result of this, this study will employ the use of semi-structured interview technique to collect data for qualitative analysis, this will permit collection of relevant information from identified stakeholders in the UK construction industry. Yin (2003) and Creswell (1994) recommend using multiple sources for data collection for case study research, but converging on the same set of findings and this will increase the validity and quality of the research substantially.

Observation is the systematic process of observing, recording, describing, analysing and interpreting people's behaviour (Saunders *et al.,* 2012). There are two types of observation; Participant and Structured. The participant observation is qualitative and used to discover "the meanings that people attach to their actions", whilst the structured observation is quantitative and is used to record "the frequency of those actions" (Saunders *et al.,* 2012). Other types of observation include the Overt and Covert observation. *Overt observations* refer to the researcher

being open about their intentions in the field and ensuring all members of the social group are aware of what is happening. An advantage of this type of observation is that it allows the researcher to be honest with the participants, thus avoiding problematic ethical issues such as deception or lack of informed consent. Furthermore, it also prevents the researcher from becoming over-familiar with the participants with the intention to keep the observation's objective and free from bias. However, a major disadvantage would be that the participants understand the aims of the observer and so there is likely to be possible observer effects (the participants changing their behaviour acting in a way that they believe is expected by the experimenter) (Saunders *et al.,* 2009).

Covert observations involve the researcher not informing members of the group the reason for their presence; keeping their true intentions secret. This automatically raises ethical concerns. In this case, the researcher may not be protected, or may not protect others, from the risk of harm, especially if the social group they are studying are a deviant group that may partake in violent acts. Also, in this type of observation there are chances that the researcher could become bias in their view and may 'go native'. An advantage of covert observation is that it allows us access to social groups that normally would not provide consent to being involved in studies. Therefore, allowing us to research and expand knowledge on lesser-known social groups, which in turn will widen our Psychological understanding of the world. Also, this type of observation avoids problems surrounding observer-effects and so may be considered to be higher in validity than overt observations (Pigarev and Kastner, 2009). The next section discusses the sampling strategy adopted for this research.

4.7.1.1 Sampling

Saunders *et al.,* (2012) state that sampling techniques provide a range of methods that enables the researcher to reduce the amount of data that are needed to collect by considering only data from a sub-group rather than all possible elements. Sampling data helps researchers to generalise their findings from the selected sample size. This procedure requires identifying the population and size of the sample to be used. Moreover, another need for sampling emerges when time and budget constraints prevent the researcher from surveying a whole population size which is not seen as practicable (Saunders *et al.,* 2012). Generally sampling techniques is divided into two categories; *Probability* or *representative sampling* and *Non-probability* or *judgmental sampling*. Saunders *et al.,* (2012) explains that **probability sampling** is mostly used in survey-based research strategies and the target samples are selected from the population with an equal chance (probability). In other words, probability sampling enables the researcher to estimate statistically the

characteristics of the population from the sample which will help to achieve the desired objectives and answer research question(s). According to Saunders *et al.,* (2012), the probability sampling process includes four stages:

- Identifying a suitable sampling frame based on the research question(s) or objectives

- Decide on a suitable sample size

- Select the most appropriate sampling techniques and select the sample

- Check that the sample is representative of the population

There are five main probability sampling techniques which are; Simple Random, Systematic, Stratified Random, Cluster and Multi-stage (Saunders *et al.,* 2012). The non-probability sampling does not rely on statistical theory and the probability of selected sample from the population is not known (Saunders *et al.,* 2012). The sampling techniques are selected based on the researcher subjective judgment. Furthermore, the researcher may be dictated to implement one or a number of non-probability sampling techniques based on the research question(s), objectives, and choice of research strategy, limited resources or the inability to specify a sampling frame. This type of sampling has five techniques: Quota, Purposive, Snowball, Self-selection and Convenience (Saunders *et al.,* 2012). Walliman (2005) noted that *theoretical sampling* which is a form of non-probabilistic sampling targets the population with adequate knowledge and experience. This research adopts the theoretical sampling technique because the respondent population which are mainly architects in the UK construction industry the right experience and knowledge in the industry for the interviews. The respondents have at least fifteen years of experience in the construction industry and the right qualifications. The drawback of theoretical sampling method is that experience and knowledge may be difficult to measure. Nonetheless, about two hundred and thirty (230) questionnaires were distributed and only one hundred (100) were returned. Also, six (6) semi structured interviews were conducted to get adequate data for the research. Random sampling method was adopted for the questionnaire survey. Random sampling is described as the probability of something being selected o the basis of each measurement or count in a population (Saunders at al., 2012). There are well over 3000 construction and architectural companies in the UK and since the strategy involves the use of survey, architects were targeted on random selection basis through the use of databases such as RIBA, CIOB and the likes. The next section addresses the various techniques used in data collection.

4.7.1.2 Qualitative- Semi-Structured Interviews

According to Saunders *et al.,* (2012) and Collis and Hussey (2003), qualitative data collection method is the process of generating, obtaining, recording or using non-numerical data through in-depth semi structured and grouped interviews, and direct observation. An *Interview* is a purposeful discussion between two or more individuals in which one individual (the interviewer) asks questions and others (interviewees) willingly answer the questions. Interviews enable the researcher to collect reliable and valid data that are relevant to the research question(s) and objectives. There are three classification of interviews; structured, semi-structured and unstructured interviews (Saunders *et al.,* 2012). *Structured* interviews use questionnaires which are developed upon predetermined and standardised set of questions. Therefore they are called 'interviewer-administered questionnaires' (Saunders *et al.,* 2012). Furthermore, this type of interviews is also referred as 'quantitative research interviews', because structured interviews are used to collect quantifiable data. Though qualitative data collection method gives a rich and in-depth investigation of the phenomenon under study, it poses the threat of cost and time consumption compared to quantitative data collection methods (Collis and Hussey, 2003). Qualitative data refers to non-numeric data or data that have not been quantified and can be a product of all research strategies (Saunders *et al.,* 2012). In qualitative research, in-depth interview is the foundation of a successful investigation (Easterby-Smith et al*.,* 2008). *Semi-structured* interviews are non-standardised interviews. Therefore they are referred to as 'qualitative research interviews' (Saunders *et al.,* 2012). In this type of interviews, the researcher uses a list of themes and questions which might be changed in each interview based on the answers of previous interview. This type of interview refers to a context in which the interviewer has a series of questions that are in the general form of an interview schedule but is able to vary the sequence of the questions (Bryman and Bell, 2007). They are widely used in qualitative research as it gives the respondents the opportunity to relate to the research matter in their own opinion and insights, which in return may yield enriched information for the researcher. The richness and vividness of the interview data enables the researcher to see and understand what is reflected rather more abstractly in other kinds of data (Gillham, 2000). Yin (2011) noted three main characteristics of semi-structured interview which sets it apart from the structured interviews:

1. The relationship between the researcher and the participant is not strictly scripted;

2. The researcher does not try to adopt any uniform behaviour or demeanour for every interview;

Semi-structured interviews due to its flexibility, allows the respondents give more detailed answers compared to other methods such as questionnaires. Semi-structured interviews allow the respondents to give organized answers to certain questions related to the social event.

The more important questions in the interview are *open*-ended rather than *close*-ended questions. *Unstructured* interviews are informal and used to explore in-depth a general area of interest. The interviewer only needs to have a clear idea about the interested topic that he wants to explore, there is no need to have a predetermined list of questions and the interviewees are free to talk about their beliefs in relation to the topic area (Saunders *et al.,* 2012). Such interviews warrants the interviewee to respond freely, with the interviewer asking a single question and responding only to points deemed worthy to be followed up. According to Saunders et al (2009), unstructured interviews have also been named informant interview due to the fact that it is the interviewee's perception which guides the conduct of the interview. In this case, the focus is on effective knowledge capturing techniques used in capturing client's requirements, importance of these KC techniques to the briefing process, barriers that influence the briefing process and factors that impact on delivery of improved performance in relation to client satisfaction. Strauss and Corbin and Strauss (1998) noted that interview questions may be based on gaps and questions raised during the literature review. Semi-structured interview questions designed for data collection will cover all of the five objectives of this research. This research employs a mixed methodology research choice, where both qualitative and quantitative methods are used at data collection stage. The reason for the mixed methodology choice is to augment and give more validity to the data collated and gathered from the respondents. This will help the researcher have a well-rounded and in-depth knowledge into the investigation and critical exploration of the various variables under investigation. Both interview and questionnaire were carried out in parallel which means both data collection techniques were done independently and not sequentially. The qualitative method applied in this research is in the form of semi-structured interviews, which includes interview of 6 architects with over 15 years' experience in the client briefing process in the UK construction industry.

For the purpose of this research, the semi-structured interviews is adopted as the main technique for qualitative data collection due to the needs of this research in gathering information from professional architects in the UK construction industry. The researcher developed an interview format guide (Appendix 1) to help control the various interview questions designed for the respondents. These guide helped create a flexible format of questioning that enables the

researcher not to solely focus on the predefined standard set of questions, but flexible enough to adjust the sequence of the questions based on the responses from the participants on specific issues which were not necessarily included in the interview guide but are however critical to the success of the research.

4.7.1.3 Quantitative -Questionnaire Surveys

As qualitative data refers to numeric data, they need to be processed, analysed, interpreted and turned into information in order to be useful and meaningful. Therefore, quantitative analysis techniques enable the researcher to explore, present, describe and examine relationships and trends within the data (Saunders *et al.,* 2012). These techniques vary from simple table or diagram to complex statistical modelling which presents the statistical relationships between variables. De Vaus, (2002) noted that the response format of a questionnaire may be designed to be exhaustive, exclusive, non-exclusive, balanced or unbalanced, ranking based, numerical rating scale (this includes Likert scale, vertical rating ladder, Semantic differential or horizontal), binary choice format, multiple choice format, non-committal (multiple attitude statement and numerical response format); respondent initiated; social desirability and acquiescent response sets. De Vaus (2002) further noted that the questionnaire layout may influence the answering procedure and the participants' time. One of the most common quantitative data collection techniques is a questionnaire. Saunders *et al.,* (2012) state that questionnaire is a general term to include all data collection techniques in which the researcher distributes the same set of questions in a predetermined order to a sample group, expecting to receive a large number of respondents. This includes structured interviews, telephone and online questionnaires.

Sekaran (2003) defined questionnaire as a pre-formulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives. They can be administered personally, mailed to the respondent or can be distributed electronically. According to Collis and Hussey (2003), the advantage of questionnaire is that it saves time and cost in collecting reasonable amount of data related to the study. Mediums by which questionnaires can be distributed include, post, telephones, emails, online and face to face, but one major factor needed to be considered is the ability to develop a good questionnaire in order to ensure that data collected are precise and meet the needs of the objectives and research question(s). Although questionnaires may be used as the only data collection method, it may be better to link them with other methods in a multiple-methods research client (Saunders et al, 2009). In this research, questionnaires are deployed as a supporting tool to provide additional quantitative data. The questionnaire was developed through the critical review of literature. The review of

literature was used to gather and identify certain KC techniques, barriers to knowledge capturing and the factors that influence the client briefing process. The variables identified were then taken into a questionnaire to test and verify the effective and important variables and options were also given to the respondent to include variables that have not been captured or included in the questionnaire.

The purpose of administering questionnaires in this research is to help the researcher in obtaining a general opinion of architects in the UK construction industry about the use of knowledge capturing techniques in client briefing as well as the factors, barriers and importance of these process for improved client satisfaction. The use of questionnaire will allow the researcher to obtain data from a larger group of respondents within the limited time frame, as well as providing a comparison of data from the small sample of interview participants which are more specific in nature.

4.7.1.4 Literature Review

Literature review is the documentation of a comprehensive review of the published and unpublished work from secondary sources of data in the areas of specific interest to the researcher (Sekaran, 2003). A literature review is also intended to avoid the researcher from reinventing the same issues that have been noted by previous researchers, as well as ensuring the researcher's knowledge is up-to-date within the same research area (Bryman and Bell, 2007) highlighted the importance of literature review in developing an argument about the significance of a research and where it leads. A competent literature review should extend beyond mere reproduction of theories and opinions of previous scholars, as well as interpret previous theories and uses these ideas to support a particular viewpoint or argument. The literature review conducted in this research is meant to capture the gap in knowledge for partnering in Malaysian construction industry and to gain secondary data for this research. Therefore, the review conducted has included various literatures on partnering, organisational culture, their factors and elements, frameworks, previous case studies and the state of partnering implementation in Malaysian construction in order to gain the insight on current scenario.

4.7.2 Data Analysis

Literature review can be used as an analytical method which can be employed to categorize the themes is a systematic approach (Saunders et al., 2012). Literature review was used to identify some of the KC techniques, factors, barriers, critical success factors and importance which

would be tested using interviews and questionnaire. The coding process for the questionnaire will take into account the variables identified by the respondents as critical to the research and opportunities are given to respondents to make further suggestions as to what other variables are critical to the success of this research. According to Saunders *et al.* (2009) and Denscombe (2010), there are five different methods for analysing qualitative data which are; content analysis, thematic analysis, grounded analysis, discourse analysis and comparative analysis.

- The *Content analysis* is a systematic technique for obtaining ideas that have been decided in advance and the data for constructs by means of transcription and coding the sentences that are compressed into theme.

- The *Thematic analysis* is a highly inductive analytical approach whereby themes emerge from the data collected and not imposed by the researcher.

- The *Grounded analysis* uses categorisation and coding collected data in order to derive theories and concepts from meanings within the data.

- The *Discourse analysis* is based on conversation; the way in which individuals talk and what persuades them to talk. The conversation or speech is analysed as performance rather than the state of the mind

- The *Comparative analysis* refers to comparing data from different individuals until no new issue arise. This type of analysis is connected to the thematic analysis.

The interviews were contacted on a one-on-one basis allowing full proximity between the researcher and participant during the data collection process through the use a referral strategy. The interview process was conducted using a face-to-face strategy. The details of the interview were recorded on an automatic voice recording app on the researcher's smart phone. These audio recordings were transcribed for further qualitative analysis. The interview data is analysed using the NVIVO 10 coding software. The NVIVO 10 coding process makes use of nodes which allows themes to be filtered. This process is used for deductive and inductive coding. Coding allows the researcher to make notes which will invariably lead to theory (Richardson and Morse, 2007). Coding is the first approach for the data gathered from the interviews. The demographic of participants included in the interview sessions and the qualitative data analysis conducted with the aid of NVivo 10 (Edhlund and McDougall, 2013) is discussed in detail in Chapter 5.

The survey questionnaire data collection process was carried out by sending the questionnaire through emails. The word document was password protected. The respondents in the various companies were given the password via email and several follow up attempts was made. Some of the interviewees who were involved in the interview provided useful contacts for the survey data distribution.

This research adopts the five Likert scale because most of the research objectives and questions aim to investigate and understand the perception of architects in the construction industry to variables such as KC techniques, importance, barriers, and factors in order to improve client satisfaction. From the questionnaire distributed to participants, one hundred (100) responses were received out of about two hundred and thirty (230) questionnaires sent out. Descriptive statistics and charts were used to present the data. This is because of the questionnaire format which is in form of binary choice format and Likert scale. Some of the analysis tests carried out in the course of the data analysis involved the use of analytical tests such as Kendall W, Cronbach alpha test, Factor analysis and so on. The first step of the coding process ensured that each category of the questionnaire was manually inputted into Microsoft Excel before it was imported into SPSS, however, statistical analysis and advanced data management software packages was used in implementing these techniques and for the purpose of this research. The SPSS 23 IBM statistical software is adopted (Saunders *et al.,* 2012). The data collected via questionnaire survey is analysed using SPSS 23 (Pallant, 2007) and is used in comparing similar data obtained through qualitative methods. The method of distribution and sampling concerning the questionnaire is discussed in detail in Chapter 6 of this thesis. A sample of the questionnaire used in this research is included in the Appendix 2 of this thesis.

4.7.3 Objectives of This Research and the Corresponding Methods of Investigation

The previous section has discussed the methods of investigation or research techniques which are used to achieve the objectives in this research. Table 4.5 displays the research objectives which will be fulfilled through the corresponding methods of investigation previously discussed.

Table 4.5: Research Objectives and methodologies adopted.

OBJECTIVES	RESEARCH STRATEGY	RESEARCH TECHNIQUE	DATA COLLECTION METHOD	TECHNIQUES ADOPTED
To explore the importance of knowledge capturing to the client briefing process in UK construction industry.	Literature review Survey	Semi-structured interview	Qualitative method	Nvivo 10
To identify the impact of knowledge capturing in eliciting clients requirements during the briefing process.	Literature review Survey	Semi-structured interview and questionnaire	Qualitative and Quantitative	Nvivo 10 and SPSS 23
To document the most effective and often used knowledge capturing techniques in client briefing in UK construction industry.	Literature review Survey	Semi-structured interview and questionnaire	Qualitative and Quantitative	Nvivo 10 and SPSS 23
To analyse barriers and enablers to knowledge capturing during client briefing in UK construction industry.	Literature review Survey	Semi-structured interview and questionnaire	Qualitative and Quantitative	Nvivo 10 and SPSS 23
To critically investigate factors that influence proper client briefing in the UK construction industry.				

For the purpose of data collection, this research will be employing a mixed methods design with the use of questionnaires for obtaining the generic quantitative data, and semi-structured interviews for gaining the rich qualitative data. With that in mind, these two methods are executed under four specific themes which reflected the research objectives to be achieved in the data collection stage. These four themes are:

1.   Importance of KC

2.   The different KC techniques

3.   Barriers to KC

4.   Factors affecting CB

These four themes guided the development of the questionnaire and the interview questions to enable comparison between the qualitative and quantitative data for triangulation. Appendix 1 of this research shows the interview schedule used for qualitative data collection in this research. The questions were developed according to the themes previously mentioned and the questions were organized based on the themes as well to ensure a smooth transition of topics during the interview sessions. The items included in the questionnaires were derived from the use of KC techniques in client briefing and the questionnaire used in this research is shown in Appendix 2

of this study. Accordingly, Chapter 5 (Qualitative Data Analysis) and Chapter 6 (Quantitative Data Analysis) in this thesis will elaborate the analysis conducted on the data collected, organized under the themes mentioned. The next section shall address the reliability and validity issues associated with the techniques applied in this research.

4.7.4 Reliability and Validation

Reliability in research addresses the level of consistency of the research instrument in producing accurate results. As this study obtains both qualitative and quantitative data, there is a need to consider the various reliability and validity issues which may arise in the course of data collection. Schreier (2012) explains reliability as a benchmark that is typically used in evaluating the quality of a specific instrument, such as a questionnaire, a test or a coding frame. Schreier (2012) further proposed two methods for the test of reliability, these are;

1.   Comparisons across persons; where two or more coders use the same coding frame to analyse the same units of coding, and they do so independently of each other. The coding frame is considered reliable if the results apply across different coders.

2.   Comparisons across points in time; where one coder uses the same coding frame to analyse the same units of coding, after a certain period of time. The coding frame is considered reliable if the results remain stable over time.

For the purpose of this research, the author has compared the results used generated from the coding frame across points in time to fulfil the qualitative reliability issue. Whether the coding is compared by different coders or compared by a single coder at different points in time, the coding frame is considered reliable to the extent that the coding is consistent. In relaying the validity of the qualitative instrument, Creswell (2009) stresses the point that qualitative validity signifies procedures that the researcher had undergone to test the accuracy of findings. Among the procedures suggested by Creswell (2009) to determine qualitative validity in the course of this research are:

1.   Member checking; where the results from the analysis were shown to the interview participants and determined whether the participants agree with the accuracy of the findings.

2.   Thick and rich descriptions; where rich and thick descriptions were used in conveying the findings to show that it is genuine and furthermore enables the reader to be transported to the research setting.

3.   Negative or discrepant information included; where information that contradicts the general perspectives of the themes is also included in the discussion of findings.

In quantitative methods, reliability implies consistency. In the case of quantitative reliability, it is the degree to which an instrument produce consistent results for same individuals at different times (Field, 2009). Reliability is concerned with the robustness of the questionnaire, and in particular whether or not it will produce consistent findings at different times and under different conditions, such as with different samples (Saunders et al, 2009). In order to determine the ability of a data collection tool in producing consistent results, reliability test was conducted for each of the objective themes for the questionnaire. Bryman and Bell (2007) highlighted the 3 common methods in measuring the reliability of a research instrument, as follows:

a.   Stability (test-retest method)
b.   Inter-observer consistency
c.   Internal reliability (Cronbach's alpha)

The stability test for reliability (test-retest method) requires the same questionnaire instrument to be administered twice to the respondents, and data from each time it is administered were then correlated in order to determine the reliability of the instrument. However, this method has some criticism in which the time interval can influence the likelihood that the respondents will answer in the same manner, thus going against the purpose of stability test (Saunders et al, 2009; Bryman and Bell, 2007). Furthermore, it is a difficult task to get the same respondents to answer the same questionnaires. Therefore, this test was not chosen as the reliability test for the quantitative instrument in this research. The second method available for reliability testing is inter-observer consistency. Trochim (2006) noted that this test is necessary to determine whether two observers are being consistent in their observations. Bryman and Bell (2007) also noted that this test is crucial for studies with more than one observer which data collection requires highly subjective judgments that affects coding and categorizing of data in the analysis stage. As the author is the sole observer and researcher for this study, this test is then not applicable for quantitative reliability testing. Cronbach's alpha however, is one of the most popular ways of measuring internal reliability (Yu, 2005). Cronbach's alpha determines the internal consistency or average correlation of items in a questionnaire to gauge its reliability and results in a value in between 0 which means no correlation, therefore no internal consistency; and 1.0 for perfect correlation, hence complete internal consistency (Saunders et al, 2009). The reliability test for the questionnaire in this research is conducted with the aid of SPSS 17 as shown in table 4.6.

Table 4.6: Reliability statistics results from SPSS 23 for KC techniques, Barriers to KC and Factors affecting CB.

Reliability Statistics for KC Techniques		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.822	.818	12

Reliability Statistics for Barriers to KC		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.886	.888	17

Reliability Statistics for Factors affecting CB		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.924	.925	36

The Cronbach's alpha values obtained in SPSS 23 for the test analysis carried out for each theme as earlier mentioned in section 4.7.7, scores of 0.818, 0.888 and 0.925 show very high consistency and internal reliability as shown in Table 4.5. Values of Cronbach's alpha between 0.7-0.8 are commonly accepted for indicating good reliability of an instrument (Field, 2009).The value 0.818, 0.888 and 0.925 shows that the results produced from the analysis of this questionnaire are trustworthy, repeatable, dependable and reliable to an acceptable extent.

Throughout the data collection and analysis stage of this research, reliability and validity is given careful consideration, reflecting in the application of multiple sources of data and methods. In addressing the validity for a quantitative instrument, various methods exists which includes; *content validity*, *construct validity* and *criterion validity* (Babbie, 2008; Saunders et al, 2009; Creswell and Plano Clark, 2011). Content validity is established through the judgment of the external experts whether the items or questions are representative of the construct investigated (Creswell and Plano Clark, 2011). In this study, the questionnaire is developed by identifying various KC

techniques, barriers to KC during and the factors that affect the CB process in the UK construction industry. These factors were identified from various authors in the course of the literature and not from the researcher, hence, the need for testing. To ensure that the questionnaire instrument generated in this research measures what it is supposed to, the questionnaires have been reviewed by a panel of seasoned and professional academics in the school of the built environment, University of Salford, through an ethical approval process prior to the data collection stage, in order to evaluate the content validity of the questionnaire. Cavana et al (2001) suggested that for an instrument to be valid it has to be reliable but must also measure what it is intended to measure. Considering that the instrument used in this research has scored a satisfactory reliability measure of Cronbach $\alpha = 0.818$, 0.888 and 0.925 and have gone through the process of experts review, the questionnaire used in this research can be regarded as a valid instrument.

Revisiting the research onion methodological research model (Sanders et al., 2012) mentioned at the beginning of this chapter, the following Figure 4.6 illustrate the selection of research philosophies, research approach, research strategies, research choices, time horizon, data collection method and research techniques made in this research through justifications discussed in their respective sections.
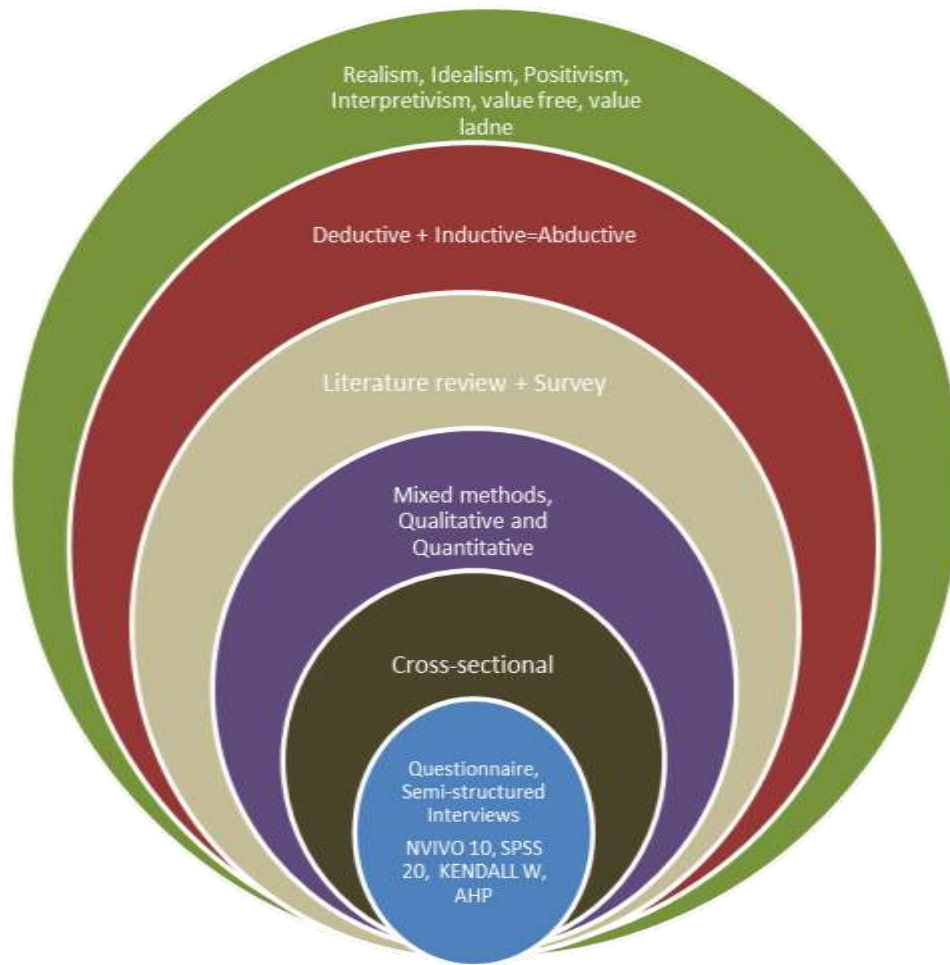
Figure 4. 5: Research Onion showing the adopted philosophies, and other layers

4.7.5 Triangulation

Triangulation of data involves combining the analysis of qualitative and quantitative data. When there are two types of data (qualitative and quantitative) available for a particular objective, triangulation is necessary (Ingram, 2002). Triangulation of data strengthens the validity of a research (Gibson and Brown, 2009). Yin (2003) noted that the purpose of triangulation is convergence and completeness. This creates a robust argument for a particular objective. For this study triangulation will be employed for the third, fourth and fifth objective. These three objectives were analysed using the Nvivo 10 software for the semi-structured interviews and the SPSS 23 software for the questionnaire survey, hence the need for triangulation. This provides a diverse perspective for the analysis.

4.7.6 Ethical Approval

Under the guidance and supervision of supervisor, the researcher was able to obtain approval for ethical approval (reference number **CST 15/17)**. This has enabled the researcher to be able to conduct interviews without any form of restriction (please refer to appendix 3).

4.8 Chapter Summary

This chapter highlighted the significance of research methodology to a research work, identifying the philosophies, methods, techniques and data collection approach used in developing a quality research thesis. The philosophical stance of this research leans more towards the idealist ontological stance, the interpretivist epistemological stance and the value laden axiological stance. The strategy adopted is the survey strategy with the mixed method strategy. It also adopts the qualitative and quantitative techniques using semi-structured interview and questionnaire for data collection. The analysis was carried out using Nvivo 10 and SPSS 23. Five major stages were designed to achieve the aim and objective of the research: literature review, survey (current practice), interviews and questionnaires (best practice), data analysis and then framework development.

Chapter 5 – Qualitative Data Analysis

5.1 Introduction

This chapter shall elaborate in detail the qualitative data analysis undertaken for this research. It presents analysis from literature and semi-structured interviews conducted by the researcher. Firstly, the method of data collection and surveyed sample shall be discussed. A focal literature review on all research objectives is carried out in order to create an underlying foundation on which to build the semi-structured interviews. The use of Nvivo 10 in data analysis will also be highlighted, as well as the design for semi structured interviews which was carried out in the data collection phase. An in-depth discussion of the analysis is also included within this chapter. Finally the key findings from the data analysis are highlighted at the end of this chapter.

5.2 Design of the Interview Process

The data collection stage is designed to enable the researcher gather relevant information form participants which can aid in in-depth analysis of specific objectives through the use of themes that emerge from the interview process. Four themes are established for the data collection in this research, and the same themes are applied in both methods of data collection. The interview sessions are conducted using a semi-structured interview schedule as attached in Appendix 1 of this thesis. In entirety, there are 4 sections within the interview schedule as follows:

5.2.1. Section I - Profile of participants

In this section, the researcher used general questions to get an overview of the participant and capture general information of the participant and their current role in their organisation. Some of the items noted by the researcher in this session include; the participants' name, job title, education and qualification background, years of experience working in that role as well as the date and venue of the interview for record purposes. Several questions regarding the participants discipline and years of experience working in that disciple were also asked. The general information are important in profiling the participants included in the qualitative data collection, as well as for drawing conclusions should there be a difference of opinions among the participants. It is appropriate to mention here that, although the name of participant and their discipline is noted and recorded in the data collection document, for the purpose of anonymity

and data protection, these names will not be published in the analysis and anywhere in this thesis; this is in line with fulfilling the ethical requirement of the University.

Table 5.1: Profile of respondents

Participant	Type Of Architect	Years Of Experience	Sector of Operation	Size of Organisation	Academic Qualification	Scale of Project
ARCT001	Commercial	25	Academia	200-500	PhD	Large
ARCT002	Residential	20	C.E.O	10-20	PhD	Small
ARCT003	Residential	20	Industry	100-250	PhD	Medium
ARCT004	Commercial	15	Academia	150-250	MSC	Medium
ARCT005	Commercial	19	Industry	50-100	MSC	Small
ARCT006	Residential	23	Industry	100-250	PhD	Medium

5.2.2. Section II – The Importance of KC in the Briefing Process

This section highlights about 6 questions aimed at investigating the importance of KC during the client briefing process in the delivery of client satisfaction in the UK construction industry. The aim of this section is to develop and understanding as well as create the necessary awareness of the benefits and significance of using KC techniques in the briefing process for improved client satisfaction. Some of the questions posed to the participants in this section tried to investigate the impact of adequately capturing clients requirements have on the overall delivery of project outcomes. Also, the researcher wants to ascertain if quality time is given or invested in the briefing process and what impact this might have on deliverables.

5.2.3. Section – III- Exploring the various KC techniques used in the client briefing process.

This section highlights the different techniques used by architects in capturing their client's requirements during the briefing process. The interviewed participants were asked a series of questions in relation to their years of experience in the briefing process on the techniques they mostly use when engaging their clients in the briefing process. Some other questions addresses what techniques architects use in general and which ones are most effective. The primary aim of this section is to have a clear understanding of the many KC techniques available to and used by different architect and why those techniques used are preferred over others. Lastly, the

researcher intends to investigate the impact of using these KC techniques on the overall delivery of the client's project in meeting the requirements and needs of the client. In total there were 4 questions included in this section.

5.2.4. Section IV – Barriers to KC That Occur During the Briefing Process

Section IV of the interview schedule was established to identify potential barriers and challenges that exist or emerge in the process of capturing client's requirements during the client brief process. Four questions were asked under this section. Few of the questions asked the participants were to describe a scenario from their experience that depicts some of the challenges faced with clients during the briefing process. The participants were then asked what step was taken to scale or overcome these barriers.

5.2.5. Section V – Factors Influencing or Impacting the Client Briefing Process

The concluding section of the interview schedule addresses the factors that affect or influence the capturing of clients requirements during the briefing process. The major question asked the participant is what are the likely factors that affect the delivery of clients' requirement while capturing clients' needs during the briefing process? The same questions were also included the research questionnaire survey in order to afford the researcher the opportunity to compare findings from both methods, thereby drawing a collective conclusion for this research.

5.3 Presentation of findings

The themes discussed in this section contain both existing and emerging themes. The following sections highlights and discuss some of these themes which is analysed from the interviewed transcripts.

5.4 Theme 1- Importance of KC in Client Briefing

The RIBA plan of work identifies the briefing process as one of the early and foundational stages of the construction life cycle. The aim of every construction procedure or procurement practice is to largely meet the needs and requirements of the client with the aim to make the client happy and satisfied. However, every briefing process is engineered by the deliberate capturing or

elicitation of client's requirements by architects who give guidance on all aspects of the client's project from design and cost through to planning and construction which helps the client gain an enormous amount of valuable information which will help them in making quality decisions for their projects. The capturing of clients knowledge in the form of requirements is seen to be a pivotal process in the realisation of the needs of the client during the briefing process. For instance, participants ARCT001 stated that *"...The briefing process is the most important step in every construction process..."*

The table below shows a representation of the number of sources and references generated in the process of analysing the theme.

Table 5.2: Importance of KC in the CB process

Parent Node: Theme	No of Sources	No of Reference
Importance of KC in the client briefing process.	5	20

Five out of the six participants interviewed agreed that using the right kind of knowledge capturing technique can contribute to the overall quality of the briefing document. In response to the question of this theme, ARCT002 stated that *"… not using the right capturing tool in eliciting your clients' needs could have a major impact on the deliverables and outcome at the later end of the project and trust me clients will not appreciate when your mistake affect project time delivery and cost…"*

One out of the interviewed participant differed in opinion as regards the use of KC techniques in capturing client's requirement at an early stage of the process. The participant argued that since the briefing process is an iterative process, the document will always need to be updated as the project progresses. This view was countered by ARCT004 who stated that

> *Capturing the needs of the client at the early stages of the briefing process can mean the difference between happy and unhappy clients which could mean less business which in turn could crumble a business. One of the major aim of an architect is to service the client and meet client's expectation in a bid to retain the client and get more business referrals. However, as the process evolves, the brief should be updated and signed off by the client*

Some other important factors identified by the interviewed participants include;

    a) Using a KC technique can eliminate unnecessary cost and allow the project deliver within

the expected time constraint.

b) KC technique can help the architect and client set clear and achievable project objective and goals.

c) Using a KC technique can reduce numerous design changes by client which are not originally covered in appointment agreement; this can cause increase in consultancy fee which was not initially budgeted by the client.

d) Communication between architect and client has to be correct and this can be achieved using the right KC technique. It can only be information if it is correct, otherwise it is garbage. The right information using the right tool can help in making proper and informed decisions.

5.4.1. Theme 1.1- Importance of the Client to the Briefing Process

Table 5.3: Importance of the Client in the CB process

Parent Node: Theme	No of Sources	No of Reference
Importance of the Client in the Briefing process.	4	11

The aim of this research is to help construction professionals especially architects to capture clients knowledge in form of requirements with the purpose of giving the client total satisfaction through performance. The "CLIENT" briefing process as the name implies is a process that is centrally based on the client and not the architect. The architect is the knowledge expert who is armed with the know-how of eliciting client's requirements which are tacit in nature thereby helping the clients interpret on paper what they find difficult expressing. Three of the respondents identified the need of the client in the successful delivery of the brief. All three respondents agreed that without the client, the briefing process is at best useless because architects do not design for themselves, they design for the client. One of the respondents ARCT005 stated that *"…everything is about the client, we do not design for ourselves but for the client, therefore the need of the client should be given priority if we must have satisfied clients..."*

The three respondents also added that a client brief does not necessarily mean a detailed or comprehensive document. A client can produce an initial brief in the form of 'I want a bedroom apartment with two toilets, one upstairs and one downstairs', those verbal statements are actually briefs. Another client can give you a call saying I want x,y,z, it is therefore the responsibility of

the architect to take note of what the client wants and needs and this forms the initial design brief. Some clients have written briefs in form of a document and this is sent to the architect as their brief. Some others send theirs through emails or telephone conversations because this is the initial point of contact with the client. Regardless of the brief communicated by the client, the architects still needs to engage the client to flesh out the requirements hidden in the actions and thoughts of the client, this is where the expertise and knowledge of the architect comes in handy.

5.4.2 Theme 1.2- Importance of the First stage of the Construction Process

Table 5.4: Importance of the First stage of the CB process

Parent Node: Theme	No of Sources	No of Reference
Importance of the First stage of the client briefing process	5	20

The RIBA plan of work gives a detailed overview of the different stages involved in the construction life cycle. Every stage has its unique qualities and functionalities which if overlooked or ignored could impact the overall delivery of the project. The RIBA plan of work 2013 gives a broken down analysis of the eight stages (0-7) involved in construction projects from inception to usage of the facility. Stage zero gives the strategic direction of the project and this is where the strategic brief, the business case and core business requirements are delivered. Following this stage is one of the most fundamental stages in the construction life cycle and the underpinning philosophy of this research is built on this stage. This stage undergoes functionalities such as developing the project Objectives, designing the project budget, understanding and clarifying the needs of the client, and then develops the client brief.

Based on the context of this research, the client briefing stage is considered as a life cycle on its own. The researcher aims to explore and investigate the KC techniques, barriers, importance and factors that influence the delivery of client's projects. Of all the interviewed participants, five out of six respondent place emphasis on the first stage of the briefing process. One of the respondents ARCT003 states that *"…The design process has a lot of stages. The first stage is usually the planning, coffee white sheet stage, where you look at the client, you have all these meetings and you have all of his notes and then look at the white sheet and start to think of the best way to document or represent your clients…"*

All six participant agree that the client briefing stage is the most important stage of the life cycle of the project because once the client brief is a true representation of the client's needs, there is a higher chance of having more satisfied clients. ARCT001 states that *"…The briefing process is the most important step in every construction process…"*

This greatly highlights the need to invest a good amount of resources and time into the briefing process. The briefing process is likened to the foundation of a building, one of the respondent said, adding that if the right foundation is laid properly, whatever structure is put on it will last long.

5.4.3 Theme 1.3 - Client satisfaction

Table 5.5: Client satisfaction

Parent Node: Theme	No of Sources	No of Reference
Satisfaction of client	6	17

Client satisfaction in the context of this research involves meeting the needs or requirement of the client which is measured against project completing to agreed time and cost. In construction projects, the triple constraints are the cost, time and quality. Meeting the demands of these three constraint shows that a company or business is delivering in accordance to project standards. In relation to this research, the standard for measuring performance is based on the architect meeting the agreed demands of the client in relation to cost, time and quality. So we say a customer a customer is satisfied when the project delivers within budget, to quality and within agreed time. All six respondents agree that capturing client's requirements properly during the briefing process can impact on client satisfaction to a large extent which can potentially lead to increased business for the architect or the company they represent? In addition, one of the respondents ARCT002 stated that *"…clients will not appreciate when your incompetence of not documenting their requirements properly affect project time delivery and cost. Some clients will even go to the point of taking you to court over such grievous mistakes and God help you if you do not have an insurance cover on yourself…"*

Another respondent added that if an architect make mistakes during the briefing process and the briefing document and design does not incorporate certain things, the client can term you as being incompetent because you have not exercised a duty of care towards the client and that can lead to legal actions against the architect. ARCT006 stated that *"…From experience, I would say, that*

if the briefing process is carried out properly, it will impact on project outcome by making sure unnecessary cost is reduced and the project is delivered within the time constraint. Also, it will help the architect and client set clear and achievable project goals and objectives…"

ARCT004 in his response during the interview expressed that lack of proper capturing of clients requirements can cause numerous design changes which were not originally covered in the briefing agreement; such changes can cause increase in consultancy fee which was not initially budgeted by the client and can make the client dissatisfied in the services rendered which means less business for the client. Respondent ARCT003 agreed to this statement mentioning that *"…unsatisfied clients mean less business which could cause a business to crumble. One of the major aims of an architect is to service the client and meet client's expectation in a bid to retain the client and get more business referrals…"*

In order to meet the clients' needs and make the customer happy, architects must be able to provide a level of satisfaction to their clients in the following areas;

1. Quality of products developed

2. Service rendered

3. Value for money.

4. Cost (i.e. what they are paying for it)

5. Time. This affects both retail and commercial clients depending on the need of the project.

In light of commercial and retail clients, time becomes a major factor because they may simply be investors and not the end-users. Therefore, analysing the client's satisfaction will largely vary and depend on a lot of other factors.

5.5 Theme 3- Effective KC techniques used in client briefing

Table 5.6: Effective KC techniques used in CB

Parent Node: Theme	No of Sources	No of Reference
Effective KC techniques used in client briefing.	6	39

Knowledge capturing (KC) techniques refers to methods or tools used in capturing the knowledge that originates from requirements. There are many techniques available in literature that have been identified in capturing knowledge, some of these techniques include interviews, focus groups, workshops, brainstorming and so on. All six respondents highlighted and identified some KC techniques which they use in engaging their clients and other techniques which they think are also effective but they do not use. In addition, thirty nine references were sighted in relation to KC techniques buttressing the viability of the process in the construction life cycle. One of the respondents ARCT002 mentioned during his interview stated that KC techniques are dependent on the type of client being engaged. The respondent stated that *"…I would say sometimes it depends on the type of client being interviewed, some clients love visuals and others like straight forward simple representations. But for the most times, when a client comes to me for a project, the first step I take is to set up an interview with them…"*

Four out of the six respondents agreed that some architects decide to go ahead and produce some sketches from the onset during the briefing process, aligning to what respondent ARCT002 stated about some client preferring visual representations to other forms of representations while some architects might try to understand the brief a lot more before going in to the sketch stage because they want the process to be in order. This goes to show that there is a high demand on the architect understanding and knowing who his/her clients are before progressing to selecting which KC techniques suits the client best. Some of the KC techniques used and highlighted by the six respondents includes Interviews, Emails, BIM, brainstorming sessions, sketches, diagrams, AutoCAD, InteriCAD and Face to face interaction. Interestingly, most of the identified KC techniques are a combination of IT and non-IT methods which ever best suit the client as the case may be. In retrospect to the listed KC techniques used by the interviewed participants, ARCT005 stated that;

> *There is a huge benefit to the use of BIM (Building Information Modelling) in the client briefing process because if you have taken the client on a journey with the wrong information, BIM allows you to change information with just a click. For example, if an individual would like a fully marbled house and the architect did not fully realize what the client meant and had been drawing it by hand, the brief produced is already wrong which will affect the cost analysed at the briefing stage. A lot of architects allow projects to go out on a business decision rather than a client decision and report back stating they've spent 'x' number of hours on this project, even though deep down they know there could have been better alternatives for the client*

On the flip side, one of the respondent added that KC techniques apply more to clients who do not have a clue as to how to articulate their needs and requirements which is where the

traditional procurement route plays a major role, where the client engages the expertise of the architect in putting together a thought or need. ARCT003 stated that *"…Most established clients or organisations already have a framework of procurement and project delivery…"*

In making the briefing process successful, the architect must understand that they are designing for the client and not for themselves, this mind set helps the architect to appreciate establishing a working relationship with the client and knowing the client enough to understand what KC technique suits the client better. Clients are more at rest and satisfied when the architect speaks their language.

5.5.1 Theme 3.1- Agile (Collaboration) vs Traditional procurement

Table 5.7: Agile (collaboration) traditional procurement

Parent Node: Theme	No of Sources	No of Reference
Agile (collaboration) vs Traditional procurement	5	11

Under the traditional procurement route, the client is responsible for selecting the architect to design the project in detail, and then prepare tender documentation, including drawings, work schedules and bills of quantities. Under this route, the contractor is not responsible for the design, because the client retains the architect to prepare any additional design information that may be required in order to review any designs changes that might be prepared by the contractor and inspect the work done. Under the traditional procurement route, communication between client and architect is vital to the successful delivery of the project. One of the three respondents that made mention of the importance of the procurement route stated that *"…in the traditional procurement route, the client lives with the architect, finishes off with the architect and the architect then stands as an umpire or supervisor for the rest of the people the client deals with…"*

On the contrary, two of the respondent identified some other procurement route which they discovered as a result of knowledge gathered from others experiences in delivering the client brief. The respondent stressed that some construction professionals believe that giving the sole power and autonomy to the architect to advice and relate with the client alone might be giving a bit too much to the architect and in the process leaving out some essential information that could help the delivery of the client's needs. ARCT004 stated that *"…People say 'let's do*

partnerships' and no longer have architects as empires. Rather let's get everyone involved in a project in the room at the same time and let them jointly advice the client - whether they are advising that client rightly or wrongly - let's not leave the fate of the client to the relationship with architect…

The respondent added that when the architect is a good one, the client is protected, but when he is a compromised architect, then they begin to advise the client on things that is of interest to them rather than the client, such as making the client buy things they do not need. Some of these could be because these architects have friends who know other friends with businesses that sell the materials they have requested the client to purchase.

Agile is an iterative, incremental method of managing the design and build activities of a particular system, product or project, with the aim of providing or developing new products or services in a highly flexible and interactive manner. Agile also refers to a group of software development methodologies based on iterative development, where requirements and solutions evolve through collaboration between self-organizing cross-functional teams. In the context of this research, agile represents the iterative nature of the client brief which involves the consistent and continuous update of the client brief through the construction life cycle of a project. One out of six respondents highlighted the need of having an iterative brief. One of the respondent argue that the construction process should operate more of a waterfall methodology which means "we must get it right at first" before we commence construction. The respondent's reason for this is that there are certain stages in the construction process that it becomes difficult to make any further changes to the already baselined brief and any changes at this stage will greatly involve a lot of cost. However, the iterative nature of the brief in the context of this research addresses the back and forth communication and process of requirement capture between the client and the architect for the purpose of producing a quality client brief. The respondent for the agile brief believes that as long as there is an iterative process of communication between the client and the architect, it could potentially eliminate the possibility of having major future changes in the cause of the construction phase. ARCT001 states that *"…the brief always needs to be updated throughout the life cycle of the project. The brief has the narrative for the project; it has all the requirements and components. It's always a parallel process, cos by the end of the project, you have a brief at the beginning and then you have a final brief at the end which always goes along the process of the designing…"*

From the researcher's point of view, it is essential to note that despite the iterative nature of the briefing process, the architect also needs to give a considerable amount of time and energy to the brief process at the early stages of the process but opportunity should be given for update of the brief when the opportunity rises. It is also essential to add that the more iterative the briefing

process is in the capturing of clients requirements at the early stages, the better the potential of eliminating possible changes that might arise in the cause of delivering the project.

5.6 Theme 4 - Barriers affecting KC in the client briefing process

A barrier is a circumstance or obstacle that prevents understanding between people or things with the aim to obstruct communication or progress. In the context of this research, barriers are challenges, issues or impediments that obstructs or disallow a certain process or event from achieving its desired objective. All six participants were asked to highlight or identify some of the potential or existing barriers that impacts on the process of capturing clients requirements during the briefing process. The aim of this theme is to explore and investigate some of the challenges or impediments that affect KC in the client briefing process in its quest to achieving the overall aim which is to satisfy the client. The table below illustrates the number of sources and references generated in the process of analysing the theme.

Table 5.8: Barriers affecting KC in the CB process

Parent Node: Theme	No of Sources	No of Reference
Barriers affecting KC in the client briefing process.	6	22

Out of all the six participants interviewed, all the participants identified some challenges in some places and in other instances share collective agreement on some of the issues identified. The different barriers mentioned in this section were developed from data in the process of analysing the transcribed interviews under theme 3. The aim of this research addresses the gaps that exist during the client briefing process when adequate attention is not given to the KC techniques that exist in helping architects capture and document properly clients' needs adequately under the traditional procurement route in the UK construction industry for improved client satisfaction.

The table below shows the number of sources and references generated in the process of analysing the sub-theme (child nodes) under theme 3. The sub-themes are arranges in order of importance based on the responses of the interviewed participants. The sub-theme which is most mentioned by participants is given more importance than those with more references.

Table 5.9: Different barriers to KC during the CB process

Child node: Sub-theme	No of Sources	No of Reference
Inadequate information	6	12
Ineffective Communication	6	10
Culture not prone to change	5	8
Clients not knowing what they want	5	6
Not paying attention and listening to the client	3	6
Personal or vested Interest of the architect	1	2

The following factors have been identified by participants as potential or existing barriers to KC process during the client briefing process and they include;

a) **Inadequate information**

The quality of information is dependent on the client but largely dependent on the knowledge of the architect. For some clients, their requirement or need at best could be in form of an idea, a statement, a conversation and so on. Such information from the client are sometimes inadequate, vague and lack the content needed to produce a proper brief, hence it is the duty and responsibility of the architect to engage the client using the right knowledge capturing techniques to elicit and document what the client actually means (tacit knowledge). There is a direct correlation between client satisfaction and the quality of the information amerced by the architect because if the briefing document and concept formation is not right as a result of inadequate information, it could most likely impact on the client's decision leading to uninformed and wrong decisions by the client. ARCT005 stated that *"…I think the direct variable of client satisfaction is on the quality of the information provided because if the script is not right from when briefing was taking place, it can lead to a wrong decision by the client. Therefore, going down the line, what you are dealing with is the product of wrong information…"*

Five out of the six respondent agreed that the quality of information at the disposal of the architect will greatly influence the outcome of every decision made by the client which will invariably impact on the overall delivery of the project. One of the respondents was asked if there could be oversaturation of information. The respondent stated that it is better to have more than enough information, as long as it is not out of context or irrelevant to the need of the client as oppose having less information because decisions made on less information can be costly to the client. The more the information, the better it is to make quality decision.

b) Ineffective Communication

Communication involves the art or process of using words, sounds, signs, or behaviours to express or exchange information in the form of ideas, thoughts, feelings and so on. Communication has to be between two or more persons before it can be termed communication. Communication is always a two way thing, the sender of the information and the receiver of the information. Under this sub-theme, all six respondents agreed that ineffective communication is a major barrier to capturing client's requirements properly in the briefing process. One of the respondents ARCT001 added that *"…one major challenge that I think could majorly affect the briefing process is communication between the architect and the client. Communication goes beyond asking the clients some questions about what they want, it's about understanding what the client wants beyond what they are saying..."*

Communication issues and the competence of the architect in knowing what communication technique to adopt have a major role to play in the process. Communication has to be correct and clear between the client and the architect. The only time communication can become valid information or knowledge is when the communication method or technique used is potent enough to capture or elicit the desired requirement from the client, then such information is deemed correct, otherwise its garbage. The only way to get the right information is by using the right communication tool and this will in turn impact on the decision made by the client.

c) Culture not embracing change

Three of the interviewed participants mentioned during their interviews that one of the barriers plaguing the construction industry is a culture not prone to change. In their response they mentioned that most of the top construction company in today's business are not familiar with the use of IT related systems to run their KC process during the briefing process. This was further elaborated by another participant who identified the use of BIM as a vital tool in capturing client's requirements, that most top construction firms are not prone to embracing systems such as BIM because that could cause a tremendous change and shift to their basic operations which could include high cost of trainings and adoption. One of the participant mentioned that,

> *There is a cultural change, diverse business interest and a scale issue in the construction industry. If you were a director and you had been running your business well for the last 25-40 years, when you talk of BIM and the infrastructure behind it, it is over their heads. They will not passionately drive it as a 25 year old graduate fresh out of university who has all the skills to use BIM despite the fact they may have the money, position or the clouds to make it a default practice for the industry.*

The typical individual will naturally react or reject the idea of change at the first glance of it because people do not really like change. Change has been identified as a prevalent barrier that mortifies opportunities and cripples business initiatives. Therefore one of the major barriers that affect proper KC during the briefing process as identified by some of the interviewed participant is a culture of change and a genuine skill/business interest concern.

d) Client not knowing what they want.

Five out of the six participants agreed that most clients do not know or have a clue to they want. One of the participants painted a scenario where the project has to be put on hold as a result of the client always changing their mind because they do not know what they want. In retrospect, another participant added that it is normal for a client not to know what they want but it is the responsibility of the architect to use his/her expertise to help the client decipher what they want. ARCT006 stated that *"…The client could be individuals with little knowledge of what they actually want which, in such cases, their brief will be very sketchy, so as the architect you will have to help them develop and articulate their brief and make a business case…"*

In another instance, three of the respondent agreed that having a conversation with the client to envision what the clients wants is key. However, in many instances, as it is in the construction industry, some clients don't have any vision of what they want; they just want profit so they ask the architect to advice on what is most acceptable as long as it yields profit. Also, the client could be individuals with little knowledge of what they actually want which, in such cases, their brief is very sketchy, it is therefore the job of the architect to help them develop and articulate their brief in order to make a business case out of it. In the case of a totally clueless client, the architect then needs to consult the appropriate authorities and do some underground research, added to the already existing knowledge they have in advising the client aright.

e) Not paying attention and listening to the client

Listening to the client and giving the client quality attention during the briefing process has been identified as one of the factors that drive the successful delivery of the client brief. A lot of vital requirements and information are lost in this process as a result of carelessness and nonchalant attitude displayed by some architects. Another point noted by the participant is that some architects think they know it all and therefore make a lot of false assumption for the client and this in the end leads to unsatisfied clients. Another important point raised by the respondent is the fact that some architects think the project is for them so they tend to interpret clients requirements and design based on what they think is right and not what the client needs.

ARCT004 has this to say about this; "...*young architects especially students struggle with the most and this boils down to the fact that 1. They don't listen 2. They don't care about the client, they think the project is for them rather than for the client and then later they start to realise that it can't be about them. So the brief is the first step of knowing your client...*"

One of the three respondents also noticed that some client do not like to listen to architects as well and this creates a major challenge in trying to capture the client's requirements during the briefing process. The participant added that in such situation, understanding your client and minding the type of knowledge capturing and approach used in such cases plays an important role is communication with clients. It is paramount that the architects strive to understand his client by listening to them and studying them before venturing into the briefing process.

f) Personal or vested Interest of the architect

Four out of the six participants mentioned and agreed that the project is not for the architect rather it is for the client. Some architects engage their clients with the aim to extort or manipulate the client to their own interest. A scenario was painted by one of the participant about an architect who advises clients against their intended needs, and being knowledgeable expert in the field, clients tend to place a great amount of trust on such architects based on their expertise in their profession. A story was shared by one of the participant about an architect who has a friend who sells construction products; the architect's tries to get the client to agree to requirements that will invariably spur the client to purchase from the friends company. Such projects in the long run go wrong because the architect is designing for his or her own stake in the project rather than for the client. ARCT004 mentioned that " ...*a lot of architects allow projects to go out on a business decision rather than a client decision and report back stating they've spent 'x' number of hours on this project, even though deep down they know there could have been better alternatives for the client...*"

The pride of the architect also plays a major role in the client briefing process. Architects tend to impose on the client's requirements and ideas under the guise that they are more knowledgeable and experienced and have the technical know-how in the related field. Another of the respondent mentioned that some architects will rather show the client their ideas in order to quicken the briefing process.

5.6.1 Theme 4.1- Tacit nature of requirements as a barrier

Table 5.10: Tacit nature of requirements as a barrier

Parent Node: Theme	No of Sources	No of Reference
Tacit nature of requirements as a barrier	4	5

One of the four respondent stated in the cause of the interview that architecture is creative imaginations captured in form which includes pigment of imagination going on in the mind and until they are captured in a proper form, it is not yet architecture; it is perhaps historical, artistic or literature. Tacit knowledge as defined in chapter 2.6.1 of this thesis is knowledge that is hidden in the mind or sub-conscious of an individual. Such knowledge is hard to codify or articulate because it is hidden in the routines, thoughts, ideas and experiences of the individual. Requirements on the other hand are thing that are needed or desired. In requirement engineering, a requirement is a functional need that a particular project, product or process must meet or perform. One of the objectives of this research is to investigate the different KC techniques that are used in capturing client's knowledge in form of requirements. Maalej and Thurimella (2013) state that certain knowledge emerge in the process of gathering requirements. Identifying this knowledge from requirements aims at externalising tacit knowledge such as is the rationale behind this research. Four respondents identified and mentioned that clients requirements are sometimes very difficult to codify because especially when the client find it difficult to articulate them. One of the four respondents ARCT002 stated that *"…eliciting requirements goes beyond asking the clients some questions about what they want, it's about understanding the needs of the client beyond what they are saying…"*

Another one of the five respondent stated that it is sometimes very difficult for architects to elicit the knowledge that emerge from clients requirements being that these requirements are sometimes hidden in the mind or thought of the client. Some client however, have only pictorial images of the type of house or building they desire in their minds and this could be a daunting task for the architect if he/she does not know how to use the right technique in engaging his/her client.

5.7 Theme 2- Factors influencing the client briefing process

A factor is a circumstance, fact, or influence that contributes to the result or outcome of a particular thing. Critical success factor (CSF) however, is an element that is required for an organisation or project to achieve its mission. In the context of this research, critical success factors are seen as drivers that enhance and contribute to the result of a thing. The participants were asked to identify some of the CSF's that influence or drive the briefing process to the realisation of its desired objective. The aim of this theme is to explore and investigate the likely parameters that makes the client briefing process achieve its desired objective which is to satisfy the client. The table below illustrates the number of sources and references generated in the process of analysing the theme.

Table 5.11: Factors influencing the CB process

Parent Node: Theme	No of Sources	No of Reference
Factors influencing the client briefing process.	5	58

Out of all the six participants interviewed, five of them identified and highlighted specific factors they have personally encountered in the course of their client briefing experience which has been noticed to drive the effectiveness of the client brief to meet its desired needs. The different factors mentioned in this section emerged from data in the process of analysing the transcribed interviews under theme 3. The aim of this objective is to investigate and explore the possible factors that can affect the client briefing process in the UK construction industry under the traditional procurement route for improved client satisfaction. Priority is however not given to private or commercial architects or any other type of architectural discipline but instead to the engagement that occur between architects and clients irrespective of the architects sector.

The table below shows the number of sources and references generated in the process of analysing the sub-theme (child nodes) under theme 2. The sub-themes are arranges in order of importance based on the responses of the interviewed participants. The sub-theme which is most mentioned by participants is given more importance than those with more references.

Table 5.12: Different factors influencing the CB process

Child node: Sub-theme	No of Sources	No of Reference
Type and Knowledge of the client you're dealing with	6	31
Relationship management	6	16
Background of architect	6	6
Trust	5	11
Knowledge and experience of the Architect	4	11
Legal requirements and regulations	2	2
Document the brief and sign it off	1	3

The following factors have been identified by the participants to drive and influence the CB process and they include;

a. Type and knowledge of the client you're dealing with

Another sub-theme factor that drives the client briefing process to achieving its desired goal is the type of client being engaged, the nature of the project and the knowledge of the client. As an architect, one of the fundamental requirements is to firstly access your client and understand what type of client you're dealing with. The client could be individuals with little knowledge of what they actually want which, in such cases, their brief will be very sketchy. As the architect, your responsibility is to help them develop and articulate their brief in order to make a business case. Whereas, when your client is a large organisation, there exist tendencies that they could be a little knowledgeable about the building process. They might already have the brief reasonably detailed, so it's the duty of the architect to go through the brief with the client ensuring that what the client wants is exactly what you understand it to be thereby making contributions along the process of brief development. The six respondents agreed that the type of client and their knowledge of the project greatly influence the overall client briefing process. Some clients are basically for profit only and do not invest more in the aesthetics of the building. Such clients place a lot of emphasis on factors such as time of delivery above others. ARCT001 stated that *"…some clients don't have any vision they just want profit so they just ask you (the architect) what you think is the best thing to do here…"*

The analysis also showed that there are some clients who already have the basic and working knowledge of the briefing process and document. These sets of clients have-ready the brief before approaching the architect. Some clients have an existing framework of brief development

which they adopt when about to embark on any form of project. The expertise and experience of the architect is needed in developing and carrying out the necessary designs based on the requirement documents. These types of clients are majorly large companies or businesses who already have a track record of such projects before. four of the respondent added that only a few of such clients exist in the construction industry, a large proportion of clients are those without prior knowledge of what the briefing process is and what is entailed in the process of capturing the client's needs. ARCT005 stated;

> *Some clients are highly informed they know exactly what they want, they come to you and they usually have a briefing document. If it's a big company or a big project, they usually would have done all of that work and research by themselves so they already have their briefing documents stating their needs and then you develop the design based on those requirements. However, a majority of clients that exist are those who either have inherited a site or they bought a site that they think it's great to do something about it. Usually these categories of people have a very small brief which is almost just an idea and then you have to help the client develop the brief*

Three of the six participants also stated that some clients are very formal or informal in their approach and it is good practice for the architect as a professional to mirror the perspective of the client. In the same way, if you place side by side a commercial client with vast years of experience in the construction briefing process in comparison to a private client, there are notable differences that emerge. Private client would naturally not put a great focus on health and safety, and often times do not see value for value in a product. On the flip side, the commercial client views this as essential and important because it impacts on the public outlook and status which builds on their reputation. It becomes evident that private clients often ask question such as "*do I really have to pay this...I was going to use this money to do this…*" displaying a different attitude to that of commercial clients.

b. Relationship management

Managing relationship between client and the architect has been identified as another factor that is vital to the successful delivery of the client needs. It involves a continuous level of engagement between the client and the architect with the aim to remove or break down the walls of misunderstanding and miscommunication. Relationship building fosters an environment where the client is able to trust the architect allowing the architect capture the vital and salient requirements of the client during the briefing process. Four out of the six respondents highlighted the need for architects to foster a working relationship with their clients. One of the

participants stated that *"…I would say a good relationship with your client helps to bring down the walls of misunderstanding…"*

All four respondents agreed that building a good relationship with the clients has afforded them the opportunity to capture the client's needs thereby advising the clients rightly. Some clients know what they want while others do not, establishing a relationship with the client gives the architect a solid understanding of who the client is and as a result can help to decode some of vital requirements of the client in the process. In addition, one of the respondents added that architects needs to act as a psychologist in most instances especially when the interest of the project is more than one person. In the case of couples or business partners, there could be cases of disagreements between partners as to what is required or needed and the client in such cases needs to act as the umpire to get the best out of the situation. Participant ARCT001 puts it better this way;

> *Well, I think sometimes we architects act as psychologists most of the time, because let's say, if the client comes to me by himself, and he's going to conduct the project by himself, that's fine because you're just dealing with one person. If you're dealing with a couple, you're dead. You have to be extremely careful about the things you say one to another because then they can clash in front of you and you wouldn't know what to say because it's their project, so I would say knowing your client well helps in capturing their requirements better*

Architects however need to invest a lot of their time aspiring to know their clients more by building a healthy relationship with them. This will afford the client the opportunity to open up to their architects allowing the architect to read and understand beyond the communicated needs of their client.

c. Background of architect

The background of the architect is an important factor to be considered in the journey of the client brief, which could be a barrier to the briefing process or a driver depending on the perspective it's been viewed from. In the context of this sub-theme, the background of the architect means and comprises of the different experience or expertise of the architect in dealing with different categories of stakeholders such as private clients, commercial clients, academic qualification and years of experience in chosen sector of architecture (example residential, commercial, interior design and so on). All six respondents highlighted at some point the impact the background of the architect might have on their ability to choose and engage with the client using the appropriate KC technique. One of the respondent ARCT003 stated that *"…in as much as the client brief is for the client, I can only engage and capture the requirements of the client to the extent to which my background allows me…"* The respondents agreed that the experience or knowledge of the

architect can affect goes a long way in determining the effectiveness of the architect in engaging the client. If an experienced private architect is asked to consult for a commercial project, the architect might deliver on the basis if the fundamental standards of architecture but might require more information and research in firstly establishing relationship and understanding the client as oppose an architect that already has a working background in dealing with private clients. The following section shows likely relationships that occur between the various themes in this section.

d. Trust

Five out of the six interviewed respondent identified trust as one of the major factors that contributes to the success of the capturing of clients requirements. Trust is one of the fundamental factors that drive the success of the briefing process between client and architect. When clients trust the architects, they are more likely to engage more freely and openly thereby allowing the architect control over the requirement capturing process. Clients will most likely do business again with an architect that they have tested and proven to be competent and effective. On the other hand, some clients will only give business to an architect that has been referred by someone they trust and they base their judgment of the architect on the trust of the referrer. The construction industry especially the traditional procurement route which largely involves the engagement between clients and architects, does not heavily base their business awareness on advertisement but rather on the quality of work delivered and referrals. ARCT001 but it better this way;

> *If the client trusts you, they usually will come to you. Working as an architect is often on a mouth to mouth basis, so if they like your work they come to your office and if they do not like your work they will never come to you because it's not really about pre-advertising although some people do. So when they come to you, usually they trust you either that you have been good in that particular kind of project before or you have actually done it before through your proven track records, then they could give you a trial*

One of the interviewed participants recalled a scenario where he worked on a project in a developing country outside the UK. He narrated that the client he worked with had so much trust and confidence in him that everything he said was ok by the client. This made the researcher probe a bit more on the basis of the level of trust by the client. It was discovered that the referee for the architect advised the client on the credibility and experience of the architect adding that the architects is a member of the RIBA with vast amount of experience in the UK construction industry. Analysing the context of the scenario shows that great value is placed on the **expertise, experience, qualification and profession** of the architect. In the quote of

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ARCT003, it is stated that *"…some clients hold architects in high regard making them trust the architect - whatever they say, they will go with it…"*

Three out of the four respondents who attested to trust as a pivotal factor to the briefing process added that since the client is investing a huge amount of money in the project, they is an expectation on the delivery of quality within budget and time from the architect. A client will most likely not invest a large sum into an architect who they do not believe has the qualification and expertise to deliver the job. ARCT003 stated that *"…clients are paying the architect a large quantity of money based on their expertise. To relieve the clients of worry and decision making, everything is done by the architect..."*

One of the respondent also added that for the client to have some level of trust in the architect, architects by necessity should strive to know and build a relationship with their clients, by so doing they remove or take down the barriers of communication that could potentially exist when engaging someone you are not familiar with.

e. Knowledge and experience of the Architect

Knowledge is a vital and important commodity for the success of any business, organisation or project. Some scholars believe that knowledge is developed when information is applied while other believe that knowledge is a collection of experience and (or) academic qualifications. Knowledge is one of the fundamental strategies used by organisations for competitive advantage, meaning the more an organisation is informed and manages their knowledge bank, the more likely they are to out sell their fellow competitors. The construction industry is however not excused from this truth, due to the high fragmented nature of the industry; knowledge is needed to be managed across the many sub-sections of the industry. In the traditional procurement route, before any project can be initiated by the client, the expertise of the architect is demanded in developing the client brief which could in retrospect affect the decision of the client. In the statement of one of the respondent ARCT002 *"…the knowledge of the architect can help the client in making quality decisions depending on what advice is given them. For example, certain laws affect certain types of structures in certain locations and without such knowledge, the client can lose money and this might affect the credibility of the architect…"*

On the flip side, ARCT004 had a counter opinion to this regards. The respondent stated that experience comes with its own bag of knowledge which overtime can help the architect in addressing certain situations that a fresh graduate might not be able to overcome. The participant added that; *"...young architects especially students and new graduates struggle with this two major and important*

factors; 1. They don't listen to the client because they assume they have all the knowledge and 2. They don't care about the client, they think the project is for them rather than for the client and then later they start to realise that it can't be about them…"

The architect needs to take time to research, carry out good feasibility studies, ground him/herself in his field of research, know the client very well, practice the art of listening, document every meeting facial or otherwise and adopt efficient KC methods that can be used in capturing the client's needs. Another respondent added that most architects often think they are designing for themselves though the background of the architect sometimes influence the way in which the architect designs but this does not erode the reality of the fact that it's the client that is going to be leaving in the building not the architect, therefore the client should be given major priority. Respondent ARCT003 in a statement during the interview stated that *"…The architect is highly respected for the knowledge they have, the experience they have, the education and the training, hence the client expects nothing less other than high level of expertise and professionalism in the dispatch of their duty…"*

All six participants agreed that the knowledge and experience of the architect plays an important role in the realisation of clients and capturing of the client needs. Four of the respondents particularly agreed that architects with good knowledge and experience of their discipline will most likely help the client in making well informed decisions. ARCT006 puts it this way *"…Also the knowledge of the architect can help the client in making quality decisions depending on what advice is given them. For example, certain laws affect certain types of structures in certain locations and without such knowledge, the client can lose money and this might affect the credibility of the architect leading to dissatisfied client…"*

It is however essential for the architect to be well grounded and vast in the knowledge of his/her discipline aiming to acquire more and more experience with the aim to help client capture and elicit their requirements and achieve the desired needs of their project. A lot of expectations is placed on the knowledge of the architect especially because the client might be paying a fortune for such services. Un-knowledgeable architects will most likely produce wrong briefing documents or designs as a result of lack of adequate knowledge needed to carry out their duty and this can lead to the client making wrong decisions based on the knowledge of the client causing the project to deliver abode budget or outside the agreed time. Knowledge can be gained through experience as well as formal and informal learning environments. Within the context of this research, knowledge acquisition by the architect is not solely based on experience only. One of the respondent added that a fresh graduate can be armed with the right knowledge necessary to engage with client and elicit their requirements properly while an architect with years of experience can be careless enough to miss the basic details thereby dissatisfying the client.

f. Legal and regulatory requirements

It is the responsibility of the municipal city council to make sure that architects abide by building regulations and codes of practice. This regulations requires that detailed drawings including itemised notes and specifications on how the building is to be built are meets the standard requirement. These drawings must identify the materials to be used and detail the construction's compliance with all relevant Building Regulations and any other statutory requirements (health and safety, disabled access etc.).

Two out of the six respondents emphasised the basic need for the architect to have the underpinning knowledge that guides building regulations. These regulations cover areas such as planning permissions, the type of building allowed in a particular area, the soil samples for the project, built up area or commercial area and so on. Respondent ARCT001 stated that;

> *There are certain requirements by regulation that you need to be fulfil. So you have to have a certain number of toilets for certain number of rooms, you have to have a certain area of rooms. You also need to understand what their financial constraints are, understand what the legal limitations are as regards to that brief, understand the zoning laws with regards to the site the brief is referring to…"*

These legal requirements and building regulations are essential to the realisation of the needs of the client because it allows the architect to properly advise his/her client on the direction to take regarding the briefing document being developed. Clients are able to make adequate and informed decisions as a result of the knowledge of the architect on what zoning laws exist with the potential to influence the overall delivery of the project.

g. Document the brief and sign it off

Of the entire six participants in the interview process, one of them addressed the need of signing off the brief document by the client before proceeding to construction phase. It is of necessity that everything discussed inform of requirements and needs must be put down in writing. Problems mostly occur when things are not properly documented and this also can lead to unsatisfied clients. The respondent puts it this way *"…You must document everything. You have to write the brief up, and it has to be signed off and approved by the client. Even if it is a discussion, send the client an email confirming the discussion. That is how you avoid problem and dissatisfied clients thereby maintaining your integrity as an architect…"*

Signing off the brief allows the client and the architect have agreed consent on the content of the requirement document, this make the client feel more secured in the hand of a professional and also helps the architect maintain integrity and professionalism.

5.8 Relationships between Themes

Certain relationships occur in the course of analyzing the themes generated from the interviews. Such themes have been noticed to have certain correlation and relationships with other themes. These relationships are highlighted in the next section.

5.8.1 Relationship between Factors, Barriers and Client satisfaction in relation to performance
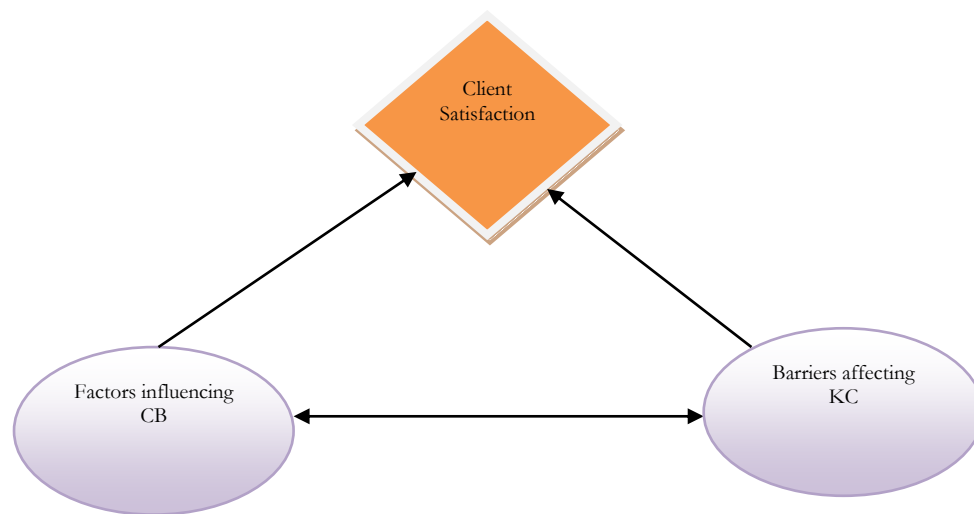
Figure 5.1: Relationships between factors, barriers and client satisfaction

The figure 5.1 above shows a relationship pattern between factors influencing the client briefing process and the barriers affecting the briefing process on client satisfaction. Six of the respondent who were interviewed agreed that certain barriers do challenge the authenticity of producing the brief despite the use of effective KC techniques. All six respondents mentioned during their interview that if the briefing process will deliver its desired objective which is to satisfy the client, then these barriers will have to be overcome. In addition, all six respondents after mentioning some of the factors or drivers that can aid the effective delivery of the client brief process stated that if these drivers are not given adequate attention, they mind end up becoming barriers which could impact the successful realization of the cline briefs objectives. One of the respondent ARCT004 stated that overcoming barriers and exploiting drivers can enable the architect to meet the demands and requirements of his/her client. For every client briefing process to meet its goals, adequate knowledge (lesson learned) of the potential barriers

that exist from previous projects and some factors that needs to be considered or given adequate attention such as relationship management needs to be taken into utmost consideration.

5.8.2 Relationship between KC techniques, First step in the briefing process and Client satisfaction
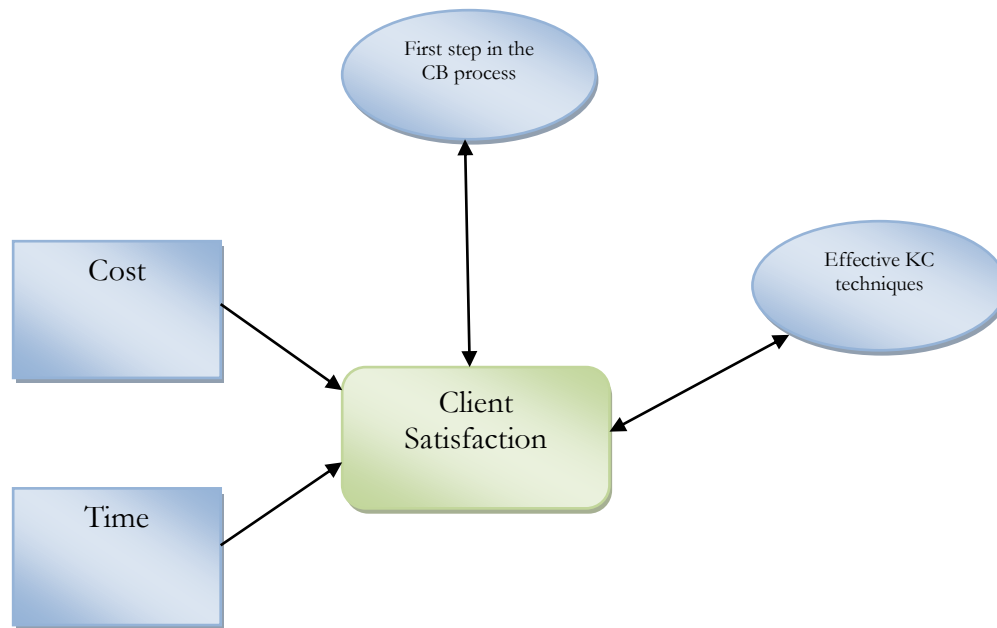
Figure 5.2: Relationship between KC techniques, client satisfaction the briefing process

The satisfaction of the client in the context of this research uses performance measures of cost of project and time of delivery to gauge customer's satisfaction quotient. Though satisfaction of the client is not only limited to cost and time but factors such as profit, product quality and service also contribute to client's satisfaction. However, this research limits the scope of the client satisfaction to performance driven factors of cost and time. ARCT001 stated during the interview that giving the initial stage (briefing stage) of the life cycle of the construction project thorough attention and time could lead to potential cost reduction and delivery within time frame. The figure above shows an associative relationship between client satisfaction and the first stage of the briefing process. ARCT005 in a statement during the interview process mentioned that having the right KC technique will to a great extent determine if the needs of the clients is captured accordingly. The figure 5.2 shows an association between the KC techniques and client satisfaction. Not capturing the knowledge that is created during the requirement

process can mean designing or building on a wrong template which could affect the time of delivery and cost of carrying out the project delivery thereby leading to unhappy clients based on the incompetence of the architect. Although the major themes and sub-themes alongside some emerging themes and sub-themes have been highlighted in the sections above, other emerging theme queried in the word frequency of the interview transcript have been presented in the word cloud below. The word cloud was chosen because it gives a clearer pictorial representation of the most words used by the respondents when investigating the different factors that influence the briefing process, the barriers that exist during the briefing process and the importance of using KC techniques during the briefing process.

Figure 5.3: Word cloud for the interview

During the analysis of the interview transcripts, some of the following lists of words were found to be more consistent throughout the process of the interview as shown in figure 5.3. Some other words listed might not have appeared as much as others but are considered important to the delivery of client satisfaction through KC techniques.

a) Client

b) Architect

c) Brief

d) Information

e) BIM

f) Knowledge

g) Requirements

h) Cost

i) Experience

j) Trust

These words represent the summary of the themes (both existing and emerging) in the qualitative analysis of the interview transcript of the respondents on KC in the client briefing process in the UK construction industry. In summary of this analysis, the issue of not having or using the right KC techniques during the client briefing process can affect the overall delivery of the brief which can mitigate against meeting the needs of the client thereby leading to unhappy clients. The model below summarizes the entire presentation for the interview transcript seeking to investigate the importance of KC techniques and how they help architects overcome barriers and drive factors in the use of KC techniques to the delivery of client's requirement for improved satisfaction in the UK construction industry. The client satisfaction is at the heart of this research and every other factor is associated with this.
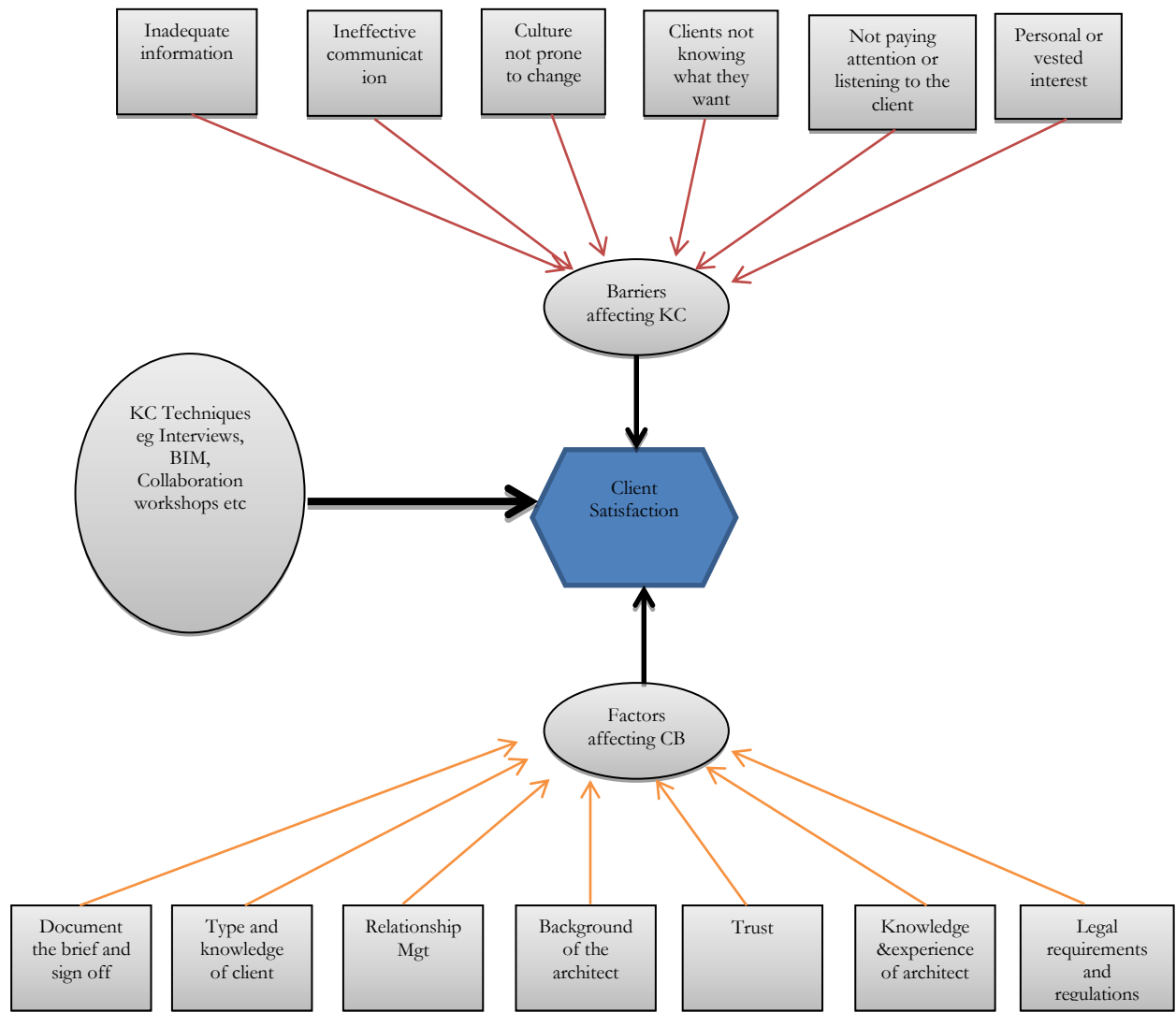
Figure 5.4: Relationship models between variables

The core and fundamental philosophy underpinning this research is the use of KC techniques in order to have happy clients. The central objective on which all other parameters add up to create is satisfaction of the client hence the reason why it has been centralized in the figure 5.4. All other themes; both the ones derived from the research objective and those that came up as emerging themes during the interview have are seen to contribute to the overall delivery of client satisfaction through the use of KC techniques.

5.9 Summary

This section has discussed interview conducted for the purpose of data collection for this research. Four main themes were explores and some others emerged in the course of the interview and this were analysed using the Nvivo 23 software which were then discussed in this

section. Findings developed from the interviewed participant's shows that KC during the client briefing process is fundamental to the success of construction projects, which eventually leads to client satisfaction. Some of the themes discussed include importance of the client briefing process which respondents have stated as the most crucial part of construction projects. It is believed that if the client briefing process is properly managed, the chances of a successful project delivery are inevitable. Another importance discussed is the role of KC which has been seen to be vital to the client briefing process and which can be used in the reduction of variations that could occur in construction projects. Another theme address is the various barriers that affect the KC process. Barriers such as inadequate information, ineffective communication, culture not prone to change have been identified by interview respondent as crucial to the success of KC in the briefing process. Other themes discussed include effective KC techniques are used in capturing or eliciting client's knowledge (requirements) during the briefing process. Some of the important techniques identified are interviews, sketching and diagram, Building Information Modelling (BIM) and so on, and finally factors that affect the CB process. Some of the important factors mentioned by the interviewed respondent include the type and knowledge of the client being engaged, relationship management, background of architect, trust and so on. The richness of qualitative data has assisted the researcher in gaining a fuller perspective on the use of KC techniques in capturing client's knowledge in form of requirements for improved client satisfaction. The next section shall discuss the analysis of quantitative data which will yield the generic industry data needed for the merging of data to draw conclusions for this research.

Chapter 6 – Quantitative Data Analysis

6.1 Introduction

This section seeks to discuss in-depth the quantitative data analysis conducted for this research. It begins with discussing questionnaire as method of quantitative data collection. The design of the questionnaire shall be explained, as well as the plan of investigation employed. The results of reliability test conducted will also be included in this section as well as the factor analysis of the factors tested in the course of this questionnaire. A detailed elaboration of the surveyed sample shall follow and the discussion continues to highlight the findings gained from quantitative data analysis, which was conducted with the aid of SPSS 23 software. The questionnaire sample is attached in Appendix 2. This section ends with a summary of key findings from the quantitative data analysis. The table below shows a description of the different test analysis conducted on the objectives used for the questionnaire analysis.

Table 6.1: Objectives and Data analysis tests

OBJECTIVES	PURPOSE	SPSS ANALYSIS
To explore and document the most effective and often used knowledge capturing techniques in client briefing in UK construction industry.	To identify the various KC techniques used in client briefing and also give room to emerging ones.	Cronbach Alpha Test Kendall W test
To identify core barriers to knowledge capturing during client briefing in UK construction industry.	To identify potential barriers to knowledge capturing during client briefing in UK construction industry.	Kendall W test Cronbach Alpha test Factor Analysis
To investigate important factors that influence Client briefing in the UK construction industry.	To investigate and test certain factors that can affect the client briefing process in the UK construction industry.	Kendall W test Cronbach Alpha Test Factor Analysis

6.2 Quantitative Data Collection – Questionnaire

The questionnaire used in this research was formulated based on three major objectives of this study. In general the questionnaire was divided into four main parts; the first part aims to understand the underlying profile of the respondent, the second part explored the factors that affect or influence the client briefing process in the construction industry, the third part addresses the effective KC techniques used in eliciting client requirements and the final part is designed to investigate the barriers that influence KC during the client briefing process in the UK construction industry. The nature of construction industries in the UK is the diverse workforce, fragmented nature of the industry which makes knowledge management challenging and also the large number of professionals at work. Interviewing all these professionals is beyond the researcher's capacity; therefore questionnaires were designed to reach an appropriate number of respondents for this research. The targeted sample for this research are professionals working in the construction industry, with major emphasis on the architectural discipline because this study takes the traditional procurement route which is majorly communication between clients and architects. The target samples for this questionnaire survey are architects who are over the age of 18 years and are working in the UK construction industry. A brief description of the research focus was attached to each questionnaire. The questionnaire employed for the use of this research has fulfilled all ethical requirements as passed by the University of Salford's ethical committee. In total, there were 230 questionnaires distributed with 100 completed responses returned. A database of Architects was used which was accessed through the referral of a fellow architect. All questionnaires are anonymised, as stated in the ethical requirement.

6.3 Questionnaire Design

The questionnaire is divided into 4 sections as follows:

a.   **Section I – Respondent profile**

The first section of the questionnaire focuses on the details of the respondent with 4 questions. These questions included are how many years of experience do you have an architect, the years of experience in the construction industry, the number of years in your current role and what type of architectural discipline they belong to. This section aims to gain a full description of the sample. This information is needed to investigate if there is any difference in opinion between

the various categories and types of architects in the UK construction industry as it pertains to factors, KC techniques and barriers.

b.   Section II – Knowledge Capturing (KC) Techniques

In this section the respondents are given questions to identify which KC technique is more effective when capturing client's requirements during the briefing process. A 5-point Likert scale was used where "1 represents not effective" to "5 representing Very effective". The aim of this section is to establish what KC technique can be recommended for capturing clients requirements effectively.

c.   Section III – Barriers to KC during the client briefing process in the UK construction industry.

Section IV questionnaire is designed to investigate the potential barriers that affect KC during the client briefing process in the UK construction industry. The questionnaire was designed to explore the experience of architects in relation to their understanding of the barriers that affect proper capturing of clients requirements during the briefing process. This was done using a 5-point Likert scale of "1 representing not important" to "5 representing very important". The findings in this section are crucial to provide a general knowledge of the barriers that affect KC during the briefing process in the UK construction industry.

d.   Section IV – Factor Influencing the Briefing Process in the UK construction Industry.

This section was designed to identify the respondents experience on a 5 Likert scale of "1 representing not important" to "5 representing very important", a series of questions relating to their experience and understanding of potential factors that could impact the briefing process in general. This section was further broken down into sub section in order to make it easy for the respondents and also to allow for better presentation. The sub-section includes areas such as Factors influencing the Client, factors affecting the briefing document, factors affecting the architect, factors affecting communication, factors affecting cost and time, and critical success factors. In total, there are 36 factors in this section.

To ensure the questionnaire is reliable in producing consistent results, a reliability test is conducted for the entire questionnaire in this research. The reliability test conducted is further explained in the preceding chapter. In addition to the reliability test using Cronbach alpha test, a factor analysis test was also conducted in order to decipher which factors are cogent to the delivery of quality briefing using KC techniques. Finally a Kendall w test was also carried out to

test for significance and effectiveness of some variables. All this test and analysis were carried out using SPSS 23 software tool.

6.4 Sampling Procedures

Considering the background of the research and the fact that accessing architects in this busy and fast paced country could pose a potential challenge, for this reason, the researcher has chosen an appropriate sampling method for this research which is the convenience and snowball sampling. Accordingly, Sekaran (2005) mentions that the convenience and snowball sampling method is preferred in situations where it is difficult to get response from sample elements selected at random and is suitable for an exploratory research. Browne (2005) highlights the importance of personal networks in this method of sampling. The non-probabilistic convenience sampling with snowball technique enables the researcher to gain initial respondents through personal networks and university alumni as well as through referral networks, and has made it possible for the researcher to obtain a reasonable number completed questionnaires for analysis. 220 questionnaires were distributed to practitioners who are representative of the population. Through the use of the abovementioned networks, 100 completed questionnaires were received. This number is a satisfactory and realistic figure considering the difficulty of the researcher in gaining access for surveys and interviews as the construction industry is a large industry with loads of busy professionals working in and out of cities. The previous sub-section has discussed the research instrument for quantitative data collection, as well as justification for the sampling methods adopted in this research. The next sub section will elaborate on the findings from the questionnaire, which is organized according to the sections in the questionnaire.

6.5 Findings from Questionnaire

6.5.1 Respondent Profile

Table 6.2: Respondents profile

Discipline of Architects	Total Number
Residential Architect	42%
Commercial Architect	39%
General Architect	3%
Education Architect	2%
Interior Design Architect	1%
Others	13%
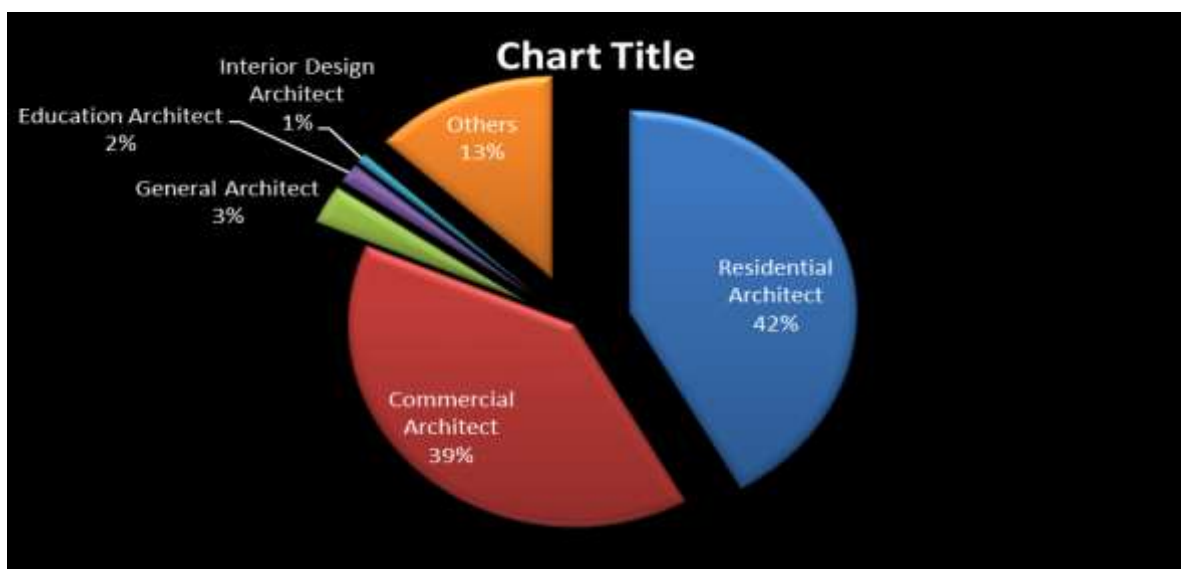
Figure 6.1: Pie chart showing discipline of respondents.

6.5.2 Number of Years in the Construction Industry

Table 6.3: Number of Years in the Construction Industry

	<5 Years	5-10 Years	10-20 Years	>20 Years	N/A
How many years of work experience do you have?	5.00%	19.00%	33.00%	43.00%	0.00%

It is important to understand in general the experience of respondents which can be determined by the number of years that the respondent has been working in the construction industry. This information may likely reflect any knowledge that they may have of Knowledge capturing in the client briefing process and how this impact on organisational performance in relation to satisfied clients in the UK construction industry. With this information, the relation between the knowledge of the architects and their working experience can be explored, to enable the researcher to gain a better understanding of the perspective of these architects in the UK construction. The figure below shows the detail experience of the respondents.

Most of the respondents in the survey have well over 10 years of working experience in general. The reason for this is because the questionnaire was targeted towards senior professional architects in the construction industry who have gained a vast amount of knowledge and experience in the architectural discipline hence the percentage of respondent with over 20 years of experience is 43%. Following immediately is those with years of working experience between 10 to 20 years which also hit a high percentage of 33%. The combination of both shows that well over half of the respondents have good working knowledge and experience of their discipline in which case their responses are vital to the success of this study.

6.5.3 Number of Years in Current Organisation

Table 6.4: Number of Years in Current Organisation

	<5 Years	5-10 Years	10-20 Years	>20 Years	N/A
How many years have you worked in your current company?	8.42%	22.11%	28.42%	37.89%	3.16%

Considering the fact that the major output of this study is to increase client satisfaction in the UK construction industry, it is only relevant and ideal to ask the respondent how long they have spent working as architects in their present organisation. This is necessary because the experience gained or relieved in the current organisation might impact on the choice of response given. For example, an architect who has recently started a role in a company will most likely have less experience of working in that organisation as oppose to one who has been there for over 10years. Also, the researcher feels that this information is crucial to see if there is any difference in the respondent's opinion in understanding the impact of knowledge capturing using KC techniques in the elicitation of client's requirements for improved performance in relation to

client satisfaction. The result shows that a good number of respondents with a percentage average of nearly 38% have been working in their current organisation for more than 20 years. Next to this are those who have worked for their organisation between 10-20years with an average of 28.42%, followed by an average of 22.11% for those between 5-10 years' experience and the least of the group are those with an average of 8.42% with years of experience below 5years.

An assumption could be made however, that since a considerable amount of the respondent have current experience in organisation above 10 years, then it might imply that the information supplied in the course of responding to the questionnaires could have a good amount of validity and relevance.

6.5.4 Number of Years as an Architect in the Construction Industry

Table 6.5: Number of Years as an Architect in the Construction Industry

	<5 Years–	5-10 Years–	10-20 Years–	>20 Years–	N/A–
How many years have you worked as an architect in the construction company?	23.33%	20.00%	14.44%	11.11%	31.11%

The aim of this question was to check if the overall years of work experience of the respondents is the same with their years of work experience in their current organisation. From the result displayed from the table, the not applicable (N/A) section hit a high return of 31% which signifies that most of the respondent's overall years of work experience and their years of experience in current organisations is similar.

6.6 Theme 1: Knowledge Capturing Techniques

The most effective knowledge capturing techniques used in the client briefing process represents techniques which have tendencies to create a more successful outcome when exploited.

Table 6.6: Knowledge capturing techniques

Objective	Item ID	Techniques	Questions
To explore and document the most effective and often used knowledge capturing techniques in client briefing in UK construction industry.	Q1	KC Techniques	Interviews
			Questionnaires
			Observation
			Storytelling
			Brainstorming
			Scenario analysis
			Collaboration
			Requirement workshops
			Facilitated workshops
			Request for proposals (RFP's)
			Prototype
			Sketches and Diagrams

Effective also means something which has the ability or power to make successful, or which actually does, produce an effect. This means that techniques which produce the desired results when used are classified as the most effective. These techniques are classified as important because they cannot be ignored when capturing client's requirements during the briefing process. These techniques are instrumental to the successful capturing of clients requirements from the architects perspective and are vital in engaging client during the briefing process. It is imperative to evaluate how effective these KC techniques are because these techniques are used in exploring the potential barriers and factors that affect the client briefing process in the UK construction industry.

6.6.1 Cronbach Alpha Test

Cronbach's alpha is most commonly used when you want to assess the internal consistency of a questionnaire (or survey) that is made up of multiple Likert-type scales and items. It is the most commonly used measure of reliability (i.e., internal consistency) originally derived by Kuder & Richardson (1937) for dichotomously scored data (0 or 1) and later generalized by Cronbach (1951) to account for any scoring method. People know that a high alpha is good, but it is important to have a deeper knowledge to use it properly. It is mostly used when the research being carried out has multiple-item measures of a concept (Tavakol and Dennick, 2011, How2Statsa, 2015). It is usually expressed as a number between .00 and 1.0 (Tavakol and Dennick, 2011, p.53) A value of .00 means no consistency in measurement while a value of 1.0 indicates perfect consistency in measurement (How2Statsb, 2015). The acceptable range is between 0.70 and 0.90 or higher depending on the type of research (How2Statsc, 2015). 0.70 is acceptable for exploratory research while 0.80 and 0.90 are acceptable for basic research and applied scenarios respectively (How2Statsc, 2015).

Table 6.7: Cronbach alpha test for KC techniques

RELIABILITY STATISTICS		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.822	.818	12

The table 6.7 is a representation of the reliability test for the knowledge capturing techniques identified in this analysis. In this case, after testing 12 items for knowledge capturing during the briefing process in the UK construction industry, the Cronbach alpha shows a score of $\alpha = .822$, which suggest high internal consistency and a reliable questionnaire.

Table 6.8: Item Statistics table for KC techniques

ITEM STATISTICS			
	Mean	**Std. Deviation**	**N**
Interviews	4.55	.827	100
Questionnaires	3.07	1.212	100
Observation	3.99	.966	100
Storytelling	3.48	1.107	100
Brainstorming	3.89	.953	100
Scenario analysis	3.63	.927	100
Collaboration	4.51	.665	100
Requirement workshops	3.88	.999	100
Facilitated workshops	3.73	1.070	100
Request for proposals (RFP's)	3.36	1.074	100
prototype	3.44	1.142	100
Sketches and Diagrams	4.71	.610	100

The table 6.8 gives the mean and standard deviations for each of the variables tested in the questionnaire. If all the items are tapping into the same concept, it is expected that the scores of the test variables are fairly similar. Items with scores a lot higher (or lower) than the others may need to be removed from the questionnaire to make it more reliable. From the analysis of the result presented in the item statistics table, 3 (sketches and diagrams, collaboration and interviews) out of the 12 test variables show high mean score above 4.5 while 2 (questionnaires and request for proposals) others shows mean scores below 3.5. In order to test these variables further, the researcher took into consideration the item-total statistics table below which can

really help to decide whether any items need to be removed. The two most important columns here are the: *Corrected Item - Total Correlation* column which helps the researcher determine how much each item correlates with the overall questionnaire score. Correlations less than r = .30 indicate that the item may not belong on the scale. Second, and more importantly, the researcher is interested in the final column in the table *Cronbach's Alpha if Item Deleted*. As the name suggests, this column gives you the Cronbach's alpha score you would get if you removed each item from the questionnaire. The current Cronbach alpha score is α = .822. If this score is affected by going down when and if an item is deleted, then such item will not be deleted, invariably, if the Cronbach score goes up after an item is deleted, the researcher might consider the option of deleting the item in order to make our questionnaire more reliable.

Table 6.9: Item-total statistics

ITEM-TOTAL STATISTICS					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Interviews	41.68	42.329	.337	.256	.819
Questionnaires	43.16	36.839	.566	.530	.801
Observation	42.24	39.671	.496	.501	.807
Storytelling	42.75	39.192	.449	.609	.812
Brainstorming	42.33	39.360	.533	.482	.804
Scenario analysis	42.60	38.378	.645	.496	.795
Collaboration	41.72	42.664	.406	.251	.815
Requirement workshops	42.35	38.824	.547	.698	.803
Facilitated workshops	42.49	37.740	.590	.699	.798
Request for proposals (RFP's)	42.87	39.441	.448	.352	.812
Prototype	42.79	38.792	.460	.403	.811
Sketches and Diagrams	41.52	44.631	.200	.182	.826

In the case of table 6.9, the only item below the 0.30 margin is the sketches and diagram technique, which also shows that deleting these variables will improve the Cronbach alpha score from the current 0.822 to 0.826. All the other tested variables will reduce the Cronbach score if deleted. In summary, a reliability analysis for perceived task values scale comprising 12 items was carried out on 12 knowledge capturing techniques used in capturing client's requirements during the client briefing process in the UK construction industry. Cronbach's alpha showed the questionnaire to reach acceptable reliability of α = 0.822. Most items appeared to be worthy of retention which if deleted might affect the Cronbach alpha score. The one exception to this is item 12 (sketches and diagrams), which would slightly increase the alpha to α = 0.826. Before

this item is removed or deleted, a further test is carried out to ascertain the need for deleting this technique. In order to strengthen the efficacy of the KC techniques already tested, the researcher will expose these KC techniques to a further test called the Cronbach alpha test.

6.6.2 Kendall W Coefficient Test

The Kendall coefficient of concordance (w) is applied to evaluate the level of agreement between the participant's responses using a 5-point Likert scale ranking. The purpose of using this method is to evaluate the most effective KC techniques used in capturing client's requirements. The effectiveness test is to allow the proposed framework identify those effective KC techniques needed to overcome the barriers to effectively capturing clients requirement, thereby leading to improved performance in relation to client satisfaction in the UK construction industry.
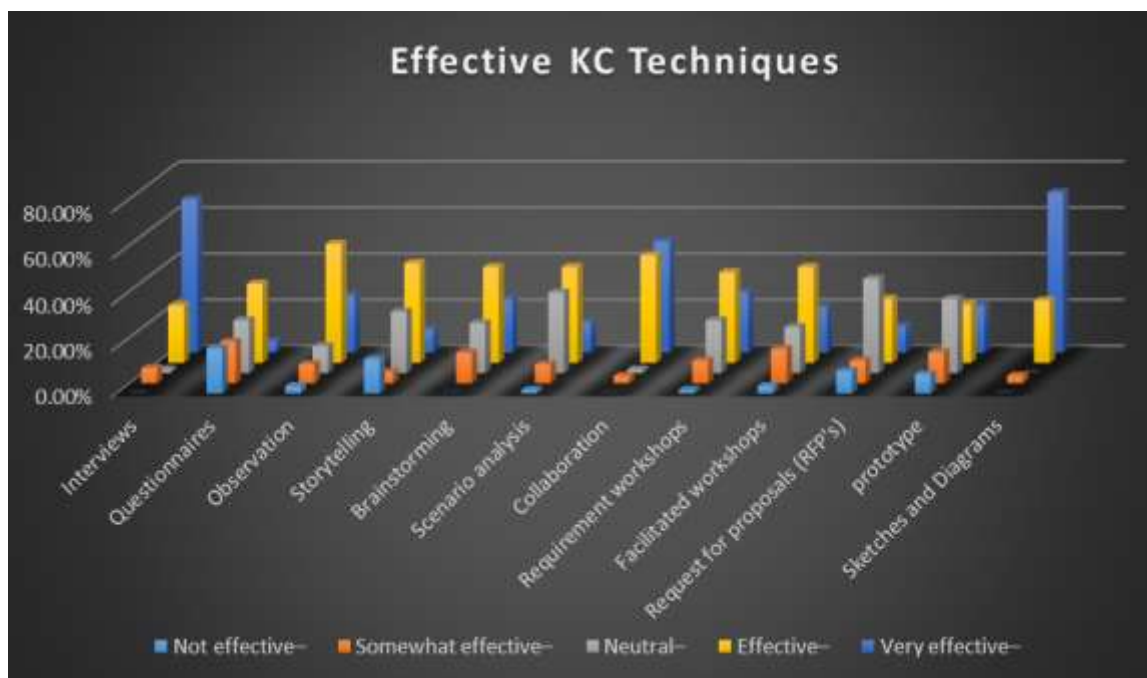
Figure 6.2: Effective KC techniques

The bar chart in figure 6.5 shows a descriptive chat of effective KC techniques analysed from the responses of 100 participants in descending order from most effective to less effective. The table shows ranges of techniques collated from 100 respondents on a 5-point Likert scale of *1- Not effective and 5- very effective*. The three topmost techniques identified as being very effective are the *Sketches and diagrams, Interviews* and *Collaboration techniques*. These results were further tested for effectiveness using the Kendall W test. The various KC techniques were majorly obtained from literature review and semi-structured interviews.

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The figure 6.6 is a representation of Kendall W test further carried out on the KC techniques of the questionnaire. The table 6.10 shows a degree of agreement of the descriptive statistics (figure 6.6) of the respondents from the questionnaire. From the Kendall W result, the technique with the highest mean value is the *use of sketches and diagrams* with a mean value of 9.52 followed by the *interview* technique with mean value of 9.03. The use of *collaborative methods for capturing client's requirements* ranks third with mean value of 8.76. *Observation* technique ranks fourth with mean value of 7.04 followed by *brainstorming* and *requirement workshops* ranking fifth with a mean value of 6.59. Other less effective techniques are *facilitated workshops, scenario analysis, storytelling, prototype* and *questionnaires* with mean values of 6.08, 5.41, 5.27, 5.11, 4.61 and 3.98 respectively.
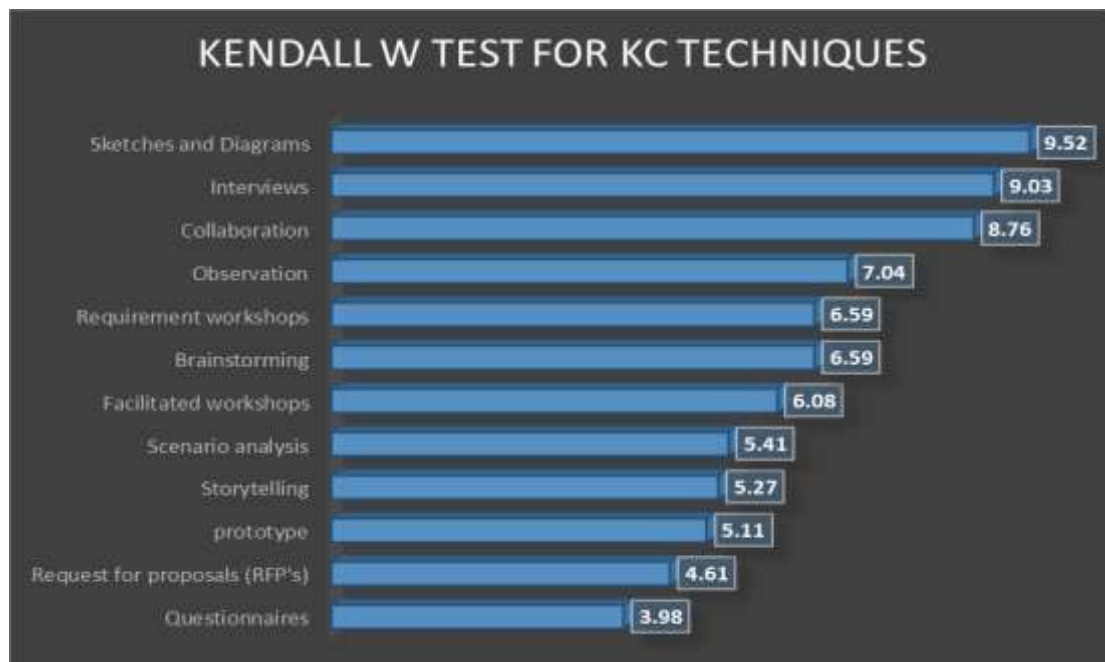
Figure 6.3: Effectiveness of KC Techniques

The Kendall W degree of agreement test score is given as 0.319. Kendall's W value is always between 0 and 1. 0 indicates that there is no agreement between the respondents, while 1 indicates perfect agreement (Pallant, 2009). The respondents' position on each of the KC techniques shows a weak agreement between the variables. This implies that the respondents have varying views regarding what method they see as most effective. Nonetheless, there is a significant association between the KC techniques based on the perspectives of 100 respondents. This is displayed via the asymp. Sig value which has to be less than 0.05 for it to be significant.

The asymp. Sig value for this test is 0.000 which shows a high significant association between the techniques.

Table 6.10: Kendall's W test for effectiveness of KC techniques

TEST STATISTICS	
N	100
Kendall's W[a]	.319
Chi-Square	262.955
Df	11
Asymp. Sig.	.000
a. Kendall's Coefficient of Concordance	

Cross referencing the Cronbach alpha score (section 6.6.1) of *Sketches and Diagrams techniques* with the Kendall W test (section 6.6.2) reveals sketches and diagrams as potential effective KC techniques. However, the disparity in the scores shown by the Cronbach test however, could be as a result of varying factors one of which could be the different architectural disciplines in the construction industry such as residential architects, commercial architects, interior design architects and so on. In this case however, the researcher will retain these techniques as it is too soon to conclude the removal of this technique and subject them to further test analysis to decipher their effectiveness in capturing or eliciting client's requirements during the briefing process.

6.7 Theme 2: Barriers to the KC Process

The aim of this theme is to identify the underlying barriers and enablers to knowledge capturing during the client briefing process in the UK construction industry. There are 17 questions under this objective aimed at identifying which barriers or enablers largely affect the KC process. The respondents have been asked at some point whether or not they have been involved in the client briefing process in the course of their professional journey. The essence of this question is to measure the viability and quality of the responses generated by the respondents. These barriers tested with the questionnaire are listed in table 6.11. The respondents are given instruction to select based on their level of experience or based on a preferred course of action on their understanding of barriers that affect KC techniques during client briefing using a 5-point Likert scale.

Table 6.11: Barriers to the KC process

Objective	Item ID	Objective	Questions
To identify barriers and enablers to knowledge capturing during client briefing in UK construction industry.	Q1	Barriers to KC in the briefing process	Inexperienced Clients
			Inadequate identification and representation of needs and requirements during the briefing process
			Unstructured approaches for knowledge capturing
			Misunderstanding and misinterpretation of client needs and requirements
			Communication gaps between client and architect
			Insufficient time given to the briefing process
			Lack of proper documentation and or changes
			Lack of proper participation of client in the briefing process
			Type of organisational culture
			Inadequate attention given to the wealth of techniques available
			Lack of process knowledge for capturing knowledge
			Trust
			Trying to capture too much
			Capturing knowledge that is not used
			Assuming one size fits all
			Knowledge of the architect
			Relationship

6.7.1 Frequency Distribution of Responses For Theme 2

The table 6.12 depicts the descriptive responses of the participants using a 5- point Likert scale to ascertain which barrier they consider most significant and which is considered less significant. The percentage of frequency distribution for the participant's responses is shown in the table 6.12.

Table 6.12: Frequency distribution of respondents for Barriers to KC

BARRIERS TESTED	Item No	Not significant–	Somewhat significant–	Neutral–	Significant–	Very significant–
Inexperienced Clients	1	8.33%	8.33%	25.00%	41.67%	16.67%
Inadequate identification and representation of needs and requirements during the briefing process	2		3.28%	13.11%	26.23%	57.38%
Unstructured approaches for knowledge capturing	3		6.67%	35.00%	38.33%	20.00%
Misunderstanding and misinterpretation of client needs and requirements	4		3.28%	8.20%	34.43%	54.10%
Communication gaps between client and architect	5		1.61%	8.06%	37.10%	53.23%
Insufficient time given to the briefing process	6		8.06%	9.68%	37.10%	45.16%
Lack of proper documentation and or changes	7		8.06%	9.68%	51.61%	30.65%
Lack of proper participation of client	8		4.84%	4.84%	43.55%	46.77%

in the briefing process						
Type of organisational culture	9	1.64%	18.03%	42.62%	31.15%	6.56%
Inadequate attention given to the wealth of techniques available	10	8.20%	11.48%	39.34%	34.43%	6.56%
Lack of process knowledge for capturing knowledge	11	10.00%	6.67%	41.67%	35.00%	6.67%
Trust	12		3.23%	12.90%	33.87%	50.00%
Trying to capture too much	13	11.48%	4.92%	57.38%	21.31%	4.92%
Capturing knowledge that is not used	14	14.75%	13.11%	50.82%	19.67%	1.64%
Assuming one size fits all	15	3.28%	8.20%	26.23%	32.79%	29.51%
Knowledge of the architect	16	4.84%		12.90%	41.94%	40.32%
Relationship	17	1.64%	1.64%	18.03%	32.79%	45.90%

From the frequency distribution table, the factor with the highest response rate of very significant is 57.38%, as a result, the researcher will only consider factors with responses >45% as more significant for this descriptive analysis. Based on the 5-point Likert scale, the barriers with response greater than 45% include*; Inadequate identification and representation of needs and requirements during the briefing process, Misunderstanding and misinterpretation of client needs and requirements, Communication gaps between client and architect, Trust, Relationship, Lack of proper participation of client in the briefing process* and *insufficient time given to the briefing process*. These are directly followed by *Lack of proper documentation and or changes with percentage score of 51.61%* under the significant column. *Trying to capture too much* and *capturing knowledge this is not used* hit high responses in the neutral category of 57.38% and 50.82% respectively. In order to further test the credibility of the responses, a Cronbach alpha reliability test, Kendall w coefficient of concordance test and a Factor analysis test is conducted.

6.7.2 Cronbach Alpha Test for Barriers to KC

This test is used to determine the reliability of all the barriers tested in the questionnaire. The morale behind using different statistical test methods is to cross analyse the various test results to see if the questionnaire items correlate in one way or the other. As earlier stated in page 9, Cronbach's alpha test is used when there is a need to assess the internal consistency of a questionnaire (or survey) that is made up of multiple Likert-type scales and items. It is the most

commonly used measure of reliability (i.e., internal consistency) originally derived by Kuder & Richardson (1937) which was later generalised by Cronbach (1951). Certain values are used to measure degree of consistency in the Cronbach alpha test. No consistency in measurement is represented by a value of 0.00 while a value of 1.0 indicates perfect consistency in measurement Cronbach (1951).

Table 6. 13: Cronbach Reliability statistics

RELIABILITY STATISTICS		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.886	.888	17

The table 6.13 shows the reliability statistics result conducted for 17 barriers that affect KC during the client briefing process in the UK construction industry. For a Cronbach test to gain high internal consistency, the Cronbach will have to be greater 0.7. The questionnaire was designed to test 17 barriers that are likely to affect KC during client briefing and in this case, the Cronbach alpha shows a score of $\alpha = .886$, which suggest high internal consistency and a reliable questionnaire

Table 6.14: Item Statistics for Barriers to KC

ITEM STATISTICS			
	Mean	Std. Deviation	N
Inexperienced Clients	3.61	1.114	100
Inadequate identification and representation of needs and requirements during the briefing process	4.43	.825	100
Unstructured approaches for knowledge capturing	3.80	.870	100
Misunderstanding and misinterpretation of client needs and requirements	4.47	.759	100
Communication gaps between client and architect	4.51	.685	100
Insufficient time given to the briefing process	4.32	.888	100
Lack of proper documentation and or changes	4.15	.833	100
Lack of proper participation of client in the briefing process	4.43	.756	100
Type of organisational culture	3.39	.899	100
Inadequate attention given to the wealth of techniques available	3.33	.991	100
Lack of process knowledge for capturing knowledge	3.33	.991	100
Trust	4.39	.804	100
Trying to capture too much	3.15	.954	100
Capturing knowledge that is not used	2.92	.941	100
Assuming one size fits all	3.91	1.042	100
Knowledge of the architect	4.24	.956	100
Relationship	4.29	.882	100

The item statistics table 6.14 gives the mean and standard deviations for each of the items tested in the questionnaire. It is assumed that if all the items are tapping into the same concept, it is expected that the scores of the items are fairly similar (Field 2005). The item statistics helps to identify factors or variables that need to be considered for removal if the internal consistency or reliability must remain high. Some variables with scores which are exceptionally higher or lower than the rest of the other variables may need to be removed from the questionnaire. The result represented in table xx shows that there is a high degree of consistency and reliability amongst most of the variables except item 14 (Capturing knowledge that is not used with score of 2.92) which is seen to have very low mean score compared to the other items. One might quickly conclude that such item should be removed from the list of factors immediately but before drawing on such conclusion, a look at the Item-total statistics might be helpful in reaching a final conclusion. The two most important columns here are the: *Corrected Item - Total Correlation* column which helps the researcher determine how much each item correlates with the overall questionnaire score. Correlations less than r = .30 indicate that the item may not belong on the scale. Second, and more importantly, the researcher is interested in the final column in the table *Cronbach's Alpha if Item Deleted*. As the name suggests, this column gives you the Cronbach's alpha score you would get if you removed each item from the questionnaire. The current Cronbach

alpha score is α = .886. If this score is affected by going down when and if an item is deleted, then such item will not be deleted, invariably, if the Cronbach score goes up after an item is deleted, the researcher might consider the option of deleting the item in order to make our questionnaire more reliable.

Table 6.15: Item-Total Statistics for Barriers to KC

ITEM-TOTAL STATISTICS					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Inexperienced Clients	63.04	72.444	.479	.483	.882
Inadequate identification and representation of needs and requirements during the briefing process	62.23	75.475	.462	.571	.882
Unstructured approaches for knowledge capturing	62.85	73.965	.538	.507	.879
Misunderstanding and misinterpretation of client needs and requirements	62.19	75.127	.537	.588	.879
Communication gaps between client and architect	62.15	75.181	.599	.624	.878
Insufficient time given to the briefing process	62.33	72.739	.610	.631	.876
Lack of proper documentation and or changes	62.51	74.280	.543	.570	.879
Lack of proper participation of client in the briefing process	62.23	76.502	.430	.561	.883
Type of organisational culture	63.27	72.360	.628	.652	.876
Inadequate attention given to the wealth of techniques available	63.32	71.788	.596	.745	.877
Lack of process knowledge for capturing knowledge	63.32	70.302	.691	.801	.873
Trust	62.27	75.631	.465	.468	.882
Trying to capture too much	63.51	74.172	.468	.576	.882
Capturing knowledge that is not used	63.73	74.225	.472	.485	.882
Assuming one size fits all	62.75	73.273	.472	.494	.882
Knowledge of the architect	62.41	74.219	.463	.531	.882
Relationship	62.36	73.639	.552	.541	.878

The Corrected Item-Total correlation on the Item-Total statistics table 6.15 shows that most of the items are between 0.45 and 0.69. measuring this against the Cronbach alpha item deleted section shows that there is a high measure of internal consistency and correlation between the overall variables tested, in which case we will not be removing or deleting any item from the list of questionnaires tested. In summary, a reliability test analysis for variables comprising 17 items was carried out on 17 barriers to KC during the client briefing process in the UK construction industry. The Cronbach's alpha score shows that the questionnaire reaches an acceptable reliability standard with score of α = 0.886. All the items appeared to be worthy of retention, which can lead to a decrease in the Cronbach score if deleted. The researcher conducted further analysis in order to arrange the tested items in order of importance or effectiveness.

6.7.3 Kendall W Coefficient Test for Barriers to KC

The Kendall coefficient of concordance (w) is used to evaluate the level of agreement between various variables. In this respect, it is used to identify the level of agreement between the barriers affecting KC during the client briefing process in the UK construction industry using a 5-point Likert scale ranking. The purpose of this method is to evaluate which barrier is ranked as most important in relation to how they affect KC during client briefing process. The figure 6.7 shows the different types of barriers that are likely to affect KC collated from 100 respondents on a 5-point Likert scale of 1 for Not effective and 5 for very effective.
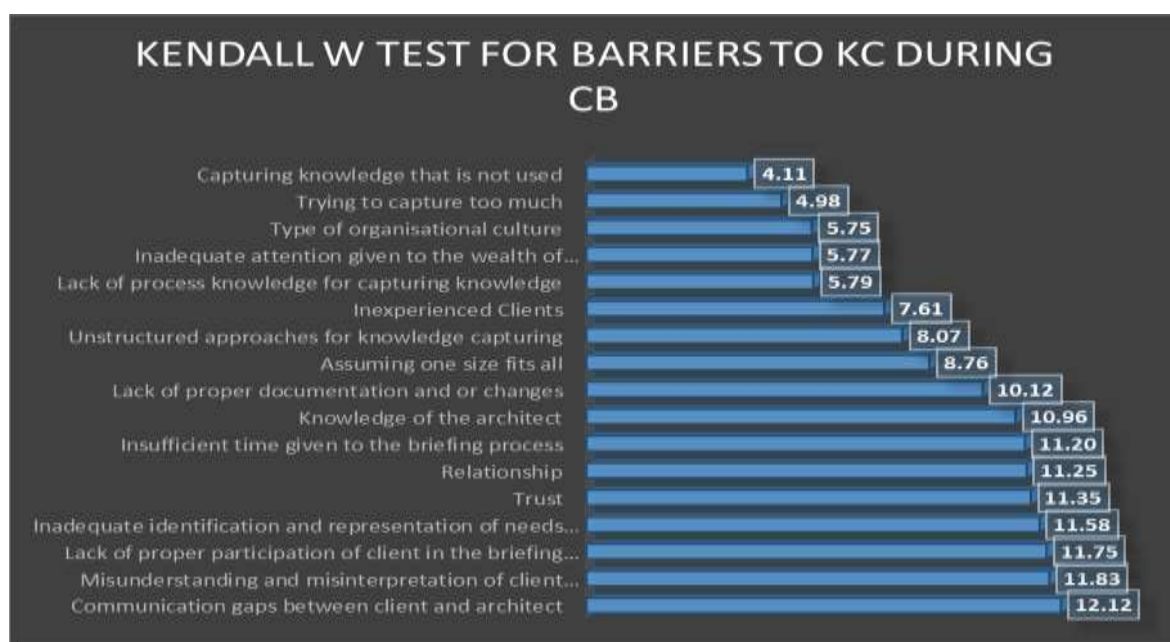
Figure 6.4: Barriers to KC during CB

From the analysed data using Kendall W, some of the results shows some measure of agreement with the frequency distribution statistics table of the barriers identified by the reponsents in the questionnaire. In ascending order from lowest to highets, barriers such as *Communication gaps between client and architect* shows a high return score of 12.12 toping the table in the list of barriers. Followed closely is *Misunderstanding and misrepresentation of clients requirements* as second most important barrier to consider, *Lack of proper participation of clients in the briefing process* coming third on list, *Inadequate identification and representation of client needs* coming in forth place, *Trust* in fifth place, *Relationships* sixth and *insufficient time given to the briefing process* comes seventh place with scores of 11.83, 11.75, 11.58, 11.35, 11.25 and 11.20 respectifuly.   The least important Kendall W score of barriers is *Capturing knowledge that is not used* and *trying to capturte too much* with scores of

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4.11 and 4.98 respectively. Cross referencing this with the cronbach alpha score in section 6.7.2 shows these two items as the least barriers as well. The Kendall's W degree of concordance is given as 0.394. Kendall's W value is always between 0 and 1. 0 indicates that there is no agreement between the respondents, while 1 indicates perfect agreement (Pallant, 2009). The position of each of the respondent on the various barriers tested using Kendall w show a weak agreement between the factors. This could imply that each respondent may have differing views or perspective to which barrier is most important. Such varying views could be as a result of years of experience as an architect or years of experience working in a particular discipline if architecture.

Table 6.16: Kendall Test statistics

TEST STATISTICS	
N	100
Kendall's W[a]	.394
Chi-Square	472.443
Df	16
Asymp. Sig.	.000
a. Kendall's Coefficient of Concordance	

Nevertheless, the Test Statistics show that there is a significant association between the barriers tested. This is displayed via the asymp. Sig. value which has to be less than 0.05 for it to be significant, and in this case the value is 0.000 which shows a very strong significance of the respondent and the technique used. The final test to be carried out on these items is the factor analysis test which helps the researcher to reduce the number of factors tested to the more important ones.

6.7.4 Factor Analysis for Barriers to KC

Factor analysis operates on the notion that measurable and observable variables can be reduced to fewer latent variables that share a common variance and are unobservable, which is known as reducing dimensionality (Bartholomew et al., 2011). These unobservable factors are not directly measured but are essentially hypothetical constructs that are used to represent variables (Cattell, 1973). Factor analysis attempts to identify underlying variables, or factors, that explain the pattern of correlations within a set of observed variables. Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of manifest variables. Factor analysis can also be used to generate

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hypotheses regarding causal mechanisms or to screen variables for subsequent analysis. Fiedel (2005) says that in general over 300 Respondents for sampling analysis is probably adequate. There is universal agreement that factor analysis is inappropriate when sample size is below 50. The table below shows a descriptive statistics of the mean, standard deviation and number of respondents of the items tested using factor analysis.

Table 6.17: Descriptive Statistics

DESCRIPTIVE STATISTICS				
	Mean	Std. Deviation	Analysis N	Missing N
Inexperienced Clients	3.61	1.114	100	0
Inadequate identification and representation of needs and requirements during the briefing process	4.43	.825	100	0
Unstructured approaches for knowledge capturing	3.80	.870	100	0
Misunderstanding and misinterpretation of client needs and requirements	4.47	.759	100	0
Communication gaps between client and architect	4.51	.685	100	0
Insufficient time given to the briefing process	4.32	.888	100	0
Lack of proper documentation and or changes	4.15	.833	100	0
Lack of proper participation of client in the briefing process	4.43	.756	100	0
Type of organisational culture	3.39	.899	100	0
Inadequate attention given to the wealth of techniques available	3.33	.991	100	0
Lack of process knowledge for capturing knowledge	3.33	.991	100	0
Trust	4.39	.804	100	0
Trying to capture too much	3.15	.954	100	0
Capturing knowledge that is not used	2.92	.941	100	0
Assuming one size fits all	3.91	1.042	100	0
Knowledge of the architect	4.24	.956	100	0
Relationship	4.29	.882	100	0

From the table 6.17, a close look at the mean score of all the variables tested shows that *communication gaps* with mean score of 4.51 tops the list of barriers that affect KC during the client briefing process. Variable such as *Misunderstanding and misrepresentation of clients' needs and requirements* with mean score of 4.47 follows closely behind in second place while *inadequate identification and representation of needs and requirements during the briefing process* and *lack of proper participation of client in the briefing process* fall in third place both having the same mean score of 4.43.

Other variables such as *Trust, Insufficient time given to the briefing process, relationship* and *knowledge of the architect* with mean score of 4.39, 4.32, 4.29 and 4.24 respectively also have mean scores above 4.00.

Table 6.18: KMO and Bartlett's Test

KMO AND BARTLETT'S TEST		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.762
Bartlett's Test of Sphericity	Approx. Chi-Square	604.655
	Df	136
	Sig.	.000

The table 6.18 shows the KMO and Barlett's test. The KMO is used to measures how adequate the sampling size is (which determines if the responses given with the sample are adequate or not). The KMO statistics varied between 0 and 1. Values of 0 indicate that the sum of partial correlation is large relative to the sum of correlation indicating diffusion in the pattern of correlation. Values closer to 1 indicate that patterns of correlation are relatively compact which shows that a factor analysis is ideal for such analysis. A KMO score of close to 0.5 shows a satisfactory factor analysis. Kaiser (1974) recommend 0.5 (value for KMO) as minimum (barely accepted), while values between 0.7-0.8 is good, values between 0.8-0.9 is great and values above 0.9 are superb. From the table above, the KMO measure is 0.762, showing that that the responses and sample size of the questionnaire using factor analysis is adequate and good enough for testing the barriers that affect KC during the client briefing process in the UK construction industry. Bartlett's test on the other hand tests the null hypothesis that the original correlation matrix is an identity matrix. This indicates that for factor analysis to be appropriate for use, there has to be some relationships between variables meaning that if the matrix was an identity matrix, then all the correlation coefficient between the variables is zero. The Bartlett's test shows a high degree of significance with sig score of 0.000 ($p<0.001$) which indicates that factor analysis is appropriate.

TOTAL VARIANCE EXPLAINED							
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	6.176	36.329	36.329	5.772	33.951	33.951	4.201
2	1.942	11.425	47.754	1.558	9.167	43.117	2.974
3	1.309	7.701	55.456	.909	5.344	48.462	3.349
4	1.222	7.190	62.645	.839	4.937	53.399	3.258
5	1.131	6.651	69.296	.711	4.180	57.579	3.137
6	.878	5.162	74.458				
7	.770	4.527	78.985				
8	.738	4.344	83.329				
9	.537	3.157	86.486				
10	.445	2.618	89.103				
11	.397	2.336	91.439				
12	.360	2.116	93.555				
13	.323	1.897	95.452				
14	.293	1.726	97.178				
15	.210	1.237	98.415				
16	.160	.940	99.355				
17	.110	.645	100.000				
Extraction Method: Principal Axis Factoring.							
a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.							

The Total Variance table 6.19 is divided into three sub-sections, i.e. Initial Eigen Values, Extracted Sums of Squared Loadings and Rotation of Sums of Squared Loadings. Eigenvalue actually reflects the number of extracted factors whose sum should be equal to number of items which are subjected to factor analysis. The table shows a list of factors (barriers) before extraction, after extraction and after rotation. Before extraction, SPSS has identified 17 items within the questionnaire tested. The eigenvalues associated with each factor represent the variance explained by that particular variable and SPSS also displays the eigenvalue in terms of the percentage of variance explained in which case item 1 explains 36.392% of total variance. The first few factors identified on the table show relatively large amounts of variance with item 1 leading the list with eigenvalue of 36.392% compared to the other items on the list. All the factors extracted are factors with eigenvalues greater than 1, leaving us with five factors. The eigenvalues associated with these variables are again displayed alongside the percentage of variance explained in the columns labelled *Extraction Sums of Squared Loadings*. It is noticed in the *extraction sum of loadings* section of the table that the values for the discarded factors are ignored hence, the table is blank after the fifth factor. The final part of the table labelled *Rotation Sums of Squared Loadings* shows the eigenvalues of the factors after rotation. Rotation has the effect of

optimizing the factor structure and this result in the five identified factors having a relative importance that is equalized. Before rotation, factor 1 accounted for considerably more variance than the remaining three (36.392% compared to 11.425, 7.701, 7.190, and 6.651%), however after extraction it accounts for only 33.951% of variance (compared to 9.167, 5.334, 4.937 and 4.180% respectively).
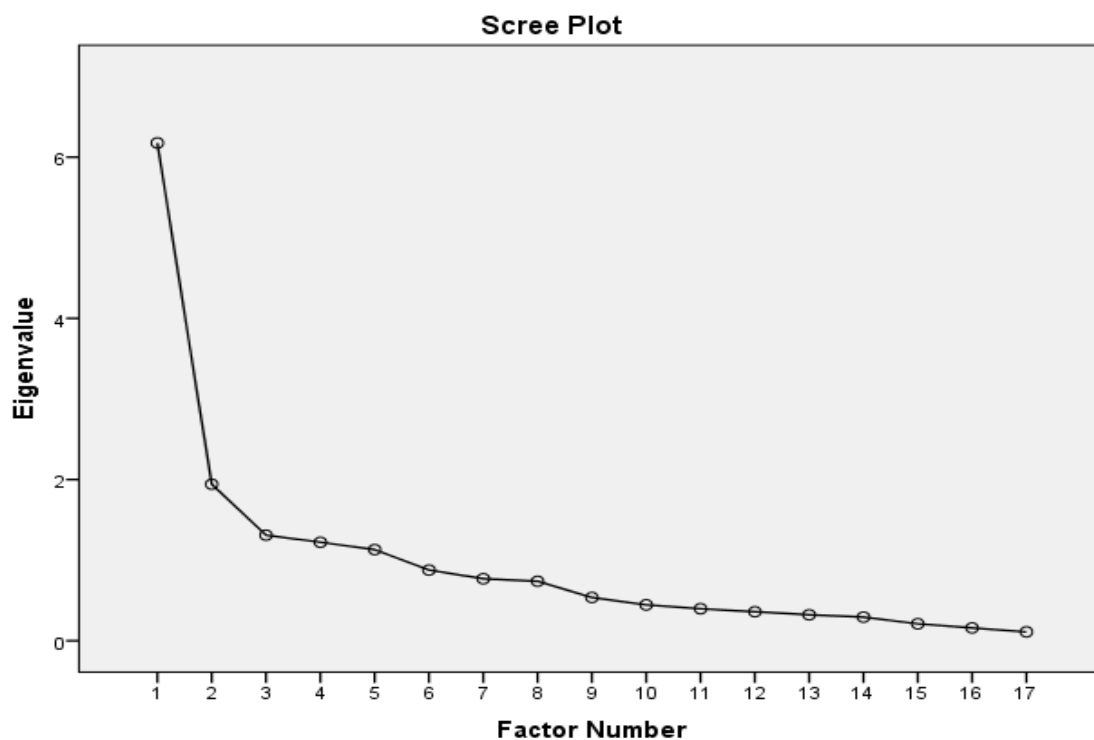
Figure 6.5: Scree plot of barriers to KC during CB

The scree plot is shown in figure 6.8 with an elbow shape indicating the point of inflexion on the curve. This curve is difficult to interpret because the curve begins to tail off after three factors, but there is another drop after five factors, then another after the eight factors before a stable plateau is reached. Therefore, we could probably justify retaining either three or five factors. If there are less than 30 variables and communalities after extraction are greater than 0.7 and the average communality is greater than 0.6 then it is safe to retain all factors with Eigen values above 1 (Kaiser's criterion) Field (2005). As a result, this test analysis carried out will retain the five factors extracted from the list of barriers affecting KC during the client briefing process in the UK construction industry. The table 6.20 shows the rotated pattern matrix which is a matrix of the factor loadings for each variable onto each factor. Factor loadings less than 0.3 have not been displayed because the software was setup to suppress loadings less than 0.30. It is seen that

before rotation most variables loaded highly onto the first factor and the remaining factors did not get high loading compared to the first. However, the pattern matrix has helped to make things a bit clearer considerably. Five component factors have been identified after extraction and some variables load very highly onto some components than others. The suppression of loadings less than 0.3 makes interpretation considerably easier which reduces the process of having to scan the matrix to identify substantive loadings.

Table 6.20: Pattern Matrix

PATTERN MATRIX[A]					
	Component				
	1	2	3	4	5
Communication gaps between client and architect	.787				
Inadequate identification and representation of needs and requirements during the briefing process	.729	-.344			.362
Misunderstanding and misinterpretation of client needs and requirements	.720				
Lack of proper participation of client in the briefing process	.795			-.364	
Type of organisational culture		.781			
Lack of proper documentation and or changes		.706			
Insufficient time given to the briefing process	.408	.447			
Relationship			.841		
Inexperienced Clients			.695		
Knowledge of the architect			.681		-.413
Inadequate attention given to the wealth of techniques available		.305		.542	
Trying to capture too much				.969	
Capturing knowledge that is not used				.776	
Lack of process knowledge for capturing knowledge			.349	.419	.405
Unstructured approaches for knowledge capturing		.373		.475	
Trust					.770
Assuming one size fits all					.659
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.					
a. Rotation converged in 9 iterations.					

In interpreting table 6.20, factor analysis suggests that values above 0.40 should be selected after any rotation is carried out and factors below this should be eliminated (Field 2005). The factors that load highly on barrier 1 are *Communication gaps between client and architect, Inadequate identification and representation of needs and requirements during the briefing process, Misunderstanding and misinterpretation of client needs and requirements, and lack of proper participation of client in the briefing process,* These factors are labelled **Lack of clients involvement in the briefing process**. The factors that load highly to the second barrier is *Type of organisational culture, Lack of proper documentation and or changes, and Insufficient time given to the briefing process,* these barriers are labelled**; A culture than does not encourages proper briefing**. The factors that load highly to barrier 3 are *relationship, knowledge of the architect and inexperienced clients*, these barrier are labelled; **inadequate relationship**

management. The factors that load highly on barrier 4 are *inadequate attention given to the wealth of techniques available, Trying to capture too much, Capturing knowledge that is not used, Lack of process knowledge for capturing knowledge and Unstructured approaches for knowledge capturing,* these factor are labelled; **Not adopting the right KC technique**. Finally, the factor that loads highly on barrier 5 are *trust and assuming one size fits all*, these barriers are labelled; **Not enough trust and flexibility.** This analysis has revealed that the initial 17 barriers tested in the questionnaire, in reality, is composed of five extracted barriers which are:

- *Lack of client's involvement in the briefing process*
- *A culture than does not encourages proper briefing*
- *Inadequate Relationship management*
- *Not adopting the right KC technique*
- *Not enough Trust and flexibility*

6.8 Theme 3: Factors Affecting the CB process

The aim of this theme is to explore and investigate the CSFs that affect the client briefing process in the UK construction industry. In total, there are 36 factors which are tested to see which ones are more important and which factors are retained after extraction. The questionnaire was designed to get a general understanding of architectural professionals on the underlying factors that influence the briefing process in the UK construction industry on a 5-point Likers scale of 1 for Not Important and 5 for Very Important. The table below shows the various sections of the factors tested in the questionnaire. These factors are analysed using the Cronbach Alpha test to check internal consistency and reliability of the questionnaire, Kendall W test to rank and group the factors in order of importance and factor analysis to extract which factors are retained after rotation.

Table 6.21: Factors influencing the CB process

Objective	Item ID	CSFs'		Questions
To investigate factors that influence proper Client briefing in the UK construction industry.	Q1	**Factors related to Owner**	1	Involvement of the owner in the client briefing process
			2	The architects level of experience with client briefing
			3	The owners level of experience with construction processes
	Q2	**Factor related to Architect**	1	How familiar the architect is with the design project
			2	How familiar the architect is with other construction projects
			3	Ability of the architect to comprehend the client requirements during briefing phase
			4	Ability of the architect to be able to conceptualize the client's requirement.
	Q3	**Factors related to the requirement doc**	1	Clarity of client requirements
			2	Establishing priority levels for various client requirements
			3	Future changes anticipated in the design process
			4	Signing off of the requirement document
	Q4	**Factors related to Communication**	1	Use of face to face communication method
			2	Frequent communication between client and architect
			3	Use of different methods to document and effectively communicate clients requirement e.g Sketches, requirement documents, Microsoft Word etc.
	Q5	**Factors related to Cost and Time**	1	Allocating enough time to the client briefing process
			2	Setting up measurable deadlines for producing the requirement documents
			3	Setting a clear budget for the whole project from the onset
			4	Changes in design requirements
			5	Adequate planning and proper briefing
			6	Fluctuations in the cost of building materials.
			7	Making sure specifications are not blown out of proportion
			8	Avoiding long waiting time for approval of drawings
			9	Preventing mistakes and discrepancies in requirement documents
			10	Economic factors
			11	Project characteristics e.g. type, size, complexity and duration of the project
	Q6	**Critical Success Factors**	1	Client representation
			2	Change management (creating tolerance for change request)
			3	Knowledge of the architect
			4	Analysing potential risk early
			5	Establishing critical success factors (CSF's) and Key performance indicators (KPI's) clearly.
			6	The nature and type of client and business
			7	Accurate decisions as a result of quality requirements
			8	Clear communication between client and architect
			9	Culture and ethics
			10	Knowledge of the client
			11	Experience of the Architect

6.8.1 Cronbach Alpha Test for Factors Affecting CB

Cronbach's alpha test is used when there is a need to assess the internal consistency of a questionnaire (or survey) that is made up of multiple Likert-type scales and items. Internal consistency describes the extent to which all the items in a test measure the same concept or construct and hence it is connected to the inter-relatedness of the items within the test. Testing for internal consistency before a test is employed helps the researcher to ensure validity of the questionnaire to be tested Moshen and Reg et al (2011). It is the most commonly used measure of reliability (i.e., internal consistency) which has certain values used to describe or measure the degree of consistency. No consistency in measurement is represented by a value of .0 while a value of 1 indicates perfect consistency in measurement Cronbach (1951).

Table 6.22: Reliability Statistics

RELIABILITY STATISTICS		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.924	.925	36

Table 6.22 shows a reliability test conducted for 36 factors affecting the client briefing process in the UK construction industry. For a Cronbach test to be said to have high internal consistency, the Cronbach alpha will need to have a score ≥ 0.7. In this instance, the Cronbach alpha shows a score of α = .924, which suggest a very high internal consistency amongst the variables tested as well as a reliable questionnaire.

Table 6.23: Item Statistics

ITEM STATISTICS			
	Mean	Std. Deviation	N
Involvement of the owner in the client briefing process	4.68	.549	100
The architects level of experience with client briefing	4.37	.653	100
The owners level of experience with construction processes	2.88	1.273	100
How familiar the architect is with the design project	4.44	.793	100
How familiar the architect is with other construction projects	3.96	.892	100
Ability of the architect to comprehend the client requirements during briefing phase	4.87	.342	100

Ability of the architect to be able to conceptualize the client's requirement.	4.65	.668	100
Clarity of client requirements	4.53	.684	100
Establishing priority levels for various client requirements	4.44	.663	100
Future changes anticipated in the design process	3.85	.954	100
Signing off of the requirement document	4.40	.771	100
Use of face to face communication method	4.69	.636	100
Frequent communication between client and architect	4.44	.620	100
Use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc.	4.35	.647	100
Allocating enough time to the client briefing process	4.57	.661	100
Setting up measurable deadlines for producing the requirement documents	4.19	.849	100
Setting a clear budget for the whole project from the onset	4.15	.783	100
Changes in design requirements	4.20	.735	100
Adequate planning and proper briefing	4.53	.622	100
Fluctuations in the cost of building materials.	3.12	1.013	100
Making sure specifications are not blown out of proportion	3.75	.974	100
Avoiding long waiting time for approval of drawings	3.49	1.095	100
Preventing mistakes and discrepancies in requirement documents	4.15	.865	100
Economic factors	3.79	.990	100
Project characteristics e.g. type, size, complexity and duration of the project	3.97	.958	100
Client representation	4.61	.733	100
Change management (creating tolerance for change request)	3.95	.884	100
Knowledge of the architect	4.31	.805	100
Analysing potential risk early	4.15	.817	100
Establishing critical success factors (CSF's) and Key performance indicators (KPI's) clearly.	3.75	1.104	100
The nature and type of client and business	3.93	.859	100
Accurate decisions as a result of quality requirements	3.97	.885	100
Clear communication between client and architect	4.83	.415	100
Culture and ethics	3.83	.921	100
Knowledge of the client	3.80	1.000	100
Experience of the Architect	4.48	.742	100

In the item statistics table above, two columns are presented to us, the mean and standard deviations columns. An assumption is made that if all the factors tested show similarity in underlying concept, then the test scores will most likely be fairly similar (Moshen and Reg et al, 2011). One of the characteristics of the item statistics is to enable the researcher identify items that might need to be considered for removal if the internal consistency or reliability must remain high. Some variables have scores which are exceptionally higher or lower than the rest of the other items and these factors might need to be removed if necessary. The result represented in table above shows that most of the items tested show a high degree of consistency and

reliability amongst most of the tested items with scores ranging from 3.50-4.90. Factor 3 which is *the owner's level of experience with construction processes* happens to have the lowest mean score with 2.88 amongst other items tested. Cross referencing this factor with the Kendall W coefficient test shows this item as one of the last 2 most un- important factors with scores as low as 7.76. Before considering this factor for removal, a look at the Item-Total statistics table might help generate a more informed decision whether to remove the item or not.

Table 6.24: Item-total Statistics

ITEM-TOTAL STATISTICS				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Involvement of the owner in the client briefing process	145.39	234.835	.315	.924
The architects level of experience with client briefing	145.69	232.324	.386	.923
The owners level of experience with construction processes	147.19	223.478	.403	.924
How familiar the architect is with the design project	145.63	230.129	.403	.923
How familiar the architect is with other construction projects	146.11	224.988	.548	.921
Ability of the architect to comprehend the client requirements during briefing phase	145.20	237.054	.310	.924
Ability of the architect to be able to conceptualize the client's requirement.	145.41	231.246	.431	.923
Clarity of client requirements	145.53	231.901	.387	.923
Establishing priority levels for various client requirements	145.63	230.102	.493	.922
Future changes anticipated in the design process	146.21	222.386	.602	.921
Signing off of the requirement document	145.67	228.036	.507	.922
Use of face to face communication method	145.37	232.967	.364	.923
Frequent communication between client and architect	145.63	231.129	.473	.922
Use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc.	145.72	229.339	.545	.922
Allocating enough time to the client briefing process	145.49	232.226	.386	.923
Setting up measurable deadlines for producing the requirement documents	145.88	227.810	.465	.922
Setting a clear budget for the whole project from the onset	145.92	229.831	.421	.923
Changes in design requirements	145.87	227.739	.548	.921
Adequate planning and proper briefing	145.53	230.279	.517	.922
Fluctuations in the cost of building materials.	146.95	219.970	.647	.920
Making sure specifications are not blown out of proportion	146.32	222.329	.591	.921
Avoiding long waiting time for approval of drawings	146.57	223.410	.484	.922
Preventing mistakes and discrepancies in requirement documents	145.92	225.129	.561	.921
Economic factors	146.28	221.880	.596	.921
Project characteristics e.g. type, size, complexity and duration of the project	146.09	227.978	.399	.923
Client representation	145.45	230.738	.411	.923
Change management (creating tolerance for change request)	146.12	225.026	.552	.921

Knowledge of the architect	145.76	224.428	.637	.920
Analysing potential risk early	145.92	225.804	.569	.921
Establishing critical success factors (CSF's) and Key performance indicators (KPI's) clearly.	146.32	221.356	.544	.922
The nature and type of client and business	146.13	228.117	.446	.923
Accurate decisions as a result of quality requirements	146.09	226.356	.500	.922
Clear communication between client and architect	145.24	236.698	.280	.924
Culture and ethics	146.24	225.158	.522	.922
Knowledge of the client	146.27	221.306	.610	.920
Experience of the Architect	145.59	225.948	.625	.921

The Item-Total Statistics table 6.24 presents us with two important columns: *Corrected Item - Total Correlation* column helps the researcher determine how much each item correlates with the overall questionnaire score. For the purpose of this test, Correlations less than r = .30 indicate that the item may not belong on the scale. The second and more important table is the *Cronbach's Alpha if Item deleted column*. As the name suggests, this column gives you the Cronbach's alpha score you would get if you removed each item from the questionnaire (Field 2005). The current Cronbach alpha score is α = .924. Any factor that would drastically increase the overall alpha score if removed might be considered for deletion in order to get a higher alpha score, consequently, if deletion of any factor will not affect increase the overall alpha score, the researcher might consider leaving the item. Cronbach's Alpha if Item Deleted column in the table above reveals a high degree of similarity in scores among all the tested factors. Deleting any factor will not necessarily increase the Cronbach alpha score showing a high measure of internal consistency and correlation between the items tested. This means that the researcher will retain all the tested factors in the questionnaire. In summary, a reliability test analysis for variables comprising 36 items was carried out on 36 factors affecting the client briefing process in the UK construction industry. The Cronbach's alpha score shows that the questionnaire reaches a high reliability standard with score of α = 0.924. All the 36 tested factors show internal consistency scores worthy of retention.

6.8.2 Kendall W Test for Factors Affecting CB

The Kendall coefficient of concordance (W) is often used in checking agreement levels between items tested using software such as SPSS as used by the researcher. For the purpose of this analysis, Kendall W was used to test 36 factors that influence or affect the client briefing process in the UK construction industry using a 5-point Likert scale of not important (1) to Very Important (5). The purpose of this method is to rank these factors that affect the client briefing process in order of importance showing us which factor should be given utmost attention. The

table xx below shows the descending order of importance of the 36 factors tested with 100 respondents on a 1-5 Likert scale of 1 for Not important and 5 for very important.
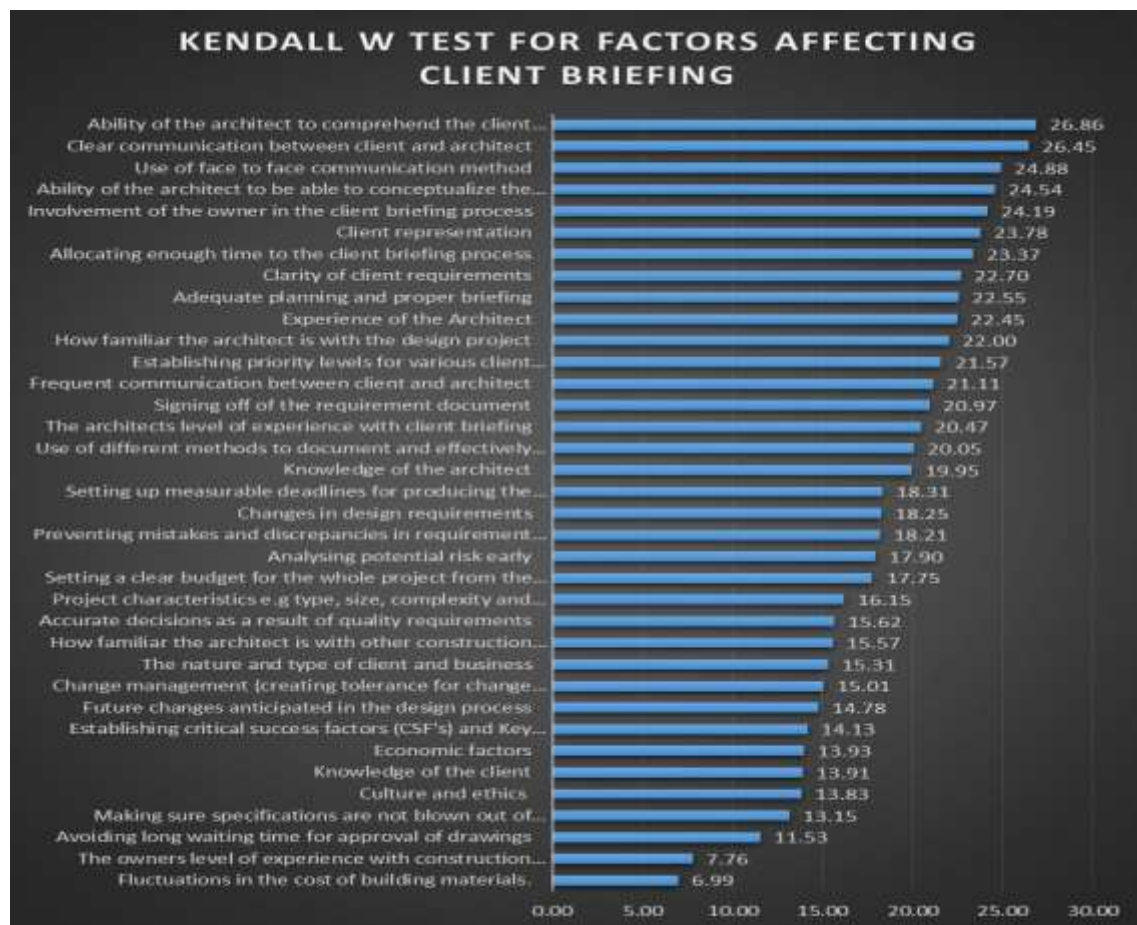
Figure 6.6: Factors affecting CB

From the analysed data using Kendall W in descending order, the factor identified as most important with the highests Kendall W coefficient of concordance is the *ability of the architect to comprehend the client requirment* with a score of 26.86. closely behind this with a score of 26.45 is *clear communication between the client and architect*. The *use of face to face communication* comes in third place with score of 24.88 followed by *the ability of the architect to conceptualise the client requirment* in forth place with score of 24.54. *Involvement of the owner in the briefing process* and *representation of the client* comes in fifth and sixth place with 24.19 and 23.78 scores respectively. The first 16 factors have been identified to have an average score above 20.00 compared to the rest of the other factors. The last 2 factors with the lowest scores below 10.00 are the *owners level of experience with the construction industry* and *flunctuation in the cost of building materials* with scores of 7.76 and 6.99 respectively.

Table 6.25: Kendall Test Statistics

TEST STATISTICS	
N	75
Kendall's W^a	.299
Chi-Square	784.413
Df	35
Asymp. Sig.	.000

Table 6.25 shows the Kendall's W degree of concordance as 0.299. The value of the Kendall's W coefficient of concordance ranges between the values of 0 and 1. 0 value indicates that there is no agreement between the respondents, while 1 indicates perfect agreement (Pallant, 2010). The score generated from the analysis shows a weak agreement between the factors tested using Kendall W. This could therefore mean that each of the respondents may have differing views or perspective to what factor is most important based on experience or knowledge. Another reason could be as a result of the diversity of background of the respondent especially in relation to their exposure to the client briefing process as well as the discipline of the architect. These factors are further tested using the Cronbach alpha method.

6.8.3 Factor Analysis for Factors Affecting CB

The table 6.26 presents us with the different factors tested in then questionnaire survey from 100 respondents. The questionnaire was tested using a 5-point Likert scale of 1. The Factor Analysis is an explorative analysis. Much like the cluster analysis grouping similar cases, the factor analysis group's similar variables into dimensions. This process is also called identifying latent variables. Factor Analysis reduces the information in a model by reducing the dimensions of the observations. It also operates on the notion that measurable and observable variables can be reduced to fewer latent variables that share a common variance and are unobservable, which is known as reducing dimensionality. Factor analysis can also be used to simplify the data, for example reducing the number of variables in predictive regression models (Bartholomew et al., 2011). The table below shows a descriptive statistics of the mean, standard deviation and number of respondents of the items tested using factor analysis.

Table 6.26: Descriptive Statistics

DESCRIPTIVE STATISTICS			
	Mean	Std. Deviation	Analysis N
Involvement of the owner in the client briefing process	4.68	.549	100
The architects level of experience with client briefing	4.37	.653	100
The owners level of experience with construction processes	2.88	1.273	100
How familiar the architect is with the design project	4.44	.793	100
How familiar the architect is with other construction projects	3.96	.892	100
Ability of the architect to comprehend the client requirements during briefing phase	4.87	.342	100
Ability of the architect to be able to conceptualize the client's requirement.	4.65	.668	100
Clarity of client requirements	4.53	.684	100
Establishing priority levels for various client requirements	4.44	.663	100
Future changes anticipated in the design process	3.85	.954	100
Signing off of the requirement document	4.40	.771	100
Use of face to face communication method	4.69	.636	100
Frequent communication between client and architect	4.44	.620	100
Use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc.	4.35	.647	100
Allocating enough time to the client briefing process	4.57	.661	100
Setting up measurable deadlines for producing the requirement documents	4.19	.849	100
Setting a clear budget for the whole project from the onset	4.15	.783	100
Changes in design requirements	4.20	.735	100
Adequate planning and proper briefing	4.53	.622	100
Fluctuations in the cost of building materials.	3.50	1.013	100
Making sure specifications are not blown out of proportion	3.75	.974	100
Avoiding long waiting time for approval of drawings	3.79	1.095	100
Preventing mistakes and discrepancies in requirement documents	4.15	.865	100
Economic factors	3.79	.990	100
Project characteristics e.g. type, size, complexity and duration of the project	3.97	.958	100
Client representation	4.61	.733	100
Change management (creating tolerance for change request)	3.95	.884	100
Knowledge of the architect	4.31	.805	100

Analysing potential risk early	4.15	.817	100
Establishing critical success factors (CSF's) and Key performance indicators (KPI's) clearly.	3.75	1.104	100
The nature and type of client and business	3.93	.859	100
Accurate decisions as a result of quality requirements	3.97	.885	100
Clear communication between client and architect	4.83	.415	100
Culture and ethics	3.83	.921	100
Knowledge of the client	3.80	1.000	100
Experience of the Architect	4.48	.742	100

The table 6.26 shows the descriptive result of the 36 factors tested using factor analysis. High mean scores indicate that such factors have significant importance based on the respondent's selection choices from the questionnaire. The factor with the highest score of 4.83 is *clear communication between client and architect* followed by *use of fact to face communication* with a mean score of 4.69. Most of the factors from the descriptive statistics table have an average mean score above 3.50 showing that most of the factors have high central tendencies when correlated amongst themselves. In contrast, the only factor with the lowest mean score is *the owner's level of experience with the construction processes* with a score of 2.88. This could mean that such factor is not heavily important based on the responses of 100 participants on a 5-point Likert scale of 1 for not important and 5 for most important.

Table 6.27: KMO and Bartlett's Test

KMO AND BARTLETT'S TEST		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.724
Bartlett's Test of Sphericity	Approx. Chi-Square	1426.717
	Df	630
	Sig.	.000

The KMO is used to measure the adequacy of the sampling size showing whether the responses given with the sample size is adequate or not. The KMO statistics varies between 0 and 1. Values close to 0 show that items might be insufficient for each factor. On the flip side, values closer to 1 indicate that patterns of correlation are relatively compact which shows that a factor analysis is ideal for such analysis. A KMO score of close to 0.5 shows a satisfactory factor analysis. Kaiser

(1974) recommend 0.5 (value for KMO) as minimum (barely accepted), while values between 0.7-0.8 is good, values between 0.8-0.9 is great and values above 0.9 are superb. The value for the KMO table is greater than .70 indicating sufficient items for each factor. Also, responses and sample size of the questionnaire using factor analysis is adequate for testing the factors that affect client briefing in the UK construction industry. Bartlett's test on the other hand tests the null hypothesis that the original correlation matrix is an identity matrix. The Bartlett test score is ($p<0.001$) showing high significance which indicate that the correlation matrix is significantly different from an identity matrix, in which correlations between variables are all zero.

Table 6.28: Total Variance Explained

TOTAL VARIANCE EXPLAINED						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.253	28.481	28.481	10.253	28.481	28.481
2	2.734	7.593	36.075	2.734	7.593	36.075
3	2.258	6.273	42.348	2.258	6.273	42.348
4	2.023	5.621	47.968	2.023	5.621	47.968
5	1.614	4.483	52.451	1.614	4.483	52.451
6	1.496	4.154	56.605	1.496	4.154	56.605
7	1.379	3.831	60.436	1.379	3.831	60.436
8	1.261	3.501	63.938	1.261	3.501	63.938
9	1.127	3.131	67.068	1.127	3.131	67.068
10	1.079	2.997	70.065	1.079	2.997	70.065
11	.942	2.617	72.682			
12	.871	2.418	75.101			
13	.815	2.263	77.364			
14	.803	2.232	79.596			
15	.796	2.210	81.806			
16	.646	1.795	83.601			
17	.593	1.648	85.249			
18	.588	1.632	86.881			
19	.520	1.444	88.325			
20	.504	1.401	89.726			
21	.463	1.285	91.010			
22	.425	1.182	92.192			
23	.377	1.047	93.239			
24	.369	1.026	94.266			
25	.311	.864	95.129			
26	.273	.758	95.887			
27	.251	.697	96.584			
28	.240	.667	97.251			
29	.189	.526	97.777			
30	.180	.500	98.278			
31	.148	.411	98.689			
32	.136	.377	99.066			
33	.102	.284	99.349			
34	.095	.263	99.612			
35	.074	.207	99.819			
36	.065	.181	100.000			
Extraction Method: Principal Component Analysis.						

The Total Variance table 6.28 has three important sub-sections, which are the Initial Eigen Values and Extracted Sums of Squared Loadings. Eigenvalue actually reflects the number of extracted factors whose sum should be equal to number of items which are subjected to factor analysis. Before extraction, 36 factors have been identified and tested using the factor analysis test. The eigenvalues associated with each factor represent the variance explained by that particular variable and SPSS also displays the eigenvalue in terms of the percentage of variance explained. The first few factors identified on the table show relatively large amounts of variance with item 1 leading the list with Eigenvalue of 28.481% whereas subsequent factors explain only small amounts of variance. The software was set to extract factors with eigenvalues greater than 1 which has then left the researcher with ten factors. The eigenvalues associated with these variables are again displayed alongside the percentage of variance explained in the columns labelled *Extraction Sums of Squared Loadings*. The blank part of the table shows factors that do not meet the 1.000 cut off point hence have been discarded from the table. Rotation has the effect of optimizing the factor structure which results in the identified factors having a relative importance that is equalized.
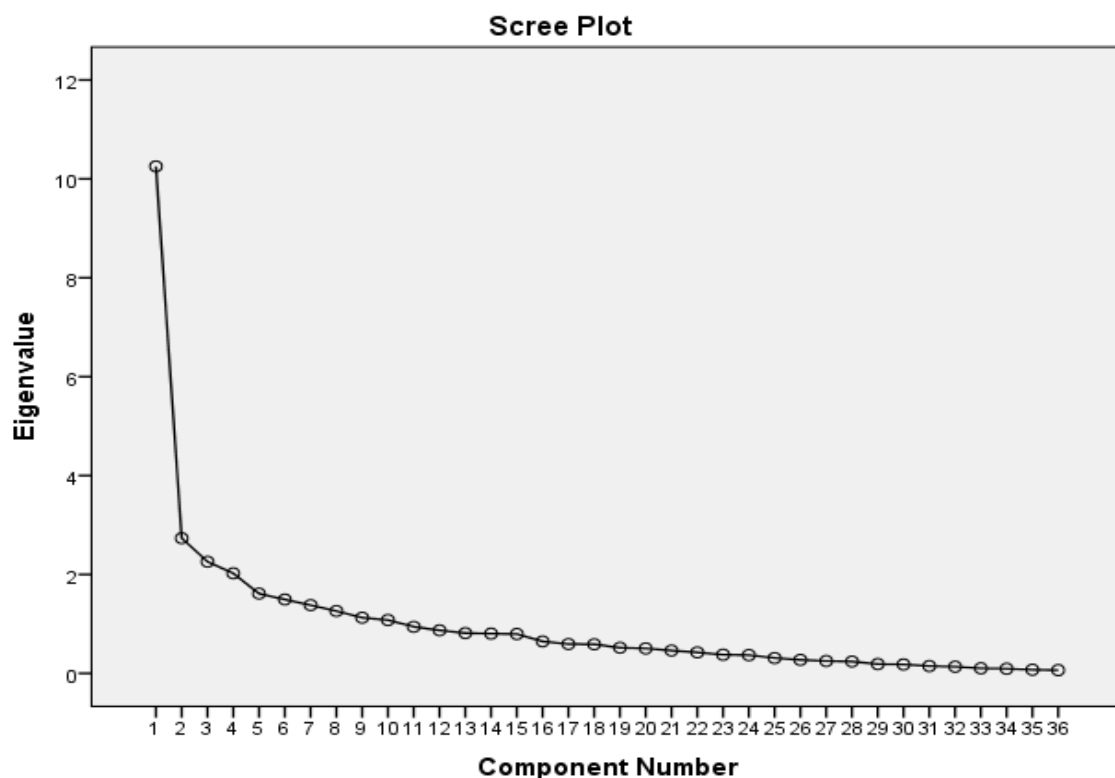

Figure 6.7: Scree plot for factors affecting CB

The scree plot is shown above with an elbow shape indicating the point of inflexion on the curve. There is a degree of difficulty in interpreting the curve because the curve has a major

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break point (elbow) at factor 2 which plateau afterwards and then drops again after factor 4 plateauing for another 6 factors then experiences a final drop and then a stable plateau is reached. Therefore, we could probably justify retaining either four or ten factors. If there are less than 30 variables and communalities after extraction are greater than 0.7 and the average communality is greater than 0.6 then it is safe to retain all factors with Eigen values above 1 (Kaiser's criterion) Field (2005). As a result, this test analysis will retain the ten factors extracted from the list of tested factors affecting the client briefing process in the UK construction industry. Loadings less than 0.3 have not been displayed because the software was setup to suppress loadings less than 0.30. However, the factor rotation matrix has helped to make things a bit clearer considerably. Table 6.30 shows a pattern matrix for the factor analysis tested for **25 general factors** *(such as factors relating to the architect, factors related to the requirement document, communication factors and cost and time factors)*.

The 36 factors were divided and analysed in two groups because rotation failed to converge after 25 iterations for the 36 factors. However, when the factors were tested in two groups, they converged at some point generating rotated pattern matrix and structure matrix. When the rotation is orthogonal (i.e. the factors are uncorrelated; orthogonal and uncorrelated are synonymous with centred variables), then the rotated factor matrix represents both the loadings and the correlations between the variables and factors. For oblique rotations, where the factors are allowed to correlate (oblimin or promax in SPSS), then the loadings and correlations are distinct. In this case the pattern matrix holds the loadings. Each row of the pattern matrix is essentially a regression equation where the standardized observed variable is expressed as a function of the factors. The loadings are the regression coefficients. The structure matrix holds the correlations between the variables and the factors. The pattern matrix also holds the beta weights to reproduce variable scores from factor scores (Thompson 2004). For the purpose of this analysis, the researcher will interpret and represent the factors using the pattern matrix. It is observed however, that analysing the factors in sections, (that is CSFs as one section and General factors as the other) generates a total of 12 factors as oppose to the initial 10 factors generated after rotation in the Total Variance explained table (table 6.25). Factor analysis suggests that values above .40 should be selected after any rotation is carried out and factors below this should be eliminated (Field 2005).

Table 6.29: Pattern Matrix for General Factors influencing the CB process

	PATTERN MATRIX^A							
	Factor							
	1	2	3	4	5	6	7	8
Project characteristics e.g. type, size, complexity and duration of the project	.714							
Economic factors	.601						.361	
Future changes anticipated in the design process	.567		.314					
How familiar the architect is with other construction projects	.443							
The owners level of experience with construction processes	.393				.329			
Setting up measurable deadlines for producing the requirement documents		.717						
Use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc.		.587						
Fluctuations in the cost of building materials.	.513	.573						
Signing off of the requirement document		.494						
How familiar the architect is with the design project		.482			.349			
Making sure specifications are not blown out of proportion	.377	.389						
Adequate planning and proper briefing			.643					
Establishing priority levels for various client requirements			.531					
Changes in design requirements	.333		.518					
Involvement of the owner in the client briefing process			.475			.405		
Allocating enough time to the client briefing process		.348	.411		.315			
Ability of the architect to be able to conceptualize the client's requirement.				.947				
Preventing mistakes and discrepancies in requirement documents				.442				
Use of face to face communication method					.679			
The architects level of experience with client briefing						.809		
Avoiding long waiting time for approval of drawings						.328		
Frequent communication between client and architect							.547	
Clarity of client requirements							.479	
Setting a clear budget for the whole project from the onset							.416	
Ability of the architect to comprehend the client requirements during briefing phase								.802
Extraction Method: Principal Axis Factoring. Rotation Method: Promax with Kaiser Normalization.								
a. Rotation converged in 16 iterations.								

From the 25 factors tested in table 6.29, 8 factors returned with eigenvalues above 1.000, however, after rotation, 3 factors highlighted in red loaded below the 0.400 value which then

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means these factors will then be deleted from the list of other factors and rotation is carried out again on the remaining factors. Table 6.30 shows the rotation of the remaining 22 factors and 7 factors fell below the 0.400 value which will then be deleted and rotation is made again.

Table 6.30: Pattern Matrix after rotation

PATTERN MATRIX^A						
	1	2	3	4	5	6
Establishing priority levels for various client requirements	.481					
Future changes anticipated in the design process	.570		.296			
Clarity of client requirements	.407					
Changes in design requirements	.435					.256
Involvement of the owner in the client briefing process	.258					
Adequate planning and proper briefing	.289	.256				
Frequent communication between client and architect	.222					-.198
Ability of the architect to comprehend the client requirements during briefing phase	.105					
Setting up measurable deadlines for producing the requirement documents		.751	-.285			
Signing off of the requirement document	.273	.510				
Use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc.		.458				
Allocating enough time to the client briefing process	.256	.260				
How familiar the architect is with other construction projects			.679	.305		
Use of face to face communication method			.419			
The architects level of experience with client briefing			.304			
Economic factors				.861		
Setting a clear budget for the whole project from the onset				.531		
Fluctuations in the cost of building materials.	-.335	.455		.584		
Ability of the architect to be able to conceptualize the client's requirement.					.506	
Preventing mistakes and discrepancies in requirement documents					.623	
How familiar the architect is with the design project		.304	.315		.316	
Project characteristics e.g. type, size, complexity and duration of the project						.929
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization. a. Rotation converged in 9 iterations.						

The remaining 15 factors were further subject to rotation and 2 factors were eliminated as shown in table 6.31.

Table 6.31: Matrix after rotation

PATTERN MATRIX^A					
	1	2	3	4	5
How familiar the architect is with the design project	.591			.250	
Setting up measurable deadlines for producing the requirement documents	.656				
Use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc.	.498				
Establishing priority levels for various client requirements		.482			
Future changes anticipated in the design process		.632		.355	
Clarity of client requirements		.424			
Changes in design requirements		.366			.339
Signing off of the requirement document	.319	.365			
Economic factors			.890		
Setting a clear budget for the whole project from the onset			.493		
Fluctuations in the cost of building materials.	.458		.631		
How familiar the architect is with other construction projects			.293	.628	
Use of face to face communication method				.403	
Project characteristics e.g. type, size, complexity and duration of the project					.878
Preventing mistakes and discrepancies in requirement documents	.326				.421
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.					
a. Rotation converged in 8 iterations.					

After deletion, 13 factors were retained and further subjected to another rotation in order to eliminate factors with values below 0.400 as shows in table 6.32.

Table 6.32: Matrix after rotation

PATTERN MATRIX^A				
	1	2	3	4
Economic factors	.803			
Project characteristics e.g. type, size, complexity and duration of the project	.790			
Fluctuations in the cost of building materials.	.679	.464		
Preventing mistakes and discrepancies in requirement documents	.506			
Setting a clear budget for the whole project from the onset	.366		.302	-.277
Setting up measurable deadlines for producing the requirement documents		.704		
Use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc.		.505		
How familiar the architect is with the design project		.508	-.244	.312
Clarity of client requirements			.468	
Future changes anticipated in the design process			.622	.410
Establishing priority levels for various client requirements			.432	.223
Use of face to face communication method				.417
How familiar the architect is with other construction projects				.543
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.				
a. Rotation converged in 11 iterations.				

After the deletion of the factor below the 0.400 value, the remaining 12 factors were further rotated and table 6.33 shows the result of the rotation.

Table 6.33: Matrix after rotation

PATTERN MATRIX^A			
	1	2	3
Project characteristics e.g. type, size, complexity and duration of the project	.875		
Economic factors	.699		
Fluctuations in the cost of building materials.	.614	.562	
How familiar the architect is with other construction projects	.436		.376
Preventing mistakes and discrepancies in requirement documents	.359	.316	
Setting up measurable deadlines for producing the requirement documents		.768	
Use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc.		.511	
How familiar the architect is with the design project		.499	
Future changes anticipated in the design process	.330		.711
Establishing priority levels for various client requirements			.475
Clarity of client requirements			.426
Use of face to face communication method			
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.			
a. Rotation converged in 6 iterations.			

After rotation of the 12 factors, 2 extra factors were deleted leaving us with a total of 10 factors, which were further subject to another rotation. After rotating the 10 factors, no other factors were found to be below the 0.400 value, hence all the remaining 10 factors were retained and grouped into 3 main factors namely;

Table 6.34: Final Pattern Matrix after several rotations

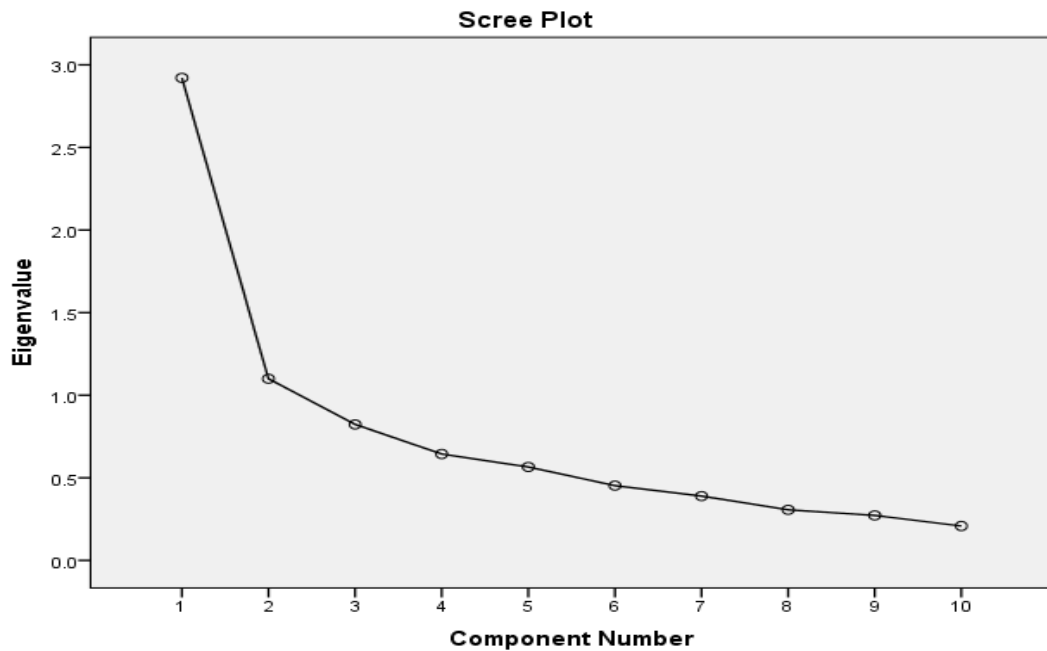| PATTERN MATRIX^A			
	1	2	3
Project characteristics e.g. type, size, complexity and duration of the project	.860		
Economic factors	.706		
Fluctuations in the cost of building materials.	.606	.592	
How familiar the architect is with other construction projects	.500		.291
Setting up measurable deadlines for producing the requirement documents		.771	
Use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc.		.518	
How familiar the architect is with the design project		.505	
Establishing priority levels for various client requirements			.466
Future changes anticipated in the design process	.415		.655
Clarity of client requirements			.443
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.			
a. Rotation converged in 6 iterations.			

Figure 6.8: Scree plot for the 25 factors affecting the CB process

The factors that load highly to factor 1 are *project characteristics e.g. type, size, complexity and duration of the project, economic factors, fluctuations in the cost of building materials and how familiar the architect is with other construction projects* and these are labelled **External Factors**. The factors that loaded highly to factor 2 are *setting up measurable deadlines for producing the requirement documents, use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc. and how familiar the architect is with the design project* and these are labelled **Management functions.** The factors that load well to factor 3 are *establishing priority levels for various client requirements, future changes anticipated in the design process and clarity of client requirements* and these will be labelled **Experience of architect in anticipating future changes through clarity of requirements.**

Table 6.35: Total Variance Explained for CSF's

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.181	38.006	38.006	3.768	34.251	34.251	3.071
2	1.243	11.298	49.304	.943	8.577	42.828	2.481
3	1.135	10.319	59.623	.733	6.664	49.492	2.530
4	1.033	9.388	69.011	.601	5.465	54.957	2.061
5	.876	7.963	76.973				
6	.667	6.061	83.034				
7	.555	5.042	88.076				
8	.476	4.326	92.402				
9	.377	3.425	95.828				
10	.251	2.281	98.108				
11	.208	1.892	100.000				

TOTAL VARIANCE EXPLAINED

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

The other section of the factor analysis (FA) is used in testing the remaining 11 CSFs in the questionnaire with responses form 100 participants, table 6.35 shows the total variance explained with focus on eigenvalues above 1.000. After rotation of 11 CSF's, table 6.36 shows the results of the rotation. After the first rotation, one factor was deleted as it was below the 0.400 value needed to qualify for retention after rotation.

Table 6.36: Pattern Matrix of CSF's

CSF PATTERN MATRIX[A]	Factor			
	1	2	3	4
Accurate decisions as a result of quality requirements	.702			
Culture and ethics	.647			
The nature and type of client and business	.576			
Clear communication between client and architect	.542			
Change management (creating tolerance for change request)	.428			.405
Experience of the Architect		1.008		
Knowledge of the architect		.527		
Knowledge of the client		.314		
Analysing potential risk early			.988	
Establishing critical success factors (CSF's) and Key performance indicators (KPI's) clearly.			.621	
Client representation				.894

Extraction Method: Principal Axis Factoring.
Rotation Method: Promax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

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After deletion, 10 factors were further rotated and table 6.37 shows the result of the rotation.

Table 6.37: Pattern Matrix of CSF's after rotation

PATTERN MATRIX[A]			
	1	2	3
Accurate decisions as a result of quality requirements	.747		
The nature and type of client and business	.680		
Culture and ethics	.529	.409	
Clear communication between client and architect	.203		
Change management (creating tolerance for change request)	.286		
Knowledge of the client		.917	
Client representation		.542	
Experience of the Architect		.384	
Establishing critical success factors (CSF's) and Key performance indicators (KPI's) clearly.			1.090
Analysing potential risk early			.588
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.			
a. Rotation converged in 4 iterations.			

Three factors were further deleted as shown in table 6.37 because they were below the threshold value for retaining factors which then leaves us with 7 factors in all. The 7 factors were further subjected to rotation as shown in table 6.38 and one factor was eliminated.

Table 6.38: Matrix after rotation

PATTERN MATRIX[A]		
	1	2
Culture and ethics	.811	
Knowledge of the client	.796	
The nature and type of client and business	.475	
Accurate decisions as a result of quality requirements	.471	
Client representation	.305	
Establishing critical success factors (CSF's) and Key performance indicators (KPI's) clearly.		1.085
Analysing potential risk early		.615
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.		
a. Rotation converged in 3 iterations.		

Table 6.39 depicts the final 5 factors that were retained after initial rotation of the 6 factors and these factors were grouped into two factors.

Table 6.39: Final Pattern Matrix of CSF's after several rotations

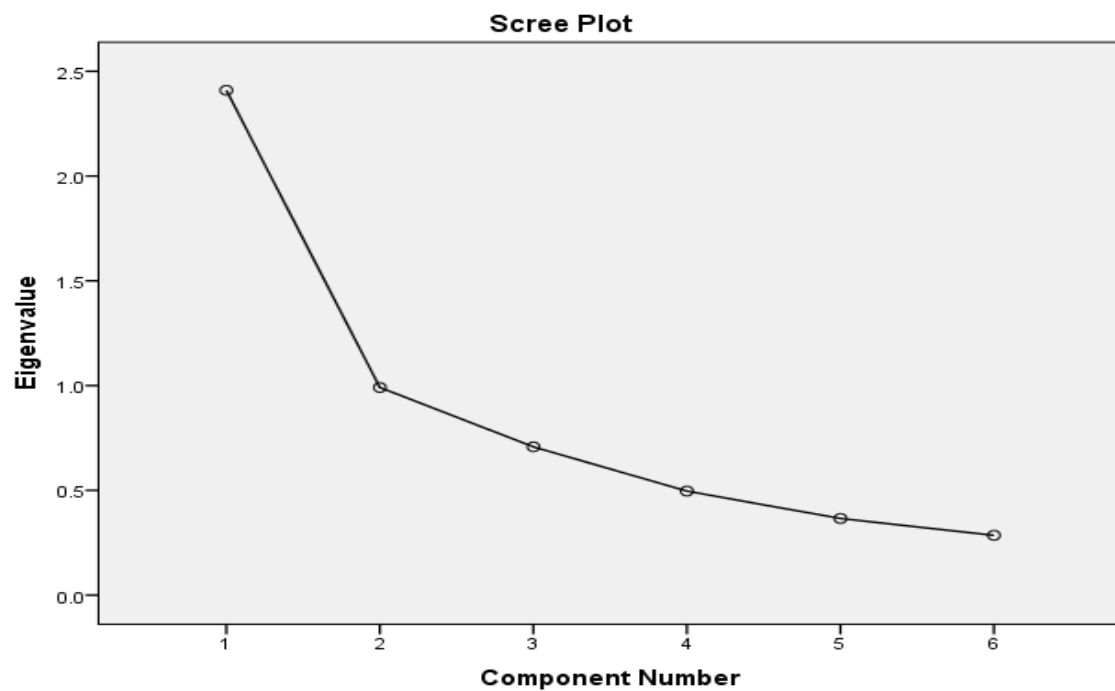| PATTERN MATRIX^A		
	1	2
Culture and ethics	.828	
Knowledge of the client	.742	
The nature and type of client and business	.522	
Accurate decisions as a result of quality requirements	.530	
Establishing critical success factors (CSF's) and Key performance indicators (KPI's) clearly.		1.084
Analysing potential risk early		
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.		
a. Rotation converged in 3 iterations.		

Figure 6.9: Scree plot for the CSF affecting the CB process

The factors that loaded more to factor 1 under the CSFs are *culture and ethics, knowledge of the client, the nature and type of client and business and accurate decisions as a result of quality requirements*, these factors are labelled **background of client and quality requirement**. The factors that loads highly to factor 2 are *establishing critical success factors (CSF's) and key performance indicators (KPI's) clearly and analysing potential risk early* and these factor will be labelled **organisational pro-activeness.**

6.9 SUMMARY

This section has discussed the questionnaire survey conducted for the purpose of data collection for this research. This section also includes the results for reliability testing for the various themes explored during the questionnaire survey. A detailed exploration of the results from the questionnaire survey was discussed in this section, and is organized into the 4 sections as included in the questionnaire itself. These initial quantitative findings is analysed with the aid of SPSS 23 software which has included descriptive frequency statistics, Cronbach alpha reliability test, factor analysis and Kendall Wallace test. Section I of the questionnaire determines the profile of the respondents who took part in the questionnaire survey. In total 100 surveys were completed and returned via an online survey platform, out of 230 surveys distributed. The respondents are specifically architects in the construction industry. Some of the criteria's for the respondents is that they must be architects, and are currently working in the UK construction industry. Section II of the questionnaire investigates the effective KC techniques used during the client briefing process. Statistical analysis was used in testing and ranking which KC technique is more effective, the test result was further subjected to a Kendall W test which identified KC techniques such as interviews, sketches and diagrams, collaboration and so on. Section III of the questionnaire seeks to understand and rank in order of importance the barriers that affect the KC process during CB. The Kendall W test was used for this ranking and the test result was further subjected to a factor analysis test where some of the factors were deleted because they fell below the minimum required threshold requirement score. Some of the barriers identified after the factor analysis results are lack of client's involvement in the briefing process, a culture than does not encourages proper briefing, inadequate relationship management and so on. Section IV of the questionnaire explores the general factors that affect the CB process which was divided into two section, one section addresses the general factors and the other section analyses the critical success factors. The factors were both analysed using the Kendal W test to rank which factors are most important for consideration and the results were then further analysed using factor analysis. Some of the factors generated in the final course of the analysis the general

factors and CSF's are external Factors, management functions, background of client and quality requirement and so on. From the quantitative data analysis, the researcher is able to explore the general views of architects regarding the use of KC techniques during the client briefing process for improved client satisfaction. The Cronbach alpha test carried out for each theme shows that the data obtained from the questionnaire survey is reliable, and recommendations and conclusions can be made by merging the questionnaire and interview findings which is discussed in the next chapter.

Chapter 7 – Discussion of Findings

7.1 Introduction

The chapters in this thesis have created the foundation needed for investigating and exploring the use of Knowledge capturing techniques in eliciting client's requirement during the client briefing process in the UK construction industry for improved client satisfaction. This chapter seeks to revisit and establish key findings from this study according to the initially established objectives and then draws conclusion from the entire study. The chapter begins by looking at the importance of KC in the client briefing process and then proceeded to discuss the important knowledge capturing techniques that affect or influence the client briefing process. The important techniques discussed in this chapter involves the combined analysis of data from literature, interview and questionnaire respondent and recommendation is provided on what KC techniques should be given priority while eliciting requirements during the briefing process. Furthermore, the chapter also discusses the salient barriers that affect KC during the client briefing process and the factors that influence the overall CB process. The following section will summarize the key findings from the literature review as well as the analysis of the investigation carried out by the researcher as they are presented in this thesis.

7.2 Discussion of Findings

Based on the objectives established in Chapter 1, the researcher has methodically set out to investigate and explore the use of knowledge capturing techniques to elicit client's requirements during the client briefing process for improved client satisfaction. The underlying foundation of this thesis began by reviewing the literature that describes what knowledge is, the concept of knowledge management, the various schools of thought that comprise knowledge management and knowledge management in the UK construction industry. The literature also explored the barriers and factors that affect KM in the construction industry as well as the impact it has on capturing client's requirements during the briefing process. This section will revisit and summarize the key findings from literature review and data collection conducted in this research, in the order of the research objectives.

7.3 Importance of Knowledge Capturing in Client briefing

Proposition 2: **The successful delivery of a construction project is dependent on adequate attention given to the knowledge capturing process.**

Construction excellence (2004) elucidate that good architects will go the extra mile in creating and meeting the needs of their clients based on the kind of building their client desires. Client satisfaction is at the heart of a good architect; however, not being able to determine what the client needs are makes delivery of the project task more difficult if not impossible. In such cases, the ability of the architect to capture or elicit the client's requirement using appropriate KC techniques will help meet the project objectives which lead to a satisfied client in the end. Using the right KC technique helps to minimise the likelihood of a client receiving an unsatisfactory building by ensuring that project requirements are fully explored, captured and communicated as clearly as possible. Whilst good briefing cannot guarantee that a building will be perfectly suited to its occupants, it can help avoid serious mistakes which could occur as a result of inadequate capturing of the clients requirements leading to increased cost of re-work and extended delivery time. Chapter 2 section 2.9.4 of the literature review identifies and highlights some of the importance of KC in the UK construction industry such as the capacity to reduce costs, increase speed of response as a result of better access to knowledge and application, improve quality of products and/or services, makes knowledge capturing effective as part of a major driver for innovation, help reduce defective designs, make the different images in the mind of the client transparent and decreases the variety of diverse imaginations, reduce cost of re-work and delayed time of delivery, improve client satisfaction, reduce tendency to 'repeat the same mistakes, better knowledge of client's requirements, stakeholder needs, customer needs, improve and strengthen relationship which will positively impact on the overall delivery of the project, less duplication of work, faster and better problem solving and more effective team working. The importance of KC in the construction industry highlighted from the literature is general to KC in the construction industry. These findings were cross-referenced with findings from the interview, which seeks to explore the importance of KC in the client briefing process in the UK construction industry. The following findings were gathered from six professional with over 19 years of experience in client briefing in the UK construction industry;

- ♦ KC at the briefing stage is the most important process of any construction project in the UK construction industry.

- ♦ Capturing client's requirements properly at the early stages of the briefing process can be the major difference between happy and unhappy clients meaning more of less business for the organisation providing the expertise.

- ♦ Using an effective KC technique eliminate unnecessary cost and allow the project deliver within the expected time constraint.

- ♦ KC helps the architect and client set clear and achievable project objective and goals.

- ♦ Effective KC can reduce numerous design changes by client, which are not originally covered in appointment agreement; this prevents unexpected consultancy fee, which was not initially budgeted by the client.

- ♦ Knowledge capturing helps the client in making proper and informed decisions.

In addition to the listed importance of KC, findings from interview also show that capturing of clients requirements during the client briefing process using KC techniques is vital for the competitiveness of an organisation which leads to improved client satisfaction. Section 3.5.3 of the literature review which mentions that for a project to meet its desired objective, the client must be given adequate attention in order to allow for proper elicitation of the clients requirements during the briefing process. This is important because when decisions are made for the project, they are made on the basis of quality information elicited from clients during the client briefing process, which then shows that KC is an essential part of the client briefing process if a project must meet its overall objective. Majority of the findings from the interview corroborates findings from literature as seen in section 2.9.4 however; one finding that emerged from the interview is the importance of the type of KC technique used during the client briefing process;

- ♦ Inability to use the appropriate KC technique in eliciting clients' requirements could have an effect on the overall delivery of the project output and outcomes, which could result in major design changes or impact the project deliverables. This shows that certain KC techniques are effective and essential to the capturing of clients requirements depending on the nature of project or type of client being engaged. It is therefore necessary that the architect identified what KC techniques are important and effective to the client briefing process in the UK construction industry before engaging the client in a briefing session. No client goes into a project with the desire to spend beyond budget and have a substandard project delivered at the end, which suggests that the adequate management

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of the KC process in the construction industry will annihilate the chances of defective deliverables and mitigate against design changes. The capturing process however, needs to be given adequate and special attention, as it is responsible for successful delivery of the project.

Wealth of KC techniques which has been identified in section 2.9.2 of this research has also been analysed and ranked in order of effectiveness in section 6.6. These findings augment the emergent finding from the interview, which stresses the importance of using KC techniques in capturing requirements from clients. The KC process is valueless if it does not engage the use of the right KC techniques during the briefing session, therefore, KC is important as highlighted in section 2.9.4 but more importantly, is the use of effective KC techniques in the process of capturing client's requirement/knowledge. The UK construction industry operates the RIBA (2013) plan of work for their construction processes. The RIBA plan of work is an 8 stage (0-7) process where every stage has its unique qualities and functionalities in contributing to the overall delivery of the project, which if overlooked or ignored could affect the quality of the deliverables at the end of the project. The client briefing stage, which is the first stage in the RIBA process where project objectives are developed, project budget is created and the needs and requirements of the clients are captured and documented. Findings from the interview establishes that once the foundational phase which is the first stage of the RIBA process is not well managed, the quality of document produced at this stage will be substandard which could lead to variations or change request thereby increasing budgeted cost or increased time of delivery. This agrees with literature in section 3.5.3 which states that the client briefing process is the most important process of the construction process, hence adequate time and effort with the use of the right KC technique most be exploited. The next section discusses the most effective KC techniques used in eliciting client's requirements during briefing.

7.4 Effective Knowledge Capturing Techniques

Proposition 1: **For every project to deliver according to client's expectation, effective KC techniques must be used during the client briefing process.**

Although previous studies have noted the impact of KC in the client briefing process, there seem to be lack of effort made in understanding the effectiveness and importance of the types of KC techniques used in eliciting client's requirements during the briefing process. Realizing this gap, the researcher aims to develop a framework that would help architects use effective KC

techniques to exploit positive factors and mitigate barriers in order to improve their client's satisfaction. This section describes findings from literature review exploring the concepts of various KC techniques that exist in the construction industry and triangulating this with findings from interview and questionnaire conducted by researcher in the UK construction industry. The notion behind KC in the global construction industry develops mainly from the need to improve client satisfaction by adequately capturing client's requirements in form of knowledge at the client briefing stage, which is the first stage in the RIBA process in the UK construction industry. Through adequate collaboration and communication between the architect and the client, certain issues relating to unsatisfied clients, cost of re-work and variation can be avoided.

Earlier on in the research, section 2.9.2 and 2.9.3 discusses the different types of KC techniques and KE techniques which exist in the construction industry. The review of literature shows that for any project to meet its desired objectives, which includes a standard level of quality, within budget and delivered within the scheduled time frame, it is important for such project to place emphasis on the foundational stage of the project, in which case is the briefing stage (RIBA, 2013). The literature has identified some KC techniques used in eliciting or capturing client's requirements during the briefing stage. These techniques include; Interviews, Observation, Questionnaires, Prototyping, Post project reviews (PPR), Scenario analysis, Group work, Brainstorming, Request for proposal (RFPs), Requirement workshops, Facilitated sessions and Collaboration. Section 2.9.3 further identified and discussed the different KE techniques. Knowledge capturing as defined by Barcerra- Fernandez (2004) is a combination of knowledge elicitation and knowledge representation. It is discovered that some of the KC and KE techniques are interrelated and similar in their functionality as discussed in section 2.9.2 and 2.9.3, owing to the fact that both techniques are used in capturing or eliciting tacit knowledge (requirement) which are then codified for ease of use. Some of the techniques that cut across both are interviews, questionnaires, workshops, and so on. This research has however, combined both techniques together to test using Kendall's W ranking of effectiveness which techniques are most effective in capturing or eliciting clients requirements during the briefing process. From the questionnaire survey in chapter 6 of this research, twelve (12) KC techniques identified in section 2.9.2 were ranked using Kendall w test for concordance to rank these techniques in order of importance based on 100 respondent's opinions. These techniques were ranked in order of importance from highest to lowest in relation to how effective these KC techniques are in the UK construction industry. The tested techniques are;

- ◆ **S&D**- Sketches and Diagrams

- ◆ **INT**- Interviews
- ◆ **COLL**- Collaboration
- ◆ **OBS**- Observation
- ◆ **REQWSP**- Requirement workshops
- ◆ **FACWSP**- Facilitated workshops
- ◆ **BS**- Brainstorming
- ◆ **SA**- Scenario analysis
- ◆ **ST**- Storytelling
- ◆ **PRT**- Prototype
- ◆ **RFP**- Request for proposals (RFP's)
- ◆ **QST**- Questionnaires.

From the ranking results of the questionnaire, sketches and diagrams, interviews and collaboration happen to be the techniques with the highest-ranking scores. These KC techniques are heavily characterised by interaction and face-to-face engagement in the process of capturing or eliciting requirements. Tacit knowledge, which is knowledge that is difficult to codify because of its ability to reside in the sub-conscious mind of the individual, which in this case is the client's minds, is mainly elicited through interaction, engagement and communication. These top 3 KC techniques ranked in section 6.6 as most effective in eliciting or capturing client's requirements during the briefing process are seen to involve high degree of face-face interaction and engagement with the client. Unlike explicit knowledge, which is knowledge that is written or represented graphically, clients requirement are mostly tacit (knowledge) in nature and most times clients find it difficult to express this hidden knowledge (requirement) to the architect in the best way possible. Architects however, who adopt the use of these KC techniques will be able to effectively elicit and capture the tacit knowledge (requirements) embedded in the mind of the client. The use of questionnaires on the other hand happen to be the technique with the lowest ranking and the reason for this is not farfetched, because this technique is majorly characterised by lack of engagement with the client at the point of capturing or eliciting requirements. This affirms that for the client briefing process to be effective, techniques, which involve high interaction with the clients, must be adopted as tacit knowledge is mostly decoded in a state of constant communication and interaction. The 12 KC techniques tested in the questionnaire centres on the use of non-IT KC techniques in capturing clients during the briefing process. Some of the non-IT KC techniques were highlighted in section 2.9.2. As part of

the questionnaire administered, options were given to respondents to identify other effective KC techniques used in eliciting client's requirements during the briefing process other than those mentioned in the questionnaire. The respondents further identified the following KC techniques as being effective in capturing client's requirements; Datasheets, 3D CAD visualisations and BIM. Although, this research work places focus on non-IT KC techniques, the emerging results from the questionnaire has identified and highlighted some IT KC techniques which are effective in capturing client's requirements.

Findings from the interview show an agreement with findings from the questionnaire. Most of the emergent findings from the questionnaire agree with KC techniques identified by the interviewed respondents. One major finding here is the agreement between the IT KC tools identified in the questionnaire and interview. Section 2.9.2 and 2.9.3 addresses the use and importance of IT KC/KE techniques in capturing or eliciting client requirements. Capturing tacit knowledge is heavily based on techniques that creates engagement and interaction between the client and architect, in which case most of the KC techniques identified in section 2.9.2 of the literature fall within this category of functionality, however, results from the findings have shown that IT KC tools are also effective in eliciting or capturing clients requirements within the UK construction industry. Three of the IT KC tools identified in the questionnaire emerging findings have strong correlation with those of the interview findings and these are BIM and 3D visualisations. Of all the IT tools highlighted from the findings, one of the IT tools identified as very effective by the interview respondents is the BIM. A good number of the interviewed respondent stated that that there is a huge benefit to the use of BIM (Building Information Modelling) in capturing client's requirement during the briefing which allows the architect to change and adjust requirements in a click. Building information modelling is can be said to be a collaborative tool (Salmon, 2009; Singh *et al,* 2011) which allows the client and architect to link their requirements to live data which enables the client to have a visual perspective of what the end product will look like (Salmon 2009). In addition to the use of BIM for knowledge capturing, the interview findings has also identified some additional techniques which are said to be effective in the KC process as shown in table 7.1, these include sketches and diagrams, interviews, collaboration, emails, brainstorming, 3D visuals (example InteriCAD). There exist an agreement between the interview findings and the rankings generated from the questionnaire as indicated by the yellow columns in table 7.1.

Table 7. 1: Correlation of Literature, Interview and Questionnaire findings on KC techniques

Findings from Literature		Findings from Interview		Findings from Questionnaire
S&D		**S&D**		**S&D**
INT		**INT**		INT
COLL		**COLL**		COLL
OBS		**BIM**		BIM
REQWSP		**BS**		3D Visualisation
FACWSP		3D Visualisation		
BS		Emails		
SA				
ST				
PRT				
RFP's				
QST				

Comparing the findings from questionnaire with those of the interview results shows a total of about 7 KC techniques used in capturing client's requirements in the UK construction industry. These are;

- ♦ **S&D**- Sketches and diagrams
- ♦ **BIM** – Building Information Modelling
- ♦ **INT**- Interviews
- ♦ **COLL**- Collaboration.
- ♦ **BS**- Brainstorming sessions
- ♦ AutoCAD, Interi CAD, 3D visuals
- ♦ Emails

Under the traditional procurement route in the UK construction industry on which this research ideology is underpinned, the communication between the architect and the client is vital to the success of any project, however, adequate attention and awareness has not been given to the wealth of techniques which are effective in eliciting or capturing client's requirements during the

client briefing process in the UK construction industry. The results of the interview and questionnaire alongside the literature have been able to help identify some KC techniques and technologies that are effective under the traditional procurement route in capturing client's requirements in the UK construction industry. Section 3.3.1 of the literature shows that the traditional procurement route does not focus on collaboration between other stakeholders involved in the client briefing process, rather it places emphasis on the interaction and communication that exist between the architect and the client. One emergent findings from the interview data analysis has revealed that there need to be a measure of involvement of other stakeholders such as the end users, project managers, contractors and so on in the client briefing process in order to allow a robust capturing of the clients requirement from various perspective, thereby allowing the project to have a stronger requirement document. A goof point to note however is that the rankings of the KC techniques as presented by the questionnaire does not negate the importance of other KC techniques, which can also be effective depending on the nature of project, type of client and the knowledge of the architect in the use of that particular KC technique. In summary, the findings from questionnaire and interview have enabled the researcher identify effective KC techniques as used in the UK construction industry and also IT KC techniques which are effective in the capturing of clients requirements. This shows that both Non-IT KC techniques and IT KC techniques are vital to the success of the client briefing process as identified from the questionnaire ranking and the interview findings. The next section discusses the barriers affecting KC during the client briefing process.

7.5 Barriers to KC Process

Proposition 3: **Certain barriers affect the efficacy of adequately capturing client's requirements during the briefing process.**

Barriers are challenges, issues or impediments that obstruct or disallow a certain process or event from achieving its desired objective. In the course of reviewing the literature, some authors have identified barriers that affect proper capturing or elicitation of client's requirements (knowledge) during the client briefing process and as a result, the researcher attempts to identify and highlight which key barriers affect KC during the client briefing process from the list of barriers identified in the literature. Section 2.9.5 and 2.9.6 of the literature has identifies certain barriers and challenges that affect KC during the client briefing process. Some of these barriers include; inexperienced Clients, inadequate identification and representation of needs and requirements during the briefing process, unstructured approaches for knowledge capturing, misunderstanding

and misinterpretation of client needs and requirements, communication gaps between client and architect and so on. Findings from questionnaire ranked these barriers from literature in order of importance from the most important barrier to the least important barrier in order to help architects focus on the barriers which requires more attention. Section 6.7.3 shows a table for the ranking result of the barriers gathered from 100 respondents. For ease of discussion, the ranking results have been subjected to code identification (ID) numbers used in representing most important to least important, the code ID used is BARR X, where X represents numbers from most important to least important and 1 represents most important.

1. **BARR 1**: Communication gaps between client and architect
2. **BARR 2**: Misunderstanding and misinterpretation of client needs and requirements
3. **BARR 3**: Lack of proper participation of client in the briefing process
4. **BARR 4**: Inadequate identification and representation of needs and requirements during the briefing process
5. **BARR 5**: Lack of Trust
6. **BARR 6**: Relationship
7. **BARR 7**: Insufficient time given to the briefing process
8. **BARR 8**: Knowledge of the architect
9. **BARR 9**: Lack of proper documentation and or changes
10. **BARR 10**: Assuming one size fits all
11. **BARR 11**: Unstructured approaches for knowledge capturing
12. **BARR 12**: Inexperienced Clients
13. **BARR 13**: Lack of process knowledge for capturing knowledge
14. **BARR 14**: Inadequate attention given to the wealth of techniques available
15. **BARR 15**: Type of organisation culture
16. **BARR 16**: Trying to capture too much
17. **BARR 17**: Capturing knowledge that is not used

From the ranking list generated from the questionnaire analysis in section 6.7, the researcher has identified the first 7 barriers as being very significant barriers to the KC process during client briefing. These barriers include communication gaps between client and architect, misunderstanding and misinterpretation of client needs and requirements, lack of proper participation of client in the briefing process, inadequate identification and representation of needs and requirements during the briefing process, lack of trust between client and architect, lack of a working relationship between client and architect and insufficient time given to the

briefing process. The first seven barriers were chosen as most important because they focus on the client as a major actor in the briefing which if not given adequate attention could impact on the overall delivery of the project outcomes. The barriers with the least scores include trying to capture too much than is needed, this could arise as a result of unclear project objectives and capturing knowledge that is not useful to the project. The knowledge and experience of the architect is another important barrier, which the researcher believes affects the KC process. Though its ranking is the 8th amongst other barriers, the knowledge and experience of the architect can influence the type of KC technique adopted during the client briefing process. The questionnaire participants were also asked to mention other barriers they know to affect KC during the client briefing process other than those mentioned in the questionnaire, additional findings from the questionnaire identifies the following barriers which were given code ID of BARR X where X represents numbers 1.1, 1.2 and so on. The following barriers were identified;

- **BARR 1.1**: Not tailoring approach to meet project objectives
- **BARR 1.2**: Lack of adequate knowledge of the architect
- **BARR 1.3**: Lack of working relationship between architect and client
- **BARR 1.4**: Lack of trust between client and architect
- **BARR 1.5**: Lack of client's participation in the briefing process

The additional findings from questionnaire show a correlation with findings identified in the literature. *BARR 1.1 agrees with BARR 10, BAR 1.2 agrees with BARR 8, BARR 1.3 shows a direct correlation with BARR 6, BARR 1.4 corroborates BARR 5 and BARR 1.5 agrees with BARR 3.* This result shows that BARR 1.3, 1.4 and 1.5 augment the first seven barriers of the ranking result generated in section 6.7 where the role of the client is given attention. Consequently, the ranking result generated by the questionnaire findings in section 6.7 was further subjected to factor analysis (FA) as reported in section 6.7.4. After rotation, no barrier was eliminated by the rotation test analysis, which means all the barriers identified from literature and analysed using the questionnaire are viable. Results from the FA however, grouped the 17 barriers based on contextual relationship into 5 groups namely; **BARR 1.1.1: Lack of client's involvement in the briefing process** (*communication gaps between client and architect, inadequate identification and representation of needs and requirements during the briefing process, misunderstanding and misinterpretation of client needs and requirements and lack of proper participation of client in the briefing process*); **BARR 1.1.2: A culture than does not encourages proper briefing** (*type of organisational culture, lack of proper documentation and or changes and insufficient time given to the briefing process*); **BARR 1.1.3: Inadequate Relationship management** (*relationship, Knowledge of the architect and Inexperienced clients*); **BARR**

1.1.4: Not adopting the right KC technique (*inadequate attention given to the wealth of techniques available, trying to capture too much, capturing knowledge that is not used and lack of process knowledge for capturing knowledge and unstructured approaches for knowledge capturing*); **BARR 1.1.5: Not enough Trust and flexibility** (*trust **and** assuming one size fits all*). In summary, the 5 groups are; **lack of client's involvement in the briefing process, a culture than does not encourage proper briefing, inadequate relationship management, not adopting the right KC technique and not enough trust and flexibility**.

These 5 barriers are the findings, which emerged from the 17 barriers tested and analysed through the use of the survey questionnaire. Findings from the interview in section 5.7 highlight some barriers that affect KC during the client briefing process. The barriers identified from the responses of 6 professional architects are listed as follows and assigned code ID INTBAR X, where X represents any number in no particular order;

    a) **INTBAR 1**: Inadequate information

    b) **INTBAR 2**: Client not knowing what they want.

    c) **INTBAR 3**: Not paying attention and listening to the client

    d) **INTBAR 4**: Ineffective Communication

    e) **INTBAR 5**: Inadequate knowledge and experience of Architect

    f) **INTBAR 6**: Change management

    g) **INTBAR 7**: Personal or vested Interest of the architect

The findings from the interview also correlate with findings from the literature and the FA results of the questionnaire. The table below shows the correlation between the interview and questionnaire findings;

Table 7. 2: Correlation of Questionnaire emergent findings and Interview findings

Questionnaire Emergent Findings	Interview Findings
BARR 1.1.1	**INTBAR 1** **INTBAR 3** **INTBAR 4**
BARR 1.1.3	**INTBAR 2** **INTBAR 5**

From the interview result, two (INTBAR 6 and 7) out of the seven barriers identified did not show any correlation with those of the literature and questionnaire analysis; these include change management and personal or vested Interest of the architect. Change is an essential commodity that cannot be over emphasised in the KC process. We cannot completely eliminate change but change can be exploited or controlled in order to reduce or eliminate the chances of construction project variations which could lead to increased cost of re-work, design changes or delay in project delivery. Be it change at the organisational level which could mean not enforcing a culture which is prone to change or change at the briefing level which could mean mitigating against excessive change request, it has been identified from the interview results that one of the barriers plaguing the construction industry is disposition to change. Additional findings from the interview assert that most top construction companies in UK do not use IT systems to capture their client's knowledge (requirements) during the briefing process because such IT systems for example BIM can cause a tremendous change to their basic operations which could include high cost of trainings and adoption. An individual or organisations natural response to change is either to avert or reject it because people see change as a disadvantaged commodity. Every project cannot fully eliminate the idea of change which will likely occur in the course of the project development; however, giving adequate attention to the client briefing process for example, can help reduce the chances of change request that might occur as a result of design mistakes or errors. Change has been identified as a prevalent barrier that mortifies opportunities and cripples business initiatives. Therefore one of the major barriers that affect proper KC during the client briefing process is pro-activeness with the aim to reduce or eliminate possible change request that could occur either at the organisation or project level.

Secondly, the interview findings highlighted personal or vested interest as another major barrier that affects KC during the briefing process. Under the traditional procurement route, any project embarked upon by the architect on behalf of the client is not for the architect but the client. Some architects have vested interest and stakes when doing business with their clients with the aim to extort or manipulate the client to their own interest need. Some architects advise the client on the use of certain materials simply because they have business partners who sell such materials which they could also make good commission from. Such projects have the tendencies to go wrong in the long run as the foundation of the project objective is already faulty because the architect is designing for his/her interest as against the client's interest. Some architects use their technical know-how skills and knowledge to impose their ideas on the client in a bid to finish the project in haste and pick up another project in order to make more profit. In some

cases, project delivery are done based on certain quotas or targets that the architect must deliver within a specified period of time, which could make the developed client brief substandard and not thorough enough, thereby producing defective designs, increasing design changes and leading to unsatisfied clients. In summary, the most important barriers that affect the KC process from the questionnaire and interview findings are ***change management, personal or vested interest of the architect, lack of client's involvement in the briefing process, a culture than does not encourages proper briefing, inadequate relationship management, not adopting the right KC technique and lack of trust and flexibility.*** The next section discusses the factors affecting the overall client briefing process in the UK construction industry.

7.6 Factors Affecting the Client Briefing Process

Proposition 4: **Certain critical factors affect the successful delivery of the client briefing process**.

For any organisation to operate an effective competitive strategy, certain factors must be present to enable such organisation achieve its set goals or objectives. These factors are essential and important in the organisation achieving successful implementation or delivery of its overall project objectives. Section 3.5.4 and 3.5.5 of the literature review identifies certain factors and barriers including CSF's which influence or contribute to the overall success of the client briefing process. Findings from the questionnaire as reported in section 6.8.1 have ranked these factors in order of importance. The ranking were assigned a code ID which is FACT X, where X represents numbers from 1 as most important. The following shows the rankings of the 36 factors analysed in the questionnaire;

FACT 1: Ability of the architect to comprehend the client requirements during briefing phase

FACT 2: Clear communication between client and architect

FACT 3: Use of face-to-face communication method

FACT 4: Ability of the architect to be able to conceptualize the client's requirement

FACT 5: Involvement of the owner (client) in the briefing process

FACT 6: Client representation

FACT 7: Allocating enough time to the client briefing process

FACT 8: Clarity of client requirements

FACT 9: Adequate, planning and proper briefing

FACT 10: Experience of the Architect

FACT 11: How familiar the architect is with the design project

FACT 12: Establishing priority levels for various client requirements

FACT 13: Frequent communication between client and architect

FACT 14: Signing off of the requirement document

FACT 15: The architect's level of experience with client briefing

FACT 16: Use of different methods to document and effectively communicate clients requirement e.g. Sketches, requirement documents, Microsoft Word etc.

FACT 17: Knowledge of the architect

FACT 18: Setting up measurable deadlines for producing the requirement documents

FACT 19: Changes in design requirements

FACT 20: Preventing mistakes and discrepancies in requirement documents

FACT 21: Analysing potential risk early

FACT 22: Setting a clear budget for the whole project from the onset

FACT 23: Project characteristics e.g. type, size, complexity and duration of the project

FACT 24: Accurate decisions as a result of quality requirements

FACT 25: How familiar the architect is with other construction projects

FACT 26: The nature and type of client and business

FACT 27: Change management (creating tolerance for change request)

FACT 28: Future changes anticipated in the design process

FACT 29: Establishing critical success factors (CSF's) and Key performance indicators (KPI's) clearly

FACT 30: Economic factors

FACT 31: Knowledge of the client

FACT 32: Culture and ethics

FACT 33: Making sure specifications are not blown out of proportion

FACT 34: Avoiding long waiting time for approval of drawings

FACT 35: The owner's level of experience with construction processes

FACT 36: Fluctuations in the cost of building materials

From the ranking result generated by the questionnaire analysis in section 6.8, the first 16 factors identified by Kendall W test have ranking score above 20.00 with the highest score as 26.86 as reported in section 6.8.1 (that is ranking FACT 1=100% and ranking FACT 16=76.5%). The researcher believes these first 16 rankings are key to the CB process and they also show a good involvement of the client in the briefing process. These factors were rated high by the respondents because the success of the briefing process is mostly dependent on how much the

architect is willing to involve the client in the CB process. The last four factors received the lowest ranking scores but were not immediately eliminated until the test result was further subjected to a FA test in order to reduce and combine factors based on contextual relationships. The 36 factors identified from the literature were divided into two sections to allow ease of response for the participant during the survey and also because rotation of FA failed to converge after 25 iterations for the 36 factors. The sections were divided into two, one section represents the general factors which are twenty five (25 factors) while the other section represents the critical success factors (CSF's) which are eleven (11 factors). These factors were subjected to FA in order to reduce the number of factors based on contextual relationships between the factors. Under the general factors analysis, first 25 factors underwent a total of 5 rotations as seen in section 6.8.3 which eliminated certain factors with loadings below 0.400. The final remaining 10 factors with loadings above 0.400 were grouped into 3 major factors, which are; ***external factors, management functions and experience of architect in anticipating future changes through clarity of requirements.*** In addition, the CSFs rotated 11 factors as reported in section 6.8.3 and had 3 rotations in all eliminating certain factors which were below the 0.400 loading threshold. A total final of 6 factors were generated which were combined and grouped under 2 major factors. The two groups of factors are; ***organisational pro-activeness*** *and* ***background of the client and quality requirement.***

From the design of the questionnaire, options were given to respondents to include other valuable factors they believe can influence the successful delivery of the CB process. These include factors such as; ***impact of experienced and inexperienced clients on the briefing process, experience of the architect, collaboration with other team members, communication between client and architect, architect's understanding of client's operating practices, little or no time given to the CB process due to clients busy schedules, anticipating design changes, client to sign off brief before project execution, clarity of client requirements', involvement of the user in the briefing process, relationship building between client and architect, risk management, budget set up and getting the stakeholder KPI's and CSFs right.*** All the factors mentioned by the respondents correlate and agree with the findings of the literature except one, which is "***Involvement of the (ultimate) users in the briefing process***". The "users" in this context refers not to the client but the people who would be using the facility after completion of the project. Section 3.5.4 stresses the importance of involving the end user in the briefing process, which could help reduce variations that might occur as a result of changes that might arise in the long run. Section

3.5.5 added that many of the architects try to establish a direct dialogue with users, which is seen as necessary to get a "feel" of what the users of the facility need because written requirements do not always match the actual expectations of the users unless they are involved in the CB process. Findings from interview identified 6 factors, which affect the CB process in the UK construction industry, and these factors were assigned code ID's of INTFAC X; where X represents any number in no particular order;

- **INTFAC 1**: Type and Knowledge of the client you're dealing with
- **INTFAC 2**: Relationship management
- **INTFAC 3**: Trust
- **INTFAC 4**: Background of architect
- **INTFAC 5**: Knowledge and experience of the Architect
- **INTFAC 6**: Legal requirements and regulations
- **INTFAC 7**: Document the brief and sign it off

Three of the factors mentioned during the interview findings (INTFAC 2, 3 and 5) show correlation with KC barriers mentioned in section 2.9.5. This reveals that there exist a relationship between the factors that affect the CB process and barriers that affect the KC process in the UK construction industry. Of all the 7 factors from the interview findings INTFAC 2, 3 6 and 7 will be given more emphasis as other factors such as INTFAC 1, 4 and 5 have already been mentioned in the literature review in section 3.5.4 . All the factors identified from the interview results agree with findings from literature in section 3.5.4, however, the signing of the brief document factor which was one of the factors tested using the questionnaire survey, was earlier eliminated in the course of the FA test, however, the Kendall ranking test in section 6.8.1 ranks this factor as 14 out of the total 36 factors which is a 61% of the overall ranking score, as a result, this factor will be retained as one of the important factors for the CB process. Signing off the document brief is an important factor in the CB process, which should be given attention as it allows the client and architect, have clear and agreed objectives before proceeding to the design and construction stage. Allowing the client to sign off the document brief demonstrates that the client agrees and is in agreement with the captured and documented requirements before proceeding to construction stage; this prevents or reduces the possibility of any future change request resulting in unplanned cost. These 10 factors have been identified as key factors influencing the CB process and they include ***external factors, trust, relationship management, management functions, experience of architect in anticipating future changes through clarity of requirements, organisational pro-activeness, background of***

the client and quality requirement, legal requirements and regulations, signing off the documented brief and involvement of the user in the briefing process. This chapter has been able to discuss the various themes of this research that emerged as a result of the interview and questionnaire data analysis. The application of the effective KC techniques to managing the KC process barriers and the CB process factors can help architects in the UK construction industry reduce the causes if variations such as cost overruns, time delays, design changes and re-work, as well as, reduce improve architect and client relationships during the briefing process with the aim of capturing and eliciting clients requirements adequately using right and effective KC techniques. The next chapter discusses the refined framework development and the set of guidelines for the framework.

7.7 Framework Development

This chapter discusses the framework development process, the set of guidelines for implementation of the framework, the conclusion, recommendation, and contribution to the body of knowledge both in industry and academia and then concludes with the limitations of this research, and reflections by the researcher for future work extending from the ideas gathered in this research. Putting together the different factors, barriers and KC techniques that has emerged from the findings of the questionnaire and interview helps to revise the initial conceptual framework developed through literature in chapter 3.9 of this research. Chapter 3 Figure 3.13 shows the conceptual framework describing the use of KC techniques in exploiting certain factors in the CB process for improved client satisfaction has been developed based on the literature review. The conceptual framework has three main components that are fundamentals to knowledge capturing in the briefing process and these are barriers, factors and techniques. All these different systems are interlinked in order to deliver improved satisfaction to the client. This conceptual framework was further revised during the process of data collection and analysis. The development of the framework is based on the review of literature, qualitative data collected through semi-structured interviews from construction professionals (architects) and a questionnaire survey distributed to over 230 participants with a response rate of 100. Chapter 2 and 3 of the thesis identifies the use of literature review in gathering data through documentary survey in order to create a platform on which the researcher is able to build the framework concept. The questionnaire survey (chapter 5) administered was used to analyse and test which factors, barriers and techniques as identified in the literature are more effective in helping the project achieve its desired objective. The findings gathered from the interview participants

(chapter 5) were further analysed and triangulated with findings from the questionnaire (chapter 6) and literature (chapter 2 and 3). The result of the triangulation helps in refining the conceptual framework as seen in figure 8.1.

7.7.1 Proposed Framework for KC during CB in the UK Construction Industry

As earlier stated in the previous session, the development of framework in this research is based on the concepts and theories explored from the literature review as well the findings gathered from both qualitative and quantitative methods. This framework places emphasis on the use of KC tools in managing important barriers to KC process and exploiting key factors influencing the CB process in the UK construction industry, to reduce the gap that exist as a result of variation, design changes and delay in project delivery that occurs in construction projects. The findings from literature review in Chapter 2 and 3 of this thesis have shown that the use of effective KC tools during the client briefing process could help mitigate against barriers and exploit success factors within the UK construction industry. By taking into consideration these barriers to KC and factors to CB, the use of effective KC techniques and technology can help bridge the gap between satisfied and unsatisfied clients in the UK construction industry. Accordingly, this framework is developed within the UK construction context. The framework developed in this research is as shown in the following Figure 7.3.
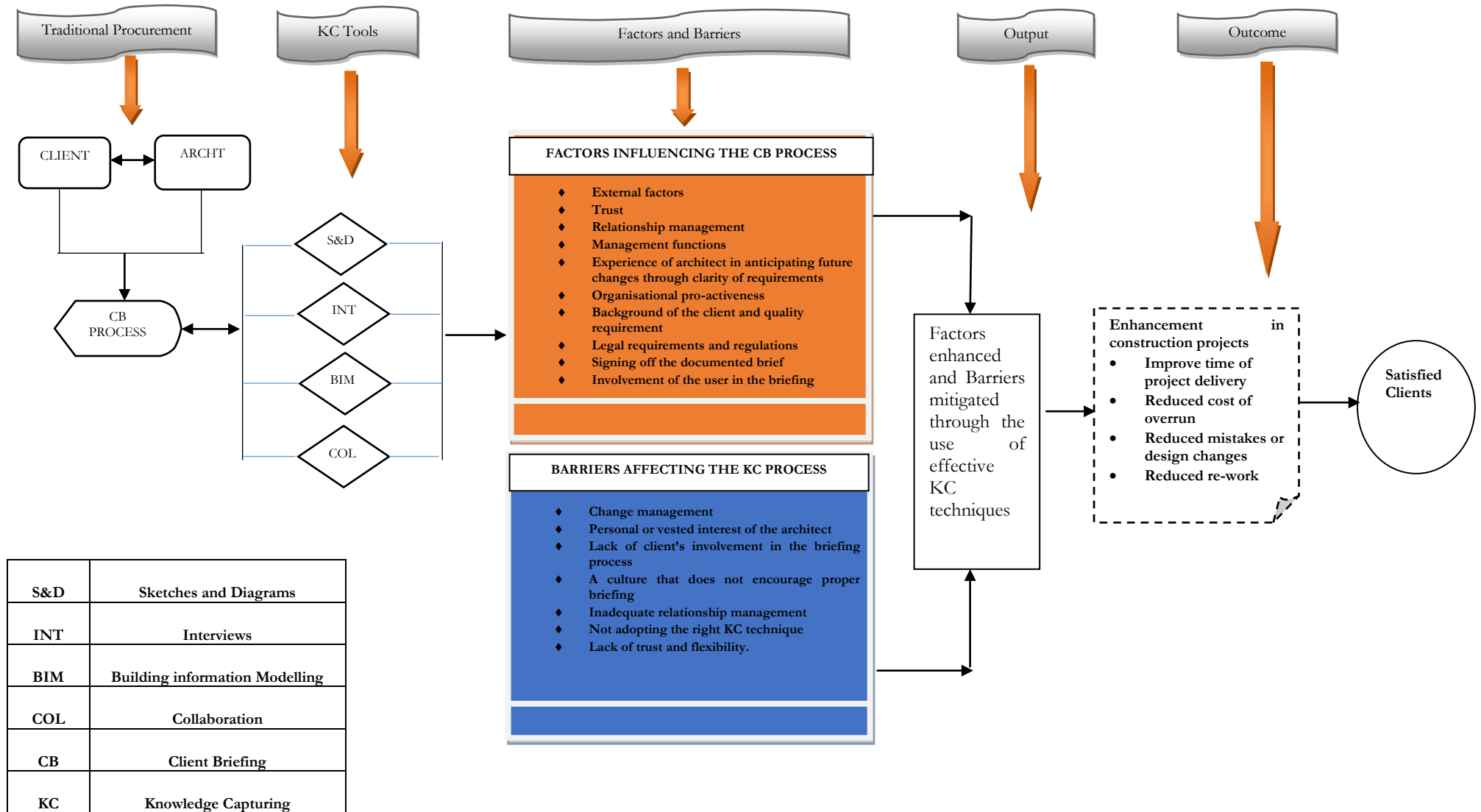
Traditional Procurement

CLIENT ⟷ ARCHT

CB PROCESS

KC Tools

S&D

INT

BIM

COL

Factors and Barriers

FACTORS INFLUENCING THE CB PROCESS

- ♦ External factors
- ♦ Trust
- ♦ Relationship management
- ♦ Management functions
- ♦ Experience of architect in anticipating future changes through clarity of requirements
- ♦ Organisational pro-activeness
- ♦ Background of the client and quality requirement
- ♦ Legal requirements and regulations
- ♦ Signing off the documented brief
- ♦ Involvement of the user in the briefing

BARRIERS AFFECTING THE KC PROCESS

- ♦ Change management
- ♦ Personal or vested interest of the architect
- ♦ Lack of client's involvement in the briefing process
- ♦ A culture that does not encourage proper briefing
- ♦ Inadequate relationship management
- ♦ Not adopting the right KC technique
- ♦ Lack of trust and flexibility.

Factors enhanced and Barriers mitigated through the use of effective KC techniques

Output

Outcome

Enhancement in construction projects

- Improve time of project delivery
- Reduced cost of overrun
- Reduced mistakes or design changes
- Reduced re-work

Satisfied Clients

S&D	Sketches and Diagrams
INT	Interviews
BIM	Building information Modelling
COL	Collaboration
CB	Client Briefing
KC	Knowledge Capturing

Figure 7. 1: Redefined Framework for KC in the CB process to improve client satisfaction

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The framework in Figure 7.3 shows how construction professionals especially architects can use effective KC tools in managing barriers and exploiting key factors that could help reduce design changes, reduce cost of variation and improved project delivery times, for improved client satisfaction. The central element of this framework is the use of effective KC tools in helping the client makes informed and important decisions with regards to successful project delivery. There are three potential output which would invariably lead to one major outcome. The outputs of this framework is to

1. Reduce the number of change request that could potentially occur if clients requirement knowledge are not captured accordingly

2. Reduce cost of re-work as a result of variations that might occur if the client briefing process is not properly managed.

3. Improve project delivery time as a result of capturing client's knowledge requirements adequately to reduce any future alterations that could delay the project delivery date.

The potential result of the output will be improved satisfied clients which could mean more referrals for the architectural company or the architect, more business and more income for the company or architect. As previously noted in the earlier sections of this chapter, some of the barriers to the KC process identified show similarity with some of the factors influencing the CB process. This shows that the KC process and the CB process are not mutually exclusive and should be run concurrently if the project must deliver its desired objectives from the client perspective. From the interview and questionnaire findings, the KC tools that have been identified to effectively aid in the successful delivery of the CB process in the UK construction industry are sketches and diagrams, interviews, BIM and collaboration. With this techniques and technology in place, the project can successfully deliver the client's needs and requirements which could lead to improved satisfaction of the clientele. The framework arrangement shows a process flow from traditional procurement route under which the architect and client are involved in the briefing process, to the use of effective KC tools in eliciting and capturing clients requirement-knowledge, to managing barriers to KC process and exploiting key factors to CB process, which then improves variations, cost and time of delivery which then leads to improved client satisfaction. This framework is beneficial to the UK construction industry, which is lacking in the use and awareness of effective KC tools to improve client satisfaction based on the empirical findings. Although this framework is developed based on the UK construction context, it can be applied to other developed countries which systems and operations are similar to those of the UK.

7.7.2 Framework Guidelines

Based on the framework developed, the following guidelines will help the architect understand the process involved in reducing variation and cost of design changes as a result of quality requirements and also improving overall client satisfaction.

<u>**Client *Brief Process***</u>

1. Start
2. Client initiates a Project
3. Identify architect for job or architect bids for project

    3.1. Yes. Proceed to client briefing stage

    3.2. No. repeat No 3

4. CB process is initiated
5. Use effective KC tools based on research of client and clients project

    5.1. Effective use of KC Yes. Manage barriers to KC process

    5.2. Effective use of KC Yes. Manage factors to CB process

    5.3. Effective use KC No. repeats No 5.

6. Sign off document
7. Proceed to design and construction.

7.8 Summary

The discussion chapter brings the qualitative analysis, quantitative analysis and the literature review for triangulation. The conclusion of the discussion chapter points to the fact that if effective KC techniques are adopted during the client briefing process, barriers to KC and factors influencing the CB which leads to variations such as cost overruns, time delays, design changes and re-work can be properly controlled. The point however, is architects needs to pay more attention to the needs of the client and establish working relationships which puts the client in a position to share communicate their needs and requirement accordingly. Also, certain KC techniques are more effective than others during this process, the ability of the architect to know the wealth of techniques available and which one to adopt based on the nature of client and project, will influence the successful delivery of the project. If project outcomes are delivered ass planned, the end result is satisfied clients which leads to reputational effectiveness and increased business opportunities for the organisation.

Chapter 8 – Conclusion, Limitations and Recommendations

8.1 Conclusion

The overall aim of this research is to develop a framework that supports the requirement elicitation process of construction professionals (architects) during the client briefing process in order to improve client satisfaction in the UK construction industry. In order to achieve the stated aim, four primary objectives were developed and analysed using a survey strategy which included document analysis (literature review), semi-structured interviews and questionnaires. Data gathered from these investigative processes were then analysed and triangulated in order to achieve the stated aim of the research. The conclusion section of this research will be addressed objective by objective which then adds up to the delivery of the overall aim of the research. The first objective is to explore the importance of knowledge capturing to the client briefing process in UK construction industry.

- ❖ To explore the importance of knowledge capturing to the client briefing process in UK construction industry.

The literature in section 2.9.4 identified some importance of knowledge capturing during the briefing process. This objective was further investigated using a semi-structured interview process to gather more data on why KC is essential to the briefing process. The findings discovered that many of the mistakes and discrepancies that arise during construction or that leads to many dissatisfied clients is as a result of not paying adequate attention to the wealth of KC techniques that are effective enough in properly capturing or eliciting clients knowledge (requirements) during the briefing process. Also, respondents mentioned that the not allocating enough time to the capturing clients knowledge during the briefing process is detrimental to the successful delivery of the project. The project is all about the client and the client's needs is to be given adequate attention, however, a lot of the clients requirements are tacit in nature and difficult to codify during the briefing process, hence the need to understand and utilise effective KC technique and technology in eliciting the clients knowledge (requirements) is very essential to the successful delivery of the project and improved client satisfaction.

❖ To document and explore the most effective and often used knowledge capturing techniques in client briefing in UK construction industry.

In the course of the literature review, certain KC and KE techniques have been identified in section 2.9.2 and 2.9.3 of the literature review to be used in capturing or eliciting client's requirements. However, these many techniques were taken into a questionnaire survey and semi-structured interview process in the UK construction industry to test and identify which techniques are most effective in capturing or eliciting clients requirements during the briefing process, though initial KC techniques were based on non-IT techniques used in eliciting clients knowledge, findings from the research has shown that some IT tools are also be effective in capturing or eliciting clients requirements during the briefing process. In total, about 5 techniques which includes some IT techniques have been generated from the list of tested techniques identified in section 2.9.2 and 2.9.3 of this literature. This research however, believes that if these KC techniques are adopted during the client briefing process, they are effective and efficient in overcoming the factors that impede successful project delivery. It is therefore essential that architects get themselves acquainted with these KC techniques and apply them during the briefing process. However, another essential finding from this research is relationship building with the client. If the architect established a good rapport with the client, chances are the architect will most certainly know the right technique to adopt as a result of the knowledge of his/her client.

❖ To critically analyse barriers to knowledge capturing during client briefing in UK construction industry.

In the course of the literature review, certain barriers have been identified to affect knowledge capturing during the client briefing process. These barriers were then taken into a questionnaire survey test and augmented using a semi-structured interview process. The output of this process highlighted some of the factors that were seen to be fundamental barriers to the KC process (chapter 7). Some of these barriers that were generated after the analysis are change management strategy, lack of client's involvement in the briefing process, a culture than does not encourages proper briefing, inadequate relationship management and so on. For construction projects organisations to deliver satisfaction to their clients, they need to take into considerations these barriers that have been identified in section 7.5 of this research. One of such barriers that is a major cause to construction variation and client dissatisfaction is not involving the client in the briefing process. One of the assumption made that strengthens the lack of involvement of the client in the briefing process is that architects assume that they are designing for themselves and hence they refuse to involve the client which is the main owner of the project in the briefing

process. Involving the client means a constant and continuous communication and engagement with the client to capture the clients knowledge (requirements) based on what is really needed. This barriers generated helps the architect to know what barriers to look out for during knowledge capturing in order to mitigate against future occurrences.

❖ To critically investigate factors that influence proper client briefing in the UK construction industry.

In addition to the before mentioned barriers to the KC process, certain factors also exist that influence the successful delivery of the overall client briefing process in the UK construction industry. Literature in section 3.5.4 identified some of these factors that affect the client briefing process. These factors were analysed using a questionnaire survey and semi-structured interview. The findings from the analysis in section 5.7 and 6.8 identified and highlighted key factors that influence the CB process amongst the list of factors identified in section 3.5.4 and 3.5.5 of the literature. Some of these generated factors include trust, experience of architect in anticipating future changes through clarity of requirements, organisational pro-activeness, background of the client and quality requirement, signing off the documented brief and involvement of the user in the briefing process. Another major factor identified here is the involvement of the client in the briefing process which augments one of the barriers to KC process mentioned in the previous section. For the project to deliver within time, budget and quality, identifying effective KC techniques and adapting them based on the knowledge and type of client built over consistent rapport and relationship, will be beneficial in controlling the barriers mentioned in section 2.9.5 and 2.9.6 and also help exploit or manage the various factors mentioned in section 3.5.4 and 3.5.5 of the literature. These generated factors are able to help the architect stir the CB process in the right direction in order to help deliver improved client satisfaction at the end of the project. A framework was finally developed in section 7.7 of this research to help construction professionals (architects) capture and elicit client knowledge (requirements) effectively during Client briefing.

❖ To develop a framework that would help construction professionals capture and elicit knowledge-requirements effectively from clients during client briefing.

In order to achieve the set aim of this research, a framework (figure 7.1) was developed from the triangulation of semi-structured interview, questionnaires and literature review in order to support construction professionals (architects) elicit clients requirement effectively during the client briefing process in the UK construction industry.

8.1.1 Contributions to the Body of Knowledge

This research is aimed at exploring and investigating effective knowledge capturing techniques that aid in successful client briefing process between architect and clients in the UK construction industry. This research also contributes to the body of knowledge in its novelty of approach, where the mixed methodology survey design was employed to answer the research questions established in Chapter 1 of this thesis. This research has contributed to both academia and industry body of knowledge throughout the entire research process. The next section discusses the contribution of this research both to academia and industry.

8.1.1.1 Contribution to Academia and Industry

While conducting an extensive literature review, chapter 2 section 2.9.2 of the literature review has identified certain knowledge capturing techniques in the course of this research. These identified KC techniques are used in eliciting or capturing client's tacit knowledge (requirements) with the aim of reducing design changes, making project delivery faster, reducing cost of rework as a result of change request due to uncaptured requirements and variations that occur as a result of not adequately eliciting clients requirement in UK construction projects which invariably leads to improved client satisfaction. The literature review has helped to identify gap in knowledge capturing and the UK construction industry which addresses the use of effective KC techniques in confronting barriers and identifying factors that influence proper knowledge capturing and client briefing in the UK construction industry, thereby reducing variation such as design changes, cost overruns, re-work and time delay in project delivery.

In understanding the concept of the various KC techniques that exist in eliciting and capturing clients requirements (knowledge) during the client briefing process in the UK construction industry, certain techniques and technologies have been identified to be effective in capturing or eliciting clients tacit knowledge during the briefing process. Section 2.9.2 of the literature has identified various KC techniques, which are used to elicit or capture client's requirements during the briefing process. It has been discovered that in addition to the non-IT KC techniques identified in chapter 2, some IT KC technologies have emerged in the course of the research analysis, which respondents have identified as effective in the capturing of clients requirements. Some of these effective techniques and technologies identified from the research analysis in chapters 4 and 5 include sketches and diagrams, interviews (both structured and semi-structured), collaboration, BIM, observation just to mention a few. The novelty of this process lies in the use of these effective KC techniques and technologies in the construction industry,

which was inspired by the work of Cheung et al (2011), to ensure that client satisfaction are improved in the UK construction industry. The key ideas gathered through the exploration of key concepts and theories in the literature review have complemented the methodological decisions made in answering the research questions. Chapter 3 of this research has explored the methodological approach in conducting this research, as well as justifying the appropriate design for this research. This research also adds to the body of knowledge through the research design selected, which is the mixed methodology survey design, within the context of the UK construction industry.

The qualitative findings discussed in Chapters 4 of this research provides insight into the barriers affecting KC processes in the UK construction industry and the factors affecting the CB process in the UK construction industry. Findings from the in-depth analysis of the qualitative data and questionnaire gathered shows that the use of effective KC techniques and technology, a segment not often focused on in previous studies within the UK construction industry, can help construction professionals (architects) in mitigating against barriers affecting the KC process and exploiting factors that aid the successful delivery of the CB process. As architects play an important role in engaging and eliciting client's tacit knowledge during the briefing process, it is critical to determine the barriers affecting KC processes and the factors influencing the CB process. In doing so, these barriers can be eliminated in order to enable productive engagement between the client and the architect during the KC process with the aim to meet the client's needs. Another significant contribution of this research is the identification of factors that influence the CB process in the UK construction industry, as highlighted in Chapter 2 of this thesis. Chapter 2 of the literature identifies well over 30 factors that influence the CB process, however, the questionnaire analysis and interview findings has helped to identify key factors that are potent in making the CB process successful, such as type and knowledge of the client you're dealing with, relationship management, trust, background of architect, legal requirements and regulations, document the brief and sign it off, external factors, management functions, experience of architect in anticipating future changes through clarity of requirements, organisational pro-activeness and background of the client and quality requirement.

Another important finding from the qualitative data is the importance of the knowledge capturing process during the CB process in the UK construction industry. Findings have identified that for any project to meets its desired objective in relation to the client's needs and requirements, capturing the client's knowledge in form of requirements using effective KC

techniques or technologies are vital to having satisfied clients at the end of the project. The more the architect is able to engage the client and elicit their un-spoken requirements which are tacit in nature, the better the chances of producing less defective projects thereby reducing the cost of re-work or design changes. The final contribution of this research is the realization of the research aim in developing a framework that will help construction professionals (architects) use effective KC tools in eliciting clients requirements for improved client satisfaction as shown in figure 7.1. Although this framework is developed under the UK construction industry, it can also be applied in other developed countries, which share similar construction systems and operations. Therefore, it can be said that the development of this framework also has helped reduce the current gap in construction project variations and design changes as a result of the application of effective KC tools during the CB process. Accordingly, the outcomes from this research can be adopted for future educational or training use beneficial for practitioners as hands-on professional development or for theoretical understanding in academic programmes. This dissemination of conceptual knowledge in in knowledge capturing and client briefing in the UK construction industry will provide in-depth understanding among academia, policy makers, practitioners and students, which in turn will encourage the engagement in knowledge management activities among firms in the UK construction industry.

This research will add to the already existing body of knowledge on KC in the UK construction industry by developing a framework that would help architectural professionals effectively capture client's requirements for improved client satisfaction in the UK construction industry. Some of the major contributions to knowledge in this study is to help professionals identify which KC techniques are more effective for eliciting or capturing client requirements in construction projects. It also contributes to research by extending previous studies on the need for giving adequate attention to the client briefing (CB) process which in turn has the capacity to making the project achieve its desired objectives. Another contribution identified is that relationship management between client and architect is vital to project output and outcomes. Construction academia and practitioners are expected to benefit from this research by improving the awareness and understanding of knowledge capturing techniques used in client requirement capturing and developing a framework that will help construction professionals effectively capture client's requirements for improved client satisfaction and project performance. In relation to construction practitioners, this research would arm stakeholders with knowledge of the key challenges and barriers that exist in construction projects with respect to client requirement capturing in client briefing. Also, the anticipated framework would help to raise a

better understanding of professionals and clients on the importance of using effective knowledge capturing techniques to elicit client's requirements which in turn produces happy clients and improved project performance in relation to cost and time.

8.2 Recommendation

This section of the research proposes recommendations to support architects in the use of effective KC techniques in capturing client's knowledge (requirements) for reducing and controlling barriers to KC and exploiting the different factors that affect the CB process, all in a bid to improve client satisfaction. Some issues and problems have been encountered in the course of this research and such have inspired such recommendations under which a project will be able to deliver its objectives successfully. These recommendations are also affected by the researchers philosophical stance which is value laden. The recommendations are as follows;

- More time and effort needs to be given to knowledge capturing during the client briefing process in the UK construction industry.
- The UK Construction industry need to invest more time and resource in identifying effective techniques in capturing client's requirements and these techniques should be made available via training platforms, information portals and so on.
- Architects should be made aware of the wealth of techniques available for capturing client's requirements and the benefit of such techniques.
- The construction industry should encourage the use of BIM technology as a KC technique because of its ability to give a pictorial image of what the client requirements are.
- Relationship building should be encouraged between client and architect, which have the potential to lower communication barriers, thereby allowing the architect to capture the tacit knowledge (requirement) of the client.
- The construction industry needs to get more buy-in and involvement of the client in the briefing process, which reduces the changes of assumptions made by the architect which could lead to potential design changes in the future.
- The construction industry should put practices in place that helps architects improve in their communication engagement with client because architects act as psychologist and business analyst where client communication and documentation is a vital skill.

The next section highlights the limitations of the study.

8.3 Limitations of This Study

This research has been able to achieve its desired aim and objectives that was initially established in earlier Chapter 1 of this study. However, throughout the entire course of this research, certain challenges and barriers were encountered which are:

♦ In-depth interview of architects only

This research places priority on in-depth investigation of architects in the UK construction industry who have experience in the client briefing process and have used certain KC techniques and tools in eliciting client's requirements during the briefing process. Future work should include data from other actors that should be involved in the client briefing process such as end users and other stakeholders involved in the briefing process in the UK construction industry.

♦ Number of survey respondent

Though this research is a combination of qualitative and quantitative data gathering techniques, the number of respondent generated for this study was 100. This in itself is not a general representation of all professional architects in the UK construction industry.

♦ Research is focused within the UK construction industry

The research has only included findings from the UK construction context. It could be argued that if the context of this research is extended to include other countries, more factors to client briefing and barriers to KC than has been mentioned to contribute to the successful delivery of client satisfaction could emerge.

♦ Validity of the proposed framework

The framework needs to be validated in future research. The main reason for not being able to test the framework is that client satisfaction is feedback oriented which could only be gathered from the responses of client who have embarked on projects where all the factors and barriers mention in the course of this study have been addressed, however, since this research focuses on the use of effective KC techniques in mitigating barriers and exploiting factors in order to improve client satisfaction, assumptions is made that if framework and guideline process in section 7.7.1 and 7.7.2 are carefully followed and adopted, chances are that construction project variations will be reduced which will invariably lead to improved client satisfaction. Moreover, due to the time constraints in completing this research, the testing of the framework is not feasible within the allocated time of this research. This is therefore recommended for future research to test and validate the framework developed in this research.

8.3 Future Research

This section proposes related areas for future research where additional inquiries could further enhance the value of this research. The many challenges and problems encountered throughout the course of this research have inspired several recommendations for future work to in extending the boundaries of knowledge capturing in the client briefing process. These recommendations are as follows;

♦ More in-depth research for each of these stakeholders – end users, architects, clients, project managers, quantity surveyors, etc. in the UK construction industry to determine their connection with the use of KC techniques in the client briefing process.

♦ Future research in the area of "User-Briefing" instead of client briefing where the project places emphasis and priority on capturing knowledge (requirement) from the users of the facility.

♦ Further research is needed in investigating the use of IT knowledge capturing tools in eliciting client's requirement during the client briefing process in the UK construction industry.

♦ Further research into the key factors that affect the different stakeholders involved in the client briefing process.

♦ More investigation into the role of government in enforcing compliance to the use of information technology for example BIM while capturing clients requirements during the client briefing process has been highlighted by participants. Further work should also focus on evaluating current KC technologies related policies in the UK construction industry in order to investigate the effectiveness of these policies.

♦ Future work should include a longitudinal qualitative study to test the framework developed in this research, which will help architects identify and sue effective KC techniques and technologies in eliciting client's requirements during the briefing process for improved project performance.

♦ Future work on the testing and validity of the framework of this research.

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APPENDICES

Appendix 1
Draft Interview Questions

Title of the Research Study:

- Knowledge (requirement) capturing in client briefing in the UK construction industry.

Additional Information:

- The aim of this research is to develop a framework that would help construction professionals (architects) capture client's requirements during client briefing process for improved client satisfaction.
- PhD research at the University of Salford

Respondent Background Information

Name:
Job Title
Education Background
Qualification
Discipline.
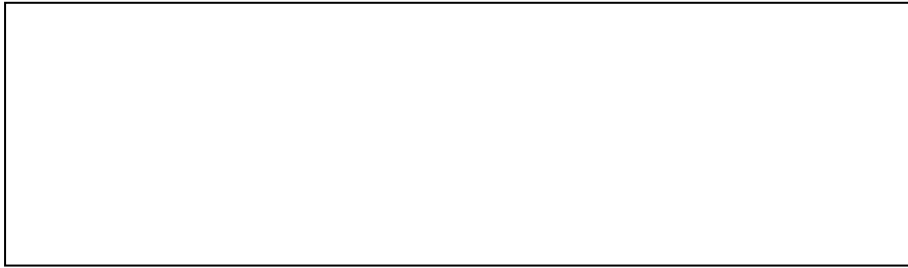
- Can you please tell me what your position is in this organization?

- How many years of experience do you have in the construction industry?

- How many years of experience do you have in Client (client briefing)?

Importance

In light of your experience, what would you say is the impact of knowledge capturing (that is capturing clients requirements) in relation to client satisfaction?

Why would you think the KC process is vital to the client briefing process in the construction industry?

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Has there been any occasion where less attention was given to the client briefing process and this impacted on the overall delivery of the project objectives? If yes, please can you give an example?

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[blank response box]
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How can we encourage the client and contractors to act positively on integrating project knowledge?
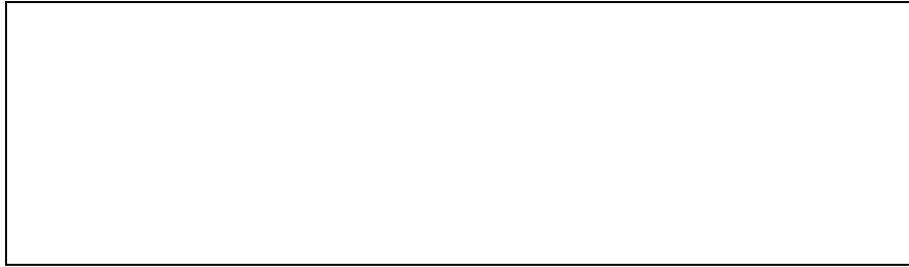
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During the process of requirement capturing in client briefing, how important is client satisfaction to the construction industry.
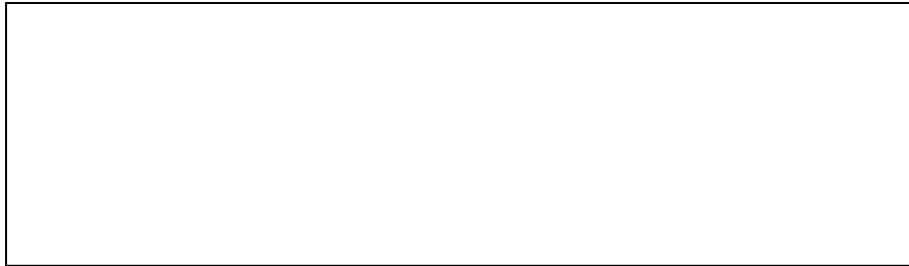
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Techniques used in capturing knowledge requirements

When knowledge capturing or eliciting techniques do you adopt when engaging your clients?

Would you say in all your years of experience as a construction professional that construction professionals that take part in the CB process are well aware of the different techniques that exist in capturing or eliciting client's knowledge (requirements)?
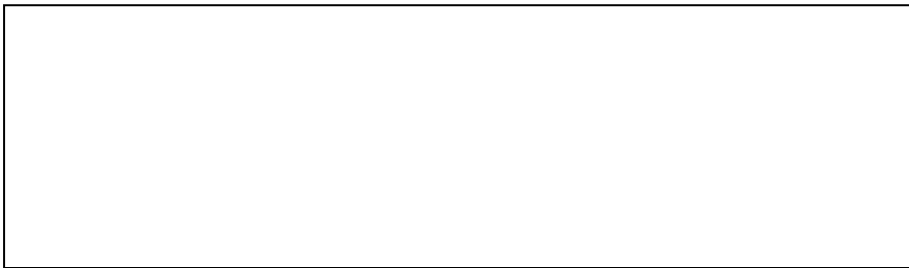
In your experience and knowledge of the CB process, what are the current techniques/ approaches used for capturing requirements during client briefing?

Is there a particular reason why these knowledge capturing techniques identified are being used?

How often are these techniques used during the client briefing process?

In light of your experience, do you think using proper knowledge capturing techniques during the CB process would impact influence client satisfaction?
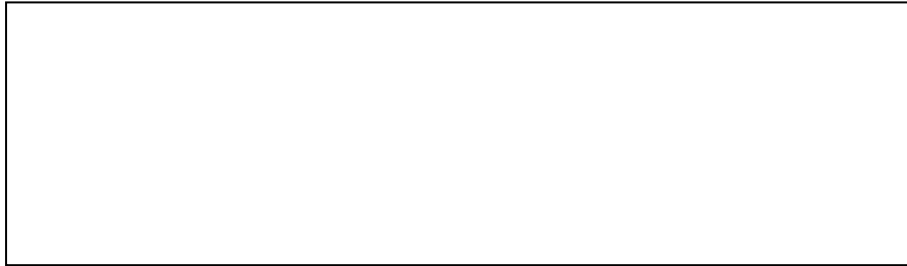
Barriers to the knowledge capturing process

If the client briefing process is important to the project success, are there certain barriers that have prevented proper client process?

Could these barriers have been prevented if proper attention was given to the client process?
How do you think such barriers could be mitigated against?

How often does your organization embark on re-work during project execution?

Are there obvious problems that prevent the client (client briefing) process from achieving its desired objectives?
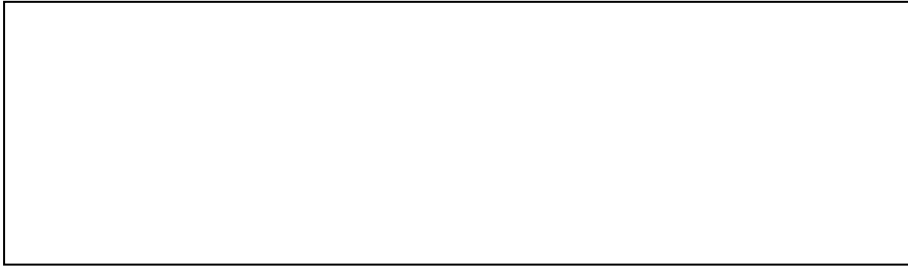
Factors affecting the Client briefing process.

How often do you engage in the CB process?

Are there certain factors that affect the briefing process?

What factors do you think are most prevalent during the CB process?

What barriers have you encountered during the CB process?

Appendix 2

Knowledge Capturing in the Design Briefing Process

2. Section A- General Information

1 What is your discipline?

☐ Residential Architect

☐ Commercial or Public Architect

☐ Industrial Architect

☐ Interior design Architect

☐ Other (please specify)

_____

2 Work Experience

	<5 Years	5-10 Years	10-20 Years	>20 Years	N/A
How many years of work experience do you have?	○	○	○	○	○
How many years have you worked as an architect in the construction company?	○	○	○	○	○
How many years have you worked in a design company?	○	○	○	○	○

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③ Section 2: Factors Influencing Client briefing
Owner and Client Factors

During the client briefing process, some clients know what they want while others do not. In these set of questionnaires, the researcher seeks to explore the impact of knowledge management especially knowledge capturing to the client briefing process. This process is however influenced by certain factors, some of which have been identified below. Kindly select in order of importance which of these client related factors affect the client briefing process in relation to project performance and client satisfaction.

	Not Important	Somewhat Important	Neutral	Important	Very Important
Involvement of the owner in the client briefing process	○	○	○	○	○
The architects level of experience with client briefing	○	○	○	○	○
The owners level of experience with construction processes	○	○	○	○	○

Other (please specify)

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3. **Section 2: Factors relating to the Architect**

(4) The factors identified below influence the role of the architect (designer) in the client briefing process. Kindly select in order of importance which factors affects the designer during the briefing process in relation to project performance and client satisfaction.

	Not Important	Somewhat Important	Neutral	Important	Very Important
How familiar the architect is with the design project	○	○	○	○	○
How familiar the architect is with other construction projects	○	○	○	○	○
Ability of the architect to comprehend the client requirements during briefing phase	○	○	○	○	○
Ability of the architect to be able to conceptualize the client's requirement.	○	○	○	○	○

Other (please specify)

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⑤ Factors related to the requirement document

Kindly select in order of importance which factors greatly impacts the requirement document

produced during the client briefing process.

	Not Important	Somewhat Important	Neutral	Important	Very Important
Clarity of client requirements	○	○	○	○	○
Establishing priority levels for various client requirements	○	○	○	○	○
Future changes anticipated in the design process	○	○	○	○	○
Signing off of the requirement document	○	○	○	○	○

Other (please specify)

⑥ Communication Factors

Kindly select what communication factors influence the client briefing process

	Not Important	Somewhat Important	Neutral	Important	Very Important
Use of face to face communication method	○	○	○	○	○

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⑥ Communication Factors

Kindly select what communication factors influence the client briefing process

	Not Important	Somewhat Important	Neutral	Important	Very Important
Use of face to face communication method	○	○	○	○	○
Frequent communication between client and architect	○	○	○	○	○
Use of different methods to document and effectively communicate clients requirement e.g Sketches, requirement documents, Microsoft Word etc.	○	○	○	○	○

Other (please specify)

⑦ Time and Cost Factors

Kindly select what Time and Cost factors influence the client briefing process in relation to project performance.

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⑦ Time and Cost Factors

Kindly select what Time and Cost factors influence the client briefing process in relation to project performance.

	Not Important	Somewhat Important	Neutral	Important	Very Important
Allocating enough time to the client briefing process	○	○	○	○	○
Setting up measurable deadlines for producing the requirement documents	○	○	○	○	○
Setting a clear budget for the whole project from the onset	○	○	○	○	○
Changes in design requirements	○	○	○	○	○
Adequate planning and proper briefing	○	○	○	○	○
Fluctuations in the cost of building materials.	○	○	○	○	○
Making sure specifications are not blown out of proportion	○	○	○	○	○
Avoiding long waiting time for	○	○	○	○	○

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Knowledge Capturing Techniques

Knowledge capturing (KC) techniques are tools used by the designer to capture or elicit requirements from clients during the briefing process. Please kindly select which of these techniques is more effective in eliciting clients requirements during the briefing process in relation to project performance and client satisfaction?

Please select which technique(s) is more effective in engaging clients during the briefing process?

	Not effective	Somewhat effective	Neutral	Effective	Very effective
Interviews	O	O	O	O	O
Questionnaires	O	O	O	O	O
Observation	O	O	O	O	O
Storytelling	O	O	O	O	O
Brainstorming	O	O	O	O	O
Scenario analysis	O	O	O	O	O
Collaboration	O	O	O	O	O
Requirement workshops	O	O	O	O	O
Facilitated workshops	O	O	O	O	O
Request for proposals (RFP's)	O	O	O	O	O
prototype	O	O	O	O	O
Sketches and Diagrams	O	O	O	O	O

Other (please specify)

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Section 4: Drivers or Enablers to the client briefing process

The following factors impact on the quality of requirement elicited during the briefing process. Please kindly select which of these drivers greatly influences the briefing process in relation to project performance and client satisfaction.

	Not important	Somewhat important	Neutral	Important	Very Important
Client representation	○	○	○	○	○
Change management (creating tolerance for change request)	○	○	○	○	○
Knowledge of the architect	○	○	○	○	○
Analysing potential risk early	○	○	○	○	○
Establishing critical success factors (CSF's) and Key performance indicators (KPI's) clearly.	○	○	○	○	○
The nature and type of client and business	○	○	○	○	○
Accurate decisions as a result of quality requirements	○	○	○	○	○
Clear					

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10 **Section 4: Barriers to Knowledge capturing in the client briefing process.**

Please select in order of significance which of the following barriers influence the client briefing

process in relation to project performance and client satisfaction

	Not significant	Somewhat significant	Neutral	Significant	Very significant
Inexperienced Clients	○	○	○	○	○
Inadequate identification and representation of needs and requirements during the briefing process	○	○	○	○	○
Unstructured approaches for knowledge capturing	○	○	○	○	○
Misunderstanding and misinterpretation of client needs and requirements	○	○	○	○	○
Communication gaps between client and architect	○	○	○	○	○
Insufficient time given to the briefing process	○	○	○	○	○

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Appendix 3- Ethical Approval

Academic Audit and Governance Committee

College of Science and Technology Research Ethics Panel (CST)

To	**Emmanuel Olatokun (and Dr Chaminda Pathirage)**
cc:	**Professor Hisham Elkadi, Head of School of SOBE**
From	**Nathalie Audren Howarth**, College Research Support Officer

MEMORANDUM

Date   **20/04/2015**

_____

Subject: **Approval of your Project by CST**

Project Title: **Knowledge capturing in Architectural Programming in the UK construction industry**

REP Reference: **CST 15/17**

Following your responses to the Panel's queries, based on the information you provided, I can confirm that they have no objections on ethical grounds to your project.

If there are any changes to the project and/or its methodology, please inform the Panel as soon as possible.

Regards,

Nathalie Audren Howarth

College Research Support Officer

Appendix 4 – Published Papers

Olatokun, E and Egbu, C (2014), Storytelling as an effective Knowledge sharing technique for improved decision making in the UK construction industry. Poster Presentation. SOBE, Salford, UK

Olatokun, E and Pathirage, C.P. (2015), Importance of knowledge capturing in the design briefing process in the construction industry, A Critical Review, 12th International Post-Graduate Research Conference 2015(IPGRC2015), Salford, UK