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Editorial

Welcome to this special doctoral workshop on research methodology which forms part of what is now a well-established support mechanism for researchers in the discipline of the Built Environment. The ARCOM doctoral series, around now for some fifteen years, has addressed many of the diverse areas that face the researcher along the doctoral journey. This doctoral workshop has as an aim to offer an opportunity to explore and share research methodologies and the theoretical underpinnings facing PhD researchers within the construction and engineering sectors. Although, research methodology forms a part of the research process, early career researchers often struggle to come to terms with what appears to be this difficult part of the process. This workshop will allow researchers together in an environment where support for their approach to the research can be shared and discussed. There is evidence that there are a lot of PhD students who would benefit from a better understanding of what approaches are available to them, why they exist, the underpinning theories and, of course, when they are applicable and suitable for a research phenomenon and this workshop session will allow for discourse and interaction to enable 'learning to take place' together.

In these proceedings are the seven final papers selected from some fifteen abstracts presented for review. It is important to recognise that the papers selected offer the opportunity for participants to learn from each other. The process of selection for the workshop, while closely aligned with the ARCOM conference proceedings, is such that it is aimed at selecting papers within the scope of the topic but very much directed to allowing doctoral researchers' the opportunity to present work in progress where formative and developmental review can be offered. The context of each paper is diverse which has added to the richness of this edition of the doctoral workshop series.

Omotayo and Kulatunga offer a defense of using Suander's Research Onion model to come to a position for their research strategy to develop a kaizen costing framework suitable for indigenous construction firms in Lagos, Nigeria. They take the reader through the systematic approach from research philosophy through research strategy and techniques and on to a suitable framework.

Flood and Scott consider and reflect on the challenges posed for an early career researcher and offer discourse around the thoughts, reflections and angst that confront the early career researcher given the context of very little exposure to research methodology in the more formative years of higher education. The authors propose the use of mind mapping as a technique to address the complexity of problem identification. They suggest the need for early immersion and reading around the philosophical underpinnings that the PhD researcher must come to terms with. Much can be learned from the preparation and publishing of the journey through the methodological minefields.

Mudaka, Udejaja and Greenwood explore and offer a framework that includes the use of exploratory research methods to addressing delivering sustainable retrofitted building projects. Their paper defends the position from the use of a more qualitative positioning and the authors defend this by proffering that a qualitative approach aids the researcher in gaining full understanding of the knowledge issues in sustainable construction. The choice of case study as the research strategy, they argue, was necessary to gain that understanding of the dynamics and contemporary phenomena present in the industry as regards to sustainable retrofitted building projects.

Taggart, Koskela and Rooke address the need and call to approach research from a more interpretivist stance as an alternative to the more traditional positivistic approaches. The methodological approach they advocate is action research and the context of their work is in the small and medium size contractor sector of the construction industry in the West of Ireland. They argue that the insights from the ongoing research work has allowed them conclude that different, but equally cogent, epistemological routes towards validity must be adopted in action research projects, especially when considering contributions to knowledge and theory development.

O' Keffe explores the methodological considerations for project management within the the hospital practice order network context. He advocates a practice theory theoretical framework as an approach to the more 'traditional' theoretical perspectives that have dominated the research landscape. He proposes the consideration of Schatzki's notion of site ontology as the research position suggesting that those topics that constitute social life should be addressed from this position. While the case is made for a more practice-theoretical positioning he makes the defense that it must be ontologically coherent and contextually driven and include constant reflecting on the relationship between the particular practice theory used and the phenomenon being considered.

Allali and Kulatunga explore through the use of case study the effect organisational culture has on the process of knowledge sharing in business organisations including Information And Communication Technology firms. This Libyan case study presents both the qualitative and quantitative approaches to the study of between organisational culture and knowledge sharing allowing the authors to examine this phenomenon. A case is also proffered for the use of triangulation to verify and underpin the validity of the approach.

The final paper by Batra and Menz apply the more traditional research framework to research the potential in adopting a public private partnership (PPP) approach to the analysis of the economic performance factors in a project. They investigate the uncertainty and sensitivity affecting the economic performance in processes in PPP projects and attempt to understand the underlying benefits of this approach and bring into the forefront the possibility of its application on housing projects as. The authors defend a further aim of the research to establish a benchmarking system through developing improved/ new optimization risk-based models and thus improve project performance.

The diversity of research topics and the geographical spread of the assembled papers reflects a clear position as to the aspects of research that take place under the overall heading of construction management. Flood and Scott along with Maduka, Udejaja & Greenwood papers address the changing environment around the drive towards more energy efficient approaches to building design. While at the very topical position of the ever demanding economic influences is reflect in the work of Batra & Menz, O'Keffe and Omotayo & Kulantuga.

Research methodology is a common linkage across the work gathered in this special edition and it emphasises the importance of spending the time to delve, explore, grapple and overcoming the many issues a researcher faces in coming to terms with and making an informed judgement as the appropriate research methodology to apply to their chosen research area.

The emerging methodologies that have been highlighted and the exemplar papers that have been examined, reviewed and presented here only scratch the surface of possibilities for further development in built environment research. What is suggested that a further deep engagement with issues of research methodology is likely to yield a dramatic growth and development in the range of skills in the armoury of the built environment researcher. What

is important is that researchers are offered an environment in which to present their early discourse around understanding the ‘minefield’ that is research methodology.

It is a pleasure to be associated with this important aspect of the work of ARCOM and the continued support for this type of scaffolded experience for the researchers as they make their own personal research journey should be supported into the future! Finally, there is a need to address the gaps in methodological approach and allow researchers flourish and blossom by allowing them the opportunity to experiment within their chosen research domain.

‘It is not the answer that enlightens but the question’
Eugene Ionesco (1907)

Professor Lloyd Scott, April 2015

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The research methodology for the development of a kaizen costing framework suitable for indigenous construction firms in Lagos, Nigeria.

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Abstract

The need for a cost management paradigm shift in the construction industry is imperative because of the prevailing challenges of managing construction cost during construction. Small and medium scale construction firms in Nigeria are faced with the challenges of competition from foreign firm, cost overrun, project delays and unsatisfied clients. This challenge may be handled with kaizen principles and kaizen costing. This paper utilized literatures related to research methodology in the built environment to create a research framework for the study. This focused on the research philosophical stands, approaches and strategy related to the built environment. The research onion model was adopted for the framework development and the sample size of two hundred and fifty (250) respondents was selected based on theoretical sampling for quantitative data collection using questionnaires. Twenty (20) interviews would be conducted within the sample size for the questionnaire. This will involve Likert scale format questionnaires and semi-structured interviews.

Keyword: kaizen costing, research, research philosophy, framework.

Introduction

Research is a well-coordinated activity aiming to contribute more knowledge to the existing body of knowledge (Fellows and Liu, 2008). The process of creating new knowledge is expected to follow a systematic sequence and order which will lead to the eventual results (Collins and Hussey, 2003). Therefore, a research would follow a specific method of inquiry which would solve an existing problem. The research methodology is a structure containing approaches, strategies and techniques needed for the conduct of a complete research (Collins and Hussey, 2003). Research methodology is therefore based on the researcher, the background of the research topic, the research aim and objectives. A framework for a research can only be designed if the nature of the study is well defined with an established research aim and objectives are set out.

Background of the study

The construction industry is a very important industry in any nation. The UK construction industry has one of the largest construction industries in the world with varying projects such as tunnelling, highway schemes, civil engineering and building projects, which utilized detailed estimating cost control and planning (Potts, 2008). Within the construction industry UK, techniques used in post-contract

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cost control include earned value analysis, cost and schedule performance, cost ratio and fixed budget system (Dikko 2002, Sanni and Hashim 2013). The main cost management techniques include target costing, life cycle costing, activity based costing and kaizen costing (Everaert et al., 2006; Jong No & Kleiner, 1997; Kaur & Kaur, 2013). These methods and techniques have been employed in many construction industries around the world.

The Nigerian construction industry also makes use of target and life cycle costing, however activity based costing and kaizen costing are rarely used. Construction firms and cost managers employ normal techniques such as cost coding, monitoring of labour, material and plant cost et al. (Sanni & Durodola, 2012), nonetheless the use of the conventional methods for controlling cost during construction may have led to cost overruns and project delays in many construction projects in Nigeria. According to Odediran et al (2012) Nigerian local construction firms are small and medium scale in nature and they experience the challenge of competing with multinational construction firms due to project emanating from project delivery such as cost overruns, project delays, constant litigation, poor management structure and client satisfaction. Considering the myriads of problems SME construction firms in Nigeria experience, kaizen costing may play a major role in curbing the challenges facing SME construction firms in Nigeria.

Kaizen costing is derived from kaizen which is a Japanese word for continuous improvement (Granja, Picchi, & Robert, 2005). Kaizen costing has been used in the Japanese construction industry since the 1960s to reduce product manufacturing cost, improve quality and also client satisfaction (Granja et al., 2005; Everaert et al., 2006). This process has been applied in the construction industry in other parts of the world but it has not been applied in Nigerian construction industry even though it is in use in Nigeria manufacturing sector (Olabisi, Sokenfun, & Oginni, 2012). The benefits of this cost management method can be used to improve the performance of construction firms in Nigeria through a strategic framework for the Nigerian construction environment.

The aim of this study is to create a new structure for conducting post-contract cost control in Nigerian indigenous construction firm in Lagos state based on kaizen costing. The objectives of this research are to:

- a) To identify and evaluate the post-contract cost control techniques used in the construction industry.
- b) To identify and evaluate the techniques used in post-contract cost control management in indigenous construction firms in Lagos, Nigeria.
- c) To assess the understanding of kaizen philosophy in indigenous construction organizations in Lagos, Nigeria.

- d) To identify and evaluate the critical success factors of adopting kaizen costing in indigenous construction firms in Lagos, Nigeria.
- e) To evaluate the possible integration of activity based costing system with kaizen costing.
- f) To develop a Kaizen costing framework which can be integrated into the post-contract cost control practices in indigenous construction firms in Lagos, Nigeria.

This paper addresses the research methodology which is required to create a kaizen costing framework based on the research aim and objectives accordingly, the first methodological aspect related to the study is discussed as a whole, while the structure of the research methodology is subsequently discussed. This involves the research philosophy, approach, strategy, sampling and data analysis. The research methodology adopted for this investigation will determine the path to take in achieving the final objective in this study.

The research methodology

In built environment research the major frameworks available for research methodology are the nested method and the research onion (Kaglioglou et al., 1998; Saunders, Lewis and Thornhill, 2012). These two models contain the same steps required for effective research; however the research onion contains more information compared to the nested model, these models are illustrated below.



Figure 1: The nested model (Kaglioglou et al., 1998)

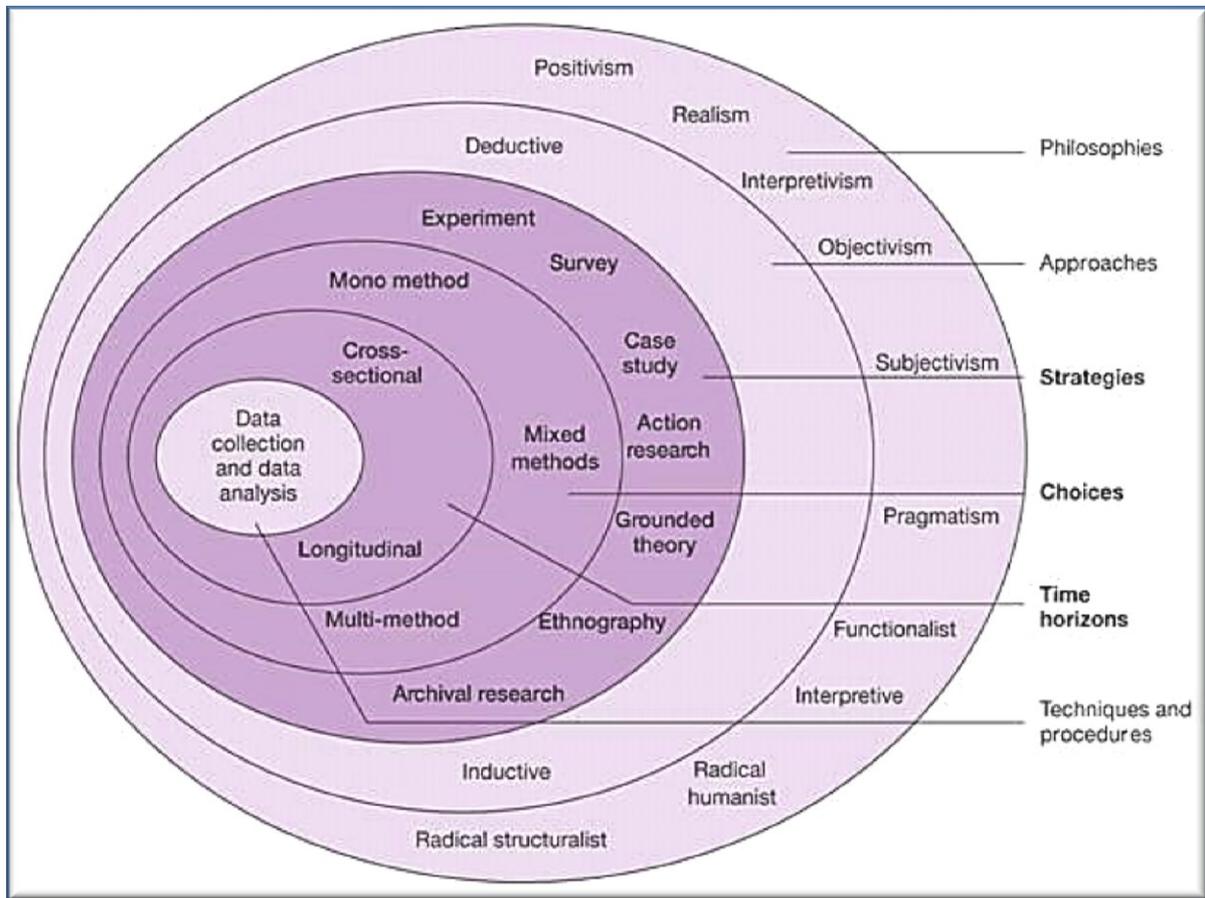


Figure 2: The research onion (Saunders et al., 2012)

The nested model contains information about the research philosophies at the first stage, the research approach at the second stage and also the research techniques at the final stage in the inner core. The research onion breaks the research philosophy down into the more detailed phases from the philosophy to the time horizon and the techniques and procedures. The choice of a research methodology model depends on the researcher and the research objectives. This study will adopt the research onion because of the detailed structure.

The research philosophy

Research philosophy is regarded as the bedrock of any research, the core stands of research philosophy guides the researcher in making the right decisions about the approach, strategy, data collection techniques and procedures on how to answer the research questions. William and Mays (2002) stated that research is based on philosophical values which define various disciplines. These philosophies are mainly divided into ontology, epistemology and axiology.

Ontology attempts to know if knowledge is a product of the mind or it exists, in this instance it suggests *realism* and *idealism* (Morgan and Smircich 1980, Lawson 2004, Krauss 2005, Carr 2006, Khin and Heng 2012). Reality may be seen may be viewed in this paper as being within the social phenomenon in some of the objectives and outside the social phenomenon. In this case some literature may be reviewed to get some data about post-contract cost control techniques, while the evaluation of kaizen philosophy will have to be evaluated based on the existing structure of organizations.

Epistemology is the philosophy which relates to how knowledge can be recognized, developed or acknowledged (Schuh and Barab 2007, Mack 2010, Mkansi and Acheampong 2012). Epistemology considers alternative ways of approaching research (Hill 1984, Khin and Heng 2012). Eriksson and Kovalainen (2008) explained that epistemology may be objective or subjective; objective epistemology recognizes the outside world which is hypothetical impartial, while the subjective epistemology suggests that the outside world is in the realm of clarifications from reflection. The two sides of epistemology are positivism and interpretivism.

The positivist handles research using the quantitative method involving surveys, experiments, simulations et al (Holden & Lynch, 2004). The interpretivist or social constructionism aims to increase the general understanding of reality, therefore the experience of the researcher is included as part of the study, includes the opinion of stakeholders. The epistemological views of positivism may be applicable to some research objectives in this study, while interpretivism may be used for other objectives. However, this can be combined in some objectives.

This is explained in table 1 below. According to Saunders et al. (2012) a researcher may decide to add his own personal experiences to the values of a research or may decide to be unbiased about the concept of value in a research. Axiology pertains to the judgement of value by a researcher. Therefore the two positions of axiology will include value-neutral and value-laden. These two sides value are related to positivism (value-neutral) and social constructionism (value-laden). Some research objectives in this study may adopt the combination of value-laden and value-free, this is based on the nature of the objectives. This is further explained in table 1.

Table 1: Justification of the research philosophical stands adopted for each objective

Research objectives	Ontology	Epistemology	Axiology
1. To identify and evaluate the post-contract cost control techniques used in the construction industry	Knowledge is derived from the existing social phenomenon, therefore idealism will be adopted. The objective can be resolved using existing literature	Since this objective can be resolved using literature, stakeholders' opinions will be involved. Intrepretivism will be adopted in this case.	This objective will be value-laden because the researcher's experience will be included.
2. To identify and evaluate the post-contract cost control management used in indigenous construction firms in Lagos, Nigeria	This objective will adopt realism and idealism because some of the techniques exist in literature will other will be gathers from outside the social phenomenon	This objective will make use of positivism and intrepretivism because some of the techniques can be identified in the academic milieu while some have to be collected from the outside world	The objective will be value-free and value –laden because of the researcher will involve his experience in the research in some case but not all.
3. To assess the understanding of kaizen philosophy in indigenous construction firms in Lagos, Nigeria.	The opinion of construction professionals are required in this objective and it will involve idealism only.	Intrepretivism is required in this objective because the opinion of the construction professions is necessary.	Value-biased is necessary because it is opinion based
4. To identify and evaluate the critical success factors of adopting kazien costing in indigenous construction firms in Lagos, Nigeria	Some of the knowledge exist within the social phenomenon and in the outside world, therefore it will be partly realism and partly idealism.	The positivist stand in this objective involves the unit of analysis, while the intrepretivism stand seeks to add more to the existing knowledge. Positivism and intrepretivism is required because the unit of analysis has to be evaluated and the stakeholder's opinions are required.	The independence of the researcher makes it value-free while the value-laden aspect adds the researcher's experience.
5. To evaluate the possible integration of activity based costing system with kaizen costing	Realism and idealism are necessary for the objective because some knowledge will be gathered from the outside world and also from the social phenomenon.	Large amount of data, simplified unit of analysis are required. The positivist stand will be adopted	The researcher would need to add his experience in the value-laden aspect of gathering opinions, but it will also be value-neutral
6. To develop a kaizen costing framework which can be integrated into the post contract cost control practices of indigenous construction firms in Lagos, Nigeria.	Realism is required alone because the framework development will involve knowledge from outside the social phenomenon		This objective is totally value-free because no bias is required for the creation of the framework

Table 1 above maps out the research objectives to the appropriate philosophical stand for the study. This will defined the type of research approach to adopt. The next section discusses the research approach which will be formed based on the research philosophies for each of the objectives. The overall research approach may determine the research strategy to utilize for the investigation and also the sample size and method of analysis.

The research approach

Mixed method research is a combination of qualitative and quantitative research methods. Amaratunga, Baldry et al. (2002) opined that mixed method allows the weaknesses of each method (qualitative and quantitative) to be complemented by the strengths of the other. (Amaratunga, Baldry et al. 2002) further added that mixed method which is also known as the broad approach is imperative for having an introspective overview of a research. The research approach may be *deductive* or *inductive*. The inductive approach is based on intepretivism while the deductive approach is more or positivism when considered from the epistemological grounds. The deductive approach views a research from a broader perspective to the main specific unit of investigation. Losee (1993) noted that the method of reasoning in deductive approach involves the creation of concepts or theories which are then tested via observation. Inductive approach is the direct opposite of deductive approach. This study will make use of both deductive and inductive approaches, this is combination is known as the abductive (Levin-Rozalis, 2004). The abductive approach is necessary based on the research objectives.

The research strategy

According to Wisker (2008) research strategy may be in form of case study, surveys, ethnography, field experiments, simulations, laboratory experiments, action research, archival analysis, role playing and so on. The suitability of these methods depends on the research objectives and the philosophy which has been adopted for the investigation. Table 2 below compares the research strategies and their suitability to the research objectives.

Table 2: Displays the suitability of the various possible research strategies for this study

Research strategy	Philosophical stand	Suitability for the research
Action research	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.
Surveys	Positivism/Realism/ value-free	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 (De Vaus, 2002). This will be 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.
Case study	Intpretivism/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 will be conducted using survey interviews for simplicity. Case study research may be longitudinal or cross sectional making using of interviews as research instruments.
Experiments	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. Experiments are usually used for pure sciences.
Content analysis	Intpretivism/ idealism/value-laden	Literature review as a form of research strategy could be content analysis, word count, narrative analysis, taxonomy analysis, qualitative comparative analysis and so on (Onwuegbuzie, Leech et al. 2012) . Some of the research objectives will be resolved from the content of the literature review in this study.

From the research strategy synthesis above survey is the most appropriate method for this research and it includes qualitative and quantitative techniques of data collection. The choice of survey strategy for this research is based upon the simplicity, intended sample population and the method of ana-

lysing the data which would be collected. The justification for adopting survey strategy is further discussed in the next section.

Surveys research strategy

Survey strategy tends to asks questions such as what, who, where, how much or how many, it focuses on contemporary phenomena and does not require the control of behavioural events (Yin, 2009). According to De Vaus (2002) surveys may be inform of quantitative or qualitative method of data collection. This involves questionnaires and interviews. The description of survey strategy by (Yin (2009) reflects the category of approach to this study which involves answering questions about what type of post-contract cost control techniques are used, the number of techniques used and the evaluation of these techniques. The survey strategy is the most suitable for this kind of research. De Vaus (2002) also described the survey strategy to be quantitative, in this case involving interviews, this is aspect of surveys would be need for the final objective which involves the creation of a kaizen costing framework. The perception and opinion of some specific stakeholders in Nigeria construction industry would be need for the formulation of a new method of conducting post contract cost control in Nigeria. The interviews will be informs of semi-structures interviews. The questionnaires will be structured using the Likert scale format. This is necessary because of several opinion are required for the formation of kaizen costing framework.

The major time horizons for a research may be longitudinal or cross-sectional (Saunders et al. 2012). This investigation has adopted the cross-sectional time horizon because the final objective which involves a framework can easily be resolved within a shooter time. Longitudinal time horizon involves several months of data collection. The surveys method adopted also supports this selection.

Research Sampling

This study will make use of theoretical sampling because it needs the opinion of experienced professionals within a specific geographical location. Twenty (20) semi-structured interviews will be distributed alongside two hundred and fifty (250) questionnaires in construction firms in Lagos Nigeria. There are about 750 medium scale construction firms in Lagos, Nigeria according to the Lagos State Ministry of Housing (Sanni and Durodola 2012), also Nwanna (1981) as cited by Sanni and Durodola (2010) noted that 40% of the population size in its few hundreds will be enough as a sample population in a research.

Data analysis and presentation

Content analysis of the literature is an analysis method which can be used to categorize the themes is a systematic approach (Saunders et al., 2012). This approach will be used to select the post-contract cost control techniques and also the critical success factors from the literature review. The coding process also allows these identified critical success factors and post-contract cost control techniques to be narrowed down to the important one for the analysis. The analytical hierarchy process will be used to analyse the important critical success factors in the research. The NVIVO coding process makes use of nodes which allows themes to be filtered. The coding process in NVIVO is in an ascending manner, this process is can be used for deductive and inductive coding. Coding allows the researcher to makes noted which will invariably lead to theory (Richards, 2009). Coding will be the first approach for the data gathered using questionnaire and interviews. Relative importance index using mean score ranking would be used to rank and analyse the most important critical success factors and post-contract cost control techniques. Initials results would then be validated for error correction and reliability using fifteen expert interviews and three live projects.

Conclusion

Based on the research onion model, the framework for this research has been designed based on the available research objectives and related philosophies. The research philosophy led to the synthesis of the research strategy. The research approach is based on the combination of deductive and inductive approaches which is described as being abductive. The final structure of the research framework is illustrated in figure 2 below. Most studies about academics such as Granja, Picchi et al. (2005) and Kaur and Kaur (2013) on kaizen and kaizen costing has been literature based, while some authors involved in detailed analysis of kaizen costing concept in relation to management decisions and impact has adopted the survey and case study strategy (Olabisi, Sokenfun et al. 2012). The research framework designed for this study will adopt the survey strategy because this research intends to have an in-depth evaluation of the perception of continuous improvement on organization behaviour and cost reduction.

Following a systematic approach from the research philosophies to the research approach, strategy, and techniques, a suitable research framework has been designed for this study. This is illustrated in the diagram below.

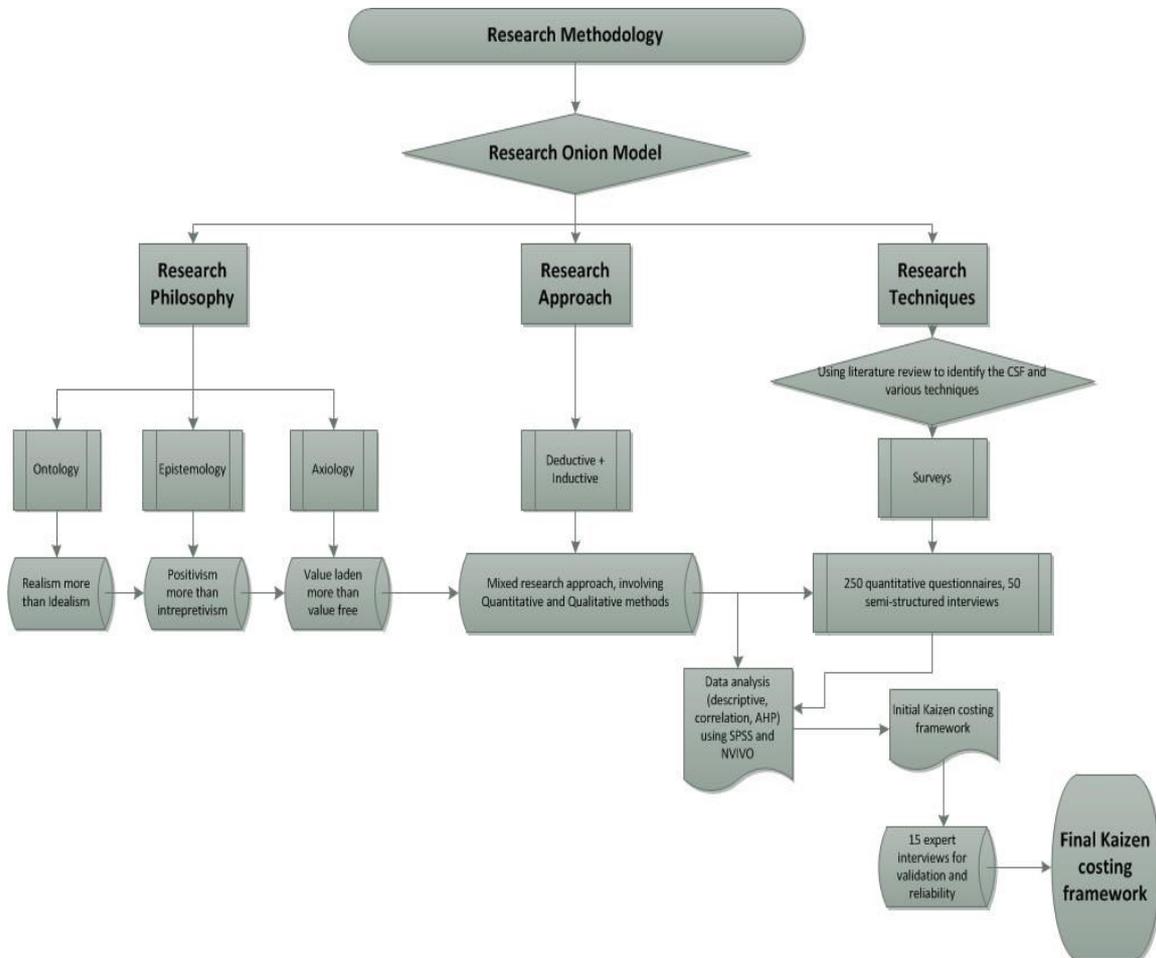


Figure 3: Conceptual research methodology framework for the development of a kaizen costing framework

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The Use of Exploratory Research in Addressing Knowledge Issues in Delivering Sustainable Retrofitted Building Projects.

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This paper describes a proposed strategy of exploring the role of knowledge management (KM) in delivering retrofitted building projects. This is based on an on-going PhD project whose primary objective is to develop a decision support system (DSS) for the key stakeholders involved in sustainable retrofitted building projects. A brief review of sustainable construction and knowledge management and its application in construction were discussed. The ways in which knowledge is managed in retrofitted building projects is then examined to provide the basis of a conceptual approach for reflecting both organisational and human dimensions. Qualitative approach adopted in this study is to help the researcher gain full understanding of the knowledge issues in sustainable construction. The choice of case study as the research strategy is necessary in order to understand the dynamics and contemporary phenomenon present in the industry as regards to sustainable retrofitted building projects. The case study involves the use of semi-structured interviews and documentary evidence and these will help in capturing relevant project knowledge that will be useful in delivering the research aim(s) and objectives and also answering the research questions. The case study process will build on the literature works; investigates on the current practices in sustainable construction; the barriers in the uptake of sustainable retrofitted building projects; what knowledge means to an individual stakeholders in delivering sustainable retrofitted building projects and the role of knowledge management in making appropriate sustainable choices in sustainable retrofitted building projects. The research design employed five steps that will be applied in collection of data. The collected data would be analysed and the outcome will be a modelling of sustainable building process for retrofits hence the development of a decision support system (DSS) prototype through managing of project knowledge. The testing of the prototype will ensure its refinement to fit for purpose.

Keywords: Qualitative approach, research strategy, sustainable construction, sustainable retrofits, knowledge management, key stakeholders, decision making.

Theoretical and Conceptual Underpinnings

The global attention given to climate change that led to the clamour for sustainable development in the 21st century is a laudable development. Efforts of different governments world-wide geared towards mitigating the climate change effects have been widespread and documented (European Commission, 2007, Kapsalaki *et al.*, 2012, McManus *et al.*, 2013). The need to reduce and mitigate climate change effects was propelled by the Brundtland's report 'Our Common Future' which charged national and international bodies to promote the course of sustainable development through three sustainability concepts; environmental, economic and social in order to reduce climate change (WCED, 1987). The report further described sustainable development as the development that meets the need of the present generation without undermining the ability of the future generations to meet their own needs (Brundtland, 1987). In a related view, the IPPC Fourth Assessment Report reaffirmed that climate change which is predominantly caused by human activities is inevitable due to increase of greenhouse gas emission (e.g. CO₂) in the atmosphere (IPCC, 2007). These have put the United Kingdom (UK) under a commitment to champion the concepts of sustainable development in the built environment particularly the construction industry due to its impacts in the society (McManus *et al.*, 2013).

The impacts of construction due to its activities has significant positive and negative effects in the UK and the entire globe (Pietrosemoli and Monroy, 2013). Some of the positive impacts includes: contribution of about 7% to the UK Gross Domestic Product (GDP) or about £110 billion in annual income; job creation: producing of different types of building and facilities to meet human needs (ICRIBC, 2002, Winch, 2010, Pietrosemoli and Monroy, 2013). The negative impacts of construction are well documented for its contribution to greenhouse gas emissions, which has impacted on climate change effect (Stern, 2006, IPCC, 2007, Weight and Rawlinson, 2007, Levin, 2008, Stolarski *et al.*, 2010). Furthermore, the built environment worldwide contributes about 30 to 40 per cent of CO₂ emission to the atmosphere and as well consume about 40% of the total energy usage (Boardman, 2007, Dixit *et al.*, 2010, Kapsalaki *et al.*, 2012). European Union (EU) estimates that the European countries contribute about 50% of CO₂ to the atmosphere (Rai *et al.*, 2011). In the United Kingdom (UK), it is established that buildings consume over 45% of UK energy usage and generate approximately 50% of greenhouse gas (GHG) emissions (Stern, 2006). These negative impacts have made the industry come under public; regulators' and government scrutiny more than ever before and have necessitated the industry to increasingly recognise the need to achieve sustainable development by engaging in sustainable construction (Zuo *et al.*, 2012). Sustainable construction has been argued to be the application of sustainable development concepts and principles to construction processes and practices (Sage, 1998, Carpenter, 2001, ICRIBC, 2002, Shellbourn *et al.*, 2006, European Commission, 2007, Winch, 2010). Sustainable construction in building projects exists in new build and retrofitted building projects. New build involves demolition and construction of an energy efficient building while retrofitted involves sustainable refurbishment of an existing building to deliver an energy efficient building. The government has stated that by 2016 every new building must be energy efficient or built on a carbon neutral basis and non-domestic buildings must be constructed on a neutral carbon basis from 2018 (Kelly, 2009).

However, it has been argued that 80% target reduction of greenhouse gas emission in the atmosphere by 2050 can be achieved in the UK if the industry recognises the need for sustainable retrofitted building projects (Glass *et al.*, 2008, Kelly, 2009, Pietrosemoli and Monroy, 2013). This is because only about one-third or 30% of new energy efficient buildings would have been constructed in response to the target and this cannot contribute significantly to GHG reduction by 2050 (Glass *et al.*, 2008). This is due to the fact that about two-third or 70% of buildings existing today in the UK will still be standing and in use by 2050 (Glass *et al.*, 2008, Kapsalaki *et al.*, 2012). In view of this, it is evident that engaging in sustainable retrofitting of existing buildings is inevitable and will contribute substantially in greenhouse gas reduction by 2050 (Glass *et al.*, 2008, Lockwood, 2008, Kelly, 2009, Jenkins, 2010, McManus *et al.*, 2013, Stevenson, 2013).

Nevertheless, delivering a sustainable retrofitted building project remains a challenge in the industry due to lack of managing knowledge in sustainable construction projects. It has been argued that there is a possibility for substantial carbon emission reduction through appropriate approaches to sustainable retrofit, however, achieving it presents a multifaceted and difficult problem to the industry due to lack of knowledge management (KM) (Stafford *et al.*, 2012, McManus *et al.*, 2013). Shellbourn *et al.* (2006); Shari and Soebarto (2012) argued that the slow uptake experienced in delivering sustainable retrofitted building projects is due to the fact that the industry has failed to realise the importance of managing knowledge in construction activities. Shellbourn *et al.* (2006) argued that to attain the goals of sustainable development via sustainable construction, it is essential to realise the need for managing knowledge to be properly adopted in the industry. This can be improved if the industry recognises the need to capture and reuse project knowledge in sustainable construction in order to avoid reinvent-

ing the wheel. The need for managing knowledge in the process of delivering a sustainable retrofitted building is vital in order to have an improved understanding of sustainable issues in the built environment and to enhance key stakeholders' understanding of the existing wide-range of technologies in appropriate decision making (Yudelso, 2009). Eliufoo (2008) reiterated that sustainable retrofitted buildings can be realized if construction activities are informed by new resources of knowledge and expertise.

Furthermore, to attain the required energy performance level in existing buildings, it is imperative to explore knowledge issues that will facilitate decision making process for primary stakeholders in delivering sustainable retrofitted building projects. This has necessitated the demand for an effective knowledge evaluation tool for the selection of sustainable technologies that would assist stakeholders in making informed sustainable choices (Pan and Dainty, 2012, Davoudpour *et al.*, 2012). Consequently, there is a need to explore KM to develop a decision support system to enhance key stakeholder's decision capabilities in having the required knowledge to make informed decisions as regards to delivering retrofitted building projects has been suggested (Pan and Dainty, 2012).

Choice of Research Approach

A research approach can be classified as quantitative and qualitative or a combination of the both which is called the mixed method (Fellows, 2008, Silverman, 2010, Neuman, 2011, Bryman, 2012). Quantitative research is concerned with explaining a phenomenon by collecting numerical data that is analysed using mathematical methods such as statistics (Aliaga and Gunderson, 2006). Qualitative research is designed to explore the human elements of a given topic, where specific methods are used to examine how individuals see and experience the world (Given, 2008). Mixed method approach is the combination of both quantitative and qualitative research approaches (Bryman, 2012). It is essential to be aware of the methodological philosophies and paradigms or debates that exist in order to understand the reason for the choice of research method. The paradigm of choice depends on the nature of the research (Dainty, 2008, Saunders *et al.*, 2012). The need to be clear with the appropriate research method used in any research has been suggested (Wilson, 2014). Having considered the nature of the research which deals with key stakeholders in the industry the research adopted qualitative research method. The reason for adopting qualitative research approach is because the researcher has to gain full understanding of the current practices due to the nature of the research which deals with key stakeholders and knowledge issues in delivering sustainable retrofitted building projects. Fellows and Liu (2003);McKie (2002) argue that qualitative method remains the most relevant because it will enable the researcher to gain understanding of the knowledge issues in order to collect relevant information and data such that theories will emerge. Dainty (2008); Sutrisna (2009); Bryman (2012) argue that qualitative research is the best used in the generation of theory and also where the research takes the position of knowing the natural reality of things as they exist. Furthermore, qualitative methods have been considered capable of studying complex situation and yielding rich findings and particularly suitable when involving human subject finding (Sutrisna and Barret, 2007). The research will explore in-depth the barriers and drivers in delivering sustainable retrofits; what knowledge means to individual key stakeholders; the need for managing knowledge in delivering projects in the industry especially in sustainable retrofits, explore on the decision support systems available in the industry and how it has been of relevance to achieving sustainable construction.

Proposed Research Strategy

In order to achieve the research objectives of this project, the following research activities will be undertaken in order to capture and present relevant knowledge and these are presented in five stages as discussed below in accordance with the research design as illustrated in Figure 1.

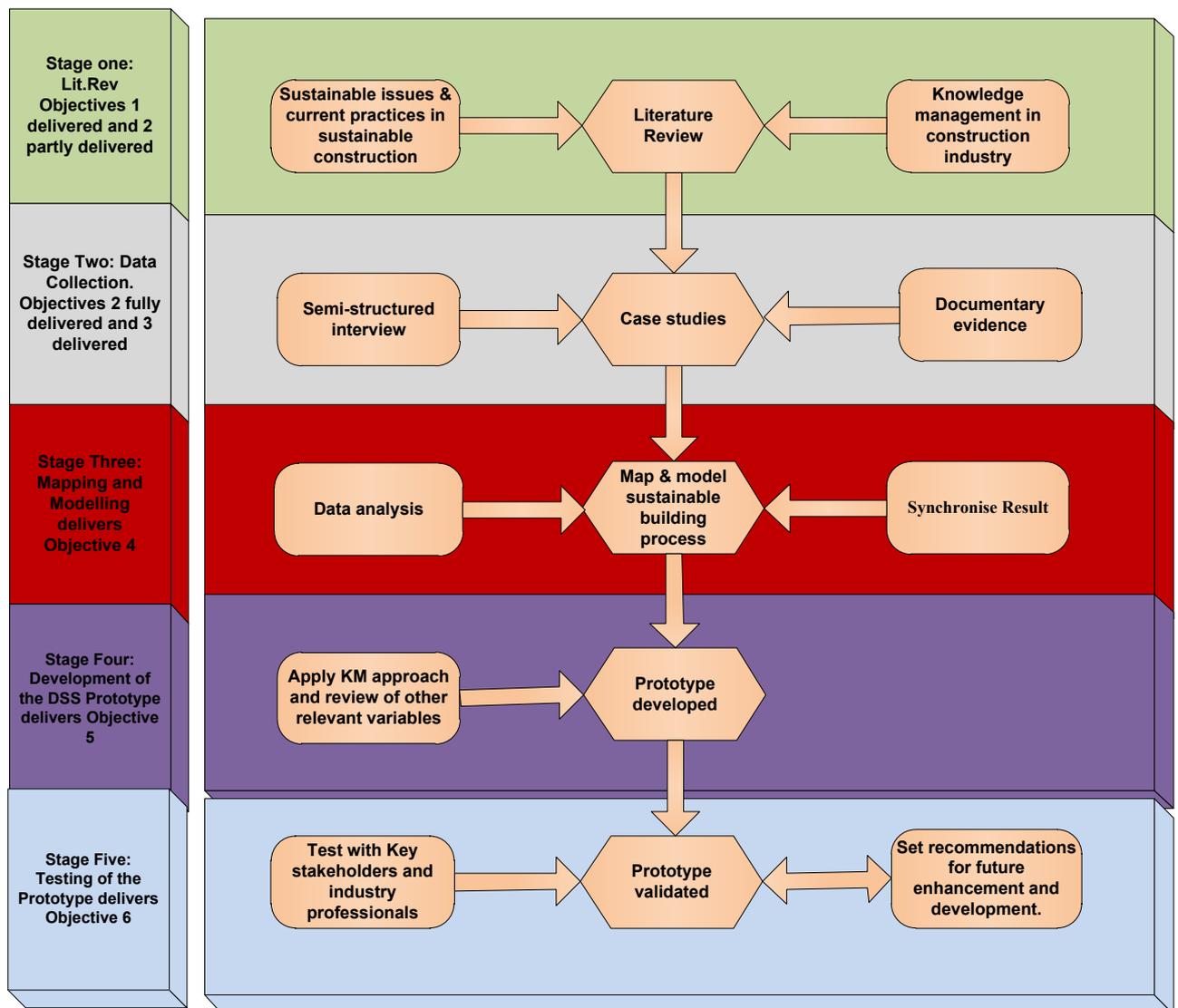


Figure 1 Research design

Stage One: Literature Review

An extensive review of literatures on Sustainability and Sustainable construction has been undertaken using published sources (journals, books, reports and online publications) and this delivered Objective 1. Through this review, many themes emerged which became the basis that assisted the researcher to develop theoretical framework for this research. The theoretical framework contributed in identifying theories essential to the research and also, identified the gaps in existing knowledge in sustainability and sustainable construction. This contributed to the development of sections and chapters of the review hence become the basis of the specific research investigation. Additionally, the review assisted the researcher to gain full insight of the research problem thereby establishing the status quo of sustainability, sustainable construction particularly retrofitted building projects and its drivers and barriers and best practices in the industry.

To deliver Objective 2, an extensive literature review will be conducted to explore the role of managing knowledge in making appropriate decisions in sustainable retrofitted building projects. It is necessary to explore knowledge management (KM) to underpin the need to inculcate it into sustainable construction particularly in retrofitted building projects. Due to the challenging nature of delivering sustainable retrofitted building projects the review will discuss some existing kinds of knowledge such as tacit and explicit knowledge in order to understand their relevance in expediting project delivery. This review will also be explored to ascertain the importance of managing knowledge in the area of knowledge creation; capture; reuse; sharing; collaboration and knowledge identification and representation in sustainable construction especially in sustainable retrofitted building projects.

Furthermore, this stage will involve the review of the existing decision support systems (DSS) models, frameworks and tools which will be useful in identifying gaps in knowledge as it regards to stakeholder management predominantly in sustainable retrofitted building projects. It will also assist the researcher to have a clear picture of the kind/type of prototype to be considered for development. The completion of this literature investigation will be useful in delivering relevant interview questions that will be pursued during data collection through case studies.

Case Studies:

Case studies approach will be used to collect data and this will build on the literature works that has been conducted and on-going. This strategy seeks to answer 'why' 'how' and 'what' in relation to issues behind reality of research investigations (Calzadilla *et al.*, 2012). It is argued that the use of case studies is considered appropriate since 'depth of insight' will be more appropriate to the development of a strategy that reflects the opinions of individuals and key stakeholders (Petty *et al.*, 2012). It has also been argued that case studies focuses on understanding of the dynamics present in the industry as regards to sustainable construction (Amaratunga *et al.*, 2002). Furthermore, Yin (2009) argues that it is an empirical investigation into contemporary phenomenon operating in a real-life context. This will help to identify the current practices in sustainable construction in the industry as it relates to sustainable retrofitted building projects. The case studies will be implemented using analysis of documentary evidence and semi-structured interviews with key stakeholders from the case organisations. The need for documentary review is due to the possibility of providing valuable information that may not be accessible by other means and also it can generate ideas for questions that can be pursued through interviews (Petty *et al.*, 2012). Scott (1990); (Berger, 1991); Bryman (2001) argued that the use of documentary evidence is essential in order for the researcher to extract the relevant information that can be deemed as statement of facts to validate individual's research objectives. The documentary evidence can be captured in the form of public records; the media; official gazettes; minutes of the meetings; reports and blue prints; visual documents. This will help the research to identify what knowledge means to the individual stakeholders and key stakeholders which will lead to the categorisation of the different knowledge that exist in sustainable construction particularly in retrofitted building projects. However, the choice of semi-structured interview is valued for its accommodation to a range of research goals, typically reflects variations in its use of questions, prompts and accompanying resources to draw the participant more fully into the topic under study (Galletta, 2013). It is also argued to have a pre-determined set of questions or issues that will be explored in-depth during the interview in order to capture project knowledge. This approach helps the interviewer/researcher the opportunity to pursue the interview in greater depths with flexibility while the interview remains conversational (interactive) (Wilson, 2014). This will enable the research to ensure that

same information is obtained from different number of participants hence enabling logical gaps in the collected data to be closed easily (Longhurst, 2009).

Furthermore, the idea of using both semi-structured interviews and documentary evidence is because knowledge in organisations can exist as both tacit or explicit knowledge (Nonaka *et al.*, 1996). Smith (2001) further explained that explicit knowledge deals with an academic document or ‘know-what’ that is described in a formal language often based on established work process documented by individuals. Describing tacit knowledge the author revealed that it to be an existing practical, action-oriented or ‘know how’ based on practice, acquired by individual experience rarely expressed openly.

Stage Three: Map and Model Sustainable Building Process

In this stage Objective 4 will be achieved and this will involve mapping and modelling sustainable building process. This will be delivered using data collected from case studies and literature reviews to synchronise results using qualitative result inferences. The mapping will be delivered in a way of illustrating knowledge that will inform primary stakeholders in making appropriate decision for sustainable building projects. The mapping and modelling of sustainable building process will also assist in the development of the DSS prototype.

Stage Four: Development of the Prototype

To develop the prototype, the researcher will integrate results and this will be achieved by making use of the mapped and modelled sustainable building processes and literature that has been reviewed. This will assist to determine the prototype layout. Furthermore, an approach which incorporates necessary tools and technologies (e.g. search engines, sustainable technology options, decision variables etc.) will be adapted to contribute in developing the prototype that will elucidate knowledge to assist primary stakeholders in making enhanced decision towards delivering sustainable retrofitted building projects. This will deliver Objective 5 hence the testing of the prototype.

Stage 5: Prototype Testing

The testing exercise will deliver objective 6. This will involve testing of the developed prototype with key stakeholders and industry professionals. The potential types of testing to be considered in this research to validate the prototype include;

System Integrated Testing (SIT): this testing method will be used to test the prototype components and detect interface defects. It also involves a high-level software testing process in which testers verify that all related systems maintain data integrity and can operate in coordination with other systems in the construction industry. This testing ensures that all sub-components are integrated successfully to provide anticipated results and after this testing the prototype undergoes user acceptance testing (Binder, 1999).

Modular Testing: the prototype will undergo an assessment to ensure the operational functionality based on individual components. This testing is to ascertain the reliability of the final product given (Frankl *et al.*, 1998). This procedure will be used so that statically valid inferences may be drawn about the overall system from the result of the component test.

User Acceptance Testing (UAT): this test is usually put in view or considered before prototype development begins so as to enable the developer have a better and clearer idea of the system to develop (Goethem and Pauline, 2013). The testing of the prototype components will be done by the developer, industry professionals, focus groups and key stakeholders to determine if it is fit for purpose. It has been argued that this test usually measures whether the system has satisfied the acceptance criteria of the stakeholders in the industry (Black, 2009, Goethem and Pauline, 2013).

The outcome of the tests will assist to enhance the ability of the researcher to present a refined, useful and more acceptable DSS to fit for purpose. The benefits of the DSS prototype and its limitations will be considered for future research development and this will contribute to recommendations that would be generated.

Conclusion

Qualitative research approach has been considered capable of studying complex situations, specifically when human beings are involved hence yielding rich findings. This has resulted in the increase of its popularity, particularly in the built environment (Sutrisna, 2009). This paper has demonstrated the need for the adoption of qualitative research approach and strategy in this study. The adoption has been considered appropriate because it is capable of generating great in-depth of data that would be relevant for the delivering of the research aim(s) and objectives and also answer research questions. The discussion in this paper has provided an insight on the stages that would be employed and applied to collection of data. It has also demonstrated on how the empirical evidence (collected data) will be analysed and presented to elicit knowledge towards delivering retrofitted building projects in the UK. The outcome of the empirical evidence would be realised in mapping and modelling of sustainable building process which will help the key stakeholders in managing project knowledge. The key contribution of the research which involves the development of DSS prototype has been revealed to be essential to the key stakeholders in the industry in order to help them make informed decisions in delivering of sustainable retrofitted building projects in the UK. The testing of the prototype is necessary to ascertain that it is fit for purpose for the industry and also provide opportunity for refinement and acceptance of the DSS.

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RESEARCH METHODOLOGY: A NOVICE RESEARCHERS' APPROACH

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ABSTRACT

This research is a detailed study on the performance of external walls aimed at providing a guidance tool which will enable designers to determine the appropriate thermal upgrade system for a housing retrofit, particularly in Ireland; taking into account wall type, climatic conditions and orientation. This paper explains the steps taken to establish a research design and methodological approach suited to the topic at hand. The choice of research methodology is a difficult step for the researcher to decide upon in the research process. When it comes down to an architectural technologist, the process becomes even more difficult. Throughout a college process of taught procedures for accurate building design, solutions do not delve into the world of methodological approaches. Research methodology is simply not a common concept or approach throughout the Architectural/Engineering and Construction (AEC) sector. This paper assesses the existing limited research in the AEC sector, while highlighting how this was interpreted by a novice researcher with a background of architectural technology, to allow accurate and precise research analysis. Each research method has inherent strengths and weaknesses. Careful attention to the methodological approach of the design process, as discussed here, can enhance the validity and consistency of a given study. Combining quantitative and qualitative approaches in research design and data collection should be considered whenever possible. Such mixed methods research improves the validity and reliability of the resulting data and reinforces fundamental implications by providing the opportunity to observe data convergence or separation in the analysis of the theory.

Keywords: Research methods; Mixed methods; Data analysis; Architecture/Engineering and Construction (AEC)

INTRODUCTION

According to Abowitz & Toole (2010) construction is essentially a social process. In effect, construction can be considered to be the application by people of technology developed by people to achieve goals established by people involving the erection or retrofitting of infrastructure and buildings (Abowitz & Toole, 2010). The fact that people play key roles in virtually all aspects of the construction process proposes that conducive to understanding the human or social factors, effective construction research requires the proper application of social science research methods (Abowitz & Toole, 2010). The focus of this paper is on various issues encountered in the application of social science methods to AEC research and on the practicality of applying a mixed methods approach to enhance the validity and consistency of potential results. A methodology refers to the philosophical framework and fundamental assumptions of the entire process of research. In any research project, it is imperative to illustrate an understanding of the research approach to increase the validity of the research. At the initiation of this research project, many questions arose in regards to the methodological approach which should be employed. Mixing qualitative and quantitative methodological techniques within the scope of a research project allows poise of the strengths and weaknesses of each approach. Using mixed methods affects not only measurement but all stages of research (Brewer & Hunter, 1989). This research has followed a very heavily quantitative methodology in the explorative phases; however this should not be misconstrued as it has been designed around a mixed methods approach. As an AEC researcher, much disillusion and confusion surrounds the subject of methodology. It is a misunderstood area of research which remains unclear yet fundamental to all research. In this paper, I aim

to highlight the journey which this research has taken, and the influence the chosen methodology has demonstrated.

The selected approach to this research has asserted the relevance of the research being carried out, and verifies its validity in within the current thinking of the AEC industry. Previously carried out research as recent as 2011, has found that software programs for U-values tend to overestimate U-values of traditional building elements. Moreover, current research recommends further research on the thermal properties of traditional building materials and construction components; improvements to the U-value calculations; and a standardised methodology for in-situ measurement of U-values (Baker, 2011; Kunzel, 1998; Little, 2009, 2010, 2011). Correspondingly, it has been noted from alternative research in the area that:

‘Evidence suggests that the approach is often flawed because it is not based on any direct measurements or observations of buildings prior to retrofit work and frequently relies on modelled assessments to prove assertions of improvement.’

(Alliance, 2012)

The quantitative studies required to develop the hypothesis of this research can be compared with previous methods which have been carried out in differing climates and populations. This previous research has projected methods of data collection, analysis, and interpretation which can be compared with, improved, added to and used as a verification tool.

REVIEW OF RESEARCH METHODOLOGICAL TYPES

The initial step for this research (which is in constant development) was to understand the different aspects to each type of methodology, their application and usefulness to the project. A methodology refers to the philosophical framework and fundamental assumptions of the entire process of research. In any research project, it is important to illustrate an understanding of the research approach to increase the validity of the research. The philosophical framework will influence the procedures of the research process. Within this research process are four stages; epistemology, theoretical perspective, methodology and methods (Crotty, 1998). The starting point of this research was to develop an ontological view on the area of study. This means the researcher embraced the idea of multiple realities and developed a personal epistemology. Epistemology refers to what should be regarded as acceptable knowledge, and is concerned with theories of knowledge. These theories attempt to answer questions surrounding the nature of knowledge, its limits and how we acquire it (Bryman, 2008; Knight, 2008). In validating the research, the aim is to contribute to social knowledge as a function of the researcher understanding their relationship with that being researched (Knight, 2008).

Quantitative research represents the dominant methodology for conducting social research (Bryman, 2008). This methodology is typically characterised by collecting numerical data, using deductive reasoning to link theory and research, a preference for a natural science approach (positivism) to explain social phenomena, and having an objectivist conception of social reality (Bryman, 2008). According to Creswell (2009), there are two primary research designs for conducting quantitative research:

1. Surveys –provide a numeric description of trends, attitudes, or opinions of a population by studying a sample of that population.

2. Experiments –determine if a specific treatment influences an outcome.

In a quantitative methodology, the data collected is hard, objective and standardized (Corbetta, 2003). Quantitative research is structured and theory precedes observation. In a qualitative study, the activities of collecting and analysing data, developing and modifying theory, elaborating or refocusing the research question, and identifying and dealing with validity threats are usually going on more or less simultaneously, each influencing all of the others. In addition, the researcher may need to reconsider or modify any design decision during the study in response to new developments or to changes in some other aspect of the design (Maxwell, 1998, 2012).

In a qualitative methodology, the data collected is soft, rich and deep while stressing ‘ecological validity’ and the applicability of social research findings to those that exist within the social situation studied (Corbetta, 2003). Contemporary qualitative research is characterised by its diversity (Punch, 2005). There are five popular research designs to conduct qualitative research (Creswell, 2009) :

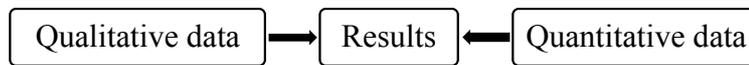
1. Ethnography is about telling a credible, rigorous, and authentic story (Fetterman, 2010).
2. Grounded theory is the systematic development of theory from the data through inductive and deductive (Phelps & Horman, 2010).
3. A case study is an idiographic examination of a single individual, family, group, organization, community or society (Rubin & Babbie, 2013).
4. Phenomenology is a research design which aims to understand people’s perceptions, perspectives, and understanding of a particular situation. A lengthy interview with people who have had direct experience with the phenomenon being studied is a typical method adopted in a phenomenology study (Leedy & Ormrod, 2005).
5. Narrative is a study of the lives of individuals (Zou, Sunindijo, & Dainty, 2014).

Mixed methods research is a new approach as a distinct research design with philosophical assumptions that guide the direction of the collection and analysis of data. Many researchers believe that both methodologies complement rather than rival each other, and quantitative research may subsequently compensate for the weaknesses of qualitative research and vice versa (Cooper & Schindler, 2008; Neuman, 2010). Bryman (2008) refers to three approaches to mixed methods research:

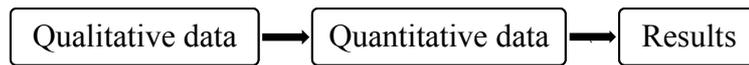
1. Complementary: two research methodologies are employed so that different aspects of an investigation can be merged.
2. Facilitation: one research methodology is employed to aid research using the other research methodology.
3. Triangulation: the use of quantitative research to corroborate qualitative research findings or vice versa.

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. Fig. 1 is an illustration further enhancing the methods fielded by Bryman (2008) highlighting how Creswell (2009) believes mixed methods research may be approached:

Merge the data:



Connect the data:



Embed the data:

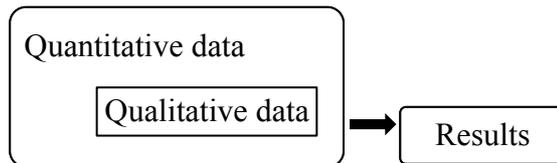


Fig. 1. Three Ways of Mixing Quantitative and Qualitative Data: after Creswell (2009).

Following Fig. 1, the author has connected the data through facilitation or connecting the data. Using the literature review, the author could relate to previous research performed in the area which would point towards the necessities and pitfalls within the current thinking within the context of thermal design research in the AEC sector. The information could be connected by findings to those that exist within the area studied, whilst the preceding data collection would be hard, objective and standardized. To verify the suitability of mixed methods approach, a review of alternate research in the AEC sector was carried out.

REVIEW OF EXISTING LITERATURE ON AEC RESEARCH METHODS

Researchers use the literature review to identify a rationale for the need for their own study. Some of the specific rationales for the research that might emerge from a literature review include:

- A lack of consistency in reported results across the studies.
- A flaw in previous research based on its design, data collection instruments, sampling, or interpretation.
- Research may have been conducted on a different population than the one in which you are interested.
- Uncertainty about the interpretation of previous studies' findings.

The literature available regarding AEC research methods is rather sparse. Fellows & Liu (2009) does however contribute in focusing upon the sequential methodological processes that should be followed to ensure effective research. Furthermore, Fellows & Liu (2009) concentrate on the philosophical issues of research methodologies. Raftery et al. (1997); Runeson (1997) and Seymour et al. (1997) discussed research methods, challenging the relative benefits of theoretical versus experimental papers and qualitative versus quantitative research. Cultural sensitivities including communication, were recognised by Loosemore (1999) rendering one method of research method more appropriate than another in differing circumstances. Walker (1997) explained his doctoral research process as a case study on the challenges of obtaining data from thirty-three projects and analysing them using linear regression. Similarly, El-Diraby & O'Connor (2004) used the collection and analysis of bridge construction

data as a case study to establish significant methodological issues as extracted from Cook & Campbell (1979), which according to Abowitz & Toole (2010) is one of the major works on experimental design in the social sciences along with Campbell & Stanley (1963). Four types of validity concern Cook & Campbell in particular. They are briefly summarized in the Table 1:

Table 1: Four Types of Validity in Social Science Research. Source: Based on Cook & Campbell (1979)

Type of validity	Key Issue
Construct Validity	Do the indicators capture the expected relationships among the concepts being researched?
Statistical conclusiveness validity	Are the relationships between hypothesized independent and dependant variables statistically significant?
Internal validity	Has the research truly demonstrated a causal link between hypothesized variables, or are there plausible alternative explanations for the statistical association between the independent and dependant variables?
External validity	Are the apparent relationships found within the sample's experimental subjects generalizable to the larger population assumed in the hypothesis?

In both the social sciences and AEC research, a clear understanding of experimental design issues is crucial not only to the soundness of any experimental data collected but for a deeper understanding of basic research processes and problems (Fellows & Liu, 2009). Careful analysis of experimental design texts, such as Cook & Campbell (1979) can improve other research exertions including surveys and ethnographic observation. Ultimately, understanding issues of internal and external validity in experiments, as well as measurement and statistical significance, helps in understanding the problems of interpretation, consistency and validity, and statistical interpretation in the AEC sector (Abowitz & Toole, 2010). Correspondingly, the author utilised this information and employed the understanding towards literature review. Alternative and similar analyses were, and still are being researched and analysed to aid current research methodologies.

THE RESEARCH APPROACH

This is a preliminary part of the research process which describes the general path / cycle of the research. The research includes five broad components; Mind map, Literature Review, Research Design, Calculations and Results, as shown in Figure 2:



Figure 2: Approach to research

RESEARCH DESIGN PARAMETERS

According to Babbie (2008), “Research design involves a set of decisions regarding what topic is to be studied among what population, with what research methods, for what purpose.” Proper research planning and design therefore encompass numerous distinctive issues. For example, if the topic is thermal upgrade in the construction industry and its effect on external wall performance, we have to determine which subjects to include from among external wall performance; the sampling technique and sample size and the methods of data collection an experiment, survey, observational study, and so on. Each of these decisions affects the quality and quantity of data collected.

Building on the theoretical mind map processes of Buzan from the 1960’s (Buzan, 2015), Figure 3 is an initial brainstorming process carried out to identify the parameters which needed to be considered for investigation. The parameters were identified through literature, both academic and specialist identifying connected issues to the central question:

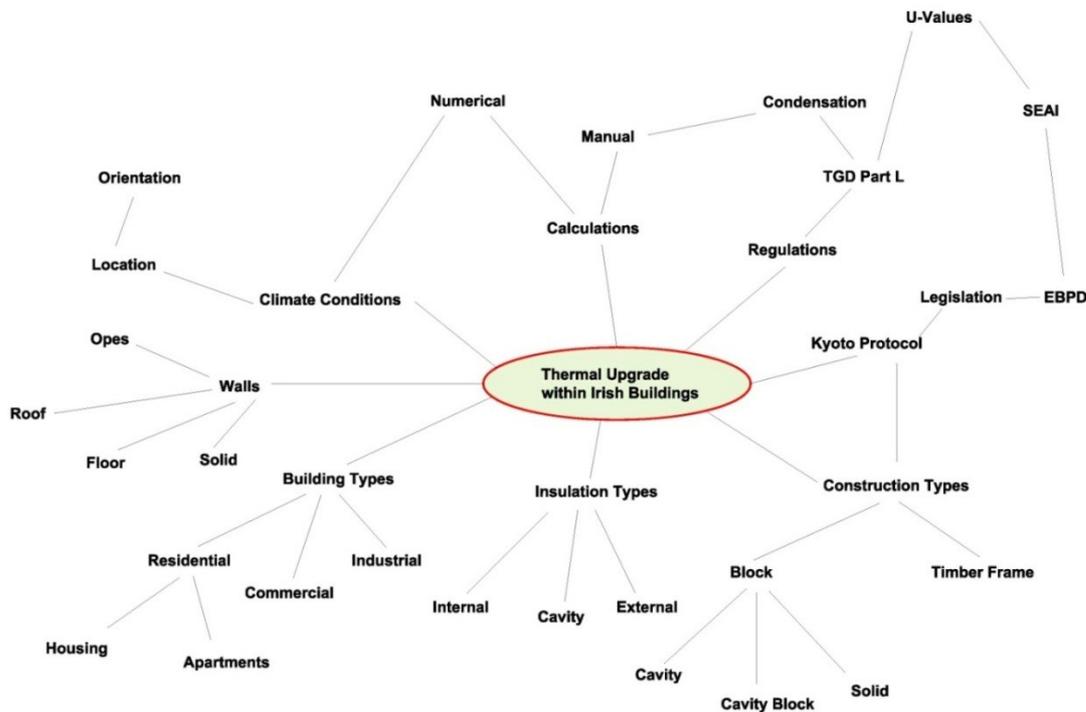


Figure 3: Mind Mapping

According to Eppler (2006) and mindmapping.com (2015) a mind map is a multi-coloured, image centred radial diagram that represents semantic or other connections between portions of learned material hierarchically. An online tool is available; however these maps were composed through AutoCAD due to a pre-established proficiency already gained through previous experience both academically and professionally. This mind mapping process allowed the initial focus of the aim and objectives but also, allows continual update and focusing of these. The key areas are addressed and explored thus; these parameters are a work in progress always progressing towards refinement as may be witnessed in the transition between Figure 3 and Figure 4. It is highlighted in Figure 4, that the fundamental aspects of the research parameters were refined and outlined after exploring all other branches of the mind map. The items not circled still have an impact on the research however their influence was not as crucial at the point in the process.

Upon approaching the current mind map (Figure 4), a clear indication of the research had emerged. Literature, previous studies, papers, articles and reports had all led the research to a refined central question (centred in Figure 4), with the most applicable influences which should be applied to this study. The result of the current mind map circles the broad area information most crucial to the research at this point, whilst the extended branches house the refined area information crucial to the study outlined in red.

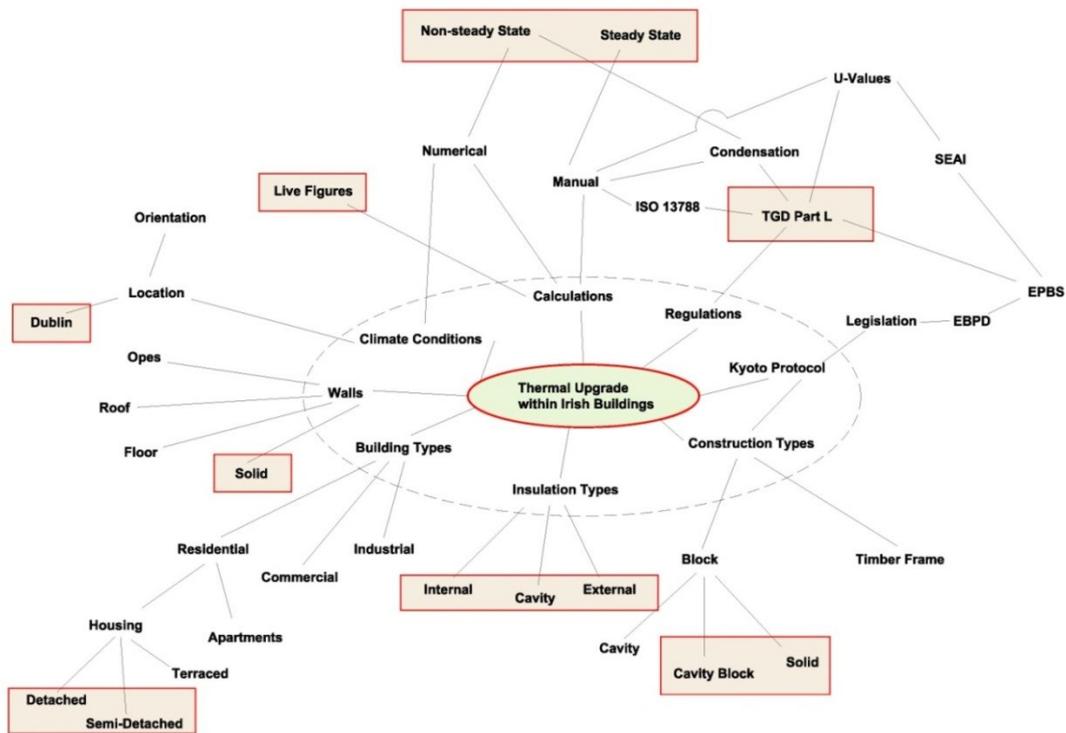


Figure 4: Mind Map Further Development

From this developing mind map, the research parameters have evolved. The established and finalised milestones to date are presented below in bold, while the outstanding and changing parameters are written below in grey;

1. **Literature Review.**
2. **Identification of problem.**
 - a. **Residential.**
 - b. **Housing.**
 - c. **Detached & Semi-detached.**
 - d. **Walls- Opaque Element.**
 - e. **Solid Block & Cavity Block.**
3. **Policy constraints and values.**
4. **Current Practice.**
5. **Calculation Methods.**
 - a. **Manual Calculation – Steady State – ISO 13788, BS 6946**
 - b. **Simulation Calculation – Non Steady State - Thermal Decrement - PhD**
 - c. **Simulation Calculation – Non Steady State (WUFI) - PhD**
6. **Live Building Analysis – PhD**
7. **Questionnaire - PhD**

Upon forming the research parameters, the research design was then asserted. Research design stems from the chosen methodology, referring to the ways in which the data will be collected and analysed in order to answer the research questions posed and so provide a framework for undertaking the research. For the purpose of selecting the correct methodology, it is vital to understand the various practiced methods which are described in the following sections.

A mixed methodology is practical in the sense that the researcher is free to use all methods possible to address a research problem and individuals tend to solve problems by combining inductive and deductive thinking making the argument more persuasive than either words or numbers in isolation (Creswell, 2009).

CURRENT METHODOLOGICAL APPROACH

The methodology used in this research to date is modelled around multi-methodological design. Data collection and analysis through past and present research by others, along with policy design standards, recorded climate data, housing figures, common external wall constructions, standard design calculation methodologies and non-standard yet required design calculation methodologies corresponds well with and suits the theory of a quantitative methodological approach (Corbetta, 2003; Maxwell, 1998, 2012). Furthermore, suiting the quantitative approach as alluded to by Maxwell (1998, 2012), the research is structured, performing a series of calculation methodologies and recording performance data to produce results which clarify the question. The early phase of the research followed a mixed methods approach and developed using mind mapping and literature review as explained earlier. As the research transitions into the PhD it will remain heavily quantitative while encompassing a mixed methods approach, incorporating some qualitative research to allow a fuller piece of research as suggested by Creswell (2009). This will be in questionnaire format which will require interpretation and discussion suiting a qualitative stance using both numbers and words to combine inductive and deductive thinking (Maxwell, 1998, 2012).

METHODS

This section explains the process of identifying the research field including contributors, institutions, references; a literature review of the pertinent research material, papers, articles, reports etc.; calculation methodology identification, breakdown, and application, further research projection, explanation and the final output proposal of the research.

Searches were undertaken of recognised relevant academic and specialist building conservation literature databases and used a variety of search fields including the terms; buildings, existing, old, conservation, energy, efficiency, refurbish, retrofit, upgrade, performance, thermal, moisture, steady state, non-steady state. A number of journals were established as principle sources of evidence including: the Association for Preservation Technology (APT); Building & Environment; Energy & Buildings; Intelligent Buildings International, International Journal of Sustainable Engineering, Journal of Information Technology in Construction and Energy Policy. A series of technical indices were then identified as paramount sources of calculation methodology and procedure literature including: Technical Guidance Documents (TGD's), British Standards (BS), The Chartered Institution of Building Services Engineers (CIBSE) Guides and The International Organization for Standardization (ISO) documents.

Websites of the statutory bodies responsible for the protection of the Irish, UK and European environment were also searched; Department of the Environment, Community and Local Government, Sustainable Energy Authority of Ireland (SEAI), National Standards Authority of Ireland (NSAI), British Research Establishment Ireland (BRE), Environmental Protection Agency (EPA), Historic Scotland, British Research Establishment (BRE), United Nations (UN) Documents, and Intelligent Energy Europe.

The searches uncovered a range of documents, some of which had more direct relevance to the research question than others. Those judged to be of some relevance were collected into an EndNote database of relevant references. Decisions on this were based on degree of relevance to the research question; if a paper was concerned specifically with the performance of residential buildings via an analysis based on measured or theoretical data it was deemed highly relevant.

Once the literature was reviewed, the problems could be identified: namely the lack of research into the separation between theoretical and practical analysis. Using the technical indices, namely current Technical Guidance Document Part L 2011, the standard calculation methodology for thermal wall design was identified as the U-value. This document then references alternative sources of calculation methodologies to dissect and improve the accuracy of this calculation methodology and material classification: BS 6946, EN ISO 13788 and CIBSE Guide A.

Through analysing these documents the U-value calculation was explained, gaps in the process established, and solutions to these gaps identified. The process was documented using techniques acquired from previous research at undergraduate level including steady state analysis of condensation risk analysis, and two-dimensional conduction heat-transfer analysis through THERM software and methods acquired (Department of Environment Community and Local Government, 2011; Hens, 2010, 2012; Künzel, 1995; Little, 2009; McMullan, 2012). The results of all of this work have been translated through peer reviewed papers, reports, posters and oral presentations.

The next phase of this research encompasses a progression from the quantitative to qualitative through application. Thermal decrement analyses will be completed as per CIBSE Design Guide A using a Dynamic Thermal Properties Calculator (DTP) developed by ARUP along with Ecotect building analyses software developed by Autodesk.

A series of hygrothermal simulations of the wall types identified through the literature review will be carried out illustrating the impact of heat, vapour & moisture transfer through the building fabric following examples set out by F. IBP, (2013), Künzel (1995, 1998) and Little (2009, 2011).

This phase will also consist of case studies which will be acquired and sensors will document the in-situ U-value performance of a selection of the identified wall types versus the theoretical values identified. This process will follow standards as set out in prEN 12494:1997, EN ISO 7345:1987 and I.S. EN ISO 8990:2007 as referred to by Department of Environment Community and Local Government (2011) and Rhee-Duverne & Baker (2013). The U-value readings will be monitored in accordance with procedures outlined in similar research by Baker (2011), Rhee-Duverne & Baker (2013) and Little (2010).

The analysis of preferred methods of thermal upgrade amongst homeowners will be documented through the composition and distribution of a questionnaire. The questionnaire will be an online survey using tools acquired from previous research. The results of this survey will be presented in a table formatted in excel highlighting key findings.

The final thesis and analysis will be compiled using a combination of excel data sheets and charts to compare and contrast the differences / similarities between all of the data. Following this, the results will be interpreted and documented, resulting in a framework design tool. Results from the survey will accompany the framework as an indicator of the sociological thinking which will need to be addressed for advancement of thermal upgrade viability.

RESEARCH DESIGN MODEL

Fig. 5 is the research process model developed to illustrate the path in which the research has progressed to date and shall progress through the PhD in accordance with the multi-methodological research design to expand the data:

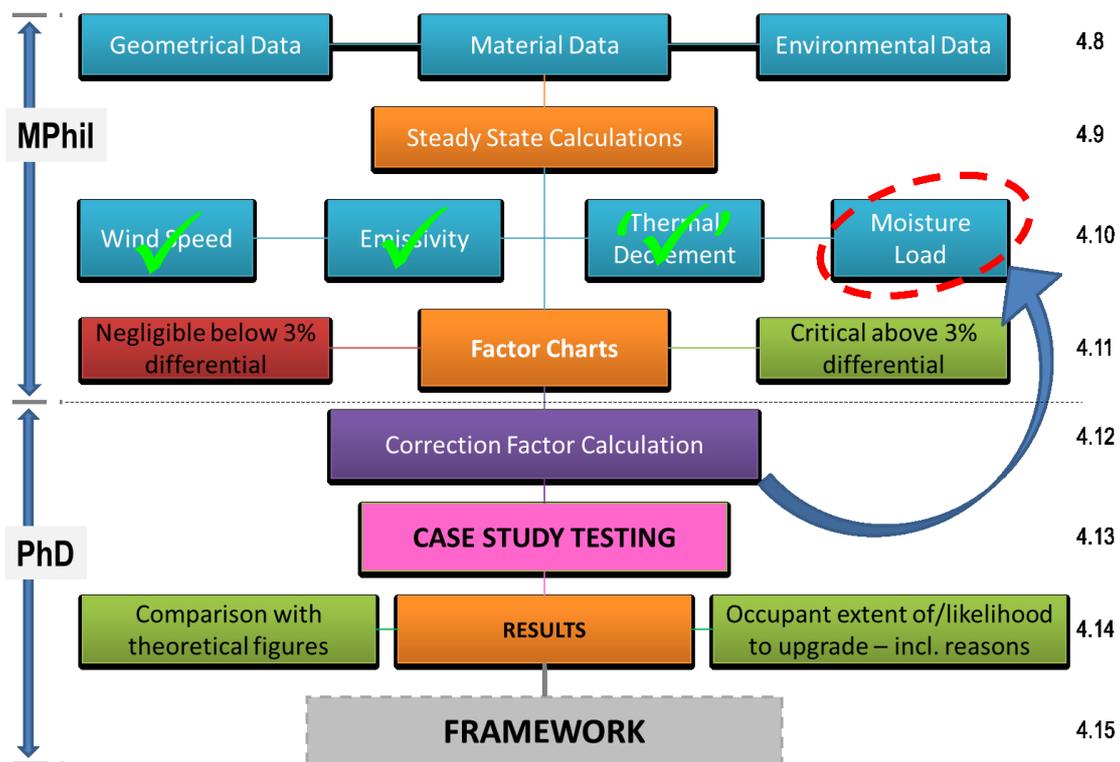


Figure: 5. Research Process

CONCLUSIONS

This paper has reviewed the process of methodological approach followed in this research along with a mixed methods approach to research design, in order to increase credibility and validity of conclusions resulting from experimental research. This paper is intended to serve as an introduction to issues and sources of enlightenment in effective research methods in AEC research in order to encourage researchers to more fully study the topic.

The realm of philosophy and research theory is something of an enigma throughout the AEC sector, particularly within architectural technology. This has been confirmed through an examination of previous research in the field, accompanied by personal experience. The understanding gained regarding the influence of an informed methodological approach has already, and continues to enhance the product of this research. Adopting a mixed methods approach has allowed a more concise and defined format of information to be assessed. Through the trawling through previous literature available on

AEC research, comparable precedent has been established to set a benchmark for results generated from this research. Previously however, the approach would have been to think of an area of interest and simply carry out the proposed research with a view to gathering results expected or hoped for.

Effective research on topics in construction is difficult and necessitates skill and knowledge that is rarely provided in AEC research programmes. To understand the full range of methodological challenges faced when doing research, graduate AEC students should take at least one course on social science research methods, preferably one that covers both qualitative and quantitative approaches, and one course.

The number of references explored to explain what is still being understood by the author really is arduous. Including social science research methods courses in a graduate curriculum in the AEC sector is uncommon. Nonetheless, integrating the knowledge consequential from such a course would prove advantageous to allow effective research within AEC research.

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THEORY DEVELOPMENT AND THE NATURE OF EMERGING KNOWLEDGE USING AN ACTION RESEARCH METHODOLOGY

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Abstract

Literature from many fields, notes an inability of traditional research approaches, in providing solutions for practical problems within organisations. Traditional approaches have had great success in the physical sciences; this has not been replicated within the social sciences. It is suggested that knowledge produced by traditional approaches is often inappropriate for use in practical problem solving. Many contributors have called for greater use of interpretivist methodological approaches to address this issue. Others, from traditional paradigms suggest that such a direction sacrifices academic rigour in search of practical relevance. This debate has often proved divisive, with the validity of many interpretivist approaches being challenged. One such methodological approach often associated with the Interpretivist paradigm is Action Research (AR). This methodology is prevalent in areas such as healthcare, education and information systems, but comparatively rare in construction management. AR has been suggested as a potential means of bridging this rigour / relevancy divide. AR however faces a number of methodological challenges in producing output that satisfies both its practitioner and academic audiences. The research, herein, considers the nature of theory development and knowledge that emerges from AR, towards improving the methodological understanding of ongoing PhD research using an AR methodology. A literature review was conducted to identify what may be learnt from other fields and also from construction management literature in AR. Insights from the ongoing PhD work are also incorporated. A significant weight of evidence was assembled supporting the validity of AR outputs, however, it is practically impossible to judge the validity of AR outputs by traditional / positivist conceptions of validity measurement. It is concluded that different, but equally cogent, epistemological routes towards validity must be adopted in AR studies when considering contributions to knowledge and theory development.

Keywords: action research, knowledge, methodology, theory building, validity

INTRODUCTION

Traditional scientific methodological approaches attained a dominant research position historically. This was based upon unprecedented successes in the physical sciences, where human understanding was enhanced by such approaches (Stringer, 1999). A 'standardised' view of traditional scientific approaches in this context emanated from a philosophical approach called positivism (Robson, 2002). Collis & Hussey (2009) highlighted the two main research approaches as firstly, positivist in nature, broadly speaking, quantitative, objective, scientific and traditionalist. Secondly they identify the interpretivism paradigm as being broadly qualitative, subjective, humanist or phenomenological. Positivist successes in the physical sciences, has not however been replicated in many areas of social sciences to any great extent. Many contributors have thus postulated that there is a significant 'relevancy gap' between the knowledge generated by traditional scientific research approaches and industry based knowledge and practice (Lewin, 1946; Baskerville & Wood-Harper, 1996; Sexton & Lu, 2009; Koskela, 2011). It is implicit in the literature that research into management practices and by extension fields such as construction management, falls within the social sciences. Any lack of relevancy here, thus has significant implications for advancement in the efficiency of construction management practice (Koskela, 2011).

The argument therein, views the knowledge produced by positivist approaches as inaccessible and often simply inappropriate for use in practical, problematic situations, such as those facing construction firms (Sexton & Lu, 2009). Sexton & Lu, conceptualise this lack of relevance as a 'fault line' between conclusion driven basic research and decision orientated applied research. They are amongst

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many who suggest that interpretivist approaches to research methodology, could beneficially be adopted to bridge this perceived relevancy gap. Such suggestions have however, not always been warmly or universally received, leading to entrenched opposition in some quarters (McKay & Marshall, 2001). Easterby-Smith et al (2002) discuss this ongoing argument in terms of a longstanding 'battle' still raging in the academic community.

Traditional positivist research has tended to focus on deductive methods to describe, codify and count data, often at the expense of actually understanding why something is happening (Easterby-Smith et al, 2002; Koskela, 2011). A significant body of literature has emerged, since the 1940s, supporting this contention of a prevailing relevancy crisis in organisational sciences, where positivist approaches have made little headway in solving the practical problems, particularly of organisations. This has led to growing use and acceptance of interpretivist approaches in the social sciences (Lewin, 1946; Susman & Evered, 1978; Baskerville & Wood-Harper, 1996; Avison et al, 1999; Sexton & Lu 2009). During the intervening period there has also been a significant reaction against positivism and its methodologies and methods (Hughes & Sharrock, 1997). The authors herein support the more pragmatic approach of Easterby-Smith et al (2002) and do not favour one approach over the other, but suggest each may be used where it is demonstrably appropriate or indeed that they can be usefully combined in appropriate situations.

This paper contributes to the ongoing debate, in a construction management context, by considering and empirically describing the use of Action Research (AR) as an interpretivist research methodology in construction. AR is a relatively uncommon research approach in the construction literature and the extent literature currently offers little in the way of detailed methodological prescription for its use in construction research.

ACTION RESEARCH METHODOLOGY

As part of an ongoing PhD study, author one, has adopted an AR methodological approach as part of a collaborative study with an SME main building contractor in the west of Ireland. The PhD is specifically focused on means of reduction and elimination of defects and rework problems found on the SME company projects. Problems of a similar nature are of course well-known, endemic and enduring in the Irish construction industry and also in construction industries in many other jurisdictions worldwide (Taggart et al, 2014).

AR is generally seen as being interpretivist in nature and post-positivist in terms of its philosophical worldpicture (Susman & Evered, 1978). However given the pragmatic philosophy of AR, utilisation of both qualitative and quantitative methods may be utilised, together with appropriate analytical techniques (Bryman, 2012).

An AR approach was adopted as an appropriate methodology for the PhD, to address two aims; firstly to resolve the current practical defects and rework problems of the SME Company. Typically such problems are socially and organisationally rooted. Secondly, the project seeks to extend the bounds of scientific knowledge in partial fulfilment of the PhD. The literature unanimously agrees on these twin problem solving and knowledge extending aims of AR (McKay & Marshall, 2001). From its originals in the 1940s (generally traced to the work of Kurt Lewin 1890 - 1947), AR has retained distinct characteristics of being focused on practical problematic issues and on improvement through the medium of change. AR research sets out not only to gain better understanding of practical problems, as with other methodological approaches, but also aims to change the current state situation, as part of the research. Traditionally, with other methods, implementation is an optional consideration after the research is concluded (Denscombe, 2012). Knowledge and theory are thus advanced by learning

through change. AR is now somewhat of an umbrella term, describing several variants, all, still essentially focused on action orientated research approaches (Coughlan & Coughlan, 2002; Huxham & Vangen, 2003). AR is seen as a participative and democratic process involving researcher and practitioners directly as participants and in that way seeks to redress the normal balance of power in knowledge creation, whilst increasing the capabilities of participants (Reason, 2006).

Participatory and Experimental Action Research (PAR)

A full description of AR methodology and its several variants is beyond the scope of this paper, but is well reviewed in Baskerville & Wood-Harper (1998). A short explanation of Participatory and Experimental Action Research, perhaps the most common variant(s), is provided here to inform the reader as to the methodology used for the ongoing PhD. AR is characterised by intervention actions, acting on problems perceived by practitioners (assisted in their definition by researchers). Participatory AR is further distinguished within AR by the practitioners acting both as subjects of the research and partial co-researchers (Baskerville, 1999).

Perhaps the most commonly discussed conceptual model of AR in the literature, emanates from the seminal contribution of Susman & Evered, (1978). See Figure 1.

AR is widely conceptualised as a 'cycle' or 'spiral' approach to research. Cyclical stages entail; (1) diagnosing, the problem scope; (2) action planning, an improvement plan; (3) action taking, implementing the plan; (4) evaluating, the implementation consequences; and, (5) specify learning from the process (Susman & Evered, 1978).

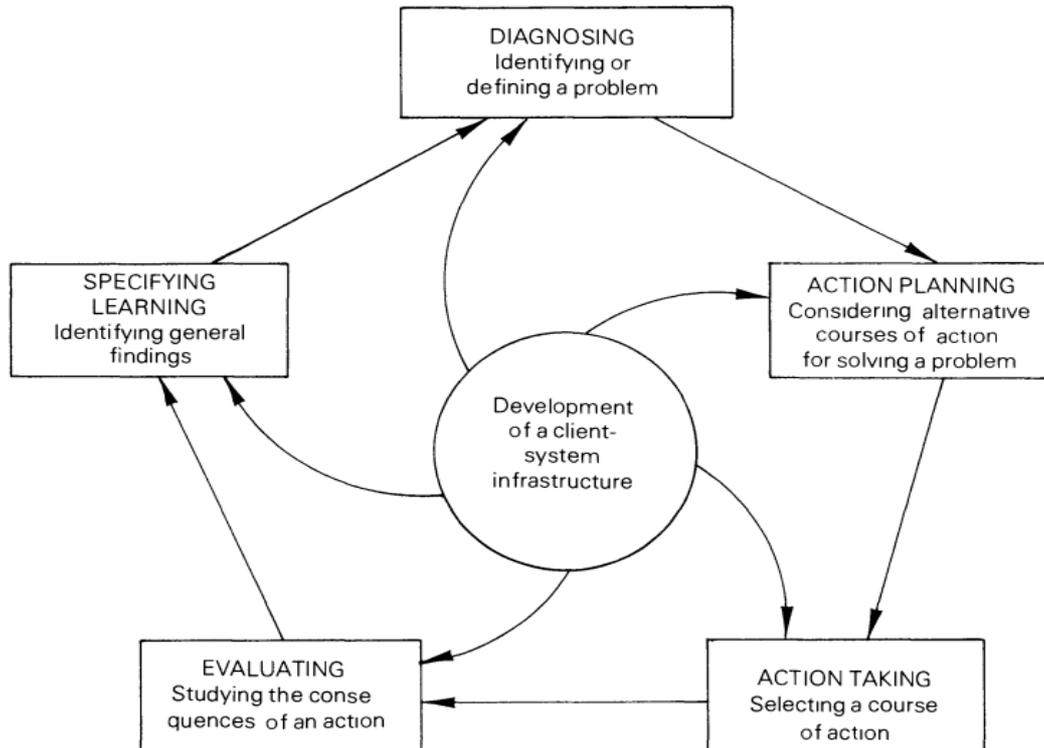


Figure 1: The Cyclical Process of Action Research - Susman & Evered, (1978, p588)

Susman & Evered (1978), did not categorise their conception as "experimental", but discussed their model in the context of Chein et al, (1948), noting the latter describing 'participant' AR as researcher and client system collaborating on the diagnosing and action planning aspects of the cycle. Researcher / client system collaboration on the action taking and subsequent evaluation elements in the form of experiments through action are described as 'experimental' AR by the latter. The authors (ibid) strongly argue for AR as a corrective to some of the deficiencies of positivist research in organisational problem solving research. However, they do not take an anti-positivist stance and support a pluralistic approach, to be determined by the research context. AR is also an iterative approach, if following completion of one full cycle, the subsequent changed situation is deemed in-sufficient, then the theory that informed the first cycle can be refined and a further cycle may take place (Robson, 2002). The development of new theories for further iterations would be informed by any knowledge gleaned from the previous cycles (Argyris & Schön, 1978). Reason, (2006 p197) however cautions that these cycles are always 'more messy' than the 'neat diagrams' drawn in AR texts. Davison et al, (2004) consider that the Susman and Evered model is now so extensively used and supported in the social sciences as to have attained 'canonical' status. Amongst its peers, it is uniquely seen to be iterative, rigorous and collaborative. The nature of the ongoing PhD study with the SME includes collaborative AR elements of both a participatory and experimental nature.

Concerns in Action Research methodology

Adoption of an AR approach provides significant methodological challenges to the researcher. These focus on core research elements in terms of generality; theory generation; theory development; the pragmatic focus of AR; design and validity of AR (Eden & Huxham, 1996). Huxham & Vangen (2003) also stress several factors having direct impact on potential validity and also having an ethical dimension (1) degree of overtness in participant involvement in the research side of the work; (2) degree of visibility of the data collection methods to the participants; and, (3) degree of risk associated with the actual change intervention. All have potential to impact on and potentially destabilise the ongoing research agenda as well as research validity.

In the context of the perceived relevancy gap in current research, AR appears to have significant potential to address this issue (Huxham & Vangen, 2003; Azhar, 2010), since attaining 'relevancy' to practitioners is one of its core stated aims. However, whilst achieving relevancy to the practitioner, satisfaction of the second core aim of extending scientific knowledge, must also be firmly addressed. Even leading proponents of AR, such as Bob Dick, note and accept that sometimes, in the headlong pursuit of action, the theory can sometimes be left behind (Dick, 2003). McKay & Marshall, 2001 confirm that most AR literature focuses on the origins, conceptions and philosophy of AR, with limited contributions on 'how to do' AR successfully. In the construction management arena, these considerations are further complicated by a scarcity of literature specifically pertaining to use of AR in the field generally which can be used for researcher guidance. AR methodological literature for construction is particularly scarce.

The remainder of this paper considers the basis of establishing the validity of AR in terms of the development of theory and the nature of the knowledge that emerges from the approach. It highlights some of the key choices available to the researcher. This is principally based on literature review, but also includes some preliminary observations emanating from the PhD study.

DISCUSSION

Research Questions (and Hypothesis)

The development of answerable research questions is not solely within the remit of the researcher, as in traditional approaches. Since AR is often a democratic approach to research, the stakeholders may sometimes be directly involved. The researcher may identify problems and bring them to the attention of the stakeholders or he / she may assist them in examining their situation and recognising their own problems. With either approach it is essential that the issues being researched are considered important by the stakeholders and do not possess solely academic interest (Berg, 2004). In this way both parties are involved in formulating questions that are answerable in the problematic setting. The degree to which the stakeholders are involved in the actual project research elements can vary considerably (Huxham & Vangen, (2003).

Successful AR is however; very difficult to undertake if there is any conflict or disharmony between researcher(s) and practitioner(s) aims and expectations (Avison et al, 1999). The researcher must tread a fine line in maintaining good working relationships in this regard, whilst remaining mindful of the effects of the relationship power balance in terms of affecting the research aims and objectives (Baskerville, 1999). The nature of AR, typically involving a variety of data collection methods and subsequent change intervention, also require the researcher to be very mindful of the ethical considerations pertaining to the various stakeholders (Hult & Lennung, 1980).

Early AR approaches, including Lewin's early works, often favoured hypothesis testing and field experiments as part of their research design. Modern AR has however developed somewhat and now more usually focuses on theoretical insights gained from expressed experiences, opinions, dilemmas and actions, rather than traditional techniques such as interviews and questionnaires (Huxham & Vangen, 2003).

The nature of knowledge generated by action research

Susman & Evered, (1978 p584-5) discussed the scientific merits of AR in terms of AR having a different 'worldpicture' to positivist paradigms. A positivist worldpicture allows that knowledge advances either by deduction or induction. (1) Propositions deduced from previously accepted laws. These are confirmed when their terms can be linked to objects and events, that are proven to relate to relations between the terms of the proposition; and, (2) Objective and undistorted observations or events are noted. These are 'scientifically' proven if it is shown they are cases following under more general laws. Positivist science considers its methods to be 'value free' whereas AR supports a 'value laden' contention. The authors (ibid) cite Habermas (1971), in support of their argument that knowledge and human interests are thoroughly interwoven and thus will be, by nature, value laden.

Fernie et al, (2003 p178) considered the nature of 'knowledge' generally, finding there is no agreed definition of what constitutes 'knowledge' and that it is a 'problematic, esoteric concept that does not lend itself well to codification'. They differentiate between explicit knowledge, which can readily be captured, explained and taught and tacit knowledge, which is personal, contextual and often difficult to explain to others. The latter poses particular methodological difficulties for those who attempt to capture and use such knowledge in other contexts. This is of particular concern when using AR, which often looks towards tacit knowledge for answers to its research problems, but is also of course, equally relevant to other interpretivist methodologies.

The characteristics of AR call for a planned action to change an existing reality, thus knowledge that informs the change must be 'actionable' in that it can be practically tested using the AR cycle. This concept of finding and using a distinct 'actionable knowledge' is strongly supported in the literature (Coghlan, 2007; Sexton & Lu, 2009; Papas et al, 2012). Sexton & Lu, (2009) claim actionable knowledge can change practice through the support and participation of those involved in the situation. The knowledge generated is 'process knowledge' in nature and supports a philosophical standpoint that theory should be united with practice. The concept of uniting theoretical and practical knowledge is a common foundation stone of AR approaches as espoused by Lewin, (1946) who cites doctors and engineers as obvious examples of practitioners who must daily use both knowledge types in their endeavours.

Such activity has two knowledge components firstly an element of explicit 'know that' knowledge gained from codified sources (books / databases etc.) and secondly 'know how' or tacit knowledge which we gain from our practice. The normal working practice and procedures of the construction industry relies heavily on the tacit knowledge of individual operatives and teams. This leads to significant implicit learning, extended learning cycles and enduring repetition of common mistakes (Bijleveld & Dorée, 2014). Epistemological conceptions of 'knowledge' in such situations are highly subjective to individual interpretation. AR also uniquely (through action) allows tracking of what stakeholders actually say and do in real, meaningful situations, as compared to what they say hypothetically (Eden & Huxham, 1996).

Positivists adopt definitions of knowledge as scientific 'truth' that exists independently of humans, whilst interpretivist researchers strongly argue that knowledge is socially constructed by and for humans (Egbu, 2004). These wider philosophical arguments are complex, challenging of epistemological standpoint, remain largely unresolved and are again beyond the immediate scope of this paper. However from the perspective of an action researcher, an AR epistemological standpoint is typically, but not exclusively, interpretivist in nature and views knowledge as both socially constructed and value laden. AR is however a very broad church, having a pragmatic philosophy, it is full of choices in such areas (Reason, 2006). Susman & Evered (1978) in their work on the scientific merits of AR, strongly contend that the argument between relevancy and rigour (when specifically applied to AR) is invalid, and somewhat of a red-herring, claiming that AR has its own legitimate epistemology and methodology and judged by those standards, AR is equally as 'scientific' as traditional approaches. They note that knowledge generated via AR approaches often does not meet the particular judgement criteria standards set for positivist approaches, but is no less valid when judged in its own epistemological terms. Baskerville (1999 p25) notes of AR that ' it is parked solidly outside of valid positivist techniques'.

The nature of theory in action research

Being pragmatic in nature (Susman & Evered, 1978; Baskerville & Myers, 2004; Reason, 2006), AR supports the contention that relevant and meaningful new theory can be built upon the existing knowledge of practitioners (Bijleveld & Dorée, 2104). The existing theories of the participants can be validated by testing them in practice and thereafter, if exhibiting potential, could potentially be developed into explicit and therefore generalizable knowledge. The authors herein, however support the position of Fernie et al (2003) that such generalisation is not by any means a straightforward process and that knowledge and theory taken from one context for use in another, usually requires a high degree of 're-contextualisation' before it can be deployed and understood in the new context. For the theory to be useful in a different setting, the impact of the differing social contexts and history must be considered. A reader should be given sufficient information about the situation in which the stimulus / response was observed such that the stimulus can be re-contextualised successfully in the readers own social setting (Baskerville & Wood-Harper, 1998). Whilst the final research output may not give

a fully generalizable theory, a 'good picture' of totality, is often of more practical use to an organisation, than detailed and abstract knowledge, devoid of context (Hult & Lennung, 1980).

The theoretical aim of AR is to produce a descriptive theory that can influence practice. It does not often directly prescribe action, but provides interested parties with a means to make sense of their own situation and to evaluate possible courses of action (Huxham, 2003). Successful testing of the theory, in different social settings, thereafter, extends confidence in the generalizability of the theory (Hult & Lennung, 1980; Robson, 2002). In this way other people's theories become personally owned and developed as they are engaged with elsewhere in an experiential manner (Somekh, 2006). Typical output of AR analysis usually takes the form of descriptive accounts, based upon the information captured by the (usually multiple) data collection methods used (Berg, 2004). At the very least the research should offer some possibility of implications beyond the immediate domain (Eden & Huxham, 1996).

Huxham (2003, p240) notes that data obtained via AR is 'timely' in that it is collected 'at the point of happening' and often throws up unexpected insights. The theory generated is descriptive theory that captures the experienced world (ibid, p246). In this way the theory development process is inductive, leading to an emergent theory. Because of these factors, Huxham suggests that, if possible, theoretical pre-conceptions should be avoided in the data collection, as existing theoretical frameworks could inhibit the emergence of new and creative insights from the data.

However, failure to use theoretical frameworks can make management of the (typically for construction) large amounts of emergent AR data both unwieldy and difficult to analyse. The nature of data emerging from construction AR, tends to be ill-structured, thus a workable means of recording this is required (Eden & Huxham, 1996). We argue here that a reasonable, pragmatic balance should be struck, and suggest viewing existing theory in terms of it being a useful initial guidance resource rather than as a rigid straightjacket. The researcher must however, remain alert to other possibilities and explanations emerging from the data, outside of the immediate framework, and must also clearly articulate how this reflection has been achieved. In this context we tend to agree with McKay & Marshall, (2001) and Baskerville (1999) that a clear theoretical framework must be present as a premise before the actual intervention stage (stage three action taking). Albeit, that the framework should remain pragmatically open to revision for subsequent iterations of the AR cycle. Problem diagnosis reports should have clear theoretical foundations.

AR does not normally provide fertile ground for theory testing in the way it would be understood in traditional paradigms (Eden & Huxham, 1996). The literature is generally agreed that the theory emerging is 'local' in nature (Eden & Huxham, 1996; Reason, 2006). This means that the emerging theory is particular to the specific contextual setting, thus making it difficult to arrange the variables in other places and to expect the same result. Although the results are context based, often repeatable observations or 'patterns' are present, thus providing the possibility of generalisation across projects (Papas et al, 2012). AR does however provide a useful methodology for situations in which the variables are inherently difficult or impossible to de-aggregate for meaningful study (Baskerville, 1999). The action phase of AR provides an ideal opportunity to try out complex theoretical frameworks, which cannot easily be disaggregated for controlled evaluation of individual theories (Eden & Huxham, 1996).

The ongoing PhD work, subsequently utilised two principal existing theoretical frameworks to help make sense of and order the emergent data; (1) Eden & Huxham, (1996), proposal of twelve contentions for action research to be considered valid 'research' was adopted, this provides a framework in which the methodological process and assumptions can be explained, defended and generalised; and, (2) Meng, (2010), Assessment framework for construction supply chain relationships: Development & evaluation, was adopted, providing a taxonomy and headings (that are clearly understood by the wide variety of participants) by which to assess the emerging data. Given the very fragmented nature of the Irish construction industry, any list of construction project defects and rework, typically involves a large and complicated range of supply chain players including designers, contractors, sub-contractors and suppliers.

Literature therefore supports the contention that AR research projects can legitimately commence diagnosing and action planning (Steps 1 and 2), methodologically, without prior theoretical understanding of the problem situation, both the content (the developing theory) and the process (research meth-

ods used) can be emergent and can be adapted over the project to reflect the unfolding situation (Dick, 2003). An AR methodology is also concurrent and overlapping; analysis of the data, interpretation of data and theory building occur at, or soon after the data is collected. This somewhat unconventional starting point and variety of methods can pose problems with research reporting. Taggart et al (2014) specifically dealt with the initial problem 'diagnosing' stage of the AR cycle with the SME, without any pre-conceived theoretical framework. During extensive peer reviews (conference & journal iterations), the technical, defects & rework content of the papers was expertly and constructively reviewed. However the AR methodology used, raised several issues for some editors and reviewers. They initially questioned the omission of clearly articulated research questions, theoretical framework and lack of hypothesis in the papers. These omissions were all correctly observed (from a positivist world picture), but showed a lack of understanding of the AR methodology. Subsequently, reflection on this situation by the authors, suggested a clear onus is placed on the researcher to clearly explain the nature of the contribution made, when using AR (or indeed other non-traditional methodologies) and to explain how they differ from the more typical explanatory contributions. Also, by extension, the nature of the contribution in the particular field of study, i.e. of construction management should be clearly articulated. Justification is thus about proving the theory is valid, but also requires an element of persuasively convincing others that this is indeed the case in an interpretivist context (Helskog, 2013; van Aken, 2014).

CONCLUSIONS

This paper has contributed to a better understanding of the nature of knowledge and development of theory using AR methodology in construction problem solving. Literature confirms that 'knowledge' does not have any one agreed definition and that the concept of knowledge is further compounded by the prevalence of trying to capture tacit knowledge, both in construction and AR research contexts. We have argued here, the need for researchers to both clearly describe the situational contexts of their AR output and also to guide the reader in how they may take and use the research output in other settings. Description should be couched in general, rather than contextually specific terms, in this way the potential for generalisation is significantly improved. In regard to theory development we have explained theory's pragmatic position in AR research approaches. The literature is divided in terms of the potential use of extent theory to guide AR approaches. We have however proposed a middle way, whereby researchers can have recourse to existing theory, where it is appropriate, but must reflect on the possibilities of such theory obscuring other conclusions or possibilities. We have also argued that whilst it can potentially be beneficial to approach the first two AR stages without theoretical preconception, a clear theoretical framework should inform the actual interventions at stage three. Construction problems, suitable for AR research approaches are often complex and socially constructed. Actions for change, without a suitable theoretical foundation can otherwise lead to great difficulty in managing and analysing the resultant data (often large) in any meaningful way.

Both the literature and observations from the ongoing PhD concur that reporting of AR research results can be problematical if viewed through the lens of a positivistic epistemological world view. Persuasive evidence from literature has been provided to support the scientific merits of AR. Additionally we have also argued that there is an obligation on researchers to explain how, and to what epistemological standards their work should be held accountable to. This approach helps to reduce the possibility of methodological misunderstanding.

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METHODOLOGICAL CONSIDERATIONS OF THE PROJECT MANAGEMENT OF A HOSPITAL PROJECT WITHIN A PRACTICE ORDER NETWORK

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Abstract:

Practice theory offers numerous theoretical affordances, especially to practitioners and researchers of project management who seek alternatives to the problematic assumed universality of 'traditional' theoretical perspectives. However there are several disagreements left unresolved in practice theory methodology that risk compromising its full potential. Illustrated by an on going, praxiographic study of the practice of project management of a major UK National Health Service (NHS) hospital project, Schatzki's notion of site ontology is drawn upon to implement a research strategy that contributes to resolving such disagreements. It is argued that whilst practice theory methodology ought to be ontologically coherent and contextually driven and, therefore, shaped by the research questions and aims, it is also important to constantly reflect dialogically on the relationship between the particular practice theory used and the phenomena being observed.

Keywords: Methodology, project management, practice theory, praxis, , teleoaffective structures.

INTRODUCTION

The continuing failure of large publicly funded national building, infrastructure and IT projects has led some commentators to conclude that such projects "never go according to plan" (Financial Times, 1999) or are "Over budget, over time, over and over again" (Flyvbjerg, 2009). Critical authors from the so-called 'Scandinavian School' (Sahlin-Andersson & Soderholm 2002) identify the lack of empirical studies and the assumed universality of project management theory as major deficiencies in the improvement efforts made to address such failures.

A practice theory perspective is investigated as an alternative representation and theoretical approach for improving project management practices within these regimes. Adopting a practice theory perspective could avoid many of the irreducible dualisms (such as actor/system, social/material, body/mind and theory/action) that describe the social world yet remain unresolved in traditional perspectives (Nicolini, 2013, p.2., Corradi et al. 2008). A practice theory perspective considers the experience of a social entity (e.g. a school or hospital) to be the outcome of a complex, interconnected world comprising activities in various states of 'becoming' (Nicolini 2013, p. 2) rather than the outcome of systematic processes with defined boundaries. At its core practice theory is concerned with pragmatic considerations such as the "centrality of ways that people make sense" (Clegg et al., 2011, p. 35). Although the use of practice theory to study organised activities has been growing since the 90s (Reckwitz, 2002; Schatzki, 2002; Schatzki et al., 2001), its application to the project management of construction remains nascent (Winter & Smith 2006; Bresnen 2009; Bresnen 2007; Askland et al. 2013; Marshall 2014).

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A practice theory perspective has the potential to grant access to the 'actuality' (Cicmil, 2006) of project management "in flight" in two distinct and beneficial ways. First, it can sensitise project managers to phenomena that are not emphasised by traditional project management paradigms. Second, it can sensitise project managers toward a deeper, reflective understanding of the dynamics of the practice of project management in ways that the rationalist, deterministic and positivist project management processes overlook. It is argued that in the often messy day to day world of project management, often constrained by conditions of bounded rationality, satisficing (Simon, 1972) and use of power (Clegg, 2010) the alternative use of a practice theory perspective can address the shortcomings of such rationalistic management processes. A practice theory approach to project management shifts away from such rationalism to a conceptualisation of project management as a practice of knowing. Instead of considering project management knowledge, *a priori* as the primary instrument available to inform action, a practice theory approach argues that it maybe more useful to think of project management as a process of knowing involving the articulation of project management knowledge recursively and as intertwined with knowing derived from actually doing project management rather than as a pre-conditioning predecessor to the other. In other words a practice theory approach allows us to think of project management not just as a process, but as something that project managers *do* and in *doing* know and learn the practice of project management. Such a practice theory approach which regards project management as a dynamic practice of knowing however requires an understanding of the relationship between the ontology of project management, propositional knowledge, know-how, teleology, and doing. The following discussion is likely to interest those who take a critical perspective, including those who draw on critical management studies in wider organisational and societal contexts (Hodgson and Cicmil, 2006) and those who more generally find themselves dissatisfied with traditional theoretical perspectives and seek an alternative qualitative approach based on the 'actuality' of day to day project management activities.

Whilst a practice theory approach has significant potential, much of the literature on practice theory methodology is nascent and contested (Schatzki, 2002, pp. xvii-xviii; Hirschauer, 2005; Halkier et al., 2011, p.6; Nicolini 2013), remaining preoccupied with abstract ontological and epistemological contemplations and providing only limited insight into the intricacy and the 'nitty gritty' of actually doing practice research (Pink, 2012; Littig 2013). Such concerns raise questions, amongst others, about what differences, if any, to research processes does it make if a practice theory is employed.

This contribution is confined to identifying and examining the methodological implications to those who choose to employ a practice theory approach and to consider the resolution of such concerns. To do this, notions and terminology, derived from dense theoretical accounts of the nature of practice theory are used to provide an argument which is used to advance a research strategy for use with a practice theory perspective (referred to from here on as 'the Strategy') that attempts to address the above methodological concerns.

This paper tackles these concerns in two parts. Part 1 develops an argument for the basis of the Strategy, advancing the case for praxiography derived from the distinguishing features of practice theory perspectives. Part 2 illustrates the theoretical implementation of the Strategy. This is done in Part 2 by mobilising a particular practice theory as currently advanced by Schatzki (Schatzki, 2002, 2005, 2010). Whilst the paper is largely focused on the methodological implications and challenges that arose from deciding to use a practice theory perspec-

tive, the use of Schatzki's practice theory is illustrated empirically by applying it to the project management of the design and procurement phases of a privately financed major NHS acute hospital in Scotland.

PART 1: DISTINGUISHING FEATURES OF PRACTICE THEORY PERSPECTIVES

Practice theory perspectives offer numerous views of social and human phenomena (see Nicolini, 2009, pp.3-8, 27-28) that privilege the Aristotelian concept of *phronesis* as a way of knowing and as a form of wisdom. *Phronesis* is a quality of mind (a virtue) that refers to practical wisdom whose aim is to produce action (*praxis*) that is informed by purposeful and value-driven deliberations. *Phronesis* has distinctive features that underpin practice theory.

Practical wisdom is enacted by determining a morally right action in a specific situation. The interplay between actions that might apply to the situation and the situation's unique features must be reflected upon (Johannessen, 1990). Further, practical wisdom is both distinct from and irreducible to theory: it is primarily concerned with the particular - not, in Aristotle's words, with "open-ended contemplation about the universals" (Aristotle, NE, Book VI). Practice theory perspectives always foreground activity and performance in the study (e.g. the constitution, development, diffusion, sustenance, and demise) of practices. It is the '*doing*' that is the basis of analysis: i.e. the practices not the practitioners involved. Practitioners 'carry' the practice (Reckwitz, 2002). Practice theories are therefore primarily concerned with action and how things get done.

Practice theories can also be distinguished ontologically from traditional perspectives by their claims regarding what constitutes social life and where it is located (Reckwitz, 2002; Schatzki, 2005). They claim that social life is not located solely within cognitive processes, communications (i.e. 'sayings') or interactions (i.e. 'doings') but instead that social life and practical wisdom are both *intertwined* with routinised actions, networks and arrangements of things including artefacts (such as the use of projectors and computer generated images) and the performativity of humans. The term 'practical knowledge' considers knowing to be bound up with action and vice-versa: knowing and doing are considered ontologically equivalent but analytically different.

Practice theories further distinguish themselves by their heterogeneity. A unified, single corpus of practice theory (Schatzki, 2002) cannot exist because, within such a corpus, individual practice theories would embody incompatible ontologies. This has significant methodological implications for practice theory driven research.

METHODOLOGICAL CONSIDERATIONS OF PRACTICE THEORIES

The heterogeneity of practice theories creates the opportunity for a 'programmatically' methodological approach (Nicolini, 2013, p. 215). Different methodologies can be applied in combination as the researcher's understanding reflexively develops. This heterogeneity also has epistemological significance; practice theories are not restricted to a certain methodology and a pluralistic methodology will almost always be necessary. Situation-appropriate methodologies must reveal the tacit knowledge enacted in observed *phronetic* reflections; a difficult task

given that such knowledge is not exposed through discourse, speech or signifiers. Gheradi (2000) points out that tacit knowledge manifests itself during 'moments' when ongoing practice is disrupted somehow, such as when is a breakdown in the ongoing, pre-reflexive quality of practising. Beech et al. found that "arresting moments" (2012, p. 267) were preceded by increasingly intense divisions between anticipated and encountered practices, during which practitioners experienced increasingly entrenched views and heightened emotions. Thus, developing a methodological sensitivity to 'arresting moments' may provide valuable insight into tacit knowledge by understanding the localised, situated knowledge through which it is revealed (Yanow and Tsoukas, 2009).

A second methodological implication of practice theories is the need for revealed knowledge to be interpreted by the researcher. Interpretation is the perspective by which humans make sense of something in its context using subjective reconstructions of the actions of others. Epistemological complexity arises because practice theories themselves consider objective, unmediated interpretation to be impossible. The researcher is subject to the Kantian notion that new knowledge is always mediated by *a priori* knowledge an implication thereof being the need for the researcher to be both aware of and to continuously reflect upon the influence of such mediation reflexively.

A corollary of the inaccessibility of tacit knowledge is that any expressed representation of it also requires interpretation and reflexivity. In other words, articulating and foregrounding practice requires a material activity and surrounding discursive work that is of itself, another practice (i.e. the researcher's interpretation). As Nicolini (2009, p. 4) points out, studying practice always requires the scrutiny of two practices at the same time: the epistemic practice and the 'what' we are concerned with.

THE CASE FOR PRAXIOGRAPHY TO BUILD A METHODOLOGICAL PORTFOLIO FOR PRACTICE THEORY

Adopting Mol's (2010) suggestion, 'praxiography' is used in this discussion to signify the distinctiveness of practice theory driven research in comparison to more traditional monomethodological approaches. Praxiography is the immersion of a practice theory driven researcher into the *praxis* of organised activity and its situated setting. The term also signifies the distinctive type of emic research developed below. This development will locate the particular methodology used in conjunction with Schatzki's particular practice theory.

Whilst there are resemblances, praxiography is distinct from ethnography in several respects. The term recognises and draws attention to a shift in understanding and use of theory such as that resulting from the adoption of a specific practice theory. Doing practice theory shifts traditional conceptions of the role of theory. Theory is used in practice theory as a means of sensitising and as a 'mode of engaging with the world' (Mol, 2010). This departs from an the role of theory as used in, say, a traditional laboratory experiment as abstract laws or concepts that can be falsified or proven. Instead, a continual dialogical engagement with theory through all stages of the researcher's study continually orientates the methodology towards investigation of practices and their connections (Zundel and Kokkalis, 2010). Thus, ongoing dialogue between theory and observation is one means available to praxiographers for investigating practices and the claims made about them (Baxter and Chua, 2008).

Praxiography also resonates with Pink's critique that ethnography based on social interactionism is inadequate for the study of everyday life. Such approaches remain distanced from, rather than reflexively situated in, practices (Pink, 2012). "Participant objectivation" is a form of epistemic reflexivity that Bourdieu (Bourdieu, 2003) considered essential for avoiding scholastic bias and fostering relevance to practitioners (Splitter and Seidl, 2011, pp. 100-108). It must frame the researcher's interpretation of the experiences of observed practitioners as they practice.

Recalling that practice theories analyse the 'doing' - that is, the practices rather than the practitioners, praxiography considers the analysis of practices to be the basis of analysis. Practitioners are regarded as mere 'carriers' of practice (Reckwitz, 2002). Shove et al. suggest that a practice can be considered either "a recognisable conjunction of elements consequently figuring as an entity" (i.e. practice-as-an-entity) or a performance (2012, p. 7). The latter conceptualisation provides dimensions of doing for analysis: time; time-span; the presence and reproduction of patterns; and the interdependencies between elements (i.e. materials, competencies and meanings).

Documenting practices is another concern of praxiography. Given that they represent a fracture in routine practice and are thus bound up in multiple tensions and meanings, writing-up arresting moments and the context from which they emerge is challenging. Within the constraints of prose, the researcher must capture the unfolding flow and performativity of each arresting moment as it is being studied; an analysis method that Lahlou refers to as "catching the fish and canning the fish" (2011, p. 609). The researcher must remain open to practitioners' unsettling incidents, struggles, deliberate or otherwise misunderstandings, expressions of passions, heightened emotions, and shifts in subjectivities if they are to remain sufficiently sensitive to arresting moments and able to illuminate and animate them sufficiently for a reader to appreciate their significance in the unfolding practices.

THE NEED TO ADDRESS QUESTIONS OF COHERENCE

Practice theory lets researchers consider new empirical examples of practices to create opportunity for theoretical innovation. Before using such opportunities the researcher must carefully consider the coherence of the ontological and subsequent epistemological basis of the selected practice theory (Dainty, 2008; Grix, 2010). The heterogeneity of practice theories emphasises the need to understand the similarities and differences between them thereby avoiding any risk of combining different and potentially incompatible assumptions (Nicolini, 2013). If this is not done, methodological instruments could be adopted that do not cohere with the overlying ontological and epistemological stances of the selected practice theory perspective. This would, in turn, weaken the foundation of any resulting theoretical innovation (Grix, 2010). Careful consideration *must* be given to the implications of using a *particular* practice theory. The researcher *must* remain vigilant to ensuring that the methodology (chosen to guide any particular observation) and its role in praxiography remains coherent with the *particular* ontology of the *particular* practice theory selected and in addition coherent with the research questions, aims and the characteristics of the phenomenon being investigated. For the purpose of this discussion, coherence has two components: salience and congruence.

Ontological coherence: salience

Salience is defined hereafter as the need to ensure that the methodology employed by praxiography fits at all times with the assumed ontology and with the resultant epistemic consequences of the overarching practice theory perspective adopted (Dainty, 2008, p.3). As noted above, one methodological implication of using practice theory is the use of interpretation to understand observed practice phenomenon (arresting moments in this case). It follows that praxiography entails the use of, at least, a qualitative research approach; one that unambiguously involves interpretation as a means of analysing data (Dainty, 2008).

Coherence with the research questions, aims and characteristics of the phenomenon being studied: congruence

What is empirically found depends to some extent on the characteristics of the phenomenon being studied and the research intent. Following Richards and Morse (2002, p.34), the term congruence is advanced. Congruence is here defined as the need to ensure that the methodology is aligned to a qualitative research approach, is coherent with the research questions, aims and that the researcher is sensitised (Blumer, 1969) to the characteristics of the phenomenon being studied. This will invariably require that the praxiographic researcher recursively reflects upon what the research is trying to do (as it is being done) and is immersed, initially at least, phenomenologically into the practice being investigated.

In sum, here, salience and congruence are two distinct praxiographic terms concerned with different aspects of the congruence of the methodology towards respectively the selected practice theory and the research questions, aims and phenomenological characteristics of the practice being investigated. Attending recursively to matters of salience and congruence will act, whilst carrying out the research, as a mirror for the researcher to reflect upon the coherence of the research as it progresses. Doing so mitigates the risk of ontological or phenomenological dissonance whilst engaged praxiographically and permits the plausibility of the particular practice theory selected to be evaluated against the empirical findings.

PART 2: ILLUSTRATING THE STRATEGY

The first part of this paper advanced the argument that underpins the Strategy: that using a practice theory perspective not only requires consideration of a particular practice theory but also a particular methodology that is salient towards it and remains congruent towards the research questions and aims and the phenomenon being investigated. This part illustrates the theoretical and empirical implementation of the Strategy taking into account matters of salience and congruence as defined earlier. The Strategy involves two steps. These first two are preparatory, undertaken prior to 'entering the field'. The first mobilises Schatzki's practice theory and considers its ontological and epistemological (and, therefore, methodological) implications for observing the practice of project management of a new NHS hospital during the design and procurement stages of the project. The second is concerned with the same matters but in respect to congruence. It considers the prominent characteristics of the observed phe-

nomenon (i.e. the project management during the design and procurement stages of an NHS hospital) with reference to the research aims and the research questions.

MOBILISING SCHATZKI'S PRACTICE THEORY

The first step of illustrating the Strategy mobilises Schatzki's practice theory. Building extensively on Wittgenstein and Heidegger, Schatzki has, according to Nicolini (2013, p. 163), "offered one of the more explicit and clear illustrations of the implications of a practice-based approach". "Schatzki is a central interlocutor in current debates ... on practice theory" (Caldwell, 2012, p. 2). A prominent feature of Schatzki's work is its breadth and the extent of its convincing (and, indeed, at times polemic) critique of preceding practice theory luminaries such as Bourdieu, Giddens, Taylor, Laclau, Lyotard and Chantal, to mention just a few; and of rival theories related to practice as a social phenomenon such as, for example, Actor Network Theory. For these reasons and the explicitness and clarity of his illustrations about what a practice is and is not (Cox, 2012, p. 2) Schatzki's practice theory is selected to deploy the Strategy in the field.

Introducing Schatzki's Ontology: the "site of the social"

According to Schatzki, the best way of approaching the topics that constitute social life (i.e. the nature of social existence, what it consists in, and how it may change) is to tie it to the "site of the social" (Schatzki, 2005). The site of the social, which denotes Schatzki's particular practice theory, resonates with the Heideggerian phenomenological concept of *Lichtung* or a clearing: as in, "the clearing in a forest". Heidegger's phenomenology (1929) proposes that, before we can discern a subject and an object, we need a context in which entities can show up and make sense. That is to say, we need certain conditions so that anything can appear or come to light at all. Heidegger contends that this context is provided by social practices: not solely by the agency of actors or their post-event cognitive deliberations. Schatzki adopts this concept. The "site of the social" recognises two important phenomena. The first is that many actions subsequently progress in response to interactions with other people, events and objects in a particular setting. Second, actions and entities encountered in sites help to mould the sense making of the practitioners that influence their decisions to act.

When applying the ontology of Schatzki's take on practice theory to any organised activity the 'site' is the context where, and as a part of which, the social life associated with that practice immanently occurs. In practice, these sites could be a kitchen, a hospital, a sports field or any other context where organised activity takes place. Schatzki illustrates the concept by referring to a university academic department as an example of a site (2005). Schatzki makes three further points about sites. First,

"Nothing hangs on the choice of the word 'site' to label this context. Usually, something's site is its place, or location: the site of a building, the site of the UN, the site of a battle. (Schatzki, 2005, p. 467)

Second, sites are not necessarily spatial

"It is important to emphasize that sites need not be spatial. Recording a student's grade, for example, intrinsically occurs as part of educational grading practices. This fact, however, has nothing to do with the spatial properties of practices (e.g. the particular locations in objective space at which their constituent actions occur). (Schatzki, 2005, p.468)

Third, a site is a particular type of context

"A site is a type of context. For present purposes, a context can be loosely understood as an arena or set of phenomena that surrounds or immerses something and enjoys powers of determination with respect to it. Sites, however, are a particularly interesting sort of context. What makes them interesting is that context and contextualized entity constitute one another: what the entity or event is is tied to the context, just as the nature and identity of the context is tied to the entity or event (among others).

Schatzki further claims that a site context comprises a mesh of orders and practices (Schatzki, 2005). Orders are 'material arrangements' of entities (things, people, artefacts) - and that are referred to in Schatzki's later works (Schatzki, 2010) as simply as the 'arrangements' that typically would be found in any place of a given type and which constitute the organised activities of that place. This 'site of the social' has analytical and epistemological consequences for methodology.

The notion of practical intelligibility and the centrality granted to it in Schatzki's ontology

In consideration of the governance of different actions that a person may perform at any moment Schatzki grants ontological primacy to something called 'practical intelligibility'⁵ - a fundamental 'watershed' feature of his ontology that he derived from Heidegger that distinguishes his practice theory from that of many others (Nicolini, 2012, p. 164). "Practical intelligibility is what makes sense to a person to do" (Schatzki, 2002, p. 75). Schatzki stresses however that practical intelligibility is a) not the same as rationality -as a phenomenon it "can diverge" from rationality and b) as a phenomenon is it not the same as normativity: "what makes sense for someone to do is not the same as or what is or what seems to be to the actor to be, appropriate, right or correct" (Schatzki, 2002, p.75). Nicolini cites smoking as an example of the latter (Nicolini, 2012). This notion is central to Schatzki's ontology because "practices constitutes horizons of intelligibility, and allow us to respond to different matters in different ways" (Nicolini, 2012, p.164). Schatzki (2002, p.75) argues that practical intelligibility is an individualist phenomenon and consists principally of the features possessed by, or that may be ascribed to, individuals such as a person's goals, affectivity and the projects/tasks that s/he is pursuing. He further argues, crucially however, that non-individualist phenomena (such as practices) determine 'practical intelligibility' by "moulding" the individualist phenomena.

⁵ For a more detailed account of action sketched in this section see Schatzki, *Social Practices* (1996), chapters 2 and 4.

Schatzki's ontology: three notions of practice

Putting "aside", for the purposes on his ontology, the "notion of practice as learning how or improving..." by repetition or development (Schatzki, 1996, p.89), Schatzki's ontology goes on to provide three notions of practice. First and fundamental he considers practice a "temporally unfolding and spatially dispersed nexus of doings and sayings" (Schatzki, 1996, p. 89). This notion "embraces two overall dimensions: activity and organisation" (Schatzki, 2002, p.71). The second considers it "that of a performing an action" (Schatzki, 1996, p. 89-90; Schatzki, 2002). The third, as an extension of his first two notions is first provided in his later writings (2010) in which he develops his ontology in detail with his ideas of time and space and in particular the relationship between activity and time and space. Here he refers indirectly to a notion of practice as a human activity that he considers "helps to compose a practice(s) [and] it is at once a carry on of the practice(s) involved" (Schatzki, 2010, p. 209). Schatzki considers human activity should be understood as an indeterminate temporal-spatial event⁶. Schatzki explains this notion of practice in the following terms:

"Human activity is not just an event—it is an indeterminate event (see Schatzki 2010). What I mean is that nothing regarding teleology or motivation can determine or fix, prior to activity, what a person does or why. It is only with the occurrence of activity that what a person does and why become determinate" (Schatzki, 2011, p.5).

In other words, each human activity, as an important constituent of practice(s) is "an inherently temporal-spatial happening that is not, in an important regard, pinned down by what precedes it" (Schatzki, 2010, p. x).

Practice as 'doings and sayings': linked by four 'avenues'

To be recognised (a prerequisite to the researcher's observation) as a practice, 'doings and sayings' must form a nexus. Schatzki considers a nexus to arise when practices become linked by four "avenues" (1996, p. 89) or "dimensions of the organisation of practices" (Schatzki, 2001, p.53). Illustrated in the context of project management, they are: practical understandings (such as knowing how to do things like reviewing gnatt charts, drawings and proposals); rules (such as the explicit instruments and policies that direct project management); teleoaffective structures (namely, the overarching purpose, mood or feelings linked to project management); and general understandings built from reflexive understandings and practical intelligibilities (Schatzki, 2005) developed through project management (for example, understanding how the project will impact how a new hospital can be used to treat patients).

⁶ For a more detailed account and explanation of this term than outlined here see *The Timespace of Human Activity* (2010) Chapters 1 and 2.

Schatzki defines a teleoaffective structure as a "range of normativised and hierarchically ordered ends, projects and tasks, to varying degrees, and allied to normativised emotions and moods" (Schatzki, 2002, p.80). 'Teleo' signifies that the practices are goal orientated and purposeful while 'affective' indicates that they matter to humans and that humans are emotionally committed to them. All practices entail "a set of ends that participants should or may pursue" (Schatzki, 2002, p. 80). Teleoaffective structures promote questions such as "where next" and "how to get there" (Nicolini, 2013, p.166). Practices differ in the sense of purposiveness and concurrent affinity for each of us. Compare, for example, cooking practices with Western child rearing practices: the former has a strong sense of purpose yet fewer feelings of affinity compared to the latter (Schatzki, 1996, p101). Collective perceptions of purpose and affinity lead to the recognition of emerging practices as socially valid, adding a normative dimension to their teleoaffective structure (Schatzki, 2001, p.53). Two further distinguishing features of teleoaffective structures in relation to the notion of practical intelligibility. First teleoaffective structures are not possessed by individuals like the practical intelligibility; instead they are properties of practices. Second, teleoaffective structures do not govern individual activity, as this is governed by practical intelligibility, as noted above.

THE METHODOLOGICAL IMPLICATIONS OF SCHATZKI'S PRACTICE THEORY

Having summarised the principles of Schatzki's particular practice theory (largely by examining its ontology), its distinctive methodological implications must now be considered. Schatzki's ontology exhibits commonality with other practice theories in that it affords epistemological and methodological insight by recognising that, in practice settings, knowing is not separable from doing (Nicolini et al., 2003).

Two methodological tasks are inferred from Schatzki's site ontology: the need to identify the site and the practices within it; and the need to identify the practice-arrangement bundles of which those practices are part. Arrangements - (see above) - are entities (things, people, artefacts). A bundle is a set of linked practices and arrangements. Schatzki contends that researchers do not need to track and register the "potentially labyrinthine complexity of bundles, nets of bundles and so on" but simply need an understanding of "social phenomena and their workings couched in terms of referring, not to details of the practice-arrangement bundles but to entire formations and their relations" (Schatzki, 2005, p. 477). This resonates, methodologically with the concept of congruence advanced earlier. Attending specifically to Schatzki's three notions of practice, this understanding can be provided by ensuring the researcher's methodology is aligned and subsequent observations are sensitive to 'doings and sayings' (recall the first notion above) in addition to the performance of embodied actions and dialogues of the actors observed (second notion). Observations must extend over sufficient time periods for the researcher to also become sensitive to temporal-spatial shifts in practices and to the opportunities presented during the actual occurrence of activities (events) to detect the motivation and teleology (i.e. an explanation of the human activities by way of their purpose) of the actors (third notion). Using Schatzki's practice theory a further methodological consideration is that the researcher's sensitivity and analytical purchase of the observations will be improved by monitoring the four avenues that cause emergent practices to become salient as nexuses and, thus, command the researcher's attention and prompt his or hers reflexivity engaged in praxiography. These distinctive features of Schatzki's ontology, together with the emphasis placed on the role of practical intelligibility have particular relevance to the sense-

making actions of participants and, therefore, towards any instances of arresting moments observed in the field.

APPLYING THE ONTOLOGY TO THE PROJECT MANAGEMENT OF NHS HOSPITALS

An application of the Strategy is illustrated from an ongoing praxiographic study of a large (£250 million / €298 million) new NHS acute hospital project (hereafter 'the Project') in Dumfries, Scotland for the NHS Dumfries and Galloway Health Board (hereafter the 'Board').

At the time of writing, substantive design development and procurement of the Project is nearing completion and subject to reaching financial close (i.e. entering into a contract). Construction will commence later in the Spring of 2015. The Project forms part of the Scottish Government's ambitious NPD Programme of projects (Scottish Futures Trust, 2014). Owing to the complexity of establishing the Board's requirements, the Competitive Dialogue procurement process has been used (Office of Government and Commerce, 2008). Three bidders, each of which is a consortium (structured as Special Purpose Vehicles⁷) of companies (capable of designing, constructing, financing the construction and subsequently maintaining the new hospital over a 25 year period) were short-listed at the commencement of the 36-week period allowed for the Competitive Dialogue procurement phase. This phase involved both bidders taking and developing and refining a reference design, developed independently by the Board over the course of 6 rounds of iterative monthly dialogue sessions in which the bidder's design solution have been progressively developed against predetermined evaluation criteria set out in the Invitation to Participate In Dialogue (ITPD) documentation and consequently evaluated at each round. These sessions have been audio-recorded and field work based on participant observation and the subsequent use of interview techniques such as 'interviewing to the double' (Nicolini, 2009) and confrontation interviews (Lahlou, 2011).

An initial step in the application of the Strategy begins with the identification of the 'sites' in Schatzkian terms, of project management. Following Schatzki, before we can discern a project manager as a subject and, say, an gnatt chart or organogram as an object, we need a context to observe empirically. In Schatzki's words, "Spaces *qua*⁸ openings or mediums are pre-eminently qualified to be something where, and as part of which, events occur and entities exist." Project management meetings that take place during the design and procurement stages of the project constitutes such a clearing - the 'site' in which the interactions of socialised actors provides a background understanding of what counts as objects, what counts as subjects and, thereby in terms of Schatzki's ontology, what counts as real. Such meetings are but one example of an identifiable 'site'. When creating a new hospital building through structured processes of design and procurement numerous less formal project management

⁷ Typically a bespoke 'Special Purpose Vehicle' (SPV) (Hare, 2013) enters into a contract with a building contractor and its supply chain of designers and subcontractors and a separate contract with a facilities management contractor. The SPV concurrently enters into a funding agreement to finance the project's design and construction and ultimately enters into a contract with the procuring public sector authority.

⁸ Read interchangeably as either 'In the capacity of; character or role of; as being or sometimes as 'an'

'sites' also exist and are available to the praxiographic researcher within established project management regimes.

This insight immediately divides sites of into those prescribed and formalised by NHS Project Management Policies and others that sit outside such policy stipulations. In Schatzkian terms, all such sites humans, artefacts (man-made objects such as drawings, projectors and computers) and things (entities whose being is not a result of human activities) intertwine and mesh with other as an example of a practice arrangement to shape project management practice; mould the practical intelligibility of the actors involved and bundle with other practice arrangements linked to project management all within a constellation of linked bundles that constitutes the NHS project and the NHS organisation which such organised activities sit.

A further matter of salience: viewing project management 'sites' within a socio-technical regime

Sensitising the research methodology towards Schatzki's ontology, Schatzki suggests that projects to be considered as socio-technical regimes⁹ (Schatzki, 2011). Recalling the above discussion about the need for coherence, regarding project management 'sites' within NHS projects is therefore a further matter of salience. Described non-technically, the socio-technical regime applicable to project management sites within the new hospital project under investigation include: the Health Board client (Holland, 2010) the consortiums of companies and their supply-chains bidding to provide the project (Carrillo, 2006), external government and local authority agencies, established 'models of care systems' (Anthony & Hudson-Barr, 2004; Parand et al., 2014) for delivering healthcare services, the Health Board's suppliers, extant government regulations, the professional associations of those working in and providing the hospital, local industries, businesses and community groups, patient groups and their representative bodies, local infrastructure systems, other Health Boards, and other hospitals and healthcare facilities. These phenomena are either organisations, rules, or material networks. Their configuration forms a socio-technical regime is, ontologically, a practice-arrangement bundle (see Schatzki, 2005). The critical reflection on this contextual complexity is, then, that a project management policy is also subject to numerous external stipulations. Such stipulations are examined in relation to the Strategy's requirement for congruence.

MATTERS OF CONGRUENCY RELATING TO THE RESEARCH INTENT AND THE PRACTICE OF PROJECT MANAGEMENT OF AN NHS HOSPITAL

The second step in illustrating the Strategy Relating is concerned with highlighting matters of congruence of the methodology to the research intent (i.e. the research questions and aims) and to the prominent characteristics of the phenomenon being investigated - the project management of the Project.. These considerations have been informed by two principal assumptions as follows.

⁹ Schatzki appropriates the notion of socio-technical regime from Smith et. al., (2005)

First is the assumption that the practice of project management within a large NHS project is, by definition, a complex affair subject to numerous externally imposed constraints in addition to the above social-technical complexity. As a public-sector project, the Project's principal constraints concern: affordability; value for money; legal, technical, environmental, policy, health and safety standards; procurement processes; and delivery timescales - see for example, Scottish Futures Trust Non Profit Distributing (NPD) Model (Scottish Futures Trust, 2014).

Second is the assumption that practice cannot be simply regarded as "just what people do" in some unmediated way: such a notion is a merely a return to a naive form of empiricism (Schatzki et al., 2001). Building on the first assumption, careful consideration, therefore, of matters that are suspected of mediating the practice of project management is required. Such matters considered to date include:

- The need to be publicly accountable imposes strict budgetary, value for money, affordability and business case considerations (Audit Scotland 2011; Scottish Government 2014) . These mandated policy requirements, termed here as 'external stipulations' steer the project team to "qualculate" (Tryggestad and Georg 2009, pp. 970-971) the project throughout the procurement phase of the project thereby mediating project management decision-making.
- The authority and deference granted to senior clinical and medical stakeholders -see Russell et al., (2010) and Davies & Powell, (2007) - when they are participating in project management alongside highly experience project managers (Balogun and Rouleau 2007). This observation 'matters' because, in a mutually deficient way, clinicians are largely novices in project management and, to the contrary, project managers are novices in hospital operational and clinical procedures: this can incite demanding requirements for sense-making; a cognitive process that can be consciously unfamiliar to such individuals.

AN EXAMPLE OF EARLY EMPRICAL FINDINGS: 'ARRESTING MOMENTS'

Whilst the primary aim of this paper is somewhat abstract and ontologically orientated so as to address the above noted contested methodological considerations that may limit the potential of applying a practice theory perspective toward project management, an example of some early empirical findings are provided. This example, which studies observed episodes of conflict and contestation - referred to as an example of "arresting moments" (see Beech et al. 2012 for a full discussion of such episodes) serve to support the earlier claim that can employing a practice sensitise project managers to phenomena that are not emphasised by traditional project management paradigms, namely the epistemological role of conflict.

Beech et al., found that "arresting moments" (2012, p. 267) of conflict were preceded by increasingly intense divisions between anticipated and encountered practices, during which

practitioners experienced increasingly entrenched views and heightened emotions. Applying the Strategy to the Project has revealed numerous such episodes of such "arresting moments" (- see table 1 below in Appendix 1 of one example as limited by space in this paper) observed during field work that have the value to provide an insight into tacit knowledge by understanding the localised, situated knowledge through which it is revealed (Yanow and Tsoukas, 2009). The use of the Strategy has served to demonstrate that the Project when viewed via a practice theory perspective is, in part at least, a contested activity - and that such conflicts can in themselves reveal further knowledge.

CONCLUSION

In relation to the purpose of the research: it is concluded that the theoretical argument developed for the Strategy has the potential, by using a practice theory perspective, to reveal new insights and a better understanding of stakeholder evaluation than that afforded by the currently mandated NHS Project Management Policies.

Furthermore, and of wider application, the Strategy has addressed concerns and gaps in the literature about the methodology of practice theory and advances the case for praxiography as distinct from ethnography to those interested in studying the praxis of organised activities such as the project management of hospitals.

Reflecting on the research design and processes to date has shown the potential limitations and benefits concerning the implementation of the Strategy particularly in relation to the use of a programmatic methodological approach that contemplates the use of numerous different practice theories within the same empirical setting. Being an emic qualitative approach requires considerable access to longitudinally observe events and the 'doings and sayings' of participants involved: this may present prospective researchers with challenges, not only in terms of handling, analysing and representing considerable amounts of data but also in obtaining the necessary access and time required for immersion in the field. These challenges however need to be balanced against the potential of the approach to reveal deeper insights and understanding of the actuality of the praxis of project management.

Implications for the use of the Strategy to other practices such as design evaluation and by other construction management practices have also been discussed. The plausibility of such implications would benefit from further empirical investigations and to that end areas of further empirical studies implementing the Strategy in conjunction with alternative practice theories to those used here have been indicated.

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APPENDIX 1:

Situation/Incident and context	Practice as associated and related to Design Evaluation	Role of Visual Representations	Manifestation of stakeholder power and influence	Emotion displayed	Tactics invoked	Ensuing Reflexivity	Comments
Flat Roofs: prejudiced design evaluation examples including resistance to flat roofs and internal rain pipes	Building Whole Life Cycle Costings and established maintenance practices	Significant in terms of visual aesthetics and to illustrate extent of perceived 'problems'	Strong lobbying at design evaluation scoring sessions by certain influential members of the Board's Estates representatives rejecting outright bidder's proposals for flat roofs based on unrelated prior experiences from other projects Use of position power	Utter rejection of any suggestion or proposal to include flat roofs Upset Stubbornness and refusal to listen to experience and track record of bidder's designers	Use of isolated incidents and examples from entirely different projects Exaggerated concerns articulated to non-technically qualified but highly influential stakeholders such as Chief Executive and Project Sponsor	Demonstrates a lack of understanding of the design risk transfer Refusal to accept that materials and technologies have changed.	Despite numerous attempts and trying to educate and resolve this issue persists but to a certain extent is also being encouraged by key stakeholders who are keen to be seen to challenge the notion of design risk transfer

Table 1:	Examples of	Arresting	Moments	as observed			

Applying case study approach and triangulation methods of data collection in the ICT context in Libya

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Abstract:

In the last few decades concepts such as organizational culture (OC) and knowledge sharing (KS) have been conceived as being interrelated phenomena where each one influences the other. In the current business and technology literature, there is a significant argument that specific elements of organizational culture can have influence, either positively or negatively, on the process of knowledge sharing in business organizations including in Information and Communication Technology (ICT) firms. Earlier studies in the area of KS and OC have utilized either qualitative or quantitative approaches to study the relationship between OC and KS. But in the current study the authors examined the relationship between OC and KS by using case study approach supported with triangulation methods (questionnaires, semi-structured interviews and document analysis) to reflect both qualitative and quantitative perspectives of the interaction between KS and OC. Four different small firms (two public and two private cases) in the Libyan critical context, as the country has been experiencing a political and social conflict since 2011, were selected. The authors found that using triangulation methods to collect the data in the protocol of case study approach in the Libyan context is powerful because it allowed the authors to examine the interaction between the phenomenon of SK and OC from different angles and at the same time it allowed them collect more credible and reliable data and access to the studied context and participators in different ways which enhanced the value of the collect data.

Keywords: Case study, Libya, questionnaire, semi-structured interview, triangulation methods.

INTRODUCTION

The development of the business sector and the change in the technology environment has paved the way to the creation of new concepts such as knowledge management, knowledge sharing and knowledge creation because knowledge has been seen as a major source to support not only the development of, but also the productivity purposes within, business organizations including ICT firms. Knowledge is also seen as a major capital resource in achieving competitive advantages and innovation (Arthur & Huntley, 2005; Collins & Smith, 2006; Mesmer-Magnus & De Church, 2009).

Knowledge, knowledge sharing and organisational culture in ICT businesses

According to Nonaka (1994), due to globalisation and the shift from an information era to a knowledge era (which global markets and business organisations have experienced since the 1990s), the value of knowledge to a business organisation has increased rapidly. Knowledge has become a key asset for business organisations and has paved the way for new theories such as in the area of knowledge management. Tsoukas (1996) has added that the evolvement of the use of information communication technologies to perform business functions has

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made modern organisations complex knowledge domains where both tacit and explicit knowledge exist throughout the organisation rather than residing in a single brain or text. Many researchers such as Davenport and Prusak (1998) and Ford (2001) have seen that the processes of knowledge management can be varied but they have emphasised that knowledge sharing is one of the most common processes that business organisations apply as part of their knowledge management strategy. McInerney and Koenig (2011) have linked the success of KM practices to decision making and have emphasised that KM can be seen as a series of processes and not necessarily a manipulation of things. They mentioned that a few firms used social networking and commonly adopted Web applications to increase the value of social capital and to connect practitioners with clients and colleagues.

Interestingly, Grant (1996) saw knowledge sharing not as one of the main activities of knowledge management but as a key element of the knowledge-based theory of an organisation and he reflected that the main motivation for the creation of an organisation is its superior ability to transfer and integrate multiple knowledge streams and to apply existing knowledge to future tasks. Ambrosini and Bowman (2001) and Felin and Hesterly (2007) indicated knowledge to be the key driver of an organisation's viability. Maybe this perspective can be supported by the fact that modern business firms consider the creation of unique and original knowledge to be a key strategic asset resource, therefore, knowledge sharing will be seen as a main element of organisational culture rather than one of knowledge management's activities. Wang et al. (2014) found that the level of KS in Chinese software companies' was influenced by the evaluation and reward system implemented by the top management team. Wang et al. (2014) found out that evaluation and evaluation plus reward had a positive relationship with knowledge sharing. Greater levels of knowledge sharing occurred in the evaluation-plus-reward condition compared with the evaluation condition. Wang et al. also discovered that knowledge sharing was influenced by the interaction between evaluation and reward and conscientiousness, neuroticism, and openness to experience.

Regardless of which theory to which knowledge sharing belongs, various studies have been conducted to examine the issues that influence the process of knowledge sharing in a business organisation. Research studies undertaken by researchers such as Hendriks (2004), Lichtenstein & Brain (2007) and Al-Alawi et al. (2007) indicate that different elements within the organisational culture in a business can lead to a significant influence on the process of sharing knowledge. Therefore, an understanding of what those elements are and how they can influence the process of sharing knowledge in business firms is fundamental to controlling any potential obstacles during the process and to enhance best practice. Connelly et al. (2014) stated that employees in organizations face a great dilemma every time a colleague requests knowledge: should they share their knowledge.

From the perspective of Husted and Michailva (2002), the success of a KS process relies mainly on the establishment of an Organisational Culture (OC) that motivates and rewards individual staff who practices KS. Hendriks (2004) insisted that OC not only affects the process of KS but also affects the way in which an organisation works to create knowledge. He added that the flow of knowledge to be shared in an organisation relies on the collaboration and trust which an organisational culture motivates and promotes. McGill and Slocum (1994) identified four types of OC. These are the knowing culture, the understanding culture, the thinking culture, and the learning culture. According to Hendriks (2004), each type of these cultures leads to a different type of KS.

In the ICT context, De Long and Fahey (2000) stated that a traditional OC and systems can incorporate factors that cause serious barriers which can impede the completion of successful KS processes in ICT firms. They stated that OC has a significant influence on staff behaviour in knowledge creation, knowledge sharing and in using knowledge. They added that most business organizations lack a culture that encourages collaborative work because employees believe that personal ownership of knowledge will help them ensure job security. Thus De Long and Fahey concluded that a lack of KS can present a serious barrier which might cause KM and KS failure.

Anderson et al. (2007) saw that OC should be embedded in the ICT firms to drive KS in order to increase competitive advantage and stability especially where there are limited resources. Sharing and managing knowledge issues were addressed by Davenport (2005) who noted that research studies in this area looking at small firms are limited. Furthermore, although ICT as a tool has been the focus of extensive academic papers, studying the influence of OC on sharing and managing knowledge within the context of the companies which provide ICT tools is also limited (Parirokh et al., 2008).

In the Arabic context, El Harbi (2011) found that managers can have a positive influence on encouraging the culture of KS and in running and developing useful internal systems for sharing information as well as implementing efficient methods for motivating the use of existing external knowledge. However, El Harbi also found evidence of immature national information sharing systems. The researcher linked this to the level of development in Tunisia (the country where her study was undertaken) and to the understandable attitudes of firm owners. Tong et al. (2013) wrote of different factors including the fact that OC and knowledge sharing practices are strongly related in ICT firms. Human resources' professionals can play a vital role in their organizations by increasing the awareness of the strategic areas that can facilitate a friendly knowledge sharing atmosphere, as well as enhancing knowledge management effectiveness. Furthermore, ICT practitioners can be more active in helping to develop the necessary collaborative strategic directions by understanding the relevant theories and practices.

Interestingly, the link between most of the above studies is that authors mainly intend to reflect either the qualitative epistemological perspectives of the interaction between OC and KS or the quantitative ontological perspective of OC and KS components and elements. Hence, it was very rare to find studies that reflect the interaction between both phenomenons from varied angles, which make this study unique and useful. As the authors used triangulation methods to collect data they were able to gain the following

- Supplementary sources of information that provided the authors with more insight into the studied phenomenon considering the fact that Libyan ICT context has been influenced by the political and human conflict dominating the country since 2011. Collecting information using one sort of data collection method seemed very critical because the participators in the context were not in the mood to fully cooperate and share their perspectives and opinions;
- Rich data is collected from different sources;

- Increased the validity and the creditability of the data;
- More comprehensive data is obtained;
- Different perspectives are collected from different sources which make extracting themes more convenient which will help the authors to draw conclusions and outcomes.

The research methodology, approach and strategy

Creswell (2009) stated that research methodology is the systemic approach that a research adopts to accomplish the research's aim. In the same vein, Silverman (2010) stated that research methodology is a specific approach which researchers select to help in mastering the execution of research including planning, data gathering and data analysis. From the perspective of Crotty (2003), research should include epistemology, theoretical perspective, methodology and method while Saunders et al. (2007) extended this listing into an onion model which includes philosophies, approaches, strategies, choices, time horizons, techniques and procedures. The nested or hierarchical model of Kagioglou et al. (1998) lists only three elements: research philosophy, research approach and research technique. Keraminiyage (2014) suggested using a combination of both the nested model and the onion research model. This suggested development is based upon the philosophy that both the onion research model and the nested model are connected in three major areas. These areas are research philosophy, research approach and research technique. In addition, Keraminiyage combined these models' considered time horizons and believed them to link the main issues which should be highlighted prior to the research journey in order to accomplish research-based targets on time. In this study, the authors tended to use the onion model created by Saunders et al. (2007) because it was seen as a systemic model which provides a clear guideline and helps follow up the research stages smoothly. It shows the up-coming stages which thus ensure a better control and a quicker achievement of the goals of the research. This is pertinent in the current study considering the fact that Libyan context is very critical and due to the current war situation.

In terms of the research philosophy, Bryman (2008) named three main philosophical perspectives which should be taken into consideration before making any decisions. These are ontology, epistemology and axiology. While ontology philosophy refers to the formations of reality (Bryman and Bell, 2003), epistemology philosophy refers to what should be examined as acceptable knowledge (Bryman, 2008). Axiology philosophy goes back to Greek word 'axio' which means 'worthy' and symbols meaning "science". From the perspective of axiology, the main aim is to explain what researcher values go into the research and the assumptions made by the researcher that are concerned with the value systems (Miles and Huberman, 1994).

Ontologically, this study tends more towards idealism. The nature of the research aims and objectives seeks to find the participants' varying perceptions, opinions and meanings via human interactions. This suggests that this research should not consider the phenomenon under investigation as an independent and single reality; rather, it accepts the knowledge claimed by understanding the participants' interpretations given to the reality. Accordingly, the construc-

tivism ontological position will be adopted in order to understand the social world as an outcome of the participants' interactions within a studied context.

From the epistemological perspective, this research tends more towards the interpretivism assumption. The investigation of this research is based on a phenomenon that is rooted in live-work experience. This suggests that knowledge is socially constructed through the interpretations of the major participants in the practices of KS. Thus the interpretivism epistemological position is adopted to gain an in-depth understanding of social reality through studying people's interpretations and attitudes.

From the axiological perspective, this research tends more towards the value-laden and subjective nature of research, although part of it is free-value and of an objective nature in relation to the questionnaire findings. The major assumption is that the phenomenon under investigation is interpreted with respect to the context through the direct interactions between the firms' employees. The appropriate research approach was chosen from the various alternatives for the research purpose and the questions it intends to answer (Yin, 2003). The research questions in this study intend to answer not only 'what' questions but also 'why' and 'how' questions. This means that the authors need to gain an in-depth understanding of the interrelationships of the variables.

In terms of the research approach, Bryman (2001) stated that it is vital for a researcher to base research on a theory to complete a research study successfully. The value of the theory comes from its influences on the design of the research project. Bryman and Bell (2003) believed that the main purpose in identifying an approach to research is to understand the nature of the interaction between the studied social phenomenon and the related theory. Saunders et al. (2007) distinguished between deductive and inductive approaches. Gorman & Clayton (2005) agreed with Saunders et al. (2007) and stressed that the deductive approach requires starting with a theory (questions, hypothesis); Saunders et al. (2007) tend to be predictive as a researcher starts collecting evidence. Therefore, a researcher starting with a theory is likely to rely on the deductive approach. On the other hand, the qualitative approach utilises an inductive approach. Researchers using this approach tend to be more interpretive, beginning with the evidence and then building up a theory based on it.

Based on the above discussion, it can be seen that, although this study requires the examination of the complex interaction between people (from different backgrounds) who have different concepts of OC and KS, it does not require the researcher to investigate the participants' psychological positions. Hence, this investigation of the real situation in ICT firms is based on the deductive approach while, in order to obtain a fuller picture of the real situation and of how both concepts are conceived and dealt with, the inductive approach is utilised. So both the deductive and inductive approaches are applicable and are needed in order to meet the aims and objectives of this study.

In terms of research strategy, research can be qualitative, quantitative or mixed. Creswell (2009) suggested that, although each approach can be used to answer specific questions and to investigate the phenomenon from a different angle, each one of these approaches has different biases and he suggested that using a mixed research methods' approach or using triangulation methods to collect different types of data can help a researcher reduce the possible biases of each approach. Furthermore, the case study approach is one of the research approaches that allow a researcher to use triangulation methods to collect data including questionnaires, semi-structured interviews, focus group interviews, observation or document analysis. According to Yin (2009), cases should be selected bearing in mind the purpose of the research. In the current study the authors intended to discover which elements of organizational culture have an influence on the activities relating to the process of knowledge sharing in the ICT firms in Libya and then use the emerging data to create a framework that allows better practices to the activities of knowledge sharing. Therefore, the focus was on selecting the major companies in the Libyan capital which provide ICT services to users nationally. Four cases were identified, two private firms and two public firms. In terms of selecting the participating sample, Bryman (2008) stated that samples should reflect the sector of the population (individuals) which has been selected to be the core of the investigation. Miles and Huberman (1994) stated that, in qualitative research, sampling size is less important than the samples selected for quantitative research. This research, for the questionnaire, randomly selected 500 people from the over 1000 people working in four ICT firms (two private and two public). For the semi-structured interviews purposely selected samples of decision makers were interviewed. Official documents that include information about the firms' backgrounds, the firms' strategic vision and the firms' regulations and activities relating to organizational culture and knowledge sharing processes (if there are any) are to be collected and analysed.

Data collection and data analysis methods

In this study, as mentioned earlier, authors have incorporated both qualitative and quantitative research. Triangulating the methods help the authors increase a personal understanding of the phenomenon in question, using one approach to better understand, explain, or build on the results from the other approach. Thus using the quantitative method allows the authors to gain a general picture of the real situation with regard to Libyan ICT firms including business types and general perspectives on KS and organizational culture. Thus the answers to the research question "To what extent is the culture of KS embedded in Libyan ICT firms" and all the consequent relevant probing questions were acquired by using the questionnaire. The questionnaire was sent out for distribution in the first week of February 2014. The author stayed in contact with the assistant (who was collecting the information) in order to track the progress of the data collection. Each time the author was in contact with the assistant the author's worries were expressed because there were difficulties in accessing the cases. The major reason for the difficulties was always the critical security situation in the country and the political conflict which meant that most of the companies were not performing normally and company staff frequently had difficulty in reaching their work locations. In the middle of March 2014, after almost four weeks from the beginning of the distribution, the number of the collected questionnaires did not reach more than 50 which provided additional pressure on the author who then decided to book a flight to Libya and stay there for couple of weeks in order to examine the actual problem and to attempt to solve it. The author travelled to Libya at the beginning of April 2014. The country during this time experienced a high wave of po-

litical conflict. She reached Libya on 11th April and immediately she visited all the targeted companies every day (if possible) in order to motivate the participants who were in somber mood due to the general atmosphere in the country caused by the lack of security and the critical situation of various services such as petrol and electricity. Within two weeks the author was able to collect another 68 completed questionnaires which made a total of 118 completed questionnaires received from the four firms. She booked a flight immediately to the UK to avoid any more delay in the research.

SPSS software was used to analyse the close ended questions while the open ended questions were analysed using a thematic analysis approach. Once the data entry process was completed, themes were extracted and compared with the literature. Then the semi-structured interview questions were designed and piloted with a couple of friends. Semi-structured interviews were carried out with 10 decision makers and the authors are now in the process of transcribing, translating and analysing. Further effort is also required to analyse the documents collected from the firms. The authors will use content analysis methods to analyse the documents and the analysed data will be used to create the cases' background and to provide any further clarification or support.

Conclusion

Unlike most of the studies carried out in the areas of OC and KS which tend to be either qualitative or quantitative, this study employed the case study approach supported with the triangulation methods of data collection (including a questionnaire, semi-structured interviews and document analysis) to examine the interaction between KS and OC. Using triangulation methods to collect data from crisis area such as Libya, where participants are living unusual lifestyle due to the political and social conflict, seemed to be useful because it helped the authors access to different sorts of data to fulfil their information needs toward answering the research questions and meeting the objectives and the aim of the research. Further research studies should be carried out to examine the values and the benefits of using such methods in critical contexts under different conditions should be conducted.

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Research Methodology: Assessing the potential in adopting a PPP Approach to analyze Economic performance of Projects

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Abstract

The proposed research project investigates the uncertainty and sensitivity affecting the economic performance in processes in public-private partnership projects; understand the underlying benefits of this approach and bring into forefront the possibility of its application on housing projects as well. This research further aims at establishing a benchmarking system through developing improved/ new optimization risk-based models and improving project performance. This pursuit would require application of existing techniques and develop optimized framework through historical emergence. Therefore, this looks forward to potential application of the derived models on the current and future cases and validate their applicability. The highlight of the proposal is the approach to be adopted for this study through 'historical intervention' and bringing in the PPP approach from the history to study the project processes.

Keywords: Economic Performance, Historical Intervention, Public- Private partnerships, Uncertainty & Sensitivity Analysis

INTRODUCTION

The Prime Concern: Project Performance

The definition of building performance may vary from different point of views. It could aim at a performance targeted through financial point of view, or user comfort or a developer's point of view. Often, processes incorporate huge investments that lead to a great amount of over-runs. In any project, time and cost may face significant changes due to many existing uncertainties such as inflation, economical pressure, labor performance, procurement, execution errors, design errors, and natural events such as climate changes etc. And thereby, total time and cost may differ significantly and this is where the role of processes adopted come into place.

Can we have a project 'on time', 'on budget', and a success delivering 100% of its scope?

Let us take examples of two public iconic projects. The Millennium Dome in London is one example; that met the criteria of time, cost and scope, however was not very successful. On the other hand, Sydney Opera House is an example of a project over budget, over time, not delivering 100% scope, but a success. Time, Cost, Scope and Quality form various aspects of a project's success. All these aspects are not isolated and are linked together, thereby making it is essential to be dealt in a whole-

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some scenario, balancing the risks and uncertainties involved, long-term maintaining ability, managing relationships and adhering to expectations. The aim of the processes adopted is to balance the key constraints in a project and ensure quality in performance delivery based on stakeholder values, performance metrics, project goals and established procedures.

Economic Performance

The above argument boils down to the economic performance of projects. Economic performance would deal with studying how to achieve an optimal use of the resources in hand and the effectiveness of their utilization.

Motivation

A previously conducted research (self) on Indian Scenario highlighted about 85% projects possessing over-runs as compared to Germany with only about 12% projects. However, this study was confined to a much narrow region and more qualitative approach and therefore, this study area requires more rational intervention at wider levels, for more accurate projections and developing performance control. Another study conducted over project over-runs in the industry highlights the shortfalls and overlaps of the project processes that lead to project delays and over-runs. Project delivery methods currently adopted mostly incur additional project costs (Lapinski, Horman, & Riley, 2006). These over-runs are often a result of ignoring the uncertainties and risks inherent in the project.

Furthermore, *The Global building stock that showcases an increase of about 24% from 138.2 million sq. m in 2013 to 171.3 million sq. m in 2023.* (Global Building Stock Database, 2014) This highlights the arising need for improvisation in our processes to improve the performance of future projects.

Also, the efficiency and performance of projects is still a concern despite the technological progression in the construction world. This could be due to the fact that new technologies do not affect the cost of design and construction, while improving the management of the construction process. For example, although the Computer Aided Design (CAD) has improved the efficiency of drawing, it cannot reduce design errors, and therefore can cause more rework. This can further lead to difficulties for optimizing construction process and reducing cost. Design/Build projects are one of the types, where the aim is to reduce cost and increase quality by offering improved constructability of the design. Application of new technologies along with management concepts and adopting appropriate approach are required to improve project performances.

Assessing the PPP Approach from History

The research gains high motivation from the approach to study these concerns of project processes and attempting to optimize them through adopting a suitable approach from history - The partnership approach. The idea here is to bring into forefront a solution from the past and analyze its applicability and effectiveness.

Research Hypothesis

Can the PPP Approach be adopted for bringing in Economic Benefits in construction projects?

RESEARCH METHODOLOGY

Adopting the PPP Approach from History

This research gains high motivation from the approach to study these concerns of project processes and attempting to optimize them through bringing in the PPP- approach from history, and analyze its applicability and effectiveness. And therefore, adopting a PPP approach shall be the route to way finding towards the existing uncertainties in our project processes.

The methodology is described in the following three sections:

- a. Mode of Thought: Research Framework
- b. Mode of Inquiry: Methods - Tools & Tactics
- c. Mode of Discovery: Analysis Techniques

Research Framework

Table 2: Research Framework

		Theory (Theoretical Appropriateness and Relevance)	Methods (Methodological Appropriateness and Relevance)	Application Domain
Scope		Existing Literature & Studies	Best Practices (Commercial/ Infrastructural/ Institutional)	Assessing feasibility in Housing sector
Approach		Qualitative	Quantitative	Analytical
Methods		Primary & Secondary Data collection	Primary Data Collection, Factual Study	Statistical Techniques
Determinants		Stakeholders, Contractual Arrangements	Project typologies, delivery methods	Analyzed and evaluated data
Tactics	Subjective	Surveys: Targeting all stakeholders		Developing optimized/ improved models
	Objective		MarketCase studies	
Techniques		Sensitivity Analysis	Monte Carlo Simulation	Testing developed models

Proposed Tools & Tactics

Following two tactics shall be exercised in the due course of the study:

Surveys & Interviews

Surveys and interviews shall be conducted to capture the reactions of the industry professionals and stakeholders involved, interested in, and affected by PPP. The two-targeted backdrops will be construction companies and investment companies. Following factors shall form the framework for conducting surveys:

- Role of stakeholders in identifying the loopholes in PPP projects
- Priorities of stakeholders: Financers and Investors
- The impact of the study on their market/ projects
- What techniques are available and what is needed by them
- What is expected in the future?

Market Case Studies

Market case studies shall be conducted across the best practices chosen to understand the market trends; emphasizing on processes and delivery. Following factors shall form the framework for market studies:

- Gaps in PPP's successful implementation
- Strategies implemented; their impact
- Risk factors
- Strengths & Weaknesses of the approach
- The quality and performance
- Cost-strategy relation
- Expectations and performance
- Identifying new market oriented strategies & goals

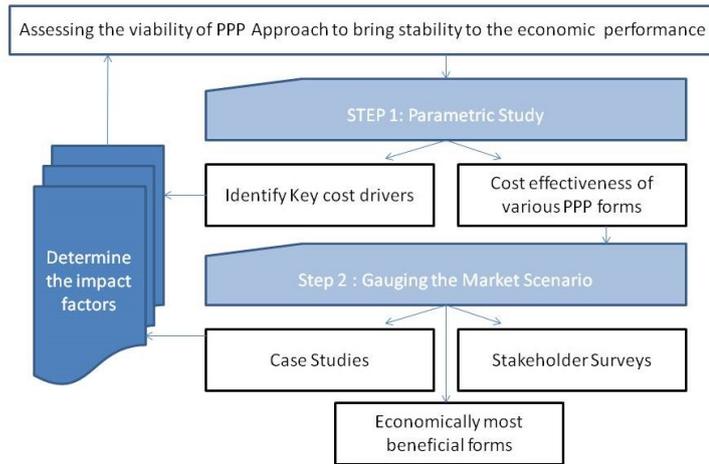
Key Questions, Determinants and Methods

Table 3: Key Determinants & Methods

<i>Proposed Methods</i>				
<i>Hypothesis</i>	<i>Research Questions</i>	<i>Research Objectives</i>	<i>Determinants</i>	<i>Methods</i>
Can the PPP Approach be adopted for bringing in economic benefits?	Is PPP a viable approach to bring stability to the economic performance of projects?	To identify the key cost drivers in PPP To test the cost effectiveness of a PPP model.	Delivery methods adopted Variation in settings/ situations/ typologies, Contracts	Literature studies, Surveys, Reports Secondary data collection, Market case studies analyses
	What are the shortfalls in the existing approach and how can better models be produced?	To examine the existing shortfalls and develop improved solutions To identify the barriers and to develop measures to eliminate them	On-going study and outcome Stakeholders involved, Contractual arrangements	Synthesis & Evaluation of data (Statistical tools) Market studies, reports analyses – optimization techniques
		To study the development in the PPP approach and analyze its effectiveness	Delivery procedures, Financial Management	Factual Data study & Analysis
		To develop innovations for widespread and improved applicability to projects	Evaluated data	Developing, Testing and Validation of Solutions
	Is there a market in PPP Housing?	To understand the applicability of PPP in Housing sector and develop strategies for the same	Project typology, stakeholders interests	Market case studies, development of strategies and models

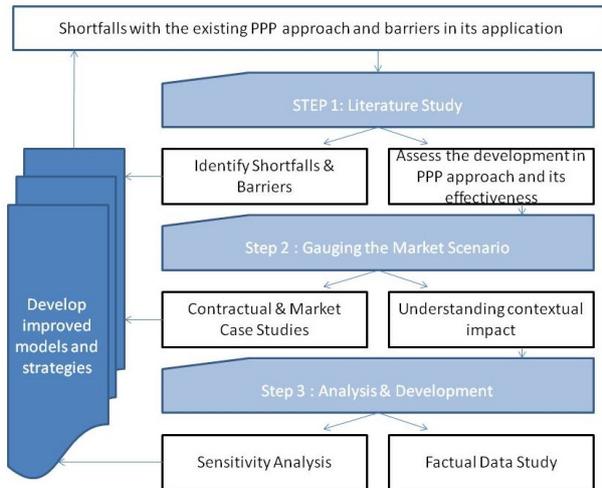
Question 1

Is PPP a viable approach to bring stability to the economic performance of projects?



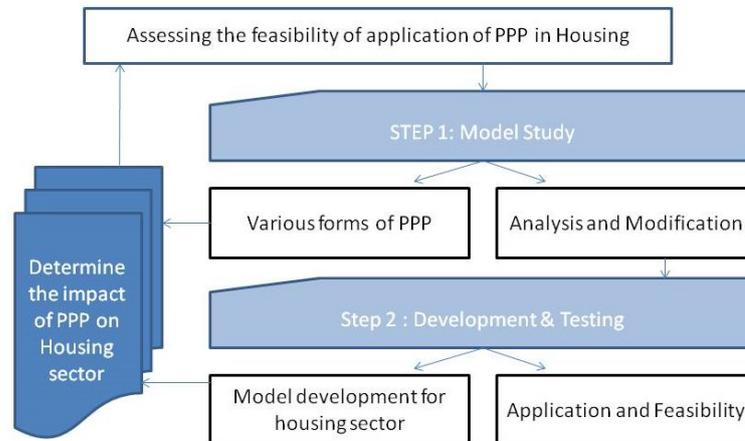
Question 2

What are the shortfalls with the existing approach and how can better models be produced to improve project economic performance?



Question 3

Is there a market in Public-Private Partnership Housing?



Proposed Analysis Techniques

Two analysis techniques have been chosen for the two respective tactics involved as follows:

a. Sensitivity Analysis (Surveys & Interviews)

Sensitivity analysis defines a likely range of variation and then assessment can be done for each variation. This helps to understand the factors and identify input-output dependency.

b. Monte Carlo Simulation (Market Case Studies)

Monte-carlo simulation is a more objective that helps to analyze multiple factors impacting a situation. This enables linkages to be established between various risks.

Together, Monte Carlo will enable determine the major factors impacting the situation under study while Sensitivity analysis will help analyze how sensitive those factors are to our study.

PROPOSED SCOPE & CHOICES OF CASES

Focus: Public-Private Partnerships

Sampling Strategies for Market Studies & Stakeholder Surveys

Europe

United Kingdom: Being the originator of Partnership Approach.

Ireland: Implementation of PPP models in the residential sector

Germany: Best Practices in PPP

Switzerland: Gauging the existing PPP Scenario and as an application domain

Asia

Hong Kong/ Singapore/ India

Table 4: Range of Stakeholders for High Performance Charrette

Engineers	Architects	Contractors	Policy makers	Investors	Owners	Financers	Statutory authorities

EXPECTED RESULTS

This research looks forward to understanding and analyzing the sensitive factors and uncertainties affecting the economic performance of the processes in adopting a PPP Approach, and understands the underlying benefits of a PPP model.

The project shall develop a universally applicable model based on economic considerations that is least affected by cultural/ regional/ contextual factors. This would further propose optimized strategies for a PPP approach and put forth the possible application of PPP approach in housing sector.

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