PARADIGM INTERPLAY TO DEVELOP A SUSTAINABILITY RELATED KNOWLEDGE MANAGEMENT STRATEGY

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In the construction industry two approaches to Knowledge Management (KM) can be distinguished. First, a functionalist perspective encourages the development of KM strategies and systems aiming to capture, reuse and manage technical knowledge usually with the help of databases and computerised systems. Second, an interpretivist perspective where knowledge is viewed as not existing independently from human interactions with a focus on the development of social structures and processes within organisations. This paper presents the methodological approach to develop a Sustainability-Related KM Strategy (SKMS) for Housing Association (HA) planned works (cyclical replacement of housing components). In this research the authors acknowledge the managerial benefits for construction practice of the functionalist approach but also argue that the socially constructed nature of knowledge requires the interpretivist approach to be considered within the development of the research methodology. As a result, the authors advocate the use of an interpretivist research paradigm with a functionalist perspective to knowledge and explore this through the context of this research, with the benefits and challenges to paradigm interplay considered.

Keywords: research methodology, knowledge management, interpretivism, functionalism, paradigm interplay.

INTRODUCTION

Increasingly, the efficient management of knowledge is being seen as an important part of developing sustainable practice (Renukappa and Egbu, 2007). However, it is not clear how to efficiently map or manage this knowledge which is referred to as 'sustainability-related knowledge' (Malone and Yohe, 2002). Recent years have seen an emerging body of literature relating to the development of KM strategies in the context of the construction industry. However, this is broad by nature, tending to reflect the delicate task, diversity of factors and context specific characteristics of organisations (Tiwana, 2000). In fact, KM approaches are numerous and include among others efforts to capture and reuse structured knowledge, projects that build a

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Leblanc H and Thomson C (2012) Paradigm interplay to develop a sustainability related knowledge management strategy *In*: Smith, S.D (Ed) *Procs 28th Annual ARCOM Conference*, 3-5 September 2012, Edinburgh, UK, Association of Researchers in Construction Management, 1145-1155.

repository of best practices, initiatives that identify sources of expertise and establish a network of experts, projects that structure and map knowledge, efforts that measure and manage the economic value of knowledge and initiatives that synthesize and share knowledge from external sources and embed it in products and processes (Davenport and Prusak, 1998; Schultze, 1998). As a result, it is difficult for construction organisations to select an appropriate approach and develop KM efforts appropriate to the organisation's needs and culture (Kamara *et al.* 2002).

This paper emerged from a research conducted by the authors focused on improving the sustainability of HA planned works. The research applied knowledge mapping to understand the flow of sustainability-related knowledge during such projects and developed a SKMS consisting of recommendations with a view of improving mechanisms of capture, storage, retrieval and exchange of sustainability-related knowledge. A methodological challenge was observed during the development of the research. To effectively conduct knowledge mapping it was apparent that neither a purely functionalist or interpretivist research paradigm was able to engage with the complex dynamic nature of sustainability-related knowledge and the specific requirements HA planned works context simultaneously. The danger with relying on a purely interpretivist approach was a tendency to reinvent the wheel, when established and recognised KM approaches, and definitions for knowledge forms and sustainability are widely understood. Moreover, the research also needed to recognise phases and activities associated with HA planned works to frame the knowledge mapping exercise around and structure the SKMS in a way that was meaningful to practitioners. On the other hand, the functionalist approach considers knowledge as an object and does not consider the dynamic socially constructed nature of knowledge and therefore would potentially reduce the practical application of the SKMS within HA planned works.

The authors therefore sought to consider the potential for paradigm interplay between interpretivism and functionalism in order to take advantage of both theories. As a result, this paper presents an interpretivist research methodology that addresses the socially constructed nature of sustainability-related knowledge using established functionalist knowledge categories, sustainability dimensions and planned work activities to guide the analysis.

The first section introduces the context of the research (HA planned works) and the approach to knowledge mapping. Next, the two popular KM perspectives in the construction industry are presented: functionalism and interpretivism. The third section explains the rationale for an interpretivist research paradigm with a functionalist perspective on knowledge and defines the forms of knowledge adopted in this research. Fourth, the qualitative research methods adopted are explored. Fifth, the research methodology is illustrated through the sixth stages of the SKMS development. Finally, the authors discuss the research limitations and conclusions.

DEVELOPING A SKMS FOR HA PLANNED WORKS

In the United Kingdom the social housing sector is mainly managed by local authorities (LAs) and HAs, and is at the forefront of the development of sustainable practices (Leblanc *et al.* 2011). In Scotland where this study was conducted, the growing number and financial capacity of HAs places this sub-sector in a privileged position to develop sustainable practices compared to LAs. Furthermore, an aging housing stock and limited budgets for new housing or large refurbishment projects, places maintenance and more precisely planned works at the centre of future efforts.

Although evidence suggests that amongst HA practitioners, awareness of the concept of sustainability is growing, changes in practice remain relatively slow (ibid). The authors argue that despite governmental initiatives and existing sustainable guidelines and frameworks, insufficient emphasis has been placed on the management of sustainability-related knowledge which is held by and is exchanged by practitioners.

The research which forms the context for this paper aims to improve the management of sustainability-related knowledge through a triple bottom line approach to sustainability considering the social, economic and environmental dimensions. In addition, knowledge mapping allows the identification, location and form of sustainability-related knowledge within HA planned works and appears central to the development of an effective SKMS (Renukappa and Egbu, 2007). More precisely a knowledge mapping social network analysis approach with an application purpose was adopted (Eppler, 2008). In this sense the developed knowledge maps (Kmaps) aimed to reflect knowledge transfer, sharing and communication between HA planned works practitioners and were built around a process model reflective of the planned works phases and activities. In the absence of a commonly accepted Planned Works Process Model, the research developed its own Generic Planned Works Model (GPWPM) to provide a structure around which the Kmaps could be structured with a view to reflect practice and to aid comparison between different projects (Leblanc, 2011). The development of a knowledge mapping exercise around such a structure reflects a knowledge application mapping approach that can be found in the work of Egbu *et al.* (2006) or Thomson *et al.* (2011). It aims to reflect practitioner 'realities' of practice and therefore to increase the potential application of related findings.

ADOPTING A KM PERSPECTIVE

From the many existing KM approaches two schools of thought can be distinguished. Those who concentrate on the benefits an organisation can derive from managing its knowledge usually through information technology and those focusing on the control of KM process through management issues (Offsey, 1997). In the former henceforth referred to as the 'functionalist perspective' knowledge is considered as an 'object' existing in a number of forms and locations while in the latter henceforth referred to as 'interpretive perspective', knowledge is considered "not to exist independent of the human experience, social practice, knowledge and knowledge use and where such knowledge is shaped by the social practices of communities of individuals" (Venters, 2002:2). The functionalist perspective considers knowledge through categories that can be managed differently according to their form (ibid). This view represents an objectivist perspective to knowledge as discussed by Nonaka and Takeuchi (1995). These authors categorise knowledge as either tacit or explicit. The interpretive perspective, on the other hand, considers that knowledge cannot be located in one place because it has no existence independent of human experience and the social practice of 'knowing' (Schultze, 1998).

In this research the functionalist perspective to knowledge was adopted since (in the context of implementing sustainability in HA planned works) it is argued that the distinction between the forms of knowledge through established categories could help practitioners to identify and manage sustainability-related knowledge. In fact, the functionalist KM perspectives corresponds to the majority of KM strategies developed in the construction industry because it aims to capture and reuse knowledge and therefore addresses the 'reinventing wheel' syndrome often described as a barrier to improving the construction industry (Ahmad *et al.* 2007). However, the authors also

suggest that the dynamism of knowledge and its socially constructed nature, as described by the interpretivist perspective, cannot be ignored and that the research methodology should reflect it. The authors were therefore faced with a methodological challenge relating to cross paradigm boundaries.

RESEARCH PHILOSOPHY

Research management is divided in two schools of thought that each reflects a philosophical perspective. These are the modernist perspective which gathers functionalism, positivism, objectivist, mainstream, traditional or conventional and the post-modernist perspective which gathers interpretivist, subjectivism, phenomenological or constructivism (Jones, 2009). Jones (2009) further explains that the management researcher might therefore disagree about philosophical assumptions regarding the nature or being (ontology) and what they can know about the phenomena they study (epistemology).

In this study, the research paradigm was directly linked to the adopted knowledge perspective. According to Darmer (2000) the functionalist perspective of knowledge corresponds to a neo-positivism research paradigm. The neo-positivism or post modernism approach differs from positivism in terms of ontology, epistemology and methodology. Neo-positivism advocates an ontology of modified realism as opposed to realism in positivism, where humans are not capable of finding definite answers to what knowledge is. In addition, neo-positivists do not believe that humans can be completely objective (as positivists think). Finally, regarding the methodology neo-positivists modify positivist controlled experiments by doing research in fields that they cannot entirely control (Darmer, 2000). As a result it can be said that neo-positivism criticises the purely positivist research paradigm described in *table 4* below.

Table 4: Description of interpretivism and positivism research paradigm methodology

	Interpretivism	Positivism
Assumptions	Inter-subjective world which science can represent with concepts and indicators; social construction or reality	Objective world which science can measure and "mirror" with expert, privileged knowledge.
Aim	To uncover socially constructed meaning of reality as understood by an individual or group	To discover universal laws that can be used to predict human activity
Stance of the researcher	Becomes fully involved with stakeholders and subject matter to achieve a full understanding of the stakeholders' world	Stands aloof and apart from stakeholders and subject matter so that decisions can be made objectively
Values	Values included and made explicit	Value free; their influence is denied
Types of reasoning	Inductive	Deductive
Research plan	Flexible, and follows the information provided by the research stakeholders	Rigorous, linear and rigid, based on research hypothesis
Typical research methods and type(s) of analysis	Ethnography; participant observation; interviews; focus groups; conversational analysis; case studies	Experiments; questionnaires; secondary data analysis; quantitatively coded documents; statistical analysis
Goodness of quality criteria	Trust worthiness and authenticity; Fit with social norms; interpersonal consensus validated by rightness of advocacy (speech acts) and actions	Conventional benchmarks of "rigor"; internal and external validity; reliability and objectivity; technical excellence validated by objective truth

Adapted from Guo and Sheffield (2008)

Despite the adoption of a functionalist perspective to knowledge in this research, it can be argued that the rigid theory testing methodology of the positivist research paradigm cannot address the specific research context aiming to understand the exchange and transformation of sustainability-related knowledge between HAs practitioners involved in planned works. Moreover, it can be argued that the neo-positivist approach is just a variation of positivism based on the criticism of its strict ontology, epistemology and methodology and its adoption would equally not address the research context.

The research context required a paradigm that considers knowledge to be viewed as part of a social interaction. According to Guo and Sheffield (2008) the interpretivist research paradigm described in *table 4* enables knowledge to be viewed in this way.

The research interpretivist paradigm provided a framework to direct research methodologies. The next section describes the influence of the interpretivist paradigm over the research methodology and how the functionalist perspective of knowledge adopted by the authors was integrated to the process.

Paradigm interplay in this research

The adoption of a philosophical position is of importance within research as it influences the analytical framework, modes of analysis and analytical process. However, in this research the contrast between positivism (more precisely functionalism) and interpretivism research paradigms poses challenges (Jones, 2009; Schultz and Hatch, 1996). More precisely, it is in the modes of analysis that the functionalist perspective adopted by the research needed to be applied. The

interpretivist associative analysis which consists of "reading meanings and exploring the association between them" (Schultz and Hatch, 1996: 537) was carried out, but integrating the functionalist categories to the analysis. This inclusion of the functionalist knowledge perspective within an interpretivist research paradigm corresponds to paradigm interplay (Schultz and Hatch, 1996). Paradigm interplay or paradigm crossing takes the view that it is impossible to ignore the multiplicity of perspectives and researchers should take advantage of the various theories offered.

In this research the adoption of an interpretivist paradigm helped to free up the rigid nature of functionalist categories. Equally, the adoption of functionalist categories within the interpretivist research helped to maintain control over the analysis and ensured that the mapping exercise reflected the established definition of knowledge and sustainability. It can also be said that paradigm interplay recognised the multi-faceted nature of knowledge which its meaning may vary according to the practitioner and context (Egbu, 2006). Finally, in this research the methodological approach considered the dynamic nature of knowledge that transform between the functionalist categories.

Defining the functionalist forms of knowledge

In this research three types of knowledge are defined: explicit, tacit and implicit. Explicit knowledge is codified and digitised for example in books, documents, reports, white papers, spreadsheets, memos and databases (Awad and Ghaziri, 2003). Tacit knowledge is not easily transformable and defined as 'know-how', past experiences, expertise, through interaction between individuals and through the memories of others (Renukappa and Egbu, 2007). Finally implicit knowledge corresponds to the part of tacit knowledge that can be easily transformed into explicit form (such as opinion and idea) (Frappaolo, 2008). Furthermore it can be said that implicit knowledge resides between tacit and explicit knowledge in the 'middle ground' zone (Frappaolo, 2008). Although the above definitions of explicit, tacit and implicit knowledge are widely accepted in the literature the lack of clear distinction between implicit and tacit considerably complicates the task of knowledge mapping. To avoid any confusion and for the sake of clarity, in this research tacit knowledge is the knowledge that resides in practitioners' minds which cannot be shared while implicit knowledge indicates the part of the practitioner tacit knowledge that can be shared through discussion or transformed into explicit form.

ADOPTING A QUALITATIVE METHODOLOGY

Within the context of this research, the research methods were used to carry out a knowledge mapping exercise. Knowledge exchange includes a human dimension that quantitative research approaches based on mathematical analysis would have difficulty capturing. As a result, qualitative research methods were considered more logical under the interpretivist paradigm, allowing for a deeper understanding of HA practitioners sustainability-related KM practices.

Multi-case study

In this research knowledge mapping aimed to develop an understanding of the flow of sustainability-related knowledge between HA practitioners in planned works, a case study approach appeared a logical choice. KM systems or strategies need to be specific and tailored to practitioners' reality of practice. The case study approach under the interpretivist research paradigm allows for the study of real-life examples and the emergence of findings grounded in reality. Despite the recognised potential

benefits, the case study approach faces criticisms such as insufficient precision, objectivity and rigor (Yin, 2003). To increase the research reliability and support data collection and analysis a protocol describing the case study objective, field procedures, questions to practitioners (both general and specific) and guiding the report was developed (table 2 below).

Table 5: Case study protocol

Objective	To map sustainability-related knowledge exchanges for every phase/activity.
Field procedures	
Respondents	Practitioners potentially having an impact on the project sustainability
Record keeping	Digital Dictaphone
Location	HA office or field
Data	Qualitative
Data collection	Interviews and sustainability policies/action plans
Data analysis	Open coding and categories
Case study questions	Does the GPWPM corresponds to the HA planned works practice?
	What are the economic, social and environmental sustainability aspects and associated knowledge source(s) and associated communication method for each planned works phase/activity?
Report	
Reporting	Presentation of steps of analysis and discussion of Kmaps per phase/activity
Unit of analysis	Organisation

In this research a multiple case study approach (4 projects) allowed for comparison of management approaches to sustainability-related knowledge amongst HAs representing a cross section of specific HA contexts. This comparison led to a relatively general strategy, potentially addressing a large number of HAs and planned works while including specific variations reflecting the case studies specificities. Semi-structured interviews ensured that sufficient control was maintained in pursuit of the objective but allowed enough room for open-ended discussion when desired by a respondent (Glaser and Strauss, 1967).

Coding under the grounded theory principles

Grounded theory coding principles were adopted to analyse the data collected in order to develop findings emerging from respondent answers in concordance with the interpretivist research paradigm. The interviews were transcribed and coded following open coding principles (see SKMS development stage 3). Respondent answers were openly coded but these codes were then classified under the case study phases and activities and categories (see SKMS development stage 4). The research coding strategy aligns with Strauss and Corbin (1990) principles who allow a certain degree of structure to the coding as opposed to Glaser's (Glaser and Strauss, 1967) 'purist views'. In the context of this research this analysis approach allowed the theory to emerge from the data as prescribed by the interpretivist research paradigm but enabled the coding to be aligned with the functionalist categories facilitating Kmaps development.

DEVELOPING THE SKMS

The knowledge mapping exercise leading to the SKMS development consisted of sixth stages as illustrated in the figure 1 below.

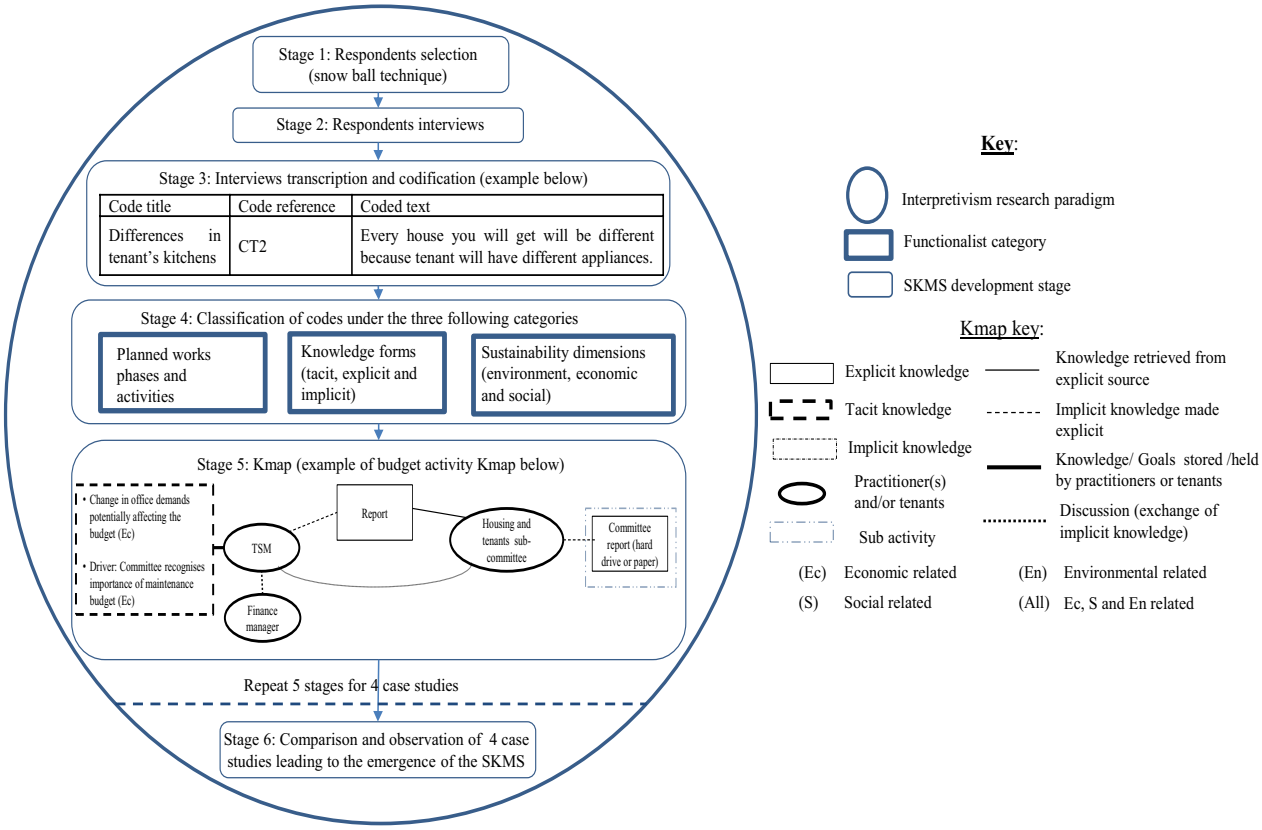

Figure 15: SKMS development stages under the interpretivist paradigm and using functionalist categories

First, HA practitioners with potential influence over the planned work project and its sustainability were selected. Based on emergent principles, it was not possible to randomly select practitioners to interview because it was acknowledged that this would influence the case study findings. As a result, the authors asked HA practitioners to help identify other practitioners as appropriate units of analysis. This approach is referred to as the 'snow ball' technique and is often used within emergent studies because it limits researcher assumptions about whom to interview and instead relies on respondents' knowledge. Second, selected respondents were asked to describe for each project activity what sustainability aspect was considered, what related knowledge was required and its nature, source and communication pathway. Third, digitally recorded interviews were transcribed and analysed under the open coding principles. The text was divided into meaningful portions that were assigned a code title and a code reference. This process allows codes to be compared and grouped together to form categories and subcategories and to let the findings emerge from the data (Strauss and Corbin, 1990). The code title was developed to briefly describe the text with the respondent's vocabulary and the code reference is composed of the respondent's abbreviation and assigned number. Fourth, the codes were classified according to the project phases and activities, the three sustainability dimensions and the functionalist knowledge forms. Fifth, based on the previous stages Kmaps for every case study planned work activities were drawn. Finally, following

the emergent principles of the research, observational themes were identified around which the sustainability-related KM strategy emerged:

- Management: Practitioners/tenants role and responsibility in the phase/activity.
- Knowledge: The type of the mapped knowledge and its flow between practitioners/tenants.
- Economic: The amount and scope of economically related knowledge or goal mapped within the phase /activity.
- Social: The amount and scope of socially related knowledge or goal mapped within the phase/activity.
- Environment: The amount and scope of environmentally related knowledge or goal mapped within the phase/activity
- Sustainability: The sustainability dimensions addressed within the phase/activity compared to the triple sustainability bottom line approach.

The structured observation and discussion of case studies knowledge mapping exercises allowed for lessons to be drawn for general practice that can then be contextualised to individual projects. The SKMS is therefore composed of 56 recommendations for improving mechanisms of sustainability-related knowledge creation, capture, storage and exchange between practitioners for every planned work activity. For example, in three case studies the 'progress meeting' activity was a formal opportunity for practitioners to discuss (exchange implicit knowledge) matters in order to solve problems and suggest solutions. Furthermore progress meeting activities were identified as formal meetings where the contractor was asked to propose sustainable solutions. Finally, progress meetings were generally explicitly summarised in minutes which therefore represent a source of knowledge that practitioners use before to take decisions. As a result the following recommendation was proposed: "HAs should emphasise the exchange of sustainability-related knowledge during progress meetings and should make the meeting minutes easily retrievable. "

LIMITATIONS

The presented methodology following paradigm interplay allows the development of a SKMS that is rooted in the practice based context through case studies. However, there are some shortcomings and limitations. The knowledge mapping exercise is time consuming and the specification of its findings can only be related in detail to its context. As a result, additional mechanisms of sustainability-related knowledge capture, exchange, storage and retrieval might be found in other HA planned works. The developed SKMS could therefore be improved through the expansion of the number of case studies. Expanding upon the number of case studies could enrich the sustainability-related KM observations allowing for a better understanding and leading to the improvement of proposed recommendations for improvement.

However, care is required to ensure that the functionalist categories applied during coding analysis respect the interpretivism paradigm and its emergent principles.

CONCLUSIONS

The presented methodology allowed for the development of a SKMS for HA planned works that emerged from a variety of practice based case studies. This paper has explored the role of paradigm interplay in allowing for the development of a strategy to draw on established definitions of knowledge types and sustainability dimensions, while considering the socially constructed nature of knowledge through an emergent

approach. Authors took advantage of the interpretivist research paradigm through the use of the snow ball technique, semi-structured interviews, case studies and open coding allowing findings to emerge from respondents' answers and their context. Furthermore, the structured approach to knowledge mapping and the adoption of functionalist categories allowed the development of Kmaps which can be compared across different studies. This also helps to minimise modernist critics about interpretivist emergent principles and the need for focus. It can be therefore concluded that in this research the authors take advantages of the interpretivist paradigm and established functionalist research approaches to increase the potential usefulness and applicability of the findings. The result is a SKMS that manages explicit, tacit and implicit knowledge like many existing KM efforts but also integrates the dynamic nature of sustainability-related knowledge reflective of context.

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