CONCEPTUALISING ACTORS' INFORMATION BEHAVIOUR: AN INVESTIGATION INTO PROJECT INFORMATION DYNAMICS

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Research into information technology in construction has received considerable attention in recent years. However, information behaviour (IB) of actors' in the project environment can be undefined, unstructured and suboptimal. The way information is obtained and shared to support project design development, organisational management and site operational activities continue to change rapidly. Major problems that continue to affect actors' performance are their exposure to different information sources and channels, unstructured Information Seeking Behaviour (ISB), and the large amount of time they spend sifting through these sources and channels to obtain context specific information just-in-time for use. Hence, this research uses comprehensive review of IB literature and interviews to investigate the information seeking activities of industry professionals in the project environment. It was found that project actors exhibited five distinct ISBs during the project delivery process which are presented and discussed with a conceptual framework to establish an agenda for future study into effective IB culture. The significance of this research is to investigate the current practices of actors' ISBs in order to define strategies to help improve performance in information seeking, project design and delivery process.

Keywords: actors, information seeking behaviour, performance, project life cycle.

INTRODUCTION

The nature and composition of construction projects is such that reliable and up-to date information underpins the processes involved in successful project delivery. Project actors (especially architects/designers) require reliable and context specific information in real time to execute projects or provide solutions to problems, and /or manage critical construction issues. To achieve such reliability, project actors require a relative ease of access to information in order to make the vital decisions involved in the construction and design process. Through the project life cycle (PLC), the level of information required by actors varies with respect to the significance of work to be done at the different phases. The most information demanding phase which influences the outcome of a project is design. The RIBA defines the design phase to comprise of concept design, design development, technical design, and specialist design. These phases culminate into the pre-construction/construction stage to define the outcome of the project and the subsequent aftercare of the infrastructure/facility. However, it is noted that the manner in which information is obtained through the exposure of actors to different fragmented sources and channels is linked to the problem of information

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overload (IO) (Allen and Wilson 2003, Bawden and Robinson 2008). Other researchers argue that actors' exposure to multiple information sources and channels can be beneficial to their information acquisition. This is because different information sources and channels actually help to reduce gaps in the acquired information from any one source (Kwasitsu 2003, Aurisicchio *et al.* 2012, Robinson 2010). Dzokoto *et al.* (2013) posits that the problem of IO can be controlled by firms adopting a SMART push information capturing system to free-up actors' from active information seeking to focus their time and attention on the project delivery process.

According to Patrashkova-Volzdoska *et al.* (2003), too much information can be as detrimental as too little information; hence a moderate level of information and communication leads to effective performance in engineering teams. Yunjie *et al.* (2006) affirms that the lack of effective ISB of employees in modern organisations is found to affect performance, ability to cope with uncertainty, knowledge acquisition, and maintenance of comfortable social relationships. However, the process of actively or passively seeking information from such sources is evidently found to take longer, and is cognitively demanding (Robinson 2010). Researchers have established that time savings, information relevance, technical quality, and ease of access are the main reasons behind actors' information sources and channels selection (Fidel and Green 2004, Pinelli 1991). However, research in this area has failed to establish the phenomena behind actors' information source preferences. Hence this paper presents findings from critical review of IB literature and exploratory study of ISBs exhibited by construction professionals during their information seeking activities in the PLC.

REVIEW OF RELATED RESEARCH THE DYNAMICS OF INFORMATION BEHAVIOUR RESEARCH

Wilson (2000) defines IB as the *"totality of human behaviour in relation to sources and channels of information, including both active and passive information seeking and information use"*. Thus, the processes employed by professionals and nonprofessionals to seek, search, store, use, share and retrieve information for use.

Researchers in the library and information sciences and knowledge management areas have traditionally used models to exhibit human IBs as a linear process in a broader spectrum. However, IB studies in recent years have narrowed to specific functions, and the relationships that exist within demographic factors. Most IB studies have ignored profiling specific IB types of individuals in context to behaviour of individuals in areas such as information sharing (Hyldegård 2009), collaborative information seeking (Talja 2002, Hertzum and Pejtersen 2000), information search process (Kuhlthau 2005), serendipitous information seeking (Foster and Ford 2003, Erdelez 2005), information foraging (Pirolli and Card 1995, Pirolli 2009), and other kinds. A fundamental contribution to understanding information discovery in context is the theory of sense-making (Savolainen 1993), and sense-making methodology by Dervin (1999). It is through these studies that the distinct ISBs of professionals in the project environment were discovered and classified to form the bases for this research.

Information seeking behaviour of actors in project design development process

Information used by designers to make decisions during the design development phase in the PLC may have significant impacts on downstream activities such as delivery delays, constructability and cost. This may be due to actors' exposure to numerous information sources and channels and the complexities in capturing relevant information in a fragmented organisation. Using the information may not be a problem, but identifying what information to retrieve, where and how to seek that

information are the major issues that need to be addressed. As the construction sector continues to change rapidly in terms of technology, lean thinking and others, it is practical for design development operations to respond to these changes in order to meet clients' needs. As a result, actors tend to use any means to meet their information requirements. Whereas some actors prefer face-to-face or systematic information seeking processes, others tend to social media or accidental/incidental information seeking process. In other situations, actors rely on their cognitive ability to meet their information needs. All these ISBs may occur at different phases of problem solving or project delivery. During the PLC, the quality and quantity of information required, and the ISB of actors varies. For example, at the idea conception phase, actors primarily rely on their intuition, knowledge and experience to generate information. Some actors consult other sources or experts for verification, but the majority of their information at this stage can be said to be cognitive dependant. As the project progresses, actors tend to adopt other information seeking preferences to capture information. According to Hertzum and Pejtersen (2000), engineers rely on their colleagues and internal documents to meet their information needs. However, the majority of information from colleagues is unstructured, and often based on tacit knowledge and experience (Robinson 2010). Evidence shows that actors in information rich environments spend the majority of their time looking for context specific information from repositories containing unstructured information, and this pattern reflects in the negative impact on their ISBs (Hertzum 2002, Robinson 2010).

These negative impacts are further exacerbated by the lack of specific processes to seek, share, and use information which can contribute to the many problems associated with project delivery, including delays, process duplication, and cost overruns. Evidence shows that a lack of effective communication and coordination between actors in the PLC are among the most important reasons behind these problems (Sebastian 2011). Often, communication between actors becomes critical, as each actor possesses different set of information. Hence it is important to establish the relationship between actors' ISB and performance, and the information systems employed for decisions and judgments making process. This will help unlock the problem of suboptimal ISBs, and pave the way for effective information seeking and sharing processes through technological solutions deployed in the sector.

RESEARCH METHODOLOGY

Throughout this study, IB literature was reviewed to identify significant patterns of ISBs exhibited by professionals in the project environment. Inductive approach was chosen with the aim to investigate and understand the information seeking activities undertaken by construction project actors in order to access and establish their ISBs in the PLC. According to Creswell (2009), qualitative research combines perspectives and expert experiences. Hence a semi-structured (face-to-face and telephone) interview was adopted because it was impractical to observe participants directly. Experts from prominent construction companies in the UK were purposefully selected on the basis of their roles and experience levels for the exploratory study. Six interviews were initially conducted, where data was audio-recorded and transcribed verbatim. Analysis of data from the six interviews showed comparable but significant differences in responses. Hence two additional interviews were conducted. At this point, there were no significant variations in responses, indicating a point of data saturation. In all, eight interviews were conducted to a desired data saturation point.

Each interview lasted an average of one hour (the point where all questions in the research instrument were answered). Hence the limited number of participants interviewed was sufficient to establish significant parallels and differences in actors' ISBs in the project environment. During the interviews, the participants were asked about their ISBs and how it impacts on their performance in the project delivery process. The collected data was analysed thematically from which five significant types of project actors ISBs emerged to establish the foundation for this research.

RESULTS CLASSIFICATION OF ACTORS' INFORMATION SEEKING BEHAVIOUR

The findings from thematic analysis of data collected from the semi-structured interviews showed significant variations and lots of parallels in actors' ISBs in the PLC. Interviewees indicated that where tasks/projects had been executed before, they normally sought information from repositories, databases or common data environments and other social media sources. However, for new tasks/projects where similar tasks had not been executed before, they relied on primary information (visit sites, create new materials, and others) to meet their information needs. In general, interviewees indicated that their first point of call when seeking information was to consider their knowledge, experiences and skills to map-out information seeking strategies in order to identify the *"where"*, *"who"* and *"how"* before initiating the search process. They also indicated that they follow stages of appraisal to ensure that correct procedures are followed to identify information channels to help capture the appropriate information. The consensus was that interviewees use both formal and informal information seeking sources and channels (including accidental/incidental, face-to-face, social media, structured or unstructured) to obtain appropriate information. In all cases, interviewees indicated that the main problems associated with their ISBs were time delays, IO, and exposure to numerous information sources and channels. In general, responses from interviewees reinforce literature review findings.

Hence the thematic analysis and comparisons of literature review and semi-structured interview data resulted in the classification of actors' ISBs into five main types. Figure 1 presents the five key types of ISBs exhibited by project actors during their information seeking process in the project environment.
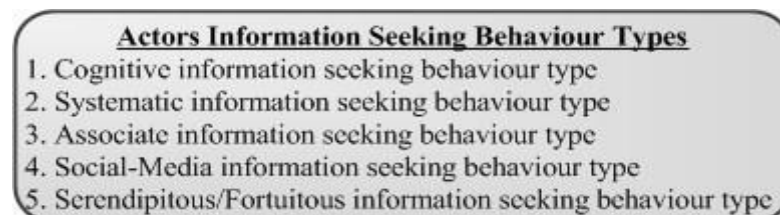
Actors Information Seeking Behaviour Types
1. Cognitive information seeking behaviour type
2. Systematic information seeking behaviour type
3. Associate information seeking behaviour type
4. Social-Media information seeking behaviour type
5. Serendipitous/Fortuitous information seeking behaviour type

Figure 1: Types of project actors' information seeking behaviour

The five types of actors' information seeking behaviour

Cognitive information seeking behaviour
This is defined as the active thinking or mental process of seeking information to develop knowledge and understanding through a person's senses, intuition, knowledge, skills, and experiences for specific needs/tasks. According to some interviewees, cognitive information seekers exhibit tendencies of relying on their experiences, skills, knowledge, pride and mental strength to generate new knowledge and new information. Some of the channels through which they seek information

include intuition, personal folders/ libraries, search engines, database catalogues, print/electronic materials, and others.

Other dimensions of cognitive information processing styles identified in literature have focused on people's learning approaches and decision making process (Ford *et al.* 2002, Ford 2004). According to Pask (1988), people use two basic approaches in their learning process. The *"holist"* tends to adopt a comprehensive approach to learning, by investigating interrelationships between different themes at the beginning of the learning process to develop a general concept and then narrow the concept down into specific detail. The *"serialist"* uses their local learning approach to adopt a step-bystep investigation process to examine one thing at a time whilst concentrating on separate topics and the sequences linking them. Wilson (1983) posits that people generate knowledge in two different ways during the cognitive authority process; based on their *"first-hand experience"*, and on *"what they have learned"* from others

(second-hand experience). People's first hand-experience is interpreted to be knowledge conceived intuitively to include their interpretation and understanding of what is around them; whilst second-hand experiences relate to knowledge gained through studies, experience, and others. Interviewees agreed that their *"first-hand experience"* to information creation is through intuition/memory. Hence cognitive ISB is a person centred process that relies on mental activities to seek information for use.

Systematic information seeking behaviour
This is a process where actors' follow a structured and/or a step-by-step approach to acquire information by employing keyword and/or bibliographic search methods through library catalogues, databases, search engines, archives, personal folders, and others. The general consensus from interviewees was that this approach to information seeking is influenced by the kind of information required at a certain stage of a task/project. Thus, they choose to design systematic and thematic search plans, information pull/push systems or alert prompts to stay abreast with new information.

Witkin *et al.* (1977) in their investigations coined the terms *"field dependence"* and *"field independence"* styles. The field independence style can be related to the *"serialist"* approach which follows a structured approach to learning; whereas the field dependence style relies on direction and guidance from others in order to achieve the learning process. This is an affirmation of response from interviewees.

Ellis (1989) indicated that the IB of scientists/researchers follows a structured approach where the information seeker identifies relevant document(s) either through a keyword search or a paper already known or recommended within the context of the study; this he termed *"starting"*. The seeker then goes through the *"chaining"* process by identifying references through the citation index. Thirdly, the seeker narrows the search down by *"browsing"* relevant sources, and further works through the most relevant documents to *"extract"* context specific information. These four stages were enhanced to include *"differentiation"*, where the source material is filtered out to capture the most relevant information, and *"monitoring"* by creating information alert or pull system to help maintain awareness of new developments in the area of study. Thus systematic information seekers tend to apply the six stages of Ellis's 1989 model.

Associate information seeking behaviour
This term is coined on the basis that project actors in certain organisation settings predominantly prefer to seek information from colleagues or friends both internal and/or external to their environment. Interviewees indicated that factors such as trust, quality, accessibility, and others are vital to the information sources and channels

used; hence their preference to interact with friends, and experienced or specialist colleagues rather than information systems. Interviewees indicated that they tend to be selective with their contacts and the kind of interactions they have. The notion of these interactions according to interviewees is to seek specific information based on some demographic characteristics including qualifications, skills and experience levels of their contacts. Often, these characteristics are influenced by the circumstance in which the association was formed. Hence organisational confidentiality and information sharing restrictions tends to enforce internal knowledge retention in contrast to external sharing and acquisition. According to Mackenzie (2005), people in positions of authority tend to employ a range of information seeking/sharing activities regardless of their speciality or responsibility. Thus organisational settings/structures encourage associate ISB.

It is widely acknowledged that engineers prefer face-to-face information seeking or sharing with colleagues inside the same organisations than others outside (Hertzum 2002, Robinson 2010). This can be linked to the nature and composition of organisational structures, team compositions, and project delivery process. Pinelli (1991) showed that engineers perceive accessibility to be the most important determinant of their information source selection. Chakrabarti *et al*. (1983) on the other hand, concludes that managers, scientists and engineers prefer availability and ease of use as the main driving factors behind their information sources.

Social media information seeking behaviour
This is the process of project actors' interacting, discussing, seeking and sharing information on the internet through social network sites including social media communities, such as YouTube, LinkedIn, blogs, and other social media platforms. Social media ISB is characterised by close relationships of actors from different organisations or industry sectors with a common goal to discuss ideas, seek and share information on similar subjects (Meho and Tibbo 2003). The ubiquitous nature of the internet is such that information seeking and sharing occur rapidly and with ease, to the extent that its influence on individuals and organisations cannot be ignored.

According to Önder and Gümüskaya (2011), the object of social media is to formulate online communities and provide a platform for interaction and user-created content shared among the members of these communities. Thomsen (1995) posits that actors can increase their knowledge and experience by using the web to gain information. Interviewees agreed that, three decades ago, organisations prevented their employees from accessing social network sites or transferring information via such media for various reasons. However, there has since been a transformational change at the workplace requiring a paradigm shift in organisational strategies and practices to promote information seeking and sharing and other forms of interactions via social media. Thus social networks have turned into a beneficial investment which can be used in organisations for speedy, easy transfer and access to real time information. However; interviewees were quick to assert that IO and information quality are major challenges to deal with in this type of information seeking process.

Serendipitous/Fortuitous information seeking behaviour
There was a clear indication from interviewees that they tend to seek information for different reasons. They may actively and/or passively seek information for reasons such as for pleasure or stimulations, other times; information is encountered without being sought. This form of information encountering is considered as serendipitous and/or fortuitous information seeking depending on the circumstance in which the

information was encountered. Many researchers consider information seeking to be a planned/intentional activity where the seeker consciously and actively look for information (Wilson 2000). However, there are clear indications that information can be encountered by chance. According to Case (2012), unintentional information encountering often triggers pre-existing or new interest to develop by opening new avenues for further exploration. This exploration is often referred to as *"browsing"* and/or *"scanning"* (Bates 2007). Case (2006) considers serendipity to be *"the action of or aptitude for encountering relevant information by accident"*. Erdelez (2005) identified six functional components of information encountering to include noticing, stopping, examining, storing, using, and returning. However, the connotations associated with the definition of serendipity raises questions about the affective state of the information seeker. Hence, fortuitous is used in this study in conjunction with serendipity. Fortuitous information seeking in this context is the act of discovering or encountering information by chance, either planned or unplanned, without any connotation. Hence interviewees indicated that they can either be happy or sad and still benefit or not benefit from this type of information seeking process.

Organisational behaviour is such that information encountered by chance cannot be avoided. In some situations, actors deliberately create opportunities to facilitate serendipitous/fortuitous information. Some interviewees indicated that they sometimes attend events mainly for browsing or environmental scanning opportunities. In such events, they purposely place themselves in situations (for example, coffee/tea breaks, network sessions, conferences, and others) to wait for the right opportunity in order to capture the needed information. According to Bawden (1986), browsing occurs in three different kinds: *"purposive"* as a deliberate seeking of new information in context; *"capricious"* as a random examination or exploration of information materials without any definite goal; and *"exploratory"* or *"semi-purposive"* as the result of some form of inspiration. These browsing activities range from reading or scanning of print/electronic materials through networking with friends/colleagues to laboratory experiments. In all these activities, new information is discovered.

CONCEPT DEVELOPMENT AND FUTURE WORK

As indicated in the above sections, it is obvious that project actors demonstrate distinct ISBs during their information seeking activities in the project environment however, these ISBs are undefined. It was also discovered that actors tend to demonstrate different behaviour patterns by adopting spontaneous strategies to seek and share information without any direction/structure. Other issues discovered include the challenges in the variations in the level and quality of information capture at the different phases of the PLC. Whereas actors may have distinct ISB type or preference, it may also be possible for actors to demonstrate other ISBs through the PLC stages to help maintain a certain level of consistency in order to capture the appropriate information for use. However, the significance of actors' ISB can only be realised if its relationship with performance is established. The output of actors' effective IB in information intensive processes such as construction activities can be considered to be directly dependent on their ability to seek appropriate information. However, this can only be achieved if actors are able to identify their ISB type(s) and information requirements. This can facilitate easy capture of appropriate information through appropriate channels and sources at the right quality and quantity just-in-time for use. Hence the questions posed are; (1) to what extend do construction project actors exhibit any of the five ISB types? (2) To what extent do any of the identified ISB types influence actors' performance in the project delivery process? Therefore this

research conceptualises actors' ISB types to establish its relationship to performance in the project design process. Figure 2 shows a conceptual framework of actors' ISB types. The object is to investigate and measure project actors (particularly, designers/architects) ISB activities during the design development process through to construction as indicated with the red arrow in figure 2. The bidirectional arrow signifies the input/output influencing factors such as quality, quantity, accessibility, time, and others that may have impact on performance level.

This forms the bases of a wider PhD study where the next stage of the research will employ quantitative methodology to undertake a detail investigation of the five ISB types of project actors identified in this paper, and test the framework with actors involved in the project design development process in construction organisations. This will help measure the relationship between designers ISB types and how this relate to their performance in problem solving or task delivery with the view to define and recommend strategies to improve construction project actors' information seeking and information sharing behaviours in the PLC.
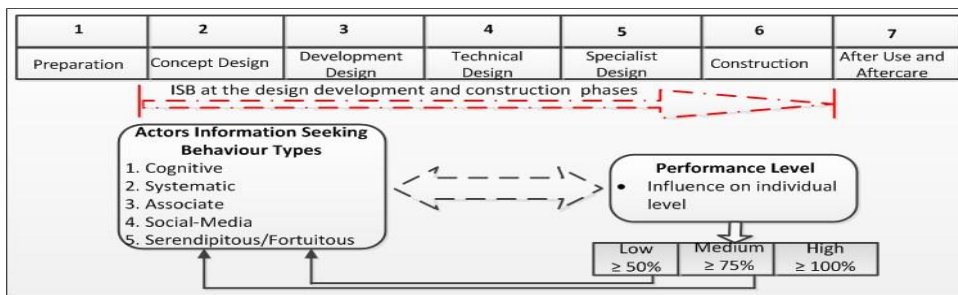

Figure 2: Conceptual framework of actors' information seeking behaviour

CONCLUSION

The ambiguous and fragmented nature of the construction process is such that the problem of IO, high amounts of time spent seeking information, and actors' exposure to different information sources and channels cannot be avoided. This is reflected in the spontaneous and dynamic nature of actors' ISBs. However, literature discoveries and exploratory studies demonstrate the need to further investigate the ISB types identified in order to examine their links to performance in the PLC. Innovative approaches to understand actors' ISBs are needed to meet the radical changes that are transforming the construction industry.

The investigations show that there is considerable need to improve the ISBs of actors' involved in the project design development process in order to reduce the amount of time spent seeking information. There is also mounting pressure on actors' to reduce process duplications, over dependence on other sources and channels, and the need to follow effective processes to meet their information needs. This research used literature review and interviews to classify actors' ISB types to set the scene for future field study. A major area to focus is to understand the dynamics of actors' ISB types and their links to performance, in order to develop strategies and systems to help improve project actors' ISBs to meet the demands of information intensive processes.

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