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Identification of Skill, Knowledge and Abilities for the Use of the Internet for Information Sharing on Construction Projects

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Abstract
Project Collaboration Websites are one of the fastest growing uses of the Internet in the construction industry. This research uses a Phenomenographic approach to analyse how this phenomen is conceived by project participants who have used the Internet for information sharing on construction projects. Six hierarchically related, qualitatively different categories of description representing different understandings of the phenomen were established. The categories of description are then represented in an outcome space linked and related in terms of effective project participation. This research starts to define how this phenomen is conceived by project participants and what skills, knowledge and abilities are required for effective project participation.

Keywords
Phenomenography, Internet, Information Sharing, Construction Projects, Project Collaboration Websites

1. Introduction

The evolvement of the Internet as a complex, flexible and boundless communication tool has opened a number of opportunities for collaborative information sharing based on Internet technology. The use of Information Technology in construction is below best practice when compared to other industries (Alsagoff 2000; Betts 1999; CICA et al. 1990; Duyshart et al. 2003; NSWDPWS 1998).

The Construction Industry is now on the verge of wide spread acceptance of Internet technology and the communication benefits this can bring. Dedicated Internet connections in US companies has almost doubled from 1997 to 2001. Project collaboration websites are one of the fastest developing areas of Internet (web-based) development (Duyshart et al. 2003). A better understanding of this phenomenon will help to develop awareness in terms of effective project participation.

This research is based on the initial stages of a PhD and focuses on the development of Project Collaboration Websites which are highly reliant on the Internet and information technology. This technology is used to overcome the requirements of 'face-to-face' meetings, to improve information and knowledge access, retrieval and archiving, to improve the effectiveness of group tasks, improve communications and to reduce costs associated with distributed work groups.

2. Research Approach

This research is utilising a qualitative approach through 'Phenomenography' (see Bowden et al. 2000; Marton et al. 1997) which has developed methods to examine the different ways that people experience a phenomen, in this research, the use of the Internet for information sharing on construction projects. This approach has been determined to be appropriate to:

- provide an empirical, representative and descriptive research approach;
- allow an appropriate investigation into the personal differences that affect skills;
- produce valid, robust and generalisable research results; and
- provide a qualitative based study in a field dominated by quantitative studies.

3. Case Study

This paper is based around the first case study interviews (first of four case studies) for this research project. This case study is the development of a new laundry facility based at Ayers Rock, Australia, to service the five single ownership resorts located in the 'resort town' of Ayers Rock. The project is run from a site office in the town of Ayers Rock with consultants spread around Australia in Darwin, Alice Springs, Brisbane, Sydney and Melbourne.

The project used Bovis Lend Lease developed Project Collaboration Website 'ProjectWeb' to facilitate, coordinate, distribute and archive all project correspondence from start of project to completion. 'ProjectWeb' allows project participants, (from the client through to sub-contractors on site), to interface and interact with all project data via an Internet interface. This can therefore be achieved without proprietary hardware and software, with a computer and Internet access from anywhere in the world.

Interview participants were selected from the case study as project team members who have developed significant experiences from the use of the Internet for information sharing. Five project team members were approached for participation, four of which agreed to involvement in the study. A brief description of the four case study interview participants is as follows:

- Participant A Client body, had been involved in the project since June 2000.
- Participant B Sub -consultant, had been involved in the project since January 2001.
- Participant C Project manager, had been involved in the project since September 2001.
- Participant D Sub-contractor, had been involved in the project since November 2002.

4. Data Gathering (Interviews)

All interviews were focused on the use of the Internet for information sharing on the project and were;

- Qualitative, focusing on the experiences of the participants;
- Recorded with two different systems to ensure a successful recording in the event of a failure;
- Relatively unstructured to allow the participants to express their experiences; and
- Transcribed before analysis.

Although the number of participants can be considered relatively small, the duration of each interview (30 – 40 minutes) and the richness of the data produced transcripts which allowed for a relevant level of phenomenographic analysis appropriate to an exploratory study. Other recent successful published phenomenographic studies (McMahon et al. 2002) have achieved appropriate levels of analysis for exploratory studies with a similar numbers of participants. As this case study is an exploratory study, the number of participants is considered appropriate for testing the interview and methodological processes.

5. Categories of Description

The phenomenographic analysis established six conceptions of the use of the internet for information sharing on construction projects and are described in the categories of description below and has been demonstrated through two quotes from the transcripts. Each category is also represented by a structure of awareness diagram which illustrate the focal and background issues within each category.

Category 1: Efficient Communications
The use of the Internet for information sharing on construction projects can be see as an efficient communications system. This conception relates to the ability for the project participants to communicate with the other members of the project team, to share information and to develop professional working relationships where they may be geographically removed from each other and/or the project site. The structure of awareness diagram (refer Figure 1) illustrates the Internet as a focal item with Project Communications. Other project communications are depicted in the background illustrating a less significant focus. This conception can be illustrated through the following quotes from the interview transcripts:

- *...you're online, sitting there and here's a message coming, bang – just shoot it off. I think it's much better than having to saying I've got to type out a fax, I've got to print out the fax, I've got to take it to the machine, send it through.* (Interview-4, ln.341)
- *...I would say it has probably, if anything, altered me to how much easier that style of technology can make the communication information...*(Interview-1, ln.279)

Category 2: Another Communications Tool
The use of the internet for information sharing on construction projects can be seen as another communication tool to be used with existing communication channels. This conception illustrates that in terms of information sharing on construction projects, the Internet is another communications tool to be added to the existing communication options. The Internet is often enhanced or replaced as a medium for sharing information depending on the situation and/or circumstance. The structure of awareness diagram (refer Figure 1) illustrated the Internet and other communications with a similar focal significance. Overall project communication are illustrated in the background with less significance. This conception can be illustrated through the following quotes from the interview transcripts:

- *...I would say probably 95 times out of 100 I would call and I would then document that outcome of that call, to, again its protecting I suppose or preserving – the word that I'm looking for is not integrity rather the feelings the esteem of the other person.* (Interview-1, ln.152)
- *...I could definitely never get the feel for what a person's like trustworthy wise by just correspondences over the web I'd need to talk to them on the phone.* (Interview-3, ln.171)

Category 3: Effective Documentation
The use of the internet for information sharing on construction projects can be seen as an effective documentation tool for project archiving. This conception illustrates the confidence that the project participants demonstrated in the systems ability to record, archive and retrieve project information. The structure of awareness diagram (refer Figure 1) illustrates documentation / archiving with a high focal significant and the Internet with less significance. The background illustrates overall project communication with lesser significance. This conception can be illustrated through the following quotes from the interview transcripts:

- *...I guess you can say, there's always a record there of everything you do and quite easy to find, to go back and get something.* (Interview-2, ln.12)
- *It has definitely increased the project's efficiency because you know that you are able to retrieve the data very quickly – no doubt about that. And most definitely increased my efficiency in terms of productivity...* (Interview-1, ln.334)

Category 4: IT Skills
The use of the internet for information sharing on construction projects can be seen as an extension of existing IT skills. This conception illustrates the participants understanding that the use of the Internet as an interface to a project communication system is an extension of their existing IT skills. This can be reflected as either within their existing skill levels or partly outside their existing skill levels. The structure of awareness diagram (refer Figure 1) illustrates IT skills with a significant focus and thew Internet with a lesser focus. The background illustrates project communication with less significance. This conception can be illustrated through the following quotes from the interview transcripts:

- *I think most of its very user friendly – its not as if your writing code. Your in there, you click around and no problem.* (Interview-1, ln.262)
- *I had trouble with it right from the start because we didn't have training. And um, so I was shown bits and pieces of what it was thought I needed to know and then I've learnt things by trial and error, at times I've asked them on site.* (Interview-2, ln.9)

Category 5: Barrier to Participation
The use of the internet for information sharing on construction projects can be seen as a barrier to effective participation. This conception illustrates that these systems can be a barrier to effective project participation in terms of cost & technology. The structure of awareness diagram (refer Figure 1) illustrates the Internet and project communication in significant focus, however separated. The background illustrates project communication in less significance. This conception can be illustrated through the following quotes from the interview transcripts:

- *Our problem at the moment the amount of time it consumes. And I think that's more down to – we're on a dial up connection.* (Interview-4, ln.38)
- *There are people out there that haven't yet embraced the technology that still cling – for whatever reason, whether it be financial or simply the old school. Don't want to move away from the faxes and the phone calls and what have you.* (Interview-1, ln.352)

Category 6: Multiplier of Communications
The use of the internet for information sharing on construction projects can be seen as a multiplier of communications. This conception represents an understanding that these systems multiply the amount of project communications, not necessarily for the benefit of the participants. The multiplication can be in a second set of files (database & lever arch) and/or through non-relevant communications to a project participant. The structure of awareness diagram (refer Figure 1) illustrates the Internet and number of communication in equal significant focus. The background illustrates all project communication in a lesser focus. This conception can be illustrated through the following quotes from the interview transcripts:

- *At our end we keep a permanent record of it anyway even though we probably don't need to because it's still in the database somewhere on ProjectWeb.* (Interview-4, ln.18)
- *Probably 50% are irrelevant. ... So many of them I'm sure if they were sending a fax, they wouldn't send another one to me.* (Interview-2, ln.296)

6. Outcome Space

The 'Outcome Space' represents graphically the relationship between each of the categories of description (refer Figure 1). This relationship describes the phenomenon under investigation – The use of the Internet for Information sharing on construction projects. In the context of the pilot case study the outcome space demonstrates a hierarchal structure based on effective project participation. The top level (category of description 1) represents an awareness of effective project participation. The lower level (category of description 5) represents an awareness of ineffective project participation. Two themes are common to all categories, the 'Internet' and 'Project Communication'. At the top level (category of description 1), project communication has a focal awareness. At the lower level (category of description

5), project communication and the Internet are separated within project participation, demonstrating a focal awareness of the barrier to effectively communicate. The Internet remains in semi or main focal awareness as it is the interface for all project communications.

7. Conclusions

Although this case study analysis is only the first of four case studies, it is premature to draw full research conclusions, however the analysis can be viewed generally in terms of the industry (construction projects), project collaboration websites and relevant project participants. The outcome space provides a hierarchical ordering of the categories of description on the basis of effective project participation. Each category of description defines a different way that the interviewees have conceived the phenomen.

Category 1 – Effective Communications, starts to indicates that the use of the Internet for information sharing is seen as effective project communication. This is significant for it's ongoing uptake and continual usage. Category 3 – Effective Documentation, starts to suggest a further confidence and significant use for the Internet for information sharing. This significance is important to understand in terms of workplace practices and accountability. Category 2 – Another Communication Tool, begins to indicates that project participants will also use other communication tools in parallel with the Internet for sharing information. This is significant in terms of developing project relationship and in understanding how project participants are communication with the available tools. Category 4 – IT Skills, begins to suggest that IT skills are an important consideration when using the Internet for information sharing. IT skills are significant in terms of selecting, training and equipping project participants. Category 6 – Multiplier of Communications, starts to indicate the easy with which use the Internet for information sharing can multiply communications in relation to traditional methods. This is significant for project participants to understand when communication with this tool. Category 5 – Barrier to Participation, starts to indicate the inability for project team members to effectively participate when issues of cost and technology are not considered. This is critically significant for the establishment and success of collaborative project web-sites and virtual teams.

This initial research starts to demonstrates very tangible outcomes from the Phenomenographic process in further developing an understanding of the use of the Internet for information sharing.

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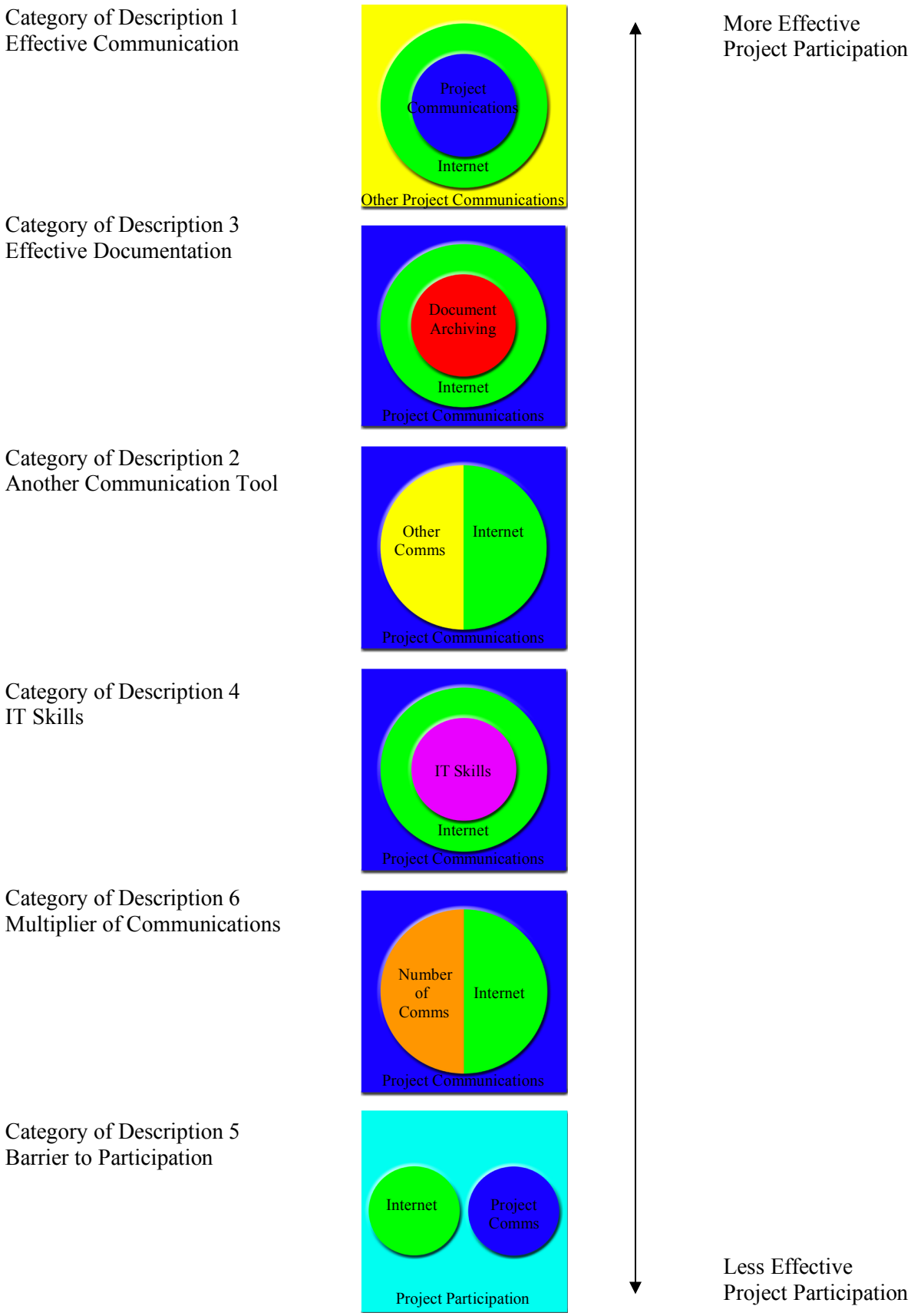

Figure 1: Outcome Space With the Six Categories of Description