Barriers to Knowledge Sharing Culture among Design Team

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***Abstract*—**Making appropriate engineering knowledge accessible to the right engineers at the right time is central to a team to building and sustaining competencies. Despite the admitted importance of knowledge sharing culture among design team, members are not likely to share knowledge because of the potential threat associated with providing critical information to other design team members. This paper has outlined barriers to design knowledge sharing culture identified in the literature. It further addresses the need to eliminate where possible and mitigate when feasible those factors identified as impacting design knowledge sharing culture among design team. Implications drawn will provide actionable knowledge to organizational management.

***Index Terms*— barriers, knowledge sharing, design team**

I. INTRODUCTION

The success of knowledge management initiatives depends on knowledge sharing, between design engineers and within and across team which allows exploit and capitalize on knowledge-based resources (Cabrera and Cabrera, 2005; Davenport and Prusak, 1998). In this 21st century, the operation knowledge of an enterprise represents its assets , wealth and is regarded as the core of intellectual capital of an enterprise (Lin, 2008).The purpose of knowledge sharing among designers is to help manufacturing industries as a whole to meet its knowledge demands or objectives in especially in new product development and designs process. Successful knowledge sharing enhanced learning, new knowledge creation and knowledge reuse (Siakas and Georgiadou, 2006). The goal of knowledge sharing can be either to create new design knowledge by combining existing knowledge in another way or to become better at exploiting the existing design knowledge. Sharing could be useful not only in better employing the existing knowledge, but also in creating new design knowledge (Huang *et al.*, 2008). Design knowledge has been recognized as a form of capital for the team and provides the only sustainable basis of competitive advantage that many teams possess (Wood, 2007).Design knowledge sharing requires that knowledge about products, components and processes, as well as knowledge about requirements is accessible on demand. The design knowledge sharing process should assist engineers in saving time in the task. For some conceptual design, there are key elements that are fairly standard, and having design knowledge about those elements readily available will save time (Nor and Egbu, 2010).

The disposition to share knowledge with co-engineers may be motivated by an aspiration to add to team performance or to increase position and rewards from being seen to use individual knowledge, however an unwillingness to share knowledge may be due to fear that one is giving out what makes one a powerful engineer, or from a desire to prevent co-engineers gaining access to one's knowledge (Sackmann and Friesl, 2007). Some theorists compare knowledge sharing with game theory, each player unwilling to surrender his or her knowledge unless the other does so as well .In the end, both players benefit from knowledge sharing, but neither is willing to give up their position of power, fearful that the other will not do the same. It is a stalemate that has to be broken by the organization through the development of an environment of knowledge sharing. While there are many factors that can be attributed to these deployment failures (Campbell, 2009).Various knowledge sharing deficiency thus suggests the presence of barriers to knowledge sharing. It is against this backdrop that this research is being undertaken to provide answers regarding the barriers to the knowledge sharing culture among design team.

The study commences by examining knowledge sharing leading to barriers associated in knowledge sharing culture. It follows subsequently by suggesting implications for researchers and practitioners and highlights the key contributions of our study. This study thus critiques literature to provide some insights into the barriers affecting knowledge sharing culture and offers suggestions for remedying.

Manuscript received April 7, 2014. This work was supported in part by the Birmingham City University. Barriers ERP System Implementation and Tacit Knowledge Sharing

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ISBN: 978-988-19253-0-5
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

II. RESEARCH METHODOLOGY

This paper is based on a systematic literature review, conducted on relevant journal papers, conference papers, and books on knowledge management, human resource management, technology management, and information management particularly focusing on key themes such as barriers to knowledge sharing. These themes were used as key words for searching for related journal articles, conference papers and books from electronic online repositories. The review first examined literature on knowledge sharing, then focus on the barriers to knowledge sharing culture among design teams.

III. BARRIERS TO KNOWLEDGE SHARING CULTURE IN DESIGN TEAM

While there are many factors that contribute to barriers to knowledge sharing. Analysis of relevant literature leads to the following classification of critical factors that may contribute to barriers in knowledge sharing culture among design team.

1, Complex nature of knowledge: Wherever design knowledge sharing takes place, it is necessary to understand the characteristics of the design knowledge itself (Barson *et al.*, 2000). This knowledge depends heavily on the individual's mental model of processes and experience which constitutes tacit knowledge to a large extent amplifies the problem (Loebecke *et al.*, 1999). Tacit design knowledge can, by its very nature, be extremely difficult to share (Barson *et al.*, 2000). According to Fong and Chu, (2006) four major reasons that make it difficult to share tacit knowledge perception , language, time available, value difference and distance. Fong and Chu (2006) went further to state knowledge sharing is more than telling hoarders to play nice. It is about capturing the tacit knowledge locked in people's heads. The difficulty is to bridge the distance between expert and novice or the difficulty to express the tacit dimension of knowledge (Huysman and Wulf, 2005). The tacit dimension of knowledge requires access to social network to share the tacit part of the knowledge (Brown and Duguid, 1991). Also, sometimes, it is quite difficult for people discovering and sharing their tacit knowledge since some of the knowledge was obtained from painful learning experiences (Yang, 2010).Several researchers suggested that design team need to emphasis core reasons for sharing, particularly tacit design knowledge (Nonaka and Takeuchi, 1995; O'Dell *et al.*, 1998).

2, Knowledge market: One reason that market mechanisms fail for the share of knowledge, under the assumption of opportunism, is the tacit nature of much knowledge (Riege, 2005). Given a potential buyer who is uncertain about the true value, revealing the knowledge to convince the buyer of its worth paradoxically reduces its value since he then would possess it without paying for it (Loebecke *et al.*, 1999).Also the incompleteness of information about the knowledge market; the asymmetry of design knowledge and the localness of knowledge. The incompleteness implies that the design engineer may not know where to find their team's own existing design knowledge. Localness of knowledge, design engineer usually get knowledge from their neighbors, as they know and trust more. But design engineer often do not know much about more distant design knowledge sources. Design engineer will contact the co-engineer in the adjacent cubicle, rather than try to discover who in the team is really knowledgeable (Cabrera and Cabrera, 2005).

Also,Knowledge markets may be shaped by the political realities prevailing in the team. If the political reality of a team allows knowledge hoarders to thrive, there is no incentive for design engineer to share their expertise. Individual design engineer usually will not share knowledge when the knowledge is regarded as valuable or important because of a fear of losing possible advantages (Bock *et al.*, 2005). Furthermore, lack of proper reward mechanism may be the major reasons that individual design engineering is usually reluctant to share design knowledge with co-designers (Ryan and O'Connor, 2009). Von Krogh *et al* (1998) also advance the notions that the use of rewards is one control technique used to transformed engineers behaviour. Definitely, reward structures must encourage the creation and transmission of knowledge. Reward systems are central to fashioning a culture in which knowledge sharing is the norm (Talebi and Moghaddam, 2006; Sudarsan *et al.*, 2005). Bell DeTienne *et al* (2004) echoed views stating that managers are becoming more conscious of' the challenges created by having a corporate culture inconsistent with KM programmers such as basing appraisal, promotion, or compensation of the workforces on the knowledge or the skill of the individual (Gan *et al.*, 2006).

3. Illusion of reward deprivation: Some design engineers see a knowledge sharing as the way they can lose their work rewards, because they give their knowledge and experience to someone else who may be rewarded by salary increases. Alongside knowledge sharing is understood as additional work. Therefore some design engineers expect "something more (Bureš, 2003)."Leveragability" refers to the potential of the "knowledge-receiving party" to increase its value from knowledge sharing by exploiting the shared knowledge "on its own" beyond the cooperation. Hence, additional value may result from leverage whenever one party "receives" knowledge. Here, leveragability is not related to opportunism which from a point of view has a negative connotation (Basaglia *et al.*, 2010). Access to the other's knowledge enables both parties to benefit from additional opportunities by leverage. A particular situation arises if a party's use of "received" knowledge has a "negative reverse-impact" on the sender. Negative reverse-impact describes the extent to which a receiver's use of knowledge acquired during cooperation may lower the sender's original value of the knowledge (Zhuge, 2002).

4. Power Perspective: One major inhibitor of knowledge sharing is that knowledge can be considered a source of power and superiority (Gupta and Govindarajan, 2000; Szulanski, 1996) Design engineers' unique knowledge often results in positive evaluations from human resource

ISBN: 978-988-19253-0-5
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

systems and design engineer gains such as cash bonuses, promotions, stretch job assignments, and protection from layoffs (Husted and Michailova, 2002). This creates a disincentive for knowledge sharing because by sharing knowledge it becomes a common good and individuals lose their distinctiveness compared to others (Wang and Noe, 2010). Such an environment can serve to discourage knowledge sharing if design engineers believe that this practice will hinder their design engineer efforts to distinguish themselves from their co-workers (Ma *et al*., 2008). In particular, teams that promote knowledge exchange by establishing knowledge markets and providing tangible incentives could actually be encouraging hoarding behaviour and competitive actions, diminishing the free flow of knowledge within team(Basaglia *et al.*, 2010).Although individuals may refrain from sharing knowledge for fear of losing power it is also feasible that individuals can increase their expert and referent power by sharing knowledge (Wang and Noe, 2010; Zhuge, 2002).

Hoarding knowledge: "Partial knowledge sharing" and "partial knowledge hiding" where an individual design engineer shares some of the knowledge, but also withholds some relevant knowledge from the recipient for whatever reason, regardless of whether or not it has been requested (Ford, 2008). Ford and Staples (2007a) suggests that partial knowledge sharing may be benevolent to assist the recipient by preventing overload, or to protect confidentiality, or self-serving to protect that the individual wants to hoard while still appearing to be sharing (Ford, 2008).Withholding of knowledge may hinder or even prevent individuals engineers from developing a knowledge foundation from which new knowledge can be generated. Indeed, this expertise when combined with 'position power' provides the power base that makes one indispensable and influential in the design team.(Zaglago, 2013b) Teams can be characterized by a significant level of knowledge hoarding and the lack of knowledge sharing among engineers. (Ardichvili *et al*., 2006). Ardichvili *et al* (2006) particularly contend that in knowledge intensive team where such knowledge hoarding barrier is broken engineers turn to believed that their job situation would essentially be reinforced by knowledge sharing, through dynamic contribution in community discussions would advance their visibility and perceived uniqueness, usefulness for the team. Engineers also perceived knowledge sharing as enhancing their prospects of future job promotions (Ardichvili *et al.*, 2006).

Culture: Culture has often been regarded as one of the barriers to knowledge sharing among design team (Lindquist *et al.*, 2006). McDermott and O'Dell (2001) argue that if culture is the biggest barrier to KM then why not match KM to culture, therefore match culture and design knowledge sharing, by building on a core value and culture that supports knowledge sharing. This is based on the assumption that the core value does not inhibit knowledge sharing. But they concede that identifying team values which can provide a catalyst for sharing knowledge is difficult (McDermott and O'Dell, 2001; Imani and Mackenzie-Davey, 2004).Team members from certain cultures may be hesitant to share ideas and to provide constructive feedback of others' ideas (Rosen *et al*., 2007). Variety of cultures embracing design engineers with different underlying norms, values and beliefs requires specialized approaches to knowledge sharing (KS) to support such design project-based team (Siakas *et al.*, 2010). According to Riege (2005) design knowledge sharing practices often seem to fail because design team attempt to adjust their team culture to fit their KM or design knowledge sharing goals and strategy, instead of knowledge sharing goals and strategies are all too often merely mentioned in a business strategy (McDermott and O'Dell, 2001).Significant variation in national-cultural and linguistic backgrounds of the design engineers establish that in the diverse environment, cultural and linguistic similarity and dissimilarity between team members may provide basis for informal connection and disconnection(Loebecke *et a*l., 1999). Social capital within the teams often opens up opportunities for network members, but since the networks are usually based on ethnicity, religion, language or profession, they can also build entry barriers to those who are outsider (Campbell, 2009).

Time pressure: It takes time to share and absorb design knowledge, particularly technical design knowledge, from teammates. The amount of cognitive effort that team members are willing and able to spend processing and responding to the information they receive may be limited. Heavy demands from local design team leader for contributions to local work frequently exacerbate this problem, reducing the time available to share design knowledge with and to learn from teammates (Rosen et al., 2007). General lack of time to identify team in need of specific design knowledge and lack of contact time and interaction between design knowledge sources and recipients (Riege, 2005).

Restrictions: Rules on access and restrictions on access to information culture can affect knowledge sharing. The perceived possible lack of usefulness in granting access to currently inaccessible information because of the possibility of information overload and the increased probability of accidents with the information when a larger number of design engineers had access to it, such as accidental deletion or moving the documents to a wrong location.Lack of interest in having access to information produced by other divisions because of the pre-judgments about the quality and relevance of that information.The transparency to be achieved by sharing information. The possibility of waiting until teammate reaches that maturity and is ready to deal with certain information. Full transparency will only be possible when design engineers are mature in the way they handle and treat that information (Julibert, 2008). Also, sharing proprietary information with collaborators leaves an organization open to the risk that this information will be revealed, either intentionally or unintentionally, to competitors (Barson *et al.*, 2000). When sharing cautiously, the information provider has to make an important trade-off. The information provider may wishes to preserve sensitive knowledge, and on the other hand, they may also wish to provide all design knowledge necessary for a successful collaboration (Adenfelt and Lagerström, 2006). When providing a design world or set of design worlds for

ISBN: 978-988-19253-0-5
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

cautious sharing, the restricted version of the design is exported for use in a separate instantiation (Adenfelt and Lagerström, 2006). Cautious sharing may involve modification of a design path rather than just omitting worlds or their subparts. When worlds are modified rather than omitted, then dependencies across the worlds need to be correctly handled (Adenfelt and Lagerström, 2006).

Efficiency and effectiveness of system: Shortage of appropriate infrastructure supporting sharing practices and deficiency of team resources that would provide adequate sharing opportunities(Riege, 2005).Unwillingness to use applications due to a mismatch with need requirements, unrealistic expectations of IS/IT systems, and difficulties in building, integrating and modifying technology-based systems. Design knowledge sharing is as much a design engineers and organisational issue as it is a technology challenge.Lack of integration of IT systems, lack of compatibility between diverse IT systems (O'Dell and Grayson, 1998). Another potential barrier to developing or maintaining the right IT infrastructure is the compatibility of technology, the integration of existing and new systems (Upadhyay *et al*., 2006). The term ''hybrid solutions'' refers to necessary interactions between design engineers and technology to facilitate sharing practice and improving design knowledge sharing in a meaningful way requires a ''delicate marriage of technology with a keen sense of cultural or behavioral awareness'' (Riege, 2005). True interoperability is difficult to achieve (Barson *et al*., 2000). Sometimes absorptive capacity may be a challenge which involves knowing something but not having the resources or enough details to act on the information (Robert Jr, 2007).

Not-Invented-Here Mentality: it's a persistent culture of avoiding new ideas unless they come from within the design team. It's a form of mistrust and elitism. Unless particular design team developed it, other teams wants no part of it. Avoiding a concept because it "wasn't invented here" stems from all the wrong ideas, from being suspicious of outside influences to being unwilling to value the work of others. The not-invented-here mentality is another barrier to design knowledge sharing. Unwillingness to give design knowledge to or accept it from design engineer in the team who has relatively low status (Cabrera and Cabrera, 2005).

Trust: If workers did not trust the members of their team, they may be reluctant to share their knowledge, likewise if the team did not trust its management. Obviously, the biggest challenge in fostering knowledge sharing culture could be, unwillingness to share knowledge due to mistrust of co-designers (Ribiere and Sitar, 2003).According to Bell DeTienne *et al* (2004) mistrust remains one of the most significant cultural challenges facing Knowledge sharing among design teams. Where lack of trust exists, a great amount of sharing will not happen. Design engineers may be hesitant to contribute to a knowledge database if they think that by doing so they will in some way devalue themselves to the team (Bell DeTienne *et al.,* 2004;Chen et al., 2010; Zaglago, 2013b). Mistrust among designers may rise from perceptions that others are not contributing equally to the team or that others might exploit their own design engineer's cooperative efforts. These doubts and suspicions create a reluctance to initiate exchanges with others design engineers or respond to others' invitations to participate in cooperative exchanges with members of the team. In the absence of trust, formal knowledge-sharing practices will be insufficient to encourage individuals design engineers to share knowledge with others within the same work environment. Shared knowledge becomes public and allows all design engineers to benefit from that knowledge. However, this may result in opportunistic behaviour and free-riding as there is a possibility to benefit without contributing (Chai and Kim, 2010; Zaglago, 2013). Lack of trust may occurred among design engineers because they may sometimes misuse design knowledge or take unjust credit for it (Riege, 2005).Again they may be lack of trust in the accuracy and credibility of design knowledge due to the source (Hendricks, 1999).

Evaluation Apprehension: Evaluation apprehension may result from self- perceptions that shared knowledge is inaccurate, not valued, and likely to result in unfavorable criticism from others (Wang and Noe, 2010).It is also possible that design engineer might be less likely to share knowledge in a team or an online community of practice that might reveal mistakes or errors made by boss or an influential peer (Wang and Noe, 2010).Design engineers high in performance goal orientation, on the other hand, are likely more concerned about demonstrating their competence and effectively performing while avoiding risks and negative judgments. They may feel that knowledge sharing depletes the time and effort available for other work activities that can result in greater design engineer benefits and rewards by exceeding expectations on performance goals. Uncertainty especially younger and less experienced design engineers can feel uncertainty, because they cannot judge if their working results represent valuable knowledge for others. It may be difficult for junior staff to estimate the worth of their knowledge for other members of staff or the company as a whole (Bureš, 2003; Cabrera and Cabrera, 2005).

IV. SOLUTION

Effective and successful knowledge emergence empowers individuals Therefore, it becomes the responsibility of an organization's knowledge leaders to ensure that those with the power disseminate. Design team leader would need to facilitate the confidence of knowledge workers in acting on incomplete information, trusting their own judgments, and taking decisive actions for capturing increasingly shorter windows of opportunity (Malhotra, 2004; Zaglago, 2012).

Design of new information architectures thus needs to take into consideration ambiguity, inconsistency, multiple perspectives, and impermanency of existing information. Such architectures need to be designed along the principles of flexible and adaptive information systems that facilitate exploitation of previous experiences while ensuring that memory of the past doesn't hinder ongoing experimentation and adaptation for the discontinuous future (Malhotra, 2004).High level of bureaucracy and administrative institution type often use procedures and approaches should

ISBN: 978-988-19253-0-5
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

be remove from knowledge sharing (Bureš, 2003)

Organization should foster coherent paradigms, the difference between design engineer intents and paradigms of company (values, strategy, mission, vision, etc.) expressing and justifying opinions should fit with the ruling paradigms of company (Bureš, 2003).

Attitudes of conflict avoidance and some conservative habits should be eliminated to enhance sharing of design knowledge, if this design knowledge contains some new thoughts or innovative ideas. Different views and perspectives should be open. Design knowledge not culturally legitimated should not be suppressed (Cabrera and Cabrera, 2005; Fahey and Prusak, 1998). In the process of knowledge sharing, the environment plays a key role in facilitating or impeding knowledge share among team members. Successful cooperation requires the existence of a climate in which design engineers feel safe in displaying behaviour that can enhance knowledge sharing (Zaglago, 2013a). Inspiring individuals to share becomes crucial, and teams have to create a healthy climate based on collaboration (Yang, 2007).

V. Conclusion

Team barriers often prevent effective knowledge sharing. It is therefore necessary to identify and eliminate the maximal number of these barriers. We provide some insight on barriers to design team knowledge sharing. Identifying challenges and discussing their impacts and suggesting some management practices that may address those challenges. Some of them are possible to remove completely but some of them will still remain. These remaining barriers are necessary to minimize in relation to the given conditions.

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ISBN: 978-988-19253-0-5
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)