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Abstract

This dissertation examines two behavioral issues related to knowledge acquisition. First, we examine whether incentives successfully motivate IS domain experts to contribute knowledge to a knowledge management system. We also investigate whether the impact of incentives differs according to the orientation of the IS expert: internal and external, and then we examine if there is a moderating effect of tasks, simple and complex, on the incentives offered for knowledge capture. Second, we investigate the efficacy of different methods in facilitating knowledge capture from multiple IS domain experts.

Keywords: Knowledge acquisition, knowledge management, knowledge capture, incentives, techniques

Introduction

We are moving from a post industrial to a knowledge based economy (Sveiby 1997; Drucker 1993). This proposition is supported by other studies (Audretsch and Thurik 1997) that note that there is a fundamental shift occurring in most OECD countries from a managed economy to an entrepreneurial economy, the characteristics of which include knowledge as the input and output (Beijerse 1999). As a result, we find that land, labor, capital- the classical factors of production have become secondary to knowledge as the primary resource of the new economy (Drucker 1992). In this knowledge based economy (OECD 1996), one of the main assets of companies is their stock of knowledge. Firms realize that their ability to create, assemble, integrate and exploit such knowledge assets would dictate their competitive advantage (Teece 1998) and as a result, the importance of knowledge in business and industry has risen dramatically and shifted from being one resource to becoming the primary resource of firms (Stenmark 2001). One of the research challenges of this knowledge economy is to improve how knowledge workers find relevant information (Mack et al. 2001). Consequently, knowledge management has become critical for firms because it enables, supports and encourages the following (Fahey et al. 2001, p. 890):

1. The processes of discovering or creating new knowledge and refining existing knowledge
2. The sharing of knowledge among individuals and across all organizational boundaries
3. The continued development and use of knowledge as part of individual's day to day work and as part of decision making

Equally important to the knowledge based economy is the related concept of organizational learning. Organizational learning has been defined as a process of detecting and correcting errors (Argyris 1993) and as a process of improving actions through better knowledge and understanding (Fiol and Lyles 1985). Organizational learning is important to firms because it is the means by which knowledge is preserved so that it can be used by individuals other than its progenitor (Sinkula 1994). Furthermore, organizational learning impacts organizational effectiveness (Adler 1990; Stata 1989) and influences a company's effective performance (Barkema & Vermeulen 1998; Bartlett & Ghoshal 1987a, 1987b; Hitt et al. 1994; Huber 1991). Both organizational learning and knowledge management are interrelated (Schultze and Leidner 2002) in that organizational learning is the process by which one unit acquires knowledge from another unit in the same organization (Goodman and Darr 1998). Numerous studies in the information systems (IS) domain in the 80's and 90's have recognized organizational learning as one of the key IS management issues (Palvia and Basu 1999; Brancheau et al. 1996; Niederman et al. 1991; Brancheau and Wetherbe 1987; Dickson et al. 1984).

The four constructs that are integrally linked to organizational learning are knowledge acquisition, information distribution, information interpretation and organizational memory (Huber 1991). While each one of these constructs is critical to the process of organizational learning, this study will focus only on knowledge acquisition (or knowledge capture) in order to make the scope of the study more manageable. For the purposes of this study, we use the definition extended by Liou (1998) according to which "knowledge acquisition is the process of extracting, structuring and organizing knowledge from several knowledge sources, usually human experts so that the problem solving expertise can be captured and transformed into a computer readable form" (Liou 1988, Ch.2-p.1). A key motivation for choosing knowledge acquisition as the focus of this dissertation study is that despite many studies conducted over the years, knowledge acquisition still continues to remain a bottleneck[1] in the development of knowledge management systems and expert systems (Lightfoot 1999; Liou 1998; Maniezzo and Morpurgo 1993; Gaines 1993; McGeorge and Rugg 1992; Nicholson 1992; Tam 1990; Boose 1986; Buchanan 1982). Studies examining the earlier mentioned "bottleneck" problem of knowledge acquisition have indicated that "the success of the knowledge acquisition processes often depended on factors that serve to make up what has been called the knowledge acquisition context[2] or environment" (Holsapple and Wagner 1995, p. 328; Forsythe and Buchanan 1989). Although there are many variables influencing knowledge acquisition such as problem domain factors, organizational factors and human factors (Holsapple and Wagner 1995), this study concerns itself with the human factors, more specifically, eliciting knowledge from human experts. We believe studying issues relating to human factors in knowledge acquisition is important because the knowledge engineer plays a major role in the knowledge engineering process. It is the knowledge engineer who mediates between the expert(s) and knowledge base, eliciting knowledge from the expert(s), encoding it for the knowledge base and refining it in collaboration with the expert(s) to achieve acceptable performance. The fact that human factors such as the performance of an expert or a knowledge engineer can play a major role in the knowledge acquisition process has been noted by several research studies (Dhaliwal and Benbasat 1990; Forsythe and Buchanan 1989). However, most of the studies on the role of human factors in knowledge acquisition have "focused primarily on certain traits of human experts: cognitive style, level of expertise and problem solving style. Other expert attributes (e.g. personality factors, prior knowledge acquisition experiences) have received little attention" (Holsapple and Wagner 1995, p. 333). What this indicates is that there is a need to continue examining issues relating to human factors such as personality in knowledge acquisition, thereby forming the theme of this dissertation.

In particular, the issues that this dissertation will attempt to address with regard to knowledge acquisition are behavioral in nature and are as follows: First, we examine whether incentives are effective in motivating knowledge providers or IS experts to contribute their knowledge to a knowledge management system, and knowledge receivers to use such knowledge. In addition, we also examine whether the effect on incentives on knowledge capture and knowledge use is moderated by task types and personal beliefs of the experts. Second, we investigate the efficacy of different methods in facilitating knowledge acquisition from multiple IS experts. Next, we explain the motivations behind this study.

A motivation of the first part of this dissertation is to study the role of incentives in knowledge acquisition. Recent studies in IS have recognized the importance of incentives and motivation in knowledge management (King et al. 2002) and as "a critical issue needing further research" (Hahn and Subramani 2000). A Delphi study of 2,073 knowledge management practitioners and managers conducted by King et al. (2002) to elucidate the most important issues in knowledge management reported that one of the top ten issues of knowledge management was "how to motivate individuals to contribute their knowledge to a knowledge management system?" (p. 94). There are many reasons why studying incentives is important in IS. Firstly, there is no comparative research on the efficacy of various practices to motivate knowledge providers to share their knowledge (Huber 2001). In addition, the author notes that "little is known with any certainty about which of these practices have what effects under what condition?" (p. 73). Clearly, these questions suggest the need for an intensive examination of the efficacy of incentives that are used to motivate knowledge providers and knowledge recipients. It is also important to study the role of incentives specifically for knowledge acquisition because there is evidence that the motivations of the provider and the receiver of knowledge greatly affect the success of organizational efforts to capture and use knowledge (Berry 2000; Rappleye 2000). Knowledge providers might not share their knowledge for fear of losing their power and status (Orlikowski 2000) and knowledge receivers might be reluctant to use knowledge not invented by them (Huber 2001). In addition, studies have suggested that in many cases the use of straight forward monetary incentives to motivate knowledge providers and knowledge receivers does not appear to be an effective solution (Hahn and Subramani 2000).

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[1]Prior studies examining the problem of knowledge acquisition have suggested that this issue is largely due to the fact that human experts can verbalize only information residing in short term memory (Ericsson and Simon 1984). Many experts find it hard to articulate the process of their decision making (Maniezzo and Morpurgo 1993; Nicholson 1992) because "human expertise embodies skills, heuristics and other problem solving techniques that have evolved over years of practice" (Tam 1990).

[2]The Knowledge Acquisition Context is the general environment in which the process occurs (Holsapple and Wagner 1995).

Secondly, prior research in the IS literature has indicated that incentives are necessary for knowledge capture and use. For example, studies done on the factors influencing the success of traceability practice highlighted the importance of incentives to knowledge workers (Surysekar and Ramesh 2001; Ramesh 1998; Ramesh et al. 1997). These authors also note that the absence of appropriate incentives caused individuals involved in traceability efforts to view it as an "unnecessary overhead impeding their productivity" (Surysekar and Ramesh 2001, p. 4). But these findings in the IS domain are in conflict with the findings of studies from the psychology domain that have argued that extrinsic incentives are ineffective (Kohn 1999) and would decrease intrinsic motivation (Lepper and Green 1978). As a result of these conflicting findings, it is not clear whether incentives are effective in motivating knowledge providers and users. This dissertation examines this issue and attempts to resolve this conflict.

Thirdly, it is well documented that because knowledge includes both tangible and intangible components, measuring the value of activities is difficult in the context of knowledge capture. A study examining the effect of incentives on such tasks indicated that the desirability of providing incentives for an activity decreases when other activities that make competing demands to an agent's time and attention are difficult to measure (Holmstrom and Milgrom 1991). For example, agents engaged in difficult to measure tasks may be paid a fixed salary and agents engaged in easily measured tasks may be paid by high powered incentives (Surysekar and Ramesh 2001). What these studies suggest is that incentives would be ineffective to motivate knowledge providers in the knowledge capture process. However, this would be in conflict with the findings of other studies that have encouraged the use of incentives in the knowledge capture process (Ramesh 1998; Ramesh et al. 1997). As a result of the conflicting findings, there is an additional need to investigate whether incentives are effective in knowledge capture.

In connection with our earlier discussion on the role of incentives to acquire knowledge, it must be noted that once IS experts are ready to share knowledge there arise additional issues on how best to capture such knowledge. Although various studies have attempted to address this issue of knowledge acquisition using single experts (Jones and Miles 1998; Holsapple and Wagner 1996), there have been few studies that have addressed this issue with respect to multiple experts. Studies in the MIS domain have not conclusively indicated which method of knowledge capture works best with respect to multiple experts. This presents a research opportunity that needs to be examined at the earliest because many firms are increasingly relying on teams or on a panel of multiple experts for problem solving and decision making. Therefore, in the second part of the dissertation, we attempt to address this research opportunity by examining the efficiency and effectiveness of three different methods of knowledge acquisition from multiple IS experts.

The rest of the proposal is structured as follows: Next, we will briefly discuss the nature of knowledge with its varied classifications. We will then discuss the role of incentives both generally and specific to knowledge acquisition, and will present the relevant hypotheses in Chapter 3. In Chapter 4, we will review the various methods that have been used towards knowledge acquisition both in the case of single and multiple experts. We will also argue why it is important to investigate the issues related to the efficiency and effectiveness of different methods of knowledge acquisition in the context of multiple experts. Finally in Chapter 5, we will conclude with a brief summary of the expected contributions of this study.

Knowledge and Knowledge Management

The question of defining knowledge is not new. It has occupied the mind of philosophers since the classical Greek era and has lead to many epistemological debates (Alavi and Leidner 2001). Both knowledge and knowledge management are very old topics and have included different research perspectives in the past that vary from being philosophical (Prusak 2001; Tsoukas 1996) to being applied (Mack et al. 2001). However, there is a lack of consensus among many researchers on what constitutes knowledge and knowledge management because these terms are difficult to define (Earl 2001). While this dissertation recognizes the existence of "thorny epistemological issues" (Meindl et al. 1994) with regard to these topics, we do not discuss them at length because it is not the primary focus. We however believe it is important to clarify that knowledge is different from data and information because the meaning of these concepts "have been a constant source of confusion" (Tuomi 2000). Essentially, data refers to the raw facts about the state of the world and information is data in some context or with some human interpretation applied. According to Davenport (1997), data are understood to be symbols that have not been interpreted and information is data with meaning. Knowledge on the other hand is information with guidance for action, i.e., knowing how to act given the information (Courtney, 2001). More precisely, knowledge is a mix of framed experience, contextual information and expert insight (Davenport and Prusak 1998). This is different from wisdom that is defined as knowledge with moral concerns or values (Merikangas, 1998). For the purposes of this dissertation, we use the definition advanced by Liebeskind (1996) according to whom knowledge is information whose validity has been established through tests of proof. Knowledge management refers to all the tools, technologies, practices and incentives deployed by an organization to "know what it knows" and to make this knowledge available to people who need to know it when they need to know it (Mack et al. 2001). This is the definition of knowledge

management that we use in this study because it is broad enough to encompass the technology, human and process aspects of knowledge management.

More recently, most voices in the KM discourse have abandoned the positivist view of knowledge as the objectified and monistic absolute truth and have adopted a pluralistic epistemology acknowledging there are many forms of human knowledge (Stenmark 2001). While the debates on what constitutes knowledge and its forms rage on, it has been widely acknowledged that knowledge has two dimensions: *tacit* and *explicit* (Markus, 2001). Drawing on Polanyi's (1966) idea of tacit knowledge, Nonaka and Takeuchi (1995) propose that there are two kinds of knowledge: explicit and tacit. Explicit knowledge is formal and systematic. It can be easily communicated and shared, for example, in product specifications, a scientific formula, or a computer program. In contrast, tacit knowledge is highly personal. It is hard to formalize and therefore difficult to communicate to others. Tacit knowledge consists of technical skills- the kind of informal, hard-to-pin down skills captured in the term "know-how" and at the same time has an important cognitive dimension. It consists of mental models, beliefs, and perspectives so ingrained that they are taken for granted and therefore cannot be easily articulated. Both tacit and explicit knowledge are important because knowledge is created and expanded through social interaction between tacit and explicit knowledge (Nonaka and Takeuchi, 1995).

We agree with Polanyi's (1998, 1967) view that "tacit knowledge is a precondition for meaningful focal knowledge and there is no explicit knowledge without subsidiary, marginal, and tacit meaning structure that underlies all focal knowledge" (Tuomi 2000). As a result, it is impossible to separate knowledge into its tacit and focal components. Rather, the tacit component of knowledge is the background from which the knower attends to the focal knowledge. Therefore, "knowledge is not converted into a separate set of explicit knowledge. Instead the structure of meaning changes so that some parts of it become focal, in relation to "the rest," which provides the periphery and the background" (Tuomi 2000, p. 111). Therefore, most forms of knowledge can neither be totally explicit nor totally tacit. Instead, we take the view in this dissertation that knowledge can be considered to have different degrees of tacitness (Ambrosini and Bowman 2001). As the degree of tacitness of knowledge increases, individuals find it difficult to articulate all their knowledge because of its elusiveness (Stenmark 2001). However, it is still possible to capture the explicit part of such knowledge and therefore one could argue that even tacit knowledge is explicit to some degree. Therefore, we focus generally on the broader concept of knowledge combining both tacit and explicit forms of knowledge as discussed earlier.

Next, we examine the role of incentives in motivating knowledge providers to contribute knowledge to a knowledge management system. In addition, we investigate the role of incentives in motivating knowledge receivers to use knowledge stored in a knowledge management system.

Role of Incentives

As noted earlier, the role of incentives in knowledge acquisition is an issue needing further research because firstly, monetary incentives do not appear to be an effective solution (Hahn and Subramani 2000) and secondly, there are issues related to power and status. For example, studies have indicated that not only are people unlikely to surrender the power they gain from being an important knowledge source, but also inequality in status between (knowledge providers and knowledge receivers) makes knowledge acquisition difficult (Leonard and Sensiper 1998). In particular to the IS field, some questions regarding incentives that need to be answered are as follows: first, it is important to examine whether incentives work in the context of knowledge acquisition. Kohn (1999) noted that although there are many individuals who believe in the power of incentives or rewards, this belief could be misplaced. Taking an example from the domain of psychology, often it is assumed in the case of children that rewards will increase children's interest in an academic assignment or their commitment to altruistic behavior (Boggiano et al. 1987; Barrett and Boggiano 1988). This belief in the power of incentives extends to business firms in that "in many workplaces, incentive plans are used a substitute for management: pay is made contingent on performance and everything else is left to take care of itself" (Kohn 1999, p. 16). However, the perception that incentives or rewards lead to beneficial results is not always true. For example, research conducted by Rothe (1970) found that supervisors tend to "demonstrate relatively less leadership" when incentives are in place. These findings assume relevance in the context of knowledge management because while recent studies have advocated the use of incentives towards knowledge capture and sharing (Ba et al. 2002; Surysekar and Ramesh 2001; Ramesh 1998; Ramesh et al. 1997), the end results could be detrimental to firms. There conflicting findings on the effectiveness of incentives on motivation and performance of individuals is something that is not yet addressed in the MIS literature. Therefore, there is a need to examine whether incentives are effective in motivating knowledge providers and knowledge recipients to share knowledge. Second, it is important to examine whether the impacts of such incentives vary according to the personal beliefs of the person. A study conducted by Lightfoot (1999) identified two categories of individuals on the basis of their personal beliefs: local and cosmopolitan. The author suggested that the motivators for these two categories of individuals should be different and therefore, one of the issues that needs to be examined is whether the effect of incentives varies between them. Third, it is important

to examine whether the nature of tasks moderate the influence of such incentives. We investigate these unanswered questions in this dissertation. These motivational problems are not limited to the reluctance of knowledge workers to share their knowledge. There is an additional bias against using knowledge from other sources i.e. "not invented here" syndrome (Huber 2001). The "not invented here" syndrome refers to the bias that could exist among recipients against using knowledge from other sources because it was not created by them. Therefore, we have motivational problems of both the knowledge holder and the potential user that need to be examined further. In what follows, we will first provide different perspectives on incentives that are taken from diverse fields such as psychology, management and IS. Later, we will examine the role of incentives specifically with regards to knowledge acquisition and will present the relevant hypotheses.

Psychological Perspectives on Incentives

Introduction

The effect of incentives or rewards on performance, learning, and behavior has been studied in psychology for a long time. Some of the early psychologists who studied rewards were Thorndike (1911), Skinner (1938), and Hull (1943). Basically, an incentive can be defined as any reinforcement that induces motivation rather than reducing motivation (Ferguson 2000). According to Ferguson, "incentives may be inner satisfactions or externally provided events, and they may be positive or negative. A positive incentive is what one seeks and a negative incentive is something one avoids. Negative incentives are more appropriate when dealing with fear and anxiety. (However), the term 'incentive' usually implies a positive outcome, so unless the word 'negative' is designated, the word incentive should be understood as a positive event" (p. 198). Incentives can also be either extrinsic outcomes or intrinsic outcomes. For example, money is an extrinsic outcome and feeling of satisfaction following good work is an intrinsic outcome. (Ferguson 2000). Therefore, incentives are not just concrete objects or verbal messages from others. Some incentives regarding intrinsic motivation are emotional outcomes, like feeling happy that one could help another person.

The two variables that are known to affect the way reward or incentive alters performance or learning are magnitude of reward and delay of reward. Studies of magnitude have included both the quantity and the quality of the reward (Ferguson 2000), and have lead to conflicting findings. On the one hand, Hull (1951), Spence (1956) and Kimble (1961) stated that reward magnitude affects only performance and not learning. Larger or more appealing rewards of all kinds increase performance speed or output that is they increase effort and not learning of new associations (Osborne 1978). On the other hand, research on the effect of saccharin on memory conducted by Stefurak and Van der Kooy (1992) found that reward magnitude affected learning.

The question of how magnitude of reward affects performance and learning differs from consideration of delay of reward. Delay of reward refers to the interval between response and reinforcement. The shorter the delay that follows a response, the more readily the response is learned (Kimble 1961, p. 140). This is called the "delay of reinforcement gradient". Studies have also examined whether humans will choose a delayed large reward over an immediate small reward. Older children and adults can and do select large delayed rewards over small immediate ones (Logue et al. 1992; Tobin et al. 1996).

Process

Since previous studies have indicated that humans are strongly motivated by incentives and often older children and adult humans perceive incentives to have cognitive and symbolic value, it is important to understand the process. Broadly speaking, "incentives goad (motivate) the individual, in that the motivational pull occurs before the performance. Regardless of whether one eventually obtains the desired job or money, the anticipation (in the here and now) of the future reward provides the motivation" (Ferguson 2000, p. 198-199). Although the term 'incentive' refers to a future event, the motivation that energizes and directs effort and behavior is in the present. In this way, incentives "pull" and motivate a person. In humans, incentives involve rewards that have value as a result of social and cultural experiences like money, gifts and awards.

Incentives and Motivation

As stated earlier, the focus of this dissertation is to examine the motivating role of incentives or rewards on knowledge providers. Motivation from reward, the pull motivation, is called incentive motivation and differs from the push motivations that are deprivation-induced. Incentive motivation can be further classified into intrinsic and extrinsic motivations (Ferguson 2000). Incentive that involves 'internal' outcomes is called intrinsic motivation and that which involves 'external' outcomes is called extrinsic motivation. Internal refers to thoughts or emotions generated within the individual and external describes events or

objects provided from outside the individual. We do not elaborate on "push" motivation since it is not the focus of this dissertation.

Intrinsic Motivation and Incentives

The term "intrinsic motivation" ranges from anticipation of inner satisfaction following some action to intrinsic pleasures derived from an activity (Staw 1976). Intrinsic motivation is typically considered to refer to the interest in the task itself (Amabile and Hennessey 1992) with the emphasis on enjoying or gaining pleasure in doing the task. Some theorists have also related intrinsic motivation to other basic human needs or motivations like satisfaction in meeting challenges (Ferguson 2000), competence (De Charms 1968), self efficacy (Bandura 1991), and self determination (Deci 1980)

Intrinsic motivation is important for multiple reasons. One reason is the fact that, "external rewards in everyday life are given in an unpredictable way with unreliable frequency. Without consistent and frequent reinforcements, people are likely to stop taking actions and doing what is required of them" (Ferguson 2000, p. 199). Although individuals have been trained on reinforcement schedule, it will not maintain behavior over long periods of sporadic rewards, because humans form expectancies and these alter motivation and behavior. "If on many occasions the rewards that one has anticipated as outcomes following actions do not occur, the person will decrease his or her expectation of external rewards and this leads to decreased motivation. If the person relies on extrinsic incentives for motivation and energy for actions comes primarily from extrinsic rather than intrinsic motivation, decreased expectation of rewards will decrease motivation and over time the person will be less productive and will exert less effort. In time, the person will become listless and withdrawn" (Ferguson 2000, p. 200). This is one of the reasons why it is important for firms to focus on intrinsic motivation. A different advantage for training people to rely on intrinsic motivation is that reliance on extrinsic motivation is not conducive to problem solving and creativity (Amabile and Hennessey 1992). "Intrinsic motivation provides a continuing source of motivation, enabling the individual to continue to exert effort and take actions even in the absence of external incentives. Moreover, intrinsic motivation is considered by many to heighten self esteem" (Ferguson 2000, p. 200).

Although it is important to enhance the intrinsic motivation of individuals because of the numerous benefits, firms must examine the use of incentives in achieving it. Use of extrinsic incentives could be detrimental because studies have found that extrinsic incentives may decrease intrinsic motivation as, for example, when a person believes the extrinsic incentive is the reason for doing an activity (Lepper and Green 1978). One of the possible explanations comes from Deci's (1975) "cognitive evaluation theory". Deci suggested that extrinsic rewards decrease intrinsically motivated activities due to a change in appraised locus of causality. "At the outset, participants engage in certain behaviors because of internal rewards, like feeling competent. But if the individuals later receive money and further engage in the activity, they will come to believe they are doing the activity (the locus of causality) for external and not internal reasons, and this diminishes the previous intrinsic motivation" (Ferguson 2000, p. 203). Thus, a person's evaluation of the cause or source of the action affects how external rewards alter motivation and action. (p. 203).

A number of studies tested Deci's cognitive evaluation theory with field as well as laboratory experiments. Some studies supported the theory and others did not. For example, findings from a study by Overskeid and Svartdal (1996) did not support Deci's formulation. Results of the study showed that interest ratings of subjects in a task were not significantly affected by reward and that groups with the high reward gave highly subjective autonomy (self determination) ratings. On the contrary, a field study by Jordan (1986) gave workers a job survey that measured internal work motivation similar to Deci's intrinsic motivation. Over a period of a few months, significant difference was found between groups: Workers that received a monetary bonus incentive that was contingent on job performance showed decreased intrinsic motivation; workers who received a promised bonus that was not tied to job performance showed an increase in intrinsic motivation. These conflicting findings do not clearly indicate whether external rewards diminish intrinsic motivation or not. Therefore, there is a need to further investigate this issue.

Incentives and Performance

Incentives affect intrinsic motivation that in turn affects performance. However, the relationship between incentives and performance is not clear because of conflicting results. Some studies suggest that incentives are not only ineffective but often positively counterproductive (Kohn 1999). According to Kohn, "rewards in general do not enhance, and often impede, performance on many different kinds of tasks, especially those that require creativity" (p. 122). For example, an investigation of the preschool children (Mccullers et al. 1987) reported that an extrinsic incentive (a promised toy) had an adverse effect on immediate drawing performance but when the children were shifted back from reward to non reward, their performance again improved. One interpretation of these data is that performance reflects various motivational factors, only one of which is intrinsic

task motivation. Although performance dropped, intrinsic motivation could have remained high. Similarly in the business context, McGregor (1960) ticked off the consequences of incentive plans, noting that they may lead to "deliberate restriction of output, hidden jigs and fixtures, hidden production, fudged records… antagonism towards those who administer the plan, cynicism with respect to managements integrity and fairness, indifference to the importance of collaboration with other parts of the organization" (p. 9-10). Another study by Rothe (1970) investigated the effects of sudden elimination of incentives for a group of welders. He posited that if a financial incentive supplies motivation, its absence should drive down production. The initial findings of the study confirmed this proposition. However, in the next couple of months, the absence of incentives had an opposite effect. The welders' production began to rise and eventually reached a level as high as or higher than it had been before (Ferguson 2000). In contrast to these studies however, a study by O'Sullivan (1993) reported that a positive correlation between performance and incentives. Thus, the effects of incentives on performance are not clear and might need a further examination in the context of knowledge management.

Conclusion

Because high effort is required for effective performance on many knowledge acquisition tasks, the way extrinsic incentives relate to beliefs about effort and task requirements is likely to have an important bearing on whether extrinsic incentives improve motivation and performance of knowledge providers and knowledge recipients. For example, a study conducted by Svartdal (1993) also suggested that because people learn incentive effort beliefs, these will mediate the amount of effort people exert on tasks offering external incentives.

Since money, praise and various other rewards have diverse symbolic meanings, these meanings will alter in complex ways how extrinsic incentives can become sources of incentive motivation. (Ferguson 2000). For human motivation, one needs to consider the symbolic nature of the reward, the experience one had with the reward (Maki et al. 1995), the conditions under which reward is sought, and the many beliefs the person holds that affect the meaning of the reward (Longstreth 1972). When human actions are rewarded, what is involved is not only the reward but the social interaction between the giver and receiver. The rewarding process thus involves human interactions and thereby human relationships. There is thus a clear need to examine the effects on incentives on motivation and performance of both knowledge providers and knowledge receivers in the context of knowledge management.

Organizational Management Perspectives on Incentives

We explain the issue of appropriate incentives using two relevant economic theories of organization: "agency theory" and transaction cost economics. We begin with agency theory.

Agency Theory

Studies have indicated that the principal agent problems in the economics literature bear some resemblance to the issues of incentive alignment in information systems (Ba et al. 2001). Very briefly, agency theory characterizes decision making in firms by a contract between a principal (owner or shareholders) and an agent (manager). According to Eisenhardt (1985), an agency relationship arises between two or more parties when one, designated as the agent, acts for the other, designated the principal, in a particular domain of decision problems. Both of the parties are assumed to be rational economic agents, maximizing their respective utility functions. The outputs of the agency, say profits, go to the principal and can be influenced by some actions that the agent takes. The objective of the principal is to design a contract to get the agent to do what is in the principal's best interests while guaranteeing that the agent would get at least the opportunity costs of working for the firm. The principal is also constrained by the fact that the agent may not like what the principal would like him/her to do. Therefore, it is important for the principal to motivate the agent to act in the principal's best interests. Because principals could achieve this objective by the use of appropriate incentives, it is important to examine the effect of such incentives towards knowledge acquisition and use.

Transaction Cost Economics

Transaction Cost Economics (TCE) was developed by Coase (1937), Klein et al. (1978) and Williamson (1975, 1981, 1985). The fundamental argument of TCE is that in acquiring inputs, firms must choose between alternative governance structures. Firms are said to adopt market contracting as a form of governance when they rely on outside suppliers. When firms rely on internal

employees, they are said to adopt organizational hierarchy as a form of governance (Milgram and Roberts 1990; Williamson 1985). TCE argues that firms will attempt to choose governance structures that will minimize the total transaction costs associated with obtaining inputs of a desired level of quality (Klass et al. 1999). Some examples of these transactional costs are the unit price, the expected costs associated with forming and maintaining contractual and employment relationships and the costs associated with monitoring performance and quality (Williamson 1975). "Transaction costs also include the costs generated by opportunistic behavior by service providers upon whom the organization has grown dependent. Examples of such opportunistic behavior include introducing excessive price increases at contract renewal, charging excessively for adjustments or add-ons during the contract period, and cutting costs by reducing service quality in areas where outcomes are not thoroughly specified" (Klass et al. 1999 p. 114). TCE also postulates that the process by which transaction costs are generated differs across the two governance structures: market contracting and organizational hierarchy. For example, while market contracting is more likely to produce costs associated with opportunistic behavior by suppliers, organizational hierarchy is more likely to produce costs associated with bureaucratic inefficiency (Williamson 1993; Mulherin 1986).

Since the rationale of firms is to choose a governance structure that reduces transaction costs, firms that have chosen to rely on internal employees and therefore an organizational form of hierarchy can have a tendency to offer incentives in the form of merit pay, bonuses etc in order to secure cooperation of their employees. This is even more essential in the case of knowledge management because not all knowledge can be made explicit. Firms could use incentives to get internal employees to share and use knowledge because a large part of knowledge that is specific to the processes and product cannot be outsourced. But, this could result in an opportunistic behavior on the part of the employees and result in an increase in transaction costs. Therefore, from a TCE perspective, there is a need to examine the effectiveness of incentives in motivating knowledge providers and knowledge recipients to share and use knowledge.

IS Perspectives on Incentives

Prior research in IS has argued that highly motivated individuals can efficiently codify knowledge if appropriate incentives are in place (Brown and Starkey 2000). Incentives are important because "in today's knowledge management systems, knowledge acquisition and sharing, instead of being done by knowledge engineers, rely on knowledge processors' effort. (As a result,) the effect of incentives on the knowledge processor's behavior regarding knowledge sharing is more pronounced" (Ba et al 2001, p.230). It must be noted that incentives need to be provided not only to the providers of knowledge to part with their knowledge to the knowledge management system but also to the recipients of such knowledge or to the users of such knowledge management system.

Incentives can be either explicit such as economic rewards, access to information and career advancement or soft such as reputation and personal satisfaction (Hall 2001). Economic incentives to acquire knowledge include increased pay or bonuses in the forms of cash or stock options. Another incentive to acquire knowledge is to give contributors of knowledge an opportunity to tap into the knowledge of others. Finally, firms can use career advancement as an incentive to acquire knowledge. This incentive not only rewards an individual's performance but also the acts of helping other colleagues perform well (Hall 2001). In the past, reputation of a provider was recognized to be instrumental in knowledge sharing and acquisition (Davenport and Prusak 1988). Although reputation is an intangible concept, it is important because a provider's reputation can result in tangible benefits such as job security and promotion (Ba et al. 2001). Knowledge can also be acquired from people because some people gain pleasure and satisfaction by demonstrating their altruistic and pro-social behavior (Hall 2001; Palfrey and Prisbey 1997; Sproull and Kiesler 1991). For example, Hahn and Subramani (2000) observed that in electronic forums, such as Usenet newsgroups, "there are people that contribute greatly to the group by providing a lot of high quality content even though these groups do not offer monetary benefits. One potential driver behind such altruistic response behavior may be social status or self esteem" (p. 307).

However, there are obstacles as indicated earlier. Knowledge acquisition may prove too difficult because knowledge altruism may not be part of the companies' culture (Markus 2001; Davenport and Prusak 1998). In addition, people might not share their knowledge for capture for fear of losing their power and status (Orlikowski 2000). As a result, it is not clear what socio-psychological factors cause knowledge holders to contribute their knowledge to a public archive (Huber 1991). In addition, little is known about the relative effectiveness of different types of extrinsic rewards as motivators "for causing experts to provide in depth responses to those who ask for their expertise" (Huber 2001). This remains an issue even today and recent studies have suggested examining the question of what incentives are effective in encouraging knowledge contribution (Alavi and Leidner 2001). This forms the first sub objective of this part of the dissertation that will seek to examine the role of extrinsic and intrinsic incentives in the context of knowledge transfer and we propose that

> ### P1: Incentives are effective in motivating knowledge providers and knowledge users.

It is also possible that the impact incentives have on a person could differ according to that person's individual characteristics. For example, Lightfoot (1999) examined the problem of unwilling experts from the perspective of a knowledge engineer building an expert system and argued that different incentives need to be given to different types of individuals: 'locals' and 'cosmopolitans' (Ritti 1968). "A local worker is one who is loyal to the organization and seeks advancement within the structure of the company. They align their work goals with those of the organization and are motivated by success as measured by company standards (e.g. promotions, job title and responsibility). Cosmopolitans seek recognition and acceptance by their professional peers across all organizations. Thus, their loyalty is to the profession, not the company where they currently work. Cosmopolitans are motivated by factors external to the organization such as the ability to publish findings, to attend conferences and to establish a reputation in the field" (Lightfoot 1999, p.144). Since these definitions are reasonably comprehensive, we use them to define "local" or "internal" and "cosmopolitan" or "external" experts in this dissertation. We use the terms "internal" and "external" to signify the orientation of such experts. Lightfoot (1999) argues that a firm should follow different strategies to motivate the two classes of experts to share knowledge. For example, while incentives such as career advancement, job security and promotion could motivate internal experts to contribute knowledge, incentives such as a larger travel budget, better equipment and more time off to conduct research could motivate external experts. Although these arguments appear rational, there has been no empirical confirmation of the arguments till date. In fact, Lightfoot (1999) states the need for future research before each strategy is formalized for implementation. Therefore, one needs to examine the role that incentives play in motivating experts, in order to confirm and validate the arguments as explained earlier. This forms the second sub objective of this study. Specifically we attempt to examine the following question in the context of IS experts by classifying them as internal and external experts:

- Does the impact of incentives differ according to the orientation of the expert: internal and external?

We provide the rationale for the propositions that come out of this question by using Herzberg's motivation-hygiene theory according to which the factors that make people happy are different from those that make them unhappy. These factors are called hygiene and motivator factors. Hygiene factors are those that avoid dissatisfaction. However, these factors do not motivate people. Examples of such factors are company policy and administration, supervision, working conditions, salary, status and security. On the other hand, motivator factors lead to satisfaction and motivate people. Such factors include achievement, recognition, responsibility, personal growth and advancement. Following these characteristics, it is reasonable to expect that incentives based on motivator factors will motivate "internal" and "external" experts to share knowledge to a greater degree than incentives based on hygiene factors. Otherwise stated,

> ### P2: Overall, Incentives based on motivator factors will motivate both internal and external experts to share knowledge to a greater degree than incentives based on hygiene factors.

Studies on tasks are not new and, in the past, tasks have been classified into various types. For example, tasks have been classified on the basis of complexity (Shaw 1954), difficulty (Bass et al. 1958), dimensions of tasks at the work-unit level (Poole 1978) and what the group or individual do to accomplish a task i.e. circumplex model (McGrath 1984). For the purpose of this dissertation, we classify tasks into simple and complex (Campbell 1988; Zigurs and Buckland 1998). Simple tasks are those "that have a single desired outcome, a single solution scheme and no conflicting interdependence or solution scheme/outcome uncertainty" (Zigurs and Buckland 1998, p.325). Thus, these tasks are free of ambiguity and require less focus on information processing. IS experts working on simple tasks should be able to share knowledge (mainly explicit) without much cognitive effort since there is no ambiguity and therefore we propose that the incentives based on hygiene needs should motivate the IS experts to share knowledge. Otherwise stated,

> ### P3: Incentives based on hygiene needs will motivate the IS experts working on simple tasks to share knowledge.

On the other hand, complex tasks are characterized by three qualities. Very briefly, complex tasks are characterized by 1) unknown and uncertain alternatives or consequences of action (March and Simon 1958, pp. 139-141). 2) inexact or unknown means-ends connections (pp.148-149). 3) the existence of a number of subtasks which may or may not be easily factored into nearly independent parts (pp. 151-152). Furthermore, complex tasks are divided into decision task types, judgment type tasks, problem tasks types and fuzzy task types (Please refer to Campbell 1988; Zigurs and Buckland 1998 for a detailed explanation of these types). An IS expert very often has to deal with such complex tasks, more specifically, judgmental tasks. The characteristics of judgmental tasks include the conflicting and probabilistic nature of task information. Therefore it requires the task doer to consider and integrate diverse sources of information and make a judgment or prediction about the likelihood of some

future event. IS experts thus deal with a lot of ambiguity and have to focus on information processing to a grater degree than with simple tasks to elicit knowledge. Therefore, we propose that incentives based on motivator needs should motivate such IS experts to a greater degree to share knowledge than incentives based on a hygiene needs. This can be stated as follows:

> **P4: Incentives based on motivator needs will motivate IS experts dealing with complex tasks to a greater degree to share knowledge than incentives based on a hygiene needs.**

Answers to the questions raised above should throw light on the role of incentives to acquire knowledge. It's also very critical that when knowledge is ready to be acquired from volunteers, firms should ensure that knowledge is captured to the fullest extent. Although, this is a question of employing the right method, it is difficult as will be discussed next.

Efficacy of Methods

As stated earlier, many studies in the IS domain have recognized that knowledge acquisition is a "*bottleneck*" and have proposed different solutions. For example, there have been numerous studies primarily in the expert systems domain that have either proposed new methods and tools of knowledge acquisition, or compared methods of knowledge acquisition (Jones and Miles 1998; Holsapple and Wagner 1996; Jones et al. 1996; Odeyato 1995; Holsapple and Raj 1994; McGeorge and Rugg 1992; Nicholson 1992; Boose 1989; Phythian and King 1992). Similarly, studies in the mainstream MIS literature have argued that the techniques for requirements analysis and knowledge acquisition are similar (Byrd et al. 1992) and have proposed methods to (1) identify sources of expertise for knowledge acquisition (Stein 1992), and, (2) capture knowledge (Agarwal and Tanniru 1990; Massey and Wallace 1991; Abdul-Gader and Kozar 1990; Moody et al. 1998).

Although literature in the MIS area does indicate the feasibility of capturing knowledge, there is no consensus about which method is better. For example, while findings from one study report improved performance in capturing knowledge using cognitive interviewing (Moody et al. 1998), findings from another study indicate that structured interview is better (Agarwal and Tanniru 1990). In addition, studies in the mainstream MIS literature have not compared the efficacy of more than two methods of knowledge acquisition for a single domain (see Burton et al. 1987 for exception) and as a result, have done little to build consensus on the best method for knowledge acquisition. For example, some studies have suggested that repertory grid analysis is an appropriate method for knowledge acquisition (Tan and Hunter 2002) in contrast to other studies that have mentioned mentoring and story telling as being appropriate (Swap et al. 2001).

Therefore, there is a need to examine the various methods of knowledge acquisition in terms of efficiency and effectiveness and identify the best method for knowledge capture. This forms the second part of the dissertation, the findings of which will help build consensus on knowledge acquisition methods that is presently lacking in the MIS domain. For the purposes of this study, we plan to use three knowledge acquisition methods that have been used in earlier studies namely, storytelling, structured interview and repertory grid analysis. First, we will seek to examine the efficiency and effectiveness of these three different knowledge acquisition methods in the context of single experts in a single domain. We plan to compare the performance of the methods in terms of efficiency and effectiveness because these measures have been used in previous studies (Agarwal and Tanniru 1990; Moody et al. 1998). In line with previous research, we measure 'efficiency' by the number of informative propositions generated per task minute (Agarwal and Tanniru 1990; Hoffman 1987). 'Effectiveness' is measured by the completeness of detail recalled per event (Moody et al. 1998). We will measure effectiveness of the technique using a completeness of detail (COD) instrument (Moody et al. 1998). COD is a seven point scale indicating the degree of completeness of detail for each event.

We will then extend our hypotheses to examine the efficiency and effectiveness of knowledge acquisition from multiple experts because prior studies have suggested that knowledge acquisition from multiple experts would avoid some of the pitfalls of relying on a single expert (Mittal and Dym 1985; Liou 1998) such as:

1. Difficulty in allocating adequate time by a key individual in the organization that may create a bottleneck in the knowledge development process

2. Personal bias that might affect the performance of the knowledge system

3. Limitation to a single line of reasoning that does not necessarily emulate real life decision making

4. Incomplete domain expertise that may affect the performance of the system (McGraw and Harbison-Briggs 1989).

Using multiple experts for eliciting knowledge would further assure that the knowledge base is complete, improves the likelihood of obtaining specialized knowledge in the sub-domains of the problem and increases the quality of the acquired knowledge (Liou 1998). Again, while the advantages of using multiple experts for knowledge acquisition are clear, there are no studies that examine the efficiency and effectiveness of the three different knowledge acquisition methods, namely, storytelling, structured interview and repertory grid analysis in the context of multiple experts. Therefore, the other sub objective of this dissertation will be to examine the efficiency and effectiveness of the three earlier chosen knowledge acquisition methods by comparing them in the context of multiple experts for a single domain.

Conclusion

Knowledge acquisition continues to remain a bottleneck. This proposal aims to contribute to the existing literature on knowledge management in many ways by primarily examining:

1. The role of incentives in knowledge acquisition.
2. The efficiency and effectiveness of methods to capture knowledge in the case of both single and multiple experts.

Specifically, the contributions of this dissertation would be manifold. First, we hope to shed some light on the incentives given to IS experts with respect to knowledge acquisition. Besides, we also attempt to provide a ranking of such incentives in terms of their perceived importance for IS experts. Second, we investigate whether the impact of incentives differs according to the orientation of the IS expert: internal and external. To this extent, we differentiate incentives as hygiene factors and motivators to study their differential impacts in capturing knowledge from IS experts. Third, we examine if there is a moderating effect of tasks, simple and complex, on the incentives offered for knowledge capture. Fourth, we examine the efficiency and effectiveness of three techniques of knowledge acquisition for multiple experts in order to observe if there is change in performance of the methods.

The findings from our study would enable a firm to capture knowledge effectively and efficiently by offering the right incentives to the right people for the right tasks using the right methods. It is hoped this would help firms to successfully implement knowledge management initiatives.

References

Available on request.