International Review of Business Research Papers
Vol.3 No.2 June 2007, Pp. 340 - 361

Enhancing Knowledge Sharing with Information and Communication Technology (ICT)

Michelle M. S. Phang* and Soon-Yau Foong**

The acceleration of technological change and trade liberalization in the 1990s have significantly intensified market competition and transformed the world economic infrastructure from a resource- and manufacturing-based economy to one in which knowledge and services are the key drivers of economic growth. In order for an organization to capitalize on its knowledge and truly become a learning organization, it must begin to systematically manage and leverage knowledge existing internally and externally to create and sustain its competitive advantage. Numerous empirical studies on knowledge management have examined the relative effectiveness of various enablers, such as organizational structure, technology, culture, managerial system and strategy on knowledge creation and sharing in organizations. The enablers examined earlier are mostly related to organizational infrastructure that promotes knowledge sharing in organizations. This paper examines specifically the critical role of information and communication technology (ICT) in facilitating and enhancing knowledge sharing and organizational performance. This study adopted a process oriented approach by using Nonaka's (1994) knowledge sharing model. The results indicate that significant positive effects of ICT support on knowledge sharing and all dimensions of knowledge sharing are significant predictors of organizational performance.

Field of Research: Knowledge Management, Managerial Accounting

1. Introduction

The intense market competition as a consequence of the advent of sophisticated technologies and trade liberalization movement in the 1990s has significantly changed the way businesses operate. Economists ascribed the changes in organizations to the transformation of the world economic infrastructure from a resource- and manufacturing-based economy to one in which knowledge and services are the key drivers of economic growth. In order for an organization to capitalize on its knowledge and truly become a learning organization, it must begin to

---

*Michelle M.S. Phang, HELP University College, Kuala Lumpur, Malaysia
Email: phangms@help.edu.my
**Soon-Yau Foong, University Putra Malaysia, Serdang, Malaysia.
Email: syfoong@putra.upm.edu.my

systematically manage and leverage knowledge existing internally and externally to create and sustain its competitive advantage. Numerous past empirical studies on knowledge management have examined the relative effectiveness of various enablers, such as organizational structure, technology, culture, managerial system and strategy on knowledge creation and sharing in organizations. The enablers examined earlier are mostly related to organizational infrastructure that promotes knowledge sharing in organizations. With the advent of information and communications technology (ICT), it is both technically and economically feasible to collect and share valuable information and knowledge for the purpose of promoting creation of innovative ideas across organizational functions, divisions and geographical boundaries (Boland et al., 1994; Davenport and Prusak, 1998; Fowler, 2000; Olson et al., 1993). ICT can contribute immensely to productivity as it can effectively condensed time and space barrier for knowledge sharing within firms as well as within a network of firms (Elliott and Jacobson, 2002). Many firms have begun to take advantage of ICT as a new and innovative way in which information of all types can be accumulated and analyzed. ICT is a part of the critical and essential technical infrastructure for knowledge sharing, and ultimately, the basic infrastructure for knowledge management activities (Bolisani and Scarso, 1999).

In recent years, there is an increasing interest in how a firm can use its ICT to facilitate knowledge sharing. A significant body of literature has explored the relationship between ICT and knowledge sharing in general (Bolisani and Scarso, 1999; Hendriks, 2001; Luan and Serban, 2002; Roberts, 2000, Johnson, 2003; Robertson et al., 2002; Song, 2002; Sproull and Kiesler, 1986). However, the nature and effectiveness of ICT in promoting knowledge sharing have not been specifically addressed. For individuals, whose competitive advantage is derived from their possession of pertinent knowledge, skills and experiences, effective knowledge creation and sharing underpin their future growth and success of their organizations. The objective of this paper is to examine empirically the relationship between ICT support and nature and extent of knowledge sharing among professional accountants in Malaysia. In addition, this study investigates the effect of knowledge sharing on organizational performance.

2. Literature Review

2.1. Knowledge as a Theoretical Construct

Epistemologists spend their entire lives trying to identify and define knowledge. There is, however, no clear consensus on the definition of knowledge. Various definitions have been derived from the knowledge management literature. For instance, the famous Japanese management scholar Ikujiro Nonaka defines knowledge as justified personal belief toward the truth (Nonaka, 1991; Nonaka and Takeuchi, 1995). Knowledge has also been defined as mix of experiences and insights (Davenport and Prusak, 1998) and methodologies and know-how (Wiig, 1993). Bolisani and Scarso (1999) consider knowledge as a combination of information, ideas, procedures, and perceptions that guide a person’s actions and decisions. As such, knowledge is generated when we make connections out of information and establish a meaningful relationship among them.

The knowledge-based view posits that knowledge is 'the' resource of the future, and it is considered to be the most prominent resource of a firm in terms of its contribution to value creation and its strategic significance to sustainable competitive advantage (Nonaka, 1991, 1994; Nonaka and Konno, 1998; Senge, 1990). However, the value of knowledge can only be realized when it is effectively shared, managed and used to enhance decision-making.

2.2. Sharing Tacit and Explicit Knowledge

The sharing of knowledge among employees is a vital component of the knowledge management activities (Cabrera and Cabrera, 2002; Jarvenpaa and Staples, 2000; Nahapiet and Ghoshal, 1998; Wasko and Faraj, 2000). Based on Nonaka's knowledge sharing model (1994), as shown in Figure 1, each of the processes is expected to enhance knowledge sharing effectiveness. Nonaka (1994) identify four modes of knowledge sharing: socialization, externalization, internalization and combination. This framework is based on the dichotomy between tacit knowledge and explicit knowledge as well as the distinctions between individual knowledge and collective knowledge. Nonaka (1994) considers the conversion process as a 'knowledge spiral' in which tacit and explicit knowledge interacts and interchanges into each other in a never-ending spiral.

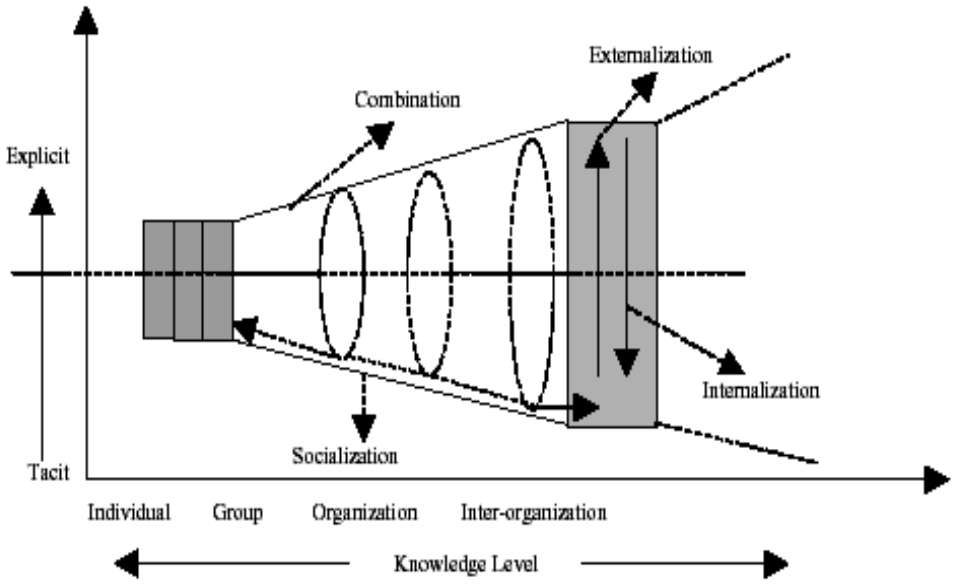

Figure 1: The Knowledge Sharing Model
Source: Adapted from Nonaka (1994)

Socialization is the sharing of tacit knowledge such as mental models and technical skills between individuals (Nonaka, 1994; Nonaka and Konno, 1998; Seufert et al., 2003). Nonaka and Konno (1998) suggest that tacit knowledge is shared through joint activities; such as spending time together and being in the same environment. Informal networks are especially crucial for this process. Externalization is the conversion of tacit knowledge into explicit knowledge, involving the transformation of one's idea, experience or insight into readily understandable form or formal models

(Bolisani and Scarso, 1999; Nonaka and Konno, 1998; Seufert et al., 2003). Combination is the conversion of explicit knowledge into more systemized or complex sets of explicit knowledge (Nonaka and Konno, 1998; Seufert et al., 2003) and making it more usable. Internalization is the conversion of explicit knowledge into tacit knowledge (Nonaka and Konno, 1998; Seufert et al., 2003). When explicit knowledge is internalized into an individual's tacit knowledge, a shared mental model is formed within the firm, thereby starting a new spiral of knowledge conversion. As the interaction among these four processes iterates, it facilitates the exchange, refinement and extension of organizational knowledge based.

2.3. The Role of ICT in Knowledge Sharing

In the early 1990s, knowledge management focused primarily on the management of data based resources (Petrides, 2002). Consequently, many believe ICT is nothing else but a tool for formatting, filtering and summarizing data into information. Today, the creation, transfer and management of knowledge are regarded as the central issues in knowledge management. In view of that, the role of ICT is more than just capturing data. A vital role is ascribed to ICT as a technical infrastructure to facilitate information handling (Hedeline and Allwood, 2002) and knowledge sharing (Rumizen, 1998) due to its very nature of facilitation, coordination and communication. Previous knowledge management research has acknowledged the critical role of ICT in knowledge management. Ware and Degoey (1998) include work flow tools for knowledge dissemination. Loudon and Loudon (1997) identify computer-aided design system for knowledge creation and groupware for knowledge sharing. Ruggles (1997) includes internet forum for knowledge transfer and Davenport and Prusak (1998) suggest data mining applications for knowledge discovery. Other studies (Flanagin, 2002; Lueg, 2001; O'Leary, 1998) also address the potential benefits of ICT as facilitator of knowledge management. These studies support much of the information system literature which states that ICT is an important enabler (O'Dell and Grayson, 1998; Ruggles, 1998) in knowledge management. Therefore, an essential component of knowledge management infrastructure would be a system that would not only collect, organize and disseminate data but would also facilitate exchange of information, insight, experience, idea and knowledge.

2.4. The Fit between ICT and Knowledge Sharing

The ability of ICT to support knowledge management in a meaningful manner depends on the basic nature of knowledge. In general, ICT have two capabilities with respect to knowledge; codifying knowledge and creating networks. For the most part, ICT has focused on applications to support the capture, storage, retrieval and distribution of explicit knowledge. Little work has been done on tapping the tacitness of knowledge. Indeed, when ICT was first widely adopted in the design of accounting information systems, which normally involve compliance of extremely explicit rules and procedures, the technologies were very much focused on automating various accounting processes (Bloodgoog and Salisbury, 2001). ICT is used to make explicit information and knowledge readily available in databases accessible by management information systems, decision support systems and expert systems. Through the use of ICT that make explicit knowledge even more explicit and more transferable, firms are able to leverage their knowledge resources.

On the other hand, it is more difficult to extract, codify and disseminate tacit knowledge as tacit knowledge is highly personal and is embedded in the human brain. Consequently, efforts to use ICT to support tacit knowledge sharing can be costly and less effective. ICT alone will not be able to capture the conditions required to share tacit knowledge fully and effectively. This suggests that ICT may only be useful for the exchange, coordination and articulation of explicit knowledge, particularly if team members are geographically far apart. In addition, the information richness theory (Daft and Lengel, 1986) asserts that the choice and use of media is heavily dependent upon the fit between the task and the media. Based on this need for appropriate "fit", ICT such as email, internet, and intranet is considered as a relatively lean media. Even though ICT provides a channel for asynchronous interactions but the interactions can be limited mostly to written words. To make tacit knowledge more explicit using a lean ICT can result in a loss of critical components of the tacit knowledge (Bloodgood and Salisbury, 2001). This type of less rich media, ICT, is potentially useful for the exchange of explicit knowledge but may be inappropriate for the transfer of tacit knowledge. Roberts (2000) adds that ICT only facilitates communication but it cannot replace face to face contact among individuals which is often a prerequisite for the successful transfer of tacit knowledge.

Other research on the choice and use of communication media, however, has rejected the idea that a particular media should be chosen based on its rich or lean properties alone (Lee, 1994; Ngwenyama and Lee, 1997). Several empirical studies find that actual media choice and use is inconsistent with the information richness theory (Yates and Orlikowski, 1992; Markus, 1994). Lee (1994) highlights that individuals do not passively receive data from others, instead, they actively interpret data to produce meaning that fits into their own perspectives. Hence, the richness afforded to a particular ICT is highly dependent on the interaction between the ICT, the individuals and the organizational context in which it is applied. Moreover, with the tremendous development in ICT, individuals may use a variety of ICT such as email, chat room, bulletin boards and discussion group to communicate information, share knowledge and combine efforts across time and space barriers (Carneiro, 2001). A further technological push by more contemporary ICT, for example, groupware technologies, video conferencing, expert databases and synchronous collaboration tools, suggests that ICT could not only harness tacit knowledge exchange but also retain, at least partially, its richness. ICT can also be used as a means to catalog those employees who are holding specific critical tacit knowledge. ICT, hence, could enable communication between those who need the knowledge and those who have the knowledge. Instead of codifying tacit knowledge, firms can make use of the networking capabilities of ICT to bring people together for sharing tacit knowledge without making it explicit. In this way, they may share tacit knowledge across distance in a virtual community. Through groupware applications and intranets, which typically include features such as shared databases, collaborative spaces, advanced communication features, electronic yellow pages, automated knowledge maps and expertise data bases, it becomes easier to locate or connect people who might either offer or provide relevant knowledge.

In general, the literature does support the relevance of ICT in facilitating knowledge sharing. However, the earlier studies do not highlight the more specific relationships

among the variables involved. In particular, they do not distinctly differentiate the relative effectiveness of ICT in sharing explicit and tacit knowledge.

2.5. Hypotheses

Based on the literature reviewed, a research model was developed to examine the relationships between knowledge sharing, ICT support and firm performance. Figure 2 illustrates the effects of ICT support on various dimensions of knowledge sharing and which in turn affect firm performance.

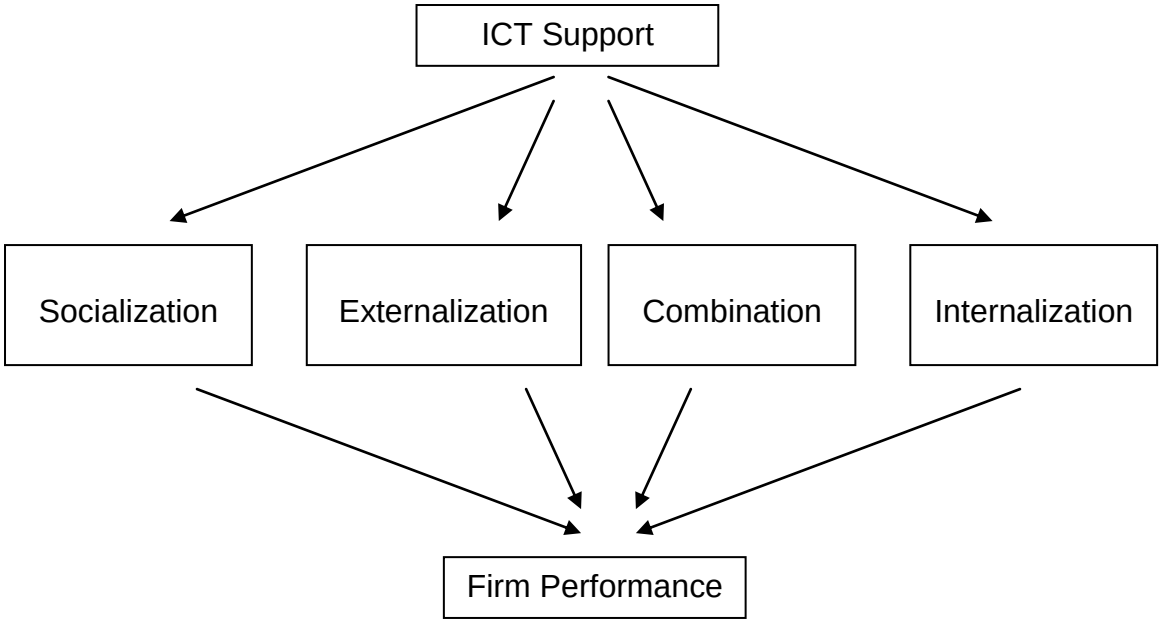

Figure 2: Effects of ICT Support on Knowledge Sharing and Firm performance

We would expect the following relationships to hold true:

H_1 : There is a positive relationship between the extent of ICT support and knowledge sharing

$H_{1(a)}$: There is a positive relationship between the extent of ICT support and knowledge sharing through the Combination mode

$H_{1(b)}$: There is a positive relationship between the extent of ICT support and knowledge sharing through the Externalization mode

$H_{1(c)}$: There is a positive relationship between the extent of ICT support and knowledge sharing through the Socialization mode

$H_{1(d)}$: The is a positive relationship between the extent of ICT support and knowledge sharing through the Internalization mode

H_2 : The extent of knowledge sharing will positively affect the level of firm performance

$H_{2(a)}$: The extent of knowledge sharing through the Combination mode will positively affect the level of firm performance

$H_{2(b)}$: The extent of knowledge sharing through the Externalization mode will positively affect the level of firm performance

$H_{2(c)}$: The extent of knowledge sharing through the Socialization mode will positively affect the level of firm performance

$H_{2(d)}$: The extent of knowledge sharing through the Internalization mode will positively affect the level of firm performance

3. Methodology and Research Design

3.1. Sample and Data Collection

This study used a questionnaire-based survey to gather quantitative data for analysis. Copies of the questionnaire were distributed to members of the Malaysian Institute of Accountants (MIA) who were practicing in Kuala Lumpur and Klang Valley. A respondent must have been an employee of a firm for at least six months. This is to ensure that each respondent has had a reasonable period of acclimation and socialization to the firm. A respondent who had worked for his present employer for less than six months was excluded from further analysis. Multiple-item measures were used and each item was measured on a five-point Likert scale, ranging from 1 to 5. The measure for each variable was adapted from prior studies to ensure the constructs used in this study have already been validated. The knowledge sharing constructs were those from Nonaka et al. (1994) and the firm performance construct was based on those used by Abernethy et al. (2004) and Bisbe and Otley (2004). However, appropriate changes in wording were made to fit the context of the accounting profession. The questionnaire was pre-tested to assess the relevance of the items included for measuring each construct, as well as to ensure that the questions asked were free from ambiguity. Comments from the pre-testing were

used to revise and improve the wordings used and the design layout. Out of the 1,000 mailed questionnaires, 120 were returned, providing a response rate of 12 %. Findings from the independent-samples t-test did not indicate significant differences between early respondents and the late respondents, suggesting the absence of any significant non-response bias.

3.2. Definitions and Measurements of Constructs

3.2.1. ICT Support

ICT is a crucial element when assessing the organizational contextual factor in a professional setting. Our literature review indicates that ICT could be valuable and useful to facilitate knowledge sharing. By integrating information networks, firms are more actively engage in collaborative, complex, problem-solving tasks and able to coordinate distributed activities across different functions and geographical boundaries. A seven-item adapted from various studies (Hedeline and Allwood, 2002; Loudon and Loudon, 1997; Ware and Degoey, 1998) was used to measure the ICT support. Anchors for ICT support scales were “Rarely” and “Always”. ICT support variable was a weighted score that was computed from the rating score for accessibility to ICT and that for perceived effectiveness of ICT.

3.2.2. Mode of Knowledge Sharing

Numerous studies have addressed knowledge management processes. For example, Ruggles (1997) considers three processes in knowledge management; generation, codification, and transfer. Marquardt (1996), however, divides knowledge management into four processes; acquisition, creation, transfer and utilization, and storage. On the other hand, O’Dell (1996) separates knowledge management processes into identify, collect, adapt, organization, apply, share, and create. Among theses processes, sharing-related activities; for example, transferring (O’Dell, 1996), disseminating (Wiig, 1993), distributing (Liebowitz, 2000) become important because firms can only realize the full value of knowledge when it is shared and used. Knowledge sharing is an iterative process whereby individuals within a firm share tacit and explicit knowledge (Nonaka and Takeuchi, 1995). This study adopted the knowledge sharing model by Nonaka and Takeuchi (1995) as the basis for knowledge sharing measures. This model has been widely accepted, and used in many research (Becerra-Fernandez and Sabherwal, 2001; Lee and Choi, 2003; Sabherwal and Bacerra-Fernandez, 2003). The study adapted the questionnaire items that had been validated by Nonaka et al. (1994) to assess the modes of knowledge sharing, with changes in wording that were perceived as appropriate for the accounting profession setting . All items were measured using a five-point Likert scale, with “Rarely” at one end and “Always” at the other end.

3.2.3. Firm Performance

The use and importance of appropriate performance measures have often been discussed and in particular, the limitation of financial or accounting-based indicators of performance. Non financial measurement, such as Balanced Scorecard (Kaplan and Norton, 1992, 1993, 1996) and *Tableau de Bord* (Epstein and Manzoni, 1998) allow a better understanding of firm performance with regard of time horizons and

from diverse perspectives. A prominent methodology, Balanced Scorecard is constructed using four groupings which representing perspectives from customer, internal business, financial and innovation and learning. Like Balance Scorecard, *Tableau de Bord* is a set of wide ranging measuring instruments showing the degree to which a firm is fulfilling its objectives. The issue of performance measures only gets more acute when it is defined in a knowledge-based economy. Grossman (2000) stresses the importance of devising unique metrics tailored to assess the strategic value of knowledge. In order to better understand firm performance, we need to develop a multiple yet coherent measures. These measures will have to be able to reflect past knowledge and new knowledge. However, the process of choosing the appropriate knowledge management performance measures is difficult due to the complexity in designing or developing the appropriate measures. This study relied on a set of self-rating, multi-items instrument adapted from Bisbe and Otley (2004) and Chenhall and Langfield-Smith (1998) to assess effectiveness of knowledge sharing on firm's performance. All items were measured using a five-point Likert scale, with "Well below average" at one end and "Well above average" at the other end.

3.3. Reliability and Validity Analysis

The instrument's reliability was evaluated using Cronbach's alpha. Analyses were carried out on 13 items for the knowledge sharing construct, the seven items for accessibility to ICT construct and the six items for firm performance construct. The minimum accepted Cronbach's alpha value was 0.7 (Hair et al., 1998; Nunnally and Bernstein, 1994; Pallant, 2001). For convergent validity, an item is considered acceptable if its item-to-total correlation is equal to or greater than 0.3 (Pallant, 2001). Factor analysis using principle component method with varimax rotation was used to check discriminant validity. According to Hair et al. (1998) and Pallant (2001), as a rule of thumb, if the loading is in the range of ±3.0 to ±0.4, it is considered meeting the minimum level for interpretation of structure. Items with loading less than 0.3 are deleted. All of the coefficients, except Question 2 on ICT, were found to be above the minimum recommended standards: Cronbach's alpha coefficients ranged from 0.773 to 0.926, item-to-total correlation ranged from 0.394 to 0.872, and factor loading ranged from 0.397 to 0.835. Question 2 on ICT was remained for further analysis even though its item-to-total correlation is below 3.0. The rationale is that intranet/email is an important technological infrastructure for knowledge management and its item-to-total correlation value of 0.282 is very near to 3.0. Judging by the relatively high values of reliability and validity, the instruments appeared to exhibit an acceptable level of reliability and validity and demonstrated an adequate basis for further analysis.

Table 1: Results of Tests of Reliability

Measure	Number of Items	N	Cronbach's Alpha
ICT support	7	105	0.7548
Knowledge Sharing			
Socialization	4	119	0.7730
Externalization	3	118	0.7834
Combination	3	119	0.7747
Internalization	3	120	0.7959
Firm performance			
Financial performance	3	112	0.8823
Non financial performance	3	115	0.9261

3.4 Correlation and Regression Analyses

The expected fit between ICT support and knowledge sharing as expressed by H_1 was tested by analyzing the zero-order correlation coefficient between the aggregated construct that represents ICT support and knowledge sharing. The correlation coefficient between ICT support and knowledge sharing would present a significant positive value if H_1 is supported. In addition, the correlation between knowledge sharing and firm performance was examined to determine the strength of the relationship. The association between knowledge sharing and firm performance as expressed by H_2 is supported if the correlation coefficient is a significant positive value. After the exploratory examination of correlation matrices, regression analysis was used to test the hypotheses. If tests on the regression were able to reject the null hypotheses, then, H_1 and H_2 would be supported. The equations for the hypotheses are as follows:

Knowledge sharing = $\beta_0 + \beta_1$ ICT + ε
Firm performance = $\beta_0 + \beta_1$ Knowledge Sharing + ε

4. Discussion of Findings

4.1. Demographic Profile of Respondents

Table 2 summarizes the respondents' profile. About 49% of the respondents were male and 51% were female. About 56% of the respondents aged between 25 to 34 years old and 40% between 35 and 44 years of age. The respondents represented individuals who were generally well educated with close to 64% possessed a bachelor's degree and about 20% with a master's degree. Approximately 42% of the respondents were members of UK's professional bodies and 35% of the respondents were members of Australia's professional bodies.

Employees of consulting and public accounting practices constituted about 37% of the total sample. This was followed by employees in the financial/banking/insurance

sector, constituting approximately 18% of the total sample. Approximately 74% of the respondents were at the managerial level and this was followed by about 14% of the respondents at the senior management level, with job designations such as partner, general manager and executive director.

4.2. Descriptive Statistics

The descriptive statistics of the variables are shown in Table 3. The mean for ICT support is 3.18 indicating ICT support as imperative infrastructure to facilitate knowledge sharing. With a mean above 4.0, internet/email is the most important ICT tool for supporting knowledge sharing. The means for all knowledge sharing dimensions are above 3.00 indicating a fairly high level of knowledge sharing through socialization, externalization, combination and internalization. Non financial performance has a higher mean and higher standard deviation than financial performance. Both means are above 3.0, reflecting an above average performance.

Table 4 shows that most employees have frequent access to ICT such as intranet, internet/email, best practices repositories, help desk/directory of expertise and groupware. The ICT that are not widely accessible are tele/video conferencing and data warehousing/mining. Table 5 shows that while respondents perceived intranet and internet/email as effective tool for knowledge sharing, they did not perceived tele/video conferencing and help desk/directory of expertise as effective tool for knowledge sharing.

Table 2: Profile of Respondents

	Number of Respondents	%
(a) Gender		
Male	58	48.7
Female	61	51.3
Total	119	100.0
(b) Age		
Under 25	0	0.0
25 – 34	67	56.3
35 – 44	47	39.5
Above 44	5	4.2
Total	119	100.0
(c) Academic Qualification		
Bachelor's	68	63.6
Master's	21	19.6
Others	18	16.8
Total	107	100.0
(d) Professional Qualification		
ACCA/CIMA/ICAEW	49	41.9
ICAA/CPA Australia	41	35.0
Others	27	23.1
Total	117	100.0
(e) Industry Type		
Manufacturing	6	5.0
Construction/Architecture/Engineering	12	10.0
Government/Education	9	7.5
Trading and Services	8	6.7
IT/Telecommunication/Software Development	7	5.8
Financial/Banking/Insurance	21	17.5
Consultancy/Public Accounting	44	36.7
Others	13	10.8
Total	120	100.0
(f) Position		
Executive	12	10.9
Managerial	81	73.6
Senior management	15	13.6
Others	2	1.8
Total	110	100.0

Table 3: Descriptive Statistics of Variables

Measure	N	Min	Max	Mean	Std. Deviation
ICT support	103	1.00	4.70	3.18	0.753
Intranet	113	1.00	5.00	3.71	1.288
Internet/email	113	1.00	5.00	4.34	0.870
Tele/video conferencing	111	1.00	5.00	2.49	1.289
Best practice repositories	110	1.00	5.00	3.09	1.062
Help desk/Directory of expertise	112	1.00	5.00	2.98	1.097
Data warehouse/mining	109	1.00	5.00	2.90	1.103
Groupware	110	1.00	5.00	3.02	1.399
Knowledge Sharing	116	1.46	4.77	3.30	0.707
Socialization	119	1.00	5.00	3.21	0.823
Externalization	118	1.00	5.00	3.33	0.867
Combination	119	1.00	5.00	3.29	0.864
Internalization	120	1.00	5.00	3.38	0.885
Firm performance	110	1.33	5.00	3.27	0.737
Financial performance	112	1.00	5.00	3.25	0.806
Non financial performance	115	1.00	5.00	3.31	0.849

Scale: 1 = Rarely or well below average, 5 = Always or well above average

Table 4: Descriptive Statistics for Accessibility to ICT

Measure	N	Min	Max	Mean	Std. Deviation
Intranet	115	1.00	5.00	3.86	1.420
Internet/email	115	1.00	5.00	4.47	0.958
Tele/video conferencing	114	1.00	5.00	2.40	1.437
Best practice repositories	113	1.00	5.00	3.12	1.174
Help desk/Directory of expertise	114	1.00	5.00	3.02	1.255
Data warehouse/mining	111	1.00	5.00	2.85	1.252
Groupware	111	1.00	5.00	3.05	1.572

Scale: 1 = Rarely, 5 = Always

Table 5: Descriptive Statistics for Perceived Effectiveness of ICT

Measure	N	Min	Max	Mean	Std. Deviation
Intranet	116	1.00	5.00	3.55	1.274
Internet/email	117	1.00	5.00	4.18	0.925
Tele/video conferencing	114	1.00	5.00	2.64	1.371
Best practice repositories	113	1.00	5.00	3.13	1.138
Help desk/Directory of expertise	115	1.00	5.00	2.97	1.123
Data warehouse/mining	112	1.00	5.00	3.00	1.170
Groupware	113	1.00	5.00	3.01	1.340

Scale: 1 = Not at all, 5 = Very effective

4.3. The Relationship between ICT and Knowledge Sharing

Data from the sample support H_1 stating that ICT support is positively correlated with knowledge sharing. As indicated in Table 6 the correlations between ICT support and dimensions of knowledge sharing are significantly positive. In particular, the association is strongest between ICT and knowledge sharing through combination. Further examination of the correlations reveals that while intranet has a significantly positive relationship with knowledge sharing through combination and internalization, internet/email has a significant positive association with socialization and externalization. Best practice repositories appeared to have positive association with all dimensions of knowledge sharing. Tele/video conferencing and help desk/directory of expertise are significantly positive associated with knowledge sharing through combination only. Data warehousing/mining is significantly correlate with all dimensions of knowledge sharing except externalization. Interestingly, groupware has no significant relationship with anyone of the dimensions of knowledge sharing at all.

Table 7 shows the regression results of ICT support against various dimensions of knowledge sharing. In general, the results suggest that only a small variance in knowledge sharing is explained by ICT support. An examination of the t-values, however, indicates the presence of significant positive relationships between ICT support and various dimensions of knowledge sharing. Therefore, H_1, $H_{1(a)}$, $H_{1(b)}$, $H_{1(c)}$ and $H_{1(d)}$ are supported.

4.4. The Relationship between Knowledge Sharing and Firm performance

Data from the sample support H_2 stating that knowledge sharing is positively correlated with firm performance. As indicated in Table 8 the correlations between knowledge sharing and firm performance are significantly positive. With the exception of socialization, all dimensions of knowledge sharing have positive significant relationship with financial and non financial performance. Overall knowledge sharing appeared to have a stronger association with non-financial performance. While knowledge sharing through internalization has the strongest relationships with both financial and non-financial performance, knowledge sharing through socialization has the weakest association with financial as well as non financial performance.

Table 9 indicates significant positive relationship between all dimensions of knowledge sharing and firm performance. Knowledge sharing explained slightly above 31% of the variance in firm performance. Given the statistical significance and the positive direction of this relationship, the result indicates that H_2 is supported. As the results indicate significant positive relationships between various dimensions of knowledge sharing and firm performance, it is reasonable to conclude that $H_{2(a)}$, $H_{2(b)}$, $H_{2(c)}$, $H_{2(d)}$ are supported. However, when all independent variables are entered into the regression equation, only internalization appeared to have a significant relationship with firm performance. In other words, internalization subsumes knowledge sharing through socialization, externalization and combination.

Table 6: Correlation between ICT Support and Knowledge Sharing

	R	*p*
Socialization	0.276	0.004
Externalization	0.269	0.005
Combination	0.360	0.001
Internalization	0.244	0.011
Total Knowledge Sharing	0.353	0.001

Table 7: Regression Analysis: ICT support and Knowledge Sharing

			Unstd. Coeff.		Std. Coeff.		
	Model		B	Std. Error	Beta	t	Sig.
1	R^2 = 0.091	Constant	2.404	.295		8.139	.000
	Adj R^2 = 0.082	ICT support	.283	.090	.301	3.130	.002
	F = 9.796						
	p = 0.002						
2	R^2 = 0.056	Constant	2.389	.347		6.882	.000
	Adj R^2 = 0.046	ICT support	.258	.106	.236	2.426	.017
	F = 5.883						
	p = 0.017						
3	R^2 = 0.049	Constant	2.521	.367		6.868	.000
	Adj R^2 = 0.046	ICT support	.255	.112	.222	2.275	.025
	F = 5.176						
	p = 0.025						
4	R^2 = 0.093	Constant	2.180	.357		6.101	.000
	Adj R^2 = 0.084	ICT support	.349	.109	.305	3.197	.002
	F = 10.223						
	p = 0.002						
5	R^2 = 0.042	Constant	2.611	.374		6.978	.000
	Adj R^2 = 0.032	ICT support	.240	.114	.204	2.098	.038
	F = 4.400						
	p = 0.038						

Dependent variable: 1. Overall knowledge sharing, 2. Socialization, 3. Externalization, 4. Combination, 5. Internalization

Table 8: Correlation between Knowledge Sharing and Firm performance

	Financial Performance		Non-Financial Performance		Overall Firm performance	
	r	*P*	*r*	*p*	*r*	*P*
Socialization	0.186	0.051	0.378	0.000	0.330	0.000
Externalization	0.315	0.001	0.378	0.000	0.407	0.000
Combination	0.447	0.000	0.472	0.000	0.522	0.000
Internalization	0.465	0.000	0.553	0.000	0.575	0.000
Overall Knowledge Sharing	0.435	0.000	0.541	0.000	0.558	0.000

Table 9: Regression Analysis: Knowledge Sharing and Firm performance

	Model		Unstd. Coeff. B	Unstd. Coeff. Std. Error	Std. Coeff. Beta	t	Sig.
1	R^2 = 0.311	Constant	1.343	.287		4.685	.000
	Adj R^2 = 0.305	Knowledge sharing	.582	.085	.558	6.857	.000
	F = 47.020						
	p = 0.000						
2	R^2 = 0.109	Constant	2.318	.271		8.567	.000
	Adj R^2 = 0.100	Socialization	.295	.082	.330	3.614	.000
	F = 13.060						
	p = 0.000						
3	R^2 = 0.165	Constant	2.113	.260		8.141	.000
	Adj R^2 = 0.158	Externalization	.346	.075	.407	4.584	.000
	F = 21.012						
	p = 0.0000						
4	R^2 = 0.272	Constant	1.800	.239		7.527	.000
	Adj R^2 = 0.266	Combination	.445	.070	.522	6.330	.000
	F = 40.069						
	p = 0.000						
5	R^2 = 0.331	Constant	1.649	.229		7.214	.000
	Adj R^2 = 0.325	Internalization	.479	.066	.575	7.311	.000
	F = 53.445						
	p = 0.000						
6	R^2 = 0.361	Constant	1.479	.274		5.394	.000
	Adj R^2 = 0.336	Socialization	-.083	.095	-.093	-.874	.384
	F = 14561	Externalization	.090	.090	.106	.999	.320
	p = 0.000	Combination	.163	.104	.191	1.569	.120
		Internalization	.360	.105	.432	3.434	.001

Dependent variable: Firm performance

5. Discussion

The results from the tests support the hypotheses regarding the predictive positive effects of ICT support on knowledge sharing and through knowledge sharing on firm performance. The positive significant relationship between ICT support and knowledge sharing supports H_1 that the greater the ICT support the greater the sharing of knowledge. This paper found that ICT support facilitated all dimensions of knowledge sharing, therefore, $H_{1(a)}$, $H_{1(b)}$, $H_{1(c)}$ and $H_{1(d)}$ are supported. As ICT is critical for codifying explicit knowledge, it is not surprise to observe that ICT support contributed more significantly to knowledge sharing through combination. As the results suggest that only a small variance in knowledge sharing is explained by ICT support, therefore, initiating knowledge sharing only through ICT support can be a risky proposition (Davenport and Prusak,1998).

Upon testing H_2, this paper found that all dimensions of knowledge sharing are salient predictors of firm performance. In particular, internalization explained the highest variance in firm performance. However, further analysis revealed that some of their effects became insignificant when they are put together. In grouping, only knowledge sharing through internalization contributed significantly to firm performance. This finding has a potentially important implication for practice. It suggests that knowledge sharing through internalization is most appropriate among professional accountants. Rather than gamble away efforts to develop all dimensions of knowledge sharing, especially under limited resource conditions, organizations should focus primarily on knowledge sharing through internalization.

6. Conclusion

This paper began with two simple questions: 1. How does ICT support affect knowledge sharing? and 2. How does knowledge sharing affect firm performance? To address these questions, this study adopted a process oriented approach by using Nonaka's (1994) knowledge sharing model. The research hypotheses were empirically examined among MIA members. From a practical point of view, the relationships among ICT support, knowledge sharing and firm performance provide clues to the types of ICT that are critical for knowledge sharing and how organizations could manage all dimensions of knowledge sharing to improve firm performance.

The findings of this study should be considered in the lights of its inherent limitations. This study only focused on the effect of ICT support on knowledge sharing among professional accountants. Although this paper is able to examine the research questions with considerable richness among individuals who regard knowledge as paramount importance in their jobs, it limited the generalizability of the results. Unlike other professions, accounting profession has its unique attributes. More than average, professional accountants required sophisticated knowledge and whose expertise is the source of competitive advantage. Therefore, it remained to be seen whether the results of this study can be generalized to other lines of work. In addition, the current findings may be potentially bias (e.g. social desirability effect) as the study is based on self-report data. Even though self-report is typical of survey questionnaire, it is by no means an ideal method of data collection. However, the fact

that the study's instrument met the minimum level of reliability, factor loadings and item-to-total correlations support the validity of the study.

References

Abernethy, M. A., Bouwens, J. and van Lent, L. 2004. "Determinants of control system design in divisional firms", *The Accounting Review*, vol. 79, no. 3, pp. 545-570.

Becerra-Fernandez, I. and Sabherwal, R. 2001. "Organizational knowledge management: A contingency perspective", *Journal of Management Information Systems*, vol. 18, no. 1, pp. 23-55.

Bisbe, J. and Otley, D. 2004. "The effects of the interactive use of management control systems on product innovation", *Accounting, Organizations and Society*, vol. 29, pp. 709-737.

Bloodgood, J. M. and Salisbury, D. 2001. "Understanding the influence of organizational change strategies on information technology and knowledge management strategies", *Decision Support Systems*, vol. 31, pp. 55-69.

Boland, R. J., Tenkasi, R. V. and Te'eni, D. 1994. "Designing information technology to support distributed cognition", *Organization Science*, vol. 5, no. 3, pp. 456-475.

Bolisani, E. and Scarso, E. 1999. "Information technology management: a knowledge-based perspective", *Technovation*, vol. 19, pp. 209-217.

Cabrera, A. and Cabrera, E. F. 2002. "Knowledge-sharing dilemmas", *Organization Studies*, vol. 23, no. 5, pp. 687-710.

Carneiro, A. 2001. "The role of intelligent resources in knowledge management", *Journal of Knowledge Management*, vol. 5, no. 4, pp. 358-367.

Chenhall, R. H. and Langfield-Smith, K. 1998. "The relationship between strategic priorities, management techniques and management accounting: an empirical investigation using a systems approach", *Accounting, Organizations and Society*, vol. 23, pp. 243-264.

Daft, R. L. and Lengel, R. H. 1986. "Organizational information requirements, media richness and structural design", *Management Science*, vol. 32, no. 5, pp. 554-570.

Davenport, T. H. and Prusak, L. 1998. Working Knowledge: How Organizations Manage What They Know, Harvard Business School Press, Boston.

Elliott, R. K. and Jacobson, P. D. 2002. "The evolution of the knowledge professional", *Accounting Horizons*, vol. 16, no. 1, pp. 69-80.

Epstein, M. and Manzoni, J. F. 1998. "Implementing corporate strategy: From tableaux de bord to balanced scorecards", *European Management Journal*, vol. 16, no. 2, pp. 190-203.

Flanagin, A. J. 2002. “The elusive benefits of the technology support of knowledge management”, *Management Communication Quarterly*, vol. 16, no. 2, pp. 242-248.

Fowler, A. 2000. “The role of AI-based technology in support of the knowledge management value activity cycle”, *Journal of Strategic Information Systems*, vol. 9, no. 1, pp. 107-128.

Grossman, R. 2000. “Measuring up”, *HR Magazine*, vol. 45, no. 1, pp. 28-35.

Gupta, A.K. and Govindarajan, V. 1984. “Business unit strategy, managerial characteristics and business unit effectiveness at strategy implementation”, *Academy of Management Journal*, vol. 27, pp. 24-41.

Hair, J. F., Black, B., Babin, B., Anderson, R.E. and Tatham, R. L. 1998. Multivariate Data Analysis, Prentice Hall, Englewood Cliffs.

Hedelin, L., and Allwood, C. M. (2002). “IT and strategic decision making”, *Industrial Management and Data Systems*, vol. 102, no. 3, pp. 125-139.

Hendriks, P. 2001. “Many rivers to cross: From ICT to knowledge management systems”, *Journal of Information Technology*, vol. 16, pp. 57-72.

Jarvenpaa. S. L., and Staples, D. S. 2000. “The use of collaborative electronic media for information sharing: An exploratory study of determinants”, *Journal of Strategic Information System*, vol. 9, no. 1, pp. 129-154.

Johnson, J. T. 2003. “The business case for collaborative technologies at professional services firms”, White Paper, Nemertes Research.

Kaplan, R. S. and Norton, D. P. 1992. “The balanced scorecard - measures that drive performance”, *Harvard Business Review*, vol. 70, no1, pp. 58-63.

Kaplan, R. S. and Norton, D. P. 1993. “Putting the balanced scorecard to work”, *Harvard Business Review*, vol. 71, no. 5, pp. 134-147.

Kaplan, R. S. and Norton, D. P. 1996. The Balanced Scorecard, Harvard Business School Press, Cambridge.

Lee, A. 1994. “Electronic mail as a medium for rich communication: An empirical investigation using hermeneutic interpretation”, *MIS Quarterly*, vol. 18, no. 2, pp. 143-157.

Lee, H. and Choi, B. 2003. “Knowledge management enablers, processes, and organizational performance: An integrative view and empirical examination”, *Journal of Management Information Systems*, vol. 20, no. 1, pp. 179-228.

Lieboowitz, J. 2000. Building Organizational Intelligence: A Knowledge Management Primer, CRC Press, Boca Raton.

Loudon, K. C. and Loudon, J. P. 1997. Management Information Systems, 2nd Edition, Prentice Hall, Upper Saddle River.

Luan, J. and Serban, A. M. 2002. "Technologies, products, and models supporting knowledge management", *New Directions for Institutional Research*, vol. 113, pp. 85-104.

Lueg, C. 2001. "Information, knowledge and networked minds", *Journal of Knowledge Management*, vol. 5, no. 2, pp.151-159.

Markus, M. L. 1994. "Electronic mail as the medium of managerial choice", *Organization Science*, vol. 5, no. 4, pp. 502-527.

Marquardt, M. 1996. Building the Learning Organization: A System Approach to Quantum Improvement and Global Success, McGraw Hill, New York.

Nahapiet, J. and Ghoshal, S. 1998. "Social capital, intellectual capital and the organizational advantage", *Academy of Management Review*, vol. 23, no. 2, pp. 242-267.

Ngwenyama, O. J. and Lee, A. S. 1997. "Communication richness in electronic mail: Critical social theory and the contextuality of meaning", *MIS Quarterly*, vol. 21, no. 2, pp. 145-168.

Nonaka, I. 1991. "The Knowledge-Creating Company", *Harvard Business Review*, November-December, pp. 96-104.

Nonaka, I. 1994. "A dynamic theory of organizational knowledge creation", *Organization Science*, vol. 5, no. 1, pp. 14-37.

Nonaka, I. and Konno, N. 1998. "The concept of "ba": Building a foundation for knowledge creation", *California Management Review*, vol. 40, no. 3, pp. 40-54.

Nonaka, I. and Takeuchi, H. 1995. The Knowledge Creating Company, Oxford University Press, Oxford.

Nonaka, I., Byosiere, P. and Konno, N. 1994. "Organizational knowledge creation theory: A first comprehensive test", *International Business Review*, vol. 3, no. 4, pp. 337-351.

Nunnally, J. C. and Bernstein, I. H. 1994. Psychometric Theory, 3rd Edition, McGraw Hill Inc, New York.

O'Dell, C. 1996. A Current Review of Knowledge Management Best Practice: Conference on Knowledge Management and the Transfer of Best Practices, Business Intelligence, London.

O'Dell, C. and Grayson, C. J. 1998. "If only we knew what we know: Identification and transfer of best practices", *California Management Review*, vol. 40, no. 3, pp. 154-174.

O'Leary, D. E. 1998. "Using AI in knowledge management: Knowledge bases and ontologies", *IEEE Intelligent Systems*, vol. 3, no. 3, pp. 34-49.

Olson, J. S., Card, T. K., Landauer, G. M., Olson, T. M. and Leggett, J. 1993. "Computer-supported co-operative work: Research issues for the 90's", *Behavior and Information Technology*, vol. 12, no. 2, pp. 115-129.

Pallant, J. 2001. SPSS Survival Manual. Open University Press, Buckingham.

Petrides, L. A. 2002. "Organizational learning and the case for knowledge-based systems", *New Direction for Institutional Research*, vol. 113, pp. 69-84.

Roberts, J. 2000. "From know-how to show-how? Questioning the role of information and communication technology in knowledge transfer", *Technology Analysis and Strategic Management*, vol. 12, no. 4, pp. 429-443.

Robertson, M., Scarbrough, H. and Swan, J. 2002. "Knowledge creation within professional service firms: The influence of the institutional context", Online: http://www.ki-network.org, accessed 20/02/04.

Ruggles, R. 1997. Tools for Knowledge Management: An Introduction, Knowledge Management Tools, Butterworth-Heinemann.

Ruggles, R. 1998. "The state of the notion: Knowledge management in practice", *California Management Review*, vol. 40, no. 3, pp. 80-89.

Rumizen, M. 1998. "Site visit: How Buckman Laboratories' shared knowledge sparked a chain reaction", *Journal of Quality and Participation*, vol. 21, pp. 34-38.

Sabherwal, R. and Becerra-Fernandez, I. 2003. "An empirical study of the effect of knowledge management processes at individual, group, and organizational levels", *Decision Sciences*, vol. 34, no. 2, pp. 225-260.

Senge, P. M. 1990. The Fifth Discipline: The Art and Practice of the Learning Organization. Century Business, London.

Seufert, A., Back, A. and Von Krogh, G. 2003. "Unleashing the power of networks for knowledge management: Putting knowledge networks into action", in Beerli, A. J., Falk, S. and Diemers, D. (Eds.), Knowledge Management and Networked Environments: Leveraging Intellectual Capital in Virtual Business Communities, AMACOM, New York, pp. 99-136.

Song, S. W. 2002. "An internet knowledge sharing system", *Journal of Computer Information Systems*, Spring, pp. 25-30.

Sproull, L. and Kiesler, S. 1986. "Reducing social context cues: Electronic mail in organizational communication", *Management Science*, vol. 32, no. 11, pp. 1492-1512.

Ware, J. P. and Degoey, P. 1998. Knowledge Work and Information Technology, Fisher Center for Management and Information Technology, Walter A. Haas School of Business, University of California at Berkeley, Berkeley.

Wasko, M. M. and Faraj, S. 2000. “It is what one does: Why people participate and help others in electronic communities of practice“, *Journal of Strategic Information System*, vol. 9, no. 1, pp. 155-173.

Wiig, K. 1993. Knowledge Management Foundations. Schema Press, Arlington.

Yates, J. and Orlikowski, W. J. 1992. “Genres of organizational communication: A structurational approach to studying communications and media”, *Academy of Management Review*, vol. 17, no. 2, pp. 299-326.