Factors influencing organizational knowledge transfer: implication for corporate performance

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Abstract

Purpose – *Whilst knowledge transfer is a major strategy for managing contemporary organizations the impact of the key factors influencing the rate of organization knowledge transfer is relatively unknown. As a contribution to this identified gap this paper aims to discuss the influence of particular organizational factors (IT systems, structured learning strategies, innovative organizational culture, and flexible structure and design) on knowledge transfer using a conceptual framework derived from the literature. The effect of both explicit and tacit knowledge transfer on innovative capabilities and organizational performance is to be examined.*

Design/methodology/approach – *The survey study, conducted amongst 1,086 high-tech companies, targeted chief executive officers), CFOs (chief financial officers), COOs (chief operation officers) or top managers/administrators as they provided more reliable environmental and organizational information.*

Findings – *The study findings, based on a sample response rate of 19.6 per cent, indicated that of the particular organizational factors considered IT systems had the most significant impact on organizational knowledge transfer followed by a structured learning strategy, and an innovative organizational culture. Personalized (tacit) knowledge transfer had a strong influence on innovative capabilities development and process innovation had a greater impact on organizational performance than product innovation.*

Originality/value – *The findings can be used by managers to more efficiently direct knowledge transfer resource allocation decisions to further optimize organizational performance.*

Keywords *Knowledge transfer, Innovation, Organizational performance*

Paper type *Research paper*

Knowledge management significantly influences strategy formulation and implementation (Grant, 1996a; Conner and Prahalad, 1996; Zander and Kogut, 1995). Whilst the literature reveals a diverse range of knowledge management definitions and perspectives (Brown and Duguid, 2000; Grant, 1996b; Spender, 1996), the acknowledged generic management intention is to improve the ''wisdom'' of the organization to enable improved decision making, and increase innovation, performance, and sustainable competitiveness outcomes (Nonaka and Takeuchi, 1995; Davenport and Prusak, 1998). Building this wisdom requires the continual creation of new knowledge, and the transfer and interpreting of this new knowledge within the existing knowledge contexts of other parts of the organization (Kusunoki *et al.*, 1998). Knowledge creation, particularly with explicit knowledge which can be captured and shared by information and technology (IT) systems in the firm (Stewart, 1998), plays a prominent role in the firm's strategy formulation process. However the creation and transfer of implicit or tacit knowledge remains the ''black box'' (Spender, 1996); the transfer and utilization of tacit knowledge, and its effect on organizational innovation and performance remains unclear.

The effectiveness of organizational knowledge transfer is influenced by key organizational factors such as structure, culture, processes and strategy, and information technology (Ives *et al.*, 2003 and Spender, 1996). Despite numerous studies to establish the link between knowledge management and innovation (Calantone *et al.*, 2002; Hurley and Hult, 1998), and

knowledge management and higher organizational performance, the relationship between knowledge transfer and organizational performance, and between innovation and organizational performance is vague. Additionally whilst the knowledge management literature includes a multitude of robust frameworks and models very few are targeted specifically at knowledge transfer. This paper contributes to this gap through examining the direct and indirect effects of organizational factors on knowledge transfer in organizations. Furthermore the links between knowledge transfer on organisational innovative capability and the links between knowledge transfer and the firm's performance are explored.

Literature review and conceptual framework

Knowledge transfer

Knowledge transfer is critical to the performance of knowledge creation and in leveraging knowledge for greater organizational performance (Von Krough *et al.*, 2000). APQC (1999) in examining what best practice firms do to develop a knowledge transfer culture reinforced the link between knowledge transfer and: business strategy; fit with overall organizational culture; fit with leadership; fit with human and social networks and institutionalization of learning disciplines.

Three primary reasons exist for the transfer and transfer of knowledge: knowledge acquisition, knowledge reuse, and knowledge creation; social capital (using social networks to create opportunities) is positively linked with knowledge management (Huysman and de Wit, 2004). Research on the effects of multiple social networks on knowledge transfer supports the premise that knowledge transfer can be advanced by studying how multiple networks affect various phases of knowledge transfer (Hansen *et al.*, 2005; Inkpen and Tsang, 2005; and Hansen *et al.* (2005). In particular, certain conditions can enhance the transfer of knowledge in various network types (Inkpen and Tsang, 2005). Lee (2003) in examining the four stages of knowledge conversion as described by Nonaka and Takeuchi (1995): tacit to tacit (socialization), tacit to explicit (articulation), explicit to explicit (combination), and explicit to tacit (internalization) posited the superior importance of the tacit to tacit knowledge conversion process; he suggested that measuring social interactions provides a workable proxy for measuring the degree of tacit to tacit knowledge transfer. Most recently research studying the issues associated with the management of knowledge transfer systems (Brauner and Becker, 2006) concluded that it is explicit and unshared knowledge, rather than tacit and shared knowledge, which is truly the most valuable for organizations. This suggests that knowledge management can be viewed as a social process and knowledge transfer as part of organizational learning since a major objective in knowledge transfer is the organizational accessibility of this knowledge. The knowledge transfer body of literature indicates that effective knowledge transfer is achieved through both formal systems (for explicit knowledge) and social networks (for tacit knowledge) and as transfer is a human behaviour it can be influenced by the organization's environment.

Organizational factors

Whilst every organization has a unique environment particular key organizational factors such as strategy, structure, culture and technology play a crucial role in the overall performance of the organization (Galbraith, 2002). Essential questions relate to how we process and transfer both explicit and tacit knowledge effectively and what the key organizational factors are that can enhance this process. Factors such as organizational controls (Turner and Makhija, 2006); culture (Bhagat *et al.*, 2002); training and education, processes and activities, leadership, HRM policies (Wong, 2005); and networks (Hansen *et al.*, 2005) are considered crucial. The ability to transfer knowledge effectively in an organization can be further enhanced by: a structured IT network which enables individuals to deposit and share knowledge (O'Dell and Grayson, 1998); a flat structure with less hierarchy and bureaucracy; a trust culture where knowledge transfer relationships between individuals and groups are transparent, and supported through equitable performance related incentives and rewards; and a learning strategy whereby firms actively promote the double loop learning (Senge, 1990).

The need for a learning strategy that enables knowledge transfer, which integrates both learning and transfer in the analysis stage is supported by the Knowledge Management Process framework (Bukowitz and Williams, 1999). However, the gap remains within existing literature as to what the impact of the various organizational factors has on knowledge transfer (both explicit and tacit). The key organizational factors selected for this study, based on the former literature analysis are: information technology systems, learning strategy, trust culture, and organisational structure and design. The study findings relate to the levels of impact on knowledge transfer through these particular organizational factors.

Organizational performance

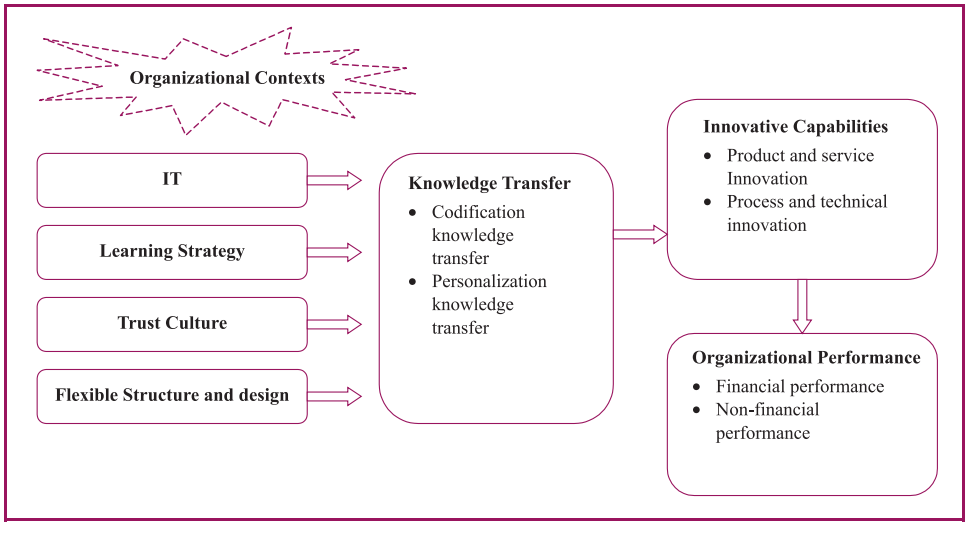
The focus on organizational performance to sustain competitive advantage is necessary for any organization. However, the measurement of organizational performance may take different forms. Traditionally, organizations assess performance based on financial outcomes; tangible units such as dollar profit, cost reduction, sales volume and inventory turnover rate are used. Intangibles such as customer satisfaction rate, frequency of patterns, rate of product development and new competencies and capabilities are infrequently used as performance indicators. However, as financial data for empirical research may not be easily obtained from firms due to the sensitivity of these data. Delaney and Huselid's (1996) approach whereby the measures are relative or benchmarked can be used for a proxy measurement of organizational performance. The measures are derived from questions asking participants' perception of the situation to assess organizational performance relative to the performance of industry competitors.

Although perceptual data introduces limitations through increased measurement error and the potential for mono-method bias, it is an acceptable method particularly when true financial data are not easily obtainable from the firms. This approach of using the measures of perceptual organizational performance correlates positively with objective measures of firm performance (Dollinger and Golden, 1992; Delaney and Huselid, 1996).

Conceptual framework and research questions

Literature review indicates that organizational factors are contextual resulting in varying degrees of influence on the knowledge transfer ability of the organization. Furthermore, the direct and indirect effect of these organizational factors can have significant impact on the firm's innovative capability. Finally, the relationship between knowledge transfer, innovation and organizational performance can be determined. The conceptual framework for this study is based on the above propositions (Figure 1).

Figure 1 Integrative framework



Research questions

The three broad research questions derived from the conceptual framework for this study are:

1. Which organizational factor has the greatest influence on knowledge transfer?
2. Which type of knowledge (explicit or tacit) would have the greatest impact on organizational innovation?
3. What is the relationship between knowledge transfer, organizational innovation and organizational performance.

Hypotheses

Relationship between organizational factors and knowledge transfer

One of the organizational factors suggested by many researchers and practitioners as an important mechanism in knowledge management is information technology (IT) systems (Sher and Lee, 2004; Bharadwaj, 2000; Duffy, 2000). Davenport *et al.* (1998) reported a positive relationship between IT systems, as an organizational factor, and knowledge transfer. They concluded that information technology, not only improves organizational performance but also accelerates knowledge transfer and transfer through enabling rapid access to search and retrieval of information as well as supporting collaboration and communication between organizational members (Lee and Hong, 2002; Alavi and Leidner, 2001). Furthermore, the integration of IT systems into business intelligence areas such as, portals, data mining, workforce search, customer relation management and e-learning could increase organizational knowledge transfer and transfer capability. However an IT system is only a tool not an ultimate solution; it still requires the willingness of individuals to share information and knowledge (Wong and Aspinall, 2003). Based on the above discussion we predict the following:

H1.
IT positively improves knowledge transfer significantly.

Organizational learning - the ability to learn from others, and the culture of openness within the organization – could have a significant impact on how knowledge is transferred (Senge, 1990). The Bukowitz and Williams (1999) Knowledge Management Process Framework indicates that the tactical component forms part of the learning strategy in the following sequence: get, use, learn and contribute. The learn and contribute process elements are considered the most challenging and vital steps for innovation and overall organizational performance. With reference to organizational learning and learning strategy within the organization, we predict:

H2. Learning strategy has a significant and positive influence on knowledge transfer.

It is suggested that improvement in knowledge transfer can be achieved through the openness of communication channels, social networks and trust (McEvily *et al.*, 2003). Relational factors like competence-based trust can interact with more traditional knowledge factors such as tacit knowledge (Levin and Cross (2004). These findings indicate a need to better understand the role of relational factors, such as trust and emotion, in facilitating or inhibiting effective knowledge transfer. Furthermore, they suggest that certain characteristics of social relations, such as perceived trustworthiness, make the social fabric of organizations more (or less) effective in creating and transferring knowledge.

Trust plays an important role in how individuals transfer and share knowledge with others; organizational controls, which are used to manage knowledge can have significant influence on how individuals behave (Turner and Makhija, 2006). An equitable reward or incentive system motivates individuals to share knowledge readily and reinforces individuals' understanding of an organizational trust culture. The evidence tends to support the proposition that when an organization has a culture of trust and cooperation, innovation,

learning and knowledge transfer take place more readily (Knapp, 1998; Conner and Prahalad, 1996). Based on the above discussion we predict the following:

H3. Trust culture has a significant and positive influence on knowledge transfer.

The design structure of an organization can be a key determinant on whether internal knowledge can be efficiently integrated within the organization (Grant, 1996b). When an organization faces a dynamic environment, it may need to use several structures to support knowledge management in the firm (Nonaka and Takeuchi, 1995). For example, some business units may need to change team structures more often than others which requires social networks, trust, and communication channels to form and re-form continally. Cross-functional teams may facilitate the formulation of a knowledge map for employees to use to find the appropriate knowledge (Greengard, 1998). Individuals who exhibit change readiness abilities may be more suitable in this flexible environment; they may be more willing to share information and knowledge so that goals can be attained quicker. It has been argued that this type of flexible structure of teams or alliances could promote greater knowledge transfers. Thus we predict the following:

H4. Flexible structure and design has a significant and positive effect on knowledge transfer.

Relationship between knowledge transfer and innovation capability:

To sustain competitiveness, organizations continuously innovate. Social networks facilitate the transfer of knowledge within organizations and through the development of inter-unit network links; the horizontal transfer of knowledge broadens organizational learning resulting in innovation (Tsai, 2001). However knowledge is difficult to spread across different units within an organization in which pre-existing relationships among business units are absent (Szulanski, 1996). This suggests that to foster organizational innovation, information and knowledge must be deliberately distributed through both structured channels (IT systems) and social network systems. The inclusion of the latter emphasises the importance of face-to-face interaction for transfer tacit knowledge rather than relying solely on IT networks for organizational innovation. The importance of social capital and multiple networks for knowledge transfer (particularly with tacit knowledge) has been demonstrated (Hansen *et al.*, 2005).

Further proposed dimensions required to measure the relationship between organizational knowledge transfer are:

- innovation in product and service innovation (e.g. the rate of knowledge transfer to product commercialization or improvement in logistic distribution channels; and
- process and technical innovation (e.g. knowledge transfer in relation to cost reduction) (Wu, 1998).

Based on the above discussion we predict the following:

H5. Knowledge transfer has a significant and positive relationship with innovation capability.

Relationship between innovation capability and organizational perrformance:

The business environment is increasingly characterized by keen domestic and global competition, rapid technological change, and constrained resources. The ability to innovate to meet these challenges is a central determinant of corporate success (Hurley and Hult, 1998; Calantone *et al.*, 2002). Although the measurement of performance tends to be still financial, recent studies have taken a more holistic approach and adopted the Balanced scorecard approach in assessing organizational performance (Kaplan and Norton, 2002). Based on this we predict the following:

H6. Innovation capability has a significant and positive effect on organizational performance.

> **"An equitable reward or incentive system motivates individuals to share knowledge readily and reinforces individuals' understanding of an organizational trust culture."**

Research methodology

A survey research method examined the relationships between organizational factors, knowledge transfer, innovation capability and organizational performance. A self-administered survey questionnaire was used to sample Taiwanese high-tech industry companies.

Sample and procedure

Samples were collected from Taiwanese high-tech companies selected from *2005 Taiwanese Top 5000 Companies* published by the China Credit Information Service (CCIS), 2005) and categorized according to their market capitalization. In total, 1,086 high-tech companies were selected for this study. High-tech firms only were selected for two main reasons: the results can be more targeted and applied to a specific industry; and focused industry analysis could prevent cross-contamination of data between industries. Only CEOs (chief executive officers), CFOs (chief financial officers), COOs (chief operation officers) or top managers/administrators were invited to participate in this study as they are widely believed to be knowledgeable about the firm and able to provide more reliable environmental and organizational information. A questionnaire, covering letter, and a self-addressed envelop were mailed to the managing director or chief executive officer of each company; questionnaires were anonymously completed and data confidentiality assured. Follow-up telephone calls and faxes to all firms encouraged respondents to complete and return the questionnaires. Of the 235 questionnaires returned, 12 were excluded due to incomplete data. In total, 223 respondent questionnaires were used for the final analysis (response rate, 19.6 per cent). Prior to the main survey, a pilot study was conducted on 32 EMBA students, who work for high-tech companies, to test the clarity and reliability of the survey instrument. Feedback from the pilot testing was satisfactory and the overall instrument reliability index was 0.71.

Survey design

The questionnaire used a five-point Likert scale from Strongly disagree (1) to Strongly agree (5) and considered four organizational factors: IT, learning strategy, trust culture, and flexible organizational structure and design.

Organizational factors

These are:

- *Information technology.* The information technology survey items were partly adopted from the IT capability survey by Tippins and Sohi (2003), which investigated the relationship between IT and organizational performance. The Cronbach's α reliability of the selected items for this survey was 0.89 and the following CFA Test results suggested that the model fit of those five items was good.
- *Learning strategy.* The learning strategy survey items were partly adopted from the Learning trend survey by Baker and Sinkula (1999) which examined the effect of learning organization on performance. The Cronbach's (of the selected items for this survey was 0.94.
- *Trust culture.* The trust culture survey items were partly adopted from the Trust survey by Mayer *et al.* (1995) which examined key issues of organizational and personal trust. The Cronbach (of the selected items for this survey was 0.92.

- *Flexible structure and design*. The flexible structure and design survey items were partly adopted from the Organization variables survey by Lok *et al.* (2005) which examined the relationships between various organizational variables and the effects on improvement programs. The Cronbach α of the selected items for this survey was 0.66.

Knowledge transfer

The knowledge transfer survey items were partly adopted from surveys by Nonaka and Takeuchi (1995), Alavi and Leidner (2001), Bhatt (2001) and Dixon (2000). Four questions were selected to identify the codification of knowledge transfer and another three questions were selected to identify the personalization of knowledge transfer. The Cronbach α of the selected items for this survey was 0.71.

Innovation capability

The innovation capability survey items were partly adopted from the survey by Prajogo and Sohal (2003), which examined the relationship between TQM practices, quality performance and innovation performance. The Cronbach α on the selected items for production innovation and process innovation was 0.89 and 0.85 respectively.

Organizational performance

The survey items of performance were partly adopted from the survey by Delaney and Huselid (1996), which examined the relationship between HRM practices and perceived organizational performance. The Cronbach α on the selected items was 0.72.

Reliability and validity

The survey items were adopted from the previous research studies and modified to the research sample. The survey was firstly administered to some management researchers, and management practices experts to evaluate the content validity. Through those experts' judgment review, survey items were deleted and modified. Thus, the content validity of the final survey was ensured to some extent.

A confirmatory factor analysis with AMOS 5.0 software on 223 returned survey data was conducted. The result was shown in Table I. According to the Structural Equation Model (SEM) index suggested by Bagozzi and Yi (1998), the p-value of Chi-square should be larger than 0.05, the value of CFI, GFI, IFI, NFI should be 0.90, and the value of RMR should be less than 0.05. Although, not all the results of the confirmatory factor analysis reached the standard level they were close to the acceptable values. Thus, the researchers believed that if all the indexes were close to the acceptable value in the testing of goodness-of-fit in the research model, it would indicate that this SEM had a good model fit. In summary, this indicated the validity of the research model in this paper.

Furthermore, the Standardized regression weights of all factors were statistically significant which suggested that all items were significantly correlated with each other. This result indicated that high convergence existed in these items (Anderson and Gerbing, 1988). Also, the Cronbach of all dimensions in this survey were higher than 0.87 (Table I); all are higher that the acceptable level of 0.70 (Nunnally, 1978). This finding indicated that all factors have relatively good internal consistency. In other words, the survey has good reliability and validity, which can be used to test the integrative framework relationship as shown in Figure 1.

Descriptive analysis

Data analysis results

Table II shows the descriptive and correlation matrix and suggests that the mean scores of the four factors of organizational context were from 3.4723 to 3.8236. The mean score of learning strategy was the highest suggesting that ''learning strategy'' had the greatest impact on knowledge transfer as compared to others. The mean score of the Codification knowledge transfer of the knowledge transfer was 3.9484. These results illustrated that

Table I Items comprising composite variables

Scale	*Component items*	*Standardized regression weight*	*Cronbach's α*
Organizational factors			
Information technology	Our company is good at using information technology to achieve success	0.814	
	Though IT, the key capabilities of our company is efficiently integrated	0.802	
	The database in this company has provided support and improvement to employees' skill	0.758	
	Managers are good at using IT to communicate with employees	0.720	
	The company has two-way communications, such as e-bill boards or regular conferences	0.682	0.9200
Learning strategy	Employees help each other on learning	0.755	
	The company encourages employee discussion and team learning	0.840	
	The company offers good learning environment to help the innovation development	0.761	
Trust culture	Employees' contribution and effort are appreciated by the company	0.679	
	The senior managers support employees when suggesting alternative perspectives	0.637	
	The company encourages employees' learning and tolerates employees' mistakes	0.769	
	The supervisor of my department trusts employees' working capability	0.593	
	The atmosphere of the company helps employees trust others	0.765	
Flexible structure and design	The company has many cross-functional teams	0.590	
	The organizational structure is rather flat	0.613	
	The flat organizational design in this firm has improve our responsible rate to customers	0.769	
	Chi-square = 267.879; DF = 98; GFI = 0.868; CFI = 0.906; IFI = 0.908 NFI = 0.862; RMR = 0.040		
Knowledge transfer			
Codification knowledge transfer	The company saves and renews important information onto the computer for easy browsing	0.747	0.8758
	Knowledge is categorized in the database for use by all company employees	0.866	
	The company saves important information though words, pictures in the computer systems	0.770	
	Employees use e-mail or internal network to share their knowledge with others	0.646	
Personalization knowledge transfer	Employees are willing to share their experience and knowledge	0.718	
	The company transfers employee experiences to other employees	0.772	
	The company transfers effective knowledge to employees through training courses, presentations and internal magazines	0.718	
	Chi-square = 76.475; DF = 13; GFI = 0.900; CFI = 0.913; IFI = 0.914 NFI = 0.898; RMR = 0.046		
Innovative capabilities			
Product and service innovation	The speed of R&D of our company is faster than our competitors	0.775	0.9273
	The speed of production improvement is faster than our competitors	0.799	
	The speed of innovating a new logistic way is faster than the competitive	0.782	
	R&D has improved production innovation skills	0.781	
	Compared to our competitors, production in our company is more customized to the customers	0.721	

(*Continued*)

Table I

Scale	*Component items*	*Standardized regression weight*	*Cronbach's α*
Process and technical innovation	Compared to our competitors, the production in our company offers more innovative products to the customers	0.684	
	The company has continuously used innovative technology to improve the quality and speed of production and services to our customers	0.737	
	The latest Human resource practices are adopted in this organisation	0.811	
	The innovations and customer satisfaction rate are higher than our competitors	0.806	
	During the last three year, our patent registration has increased significantly	0.712	
	Chi-square = 206.031; DF = 34; GFI = 0.845; CFI = 0.880; IFI = 0.881 NFI = 0.861; RMR = 0.039		
Organizational performance			
Financial performance	During the last three years	0.806	0.8826
	During the last three years	0.762	
	During the last three years	0.794	
Non-financial performance	During the last three years, the comparative advantage of our company has significantly improved	0.561	
	During the last three years, employee productivity has improved significantly	0.798	
	The organizational structure innovation is more flexible than the competitors	0.816	
	Chi-square = 48.79; DF = 8; GFI = 0.935; CFI = 0.942; IFI = 0.943 NFI = 0.932; RMR = 0.033		

Table II Descriptive and correlation matrix

	Mean	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Factor 1	3.6152	.6917	1.000									
Factor 2	3.8236	.6342	0.648**	1.000								
Factor 3	3.7803	.5820	0.553**	0.728**	1.000							
Factor 4	3.4723	.6592	0.720**	0.547**	0.521**	1.000						
KT1	3.9484	.7048	0.454**	0.506**	0.437**	0.330**	1.000					
KT2	3.6738	.6370	0.527**	0.606**	0.596**	0.461**	0.675**	1.000				
INNO1	3.5049	.5764	0.639**	0.502**	0.532**	0.538**	0.444**	0.521**	1.000			
INNO2	3.5238	.6564	0.687**	0.516**	0.498**	0.581**	0.420**	0.537**	0.784**	1.000		
PERF1	3.6921	0.7419	0.483**	0.411**	0.415**	0.525**	0.334**	0.374**	0.583**	0.613**	1.000	
PERF2	3.6951	0.7261	0.580**	0.453**	0.414**	0.560**	0.350**	0.375**	0.610**	0.748**	0.764**	1.000

Notes: *$p < 0.05$; **$p < 0.01$. Factor 1: IT; Factor 2: learning strategy; Factor 3: trust culture; Factor 4: flexible structure and design; KT1: codification knowledge transfer; KT2: personalization knowledge transfer; INNO1: production and service innovation; INNO2: process and technical innovation; PERF1: financial performance; PERF2: non-financial performance; $n = 223$

organizations focused more on processing the information transfer by building up knowledge information systems and less on personalized networks using tacit knowledge.

The mean scores of two factors of innovation capability scales were very close, 3.5049 and 3.5238 respectively. This finding suggested that production and service innovation and process and technical innovation had a similar degree of impact on organizational innovation capability. Finally, the mean scores of the financial performance and non-financial performance of organizational performance were similar, 3.692 and 3.695 respectively. This result suggests that there is no significant difference between innovation on financial or non-financial performance.

Table II also shows the results of the Pearson correlations. Four factors of organizational factors and two factors of knowledge transfer correlated positively and significantly with each other. Personalization knowledge transfer had a relatively high relationship with the learning strategy ($r = 0.606$), and with trust culture ($r = 0.596$). The two factors of knowledge transfer were significantly correlated with the two factors of innovation capability. Personalization knowledge transfer had the highest correlation with process and technical innovation ($r = 0.537$) followed by the correlation with production and service innovation ($r = 0.521$).

Four organizational factors had relatively high correlations with the two factors of innovation capability. IT had higher correlations with production and technical innovation ($r = 0.687$) than with other organizational factors. Finally, production and service innovation factors had the highest correlation with non-financial performance ($r = 0.748$), which indicated that the introduction of IT had a positive relationship with the improvement of the production process or the technology skills, and also the development of comparative advantage of the organizations.

Structure model analysis results

Using the integrative model in Figure 1, this research tested and compared two models: before modification and after modification.

Model 1: The organizational factors in this model include IT, learning strategy, trust culture, and flexible structure and design as theses four factors directly influence knowledge transfer. Codification and personalization knowledge transfer directly influence the knowledge transfer respectively; Production innovation and process innovation had direct influences on organizational performance.

Model 2: According to the Chi-square (p-value) and RMESA index (shown in Table III), model 2 has some space for improving. Thus, Model 2 was modified from model 1.

The main difference of model 2 to model 1 is that four organizational factors had a direct influence on organizational performance and innovation respectively.

Table III presents the comparative results of models 1 and 2. Compared to model 1, model 2 has higher model fit degrees (Chi-square = 20.592, df = 21, p-value = 0.245, CFI = 0.988, GFI = 0.982, TLI = 0.994, NFI = 0.988, RMESA = 0.031).

Model 2 with lower Chi-square, RMESA and higher CFI, GFI, TLI (= 0.994), NFI indexed values, which indicates that this model had a higher model fit. Thus, model 2 was selected as the better-fit model with the knowledge transfer principles suggested in the integrative framework used in this study. With reference to the measurement model analysis the β values were significant, that is higher than 0.5.

Hypothesis testing was performed based on the results from model 2 (Figure 2). Only paths with significant results are shown in Figure 2. All four organizational factors had significantly positive relationship with knowledge transfer. The β value of IT to knowledge transfer was the highest at 0.744 ($p < 0.01$), learning strategy to knowledge transfer was 0.688 ($p < 0.01$), trust culture to knowledge was 0.660($p < 0.01$), and flexible structure and design to knowledge was 0.623 ($p < 0.01$). Thus, *H1*, *H2*, *H3*, *H4* were all supported.

Since only personalization knowledge transfer had a significant correlation with innovation capability (βvalue = 0.192, $p < 0.05$), *H5* was partially supported. Production innovation (β value = 0.286, $p < 0.01$) and process innovation (β value = 0.486, $p < 0.01$) had

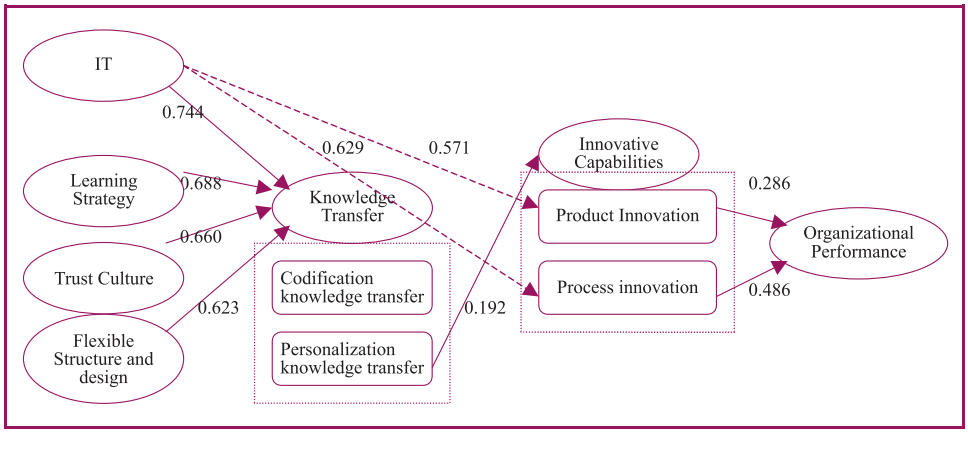
"Codification and personalization knowledge transfer directly influence the knowledge transfer respectively; production innovation and process innovation had direct influences on organizational performance."

Table III Parameter estimates for the two structural modes

Standardized estimate for each path (β values)	*Model 1*	*Model 2*
Measurement model		
IT to technology context	0.660**	0.744**
Learning strategy to strategy context	0.744**	0.688**
Trust culture to culture context	0.688**	0.660**
Flexible structure to structure context	0.623**	0.623**
Codification knowledge transfer to knowledge transfer	0.751**	0.751**
Personalization knowledge transfer to knowledge transfer	0.954**	0.954**
Product innovation to innovation capabilities	0.814**	0.512*
Process and technical innovation to innovation capabilities	0.938**	0.784**
Financial performance to organizational performance	0.923**	0.923**
Non-financial performance to organizational performance	0.871**	0.871**
Structural model		
IT to knowledge transfer	0.908**	0.908**
Learning to Knowledge Transfer	0.939**	0.939**
Trust to knowledge transfer	0.873**	0.873**
Flexible structure to knowledge transfer	0.910**	0.910**
Codification knowledge transfer to innovation capabilities	0.106	0.012
Personalization knowledge transfer to innovation capabilities	0.480**	0.192*
Product innovation to organizational performance	0.286**	0.286**
Process innovation to organizational performance	0.486**	0.486**
IT to product innovation	N/A	0.571**
IT to process innovation	N/A	0.629**
Learning to product innovation	N/A	0.104
Learning to process innovation	N/A	0.019
Trust to product innovation	N/A	0.065
Trust to process innovation	N/A	0.040
Flexible structure to product innovation	N/A	−0.115
Flexible structure to process innovation	N/A	−0.054
Model goodness-of-fit		
Chi-square	118.599	20.592
Degree of freedom	25	17
p-value	0.000	0.245
CMIN/DF	4.744	1.211
GFI	0.917	0.982
CFI	0.945	0.998
NFI	0.932	0.988
IFI	0.945	0.998
TLI	0.900	0.994
RMESA	0.130	0.031

Notes: *$p < 0.05$; **$p < 0.01$

Figure 2 Integrative framework of knowledge transfer



significant positive relationships with organizational performance respectively. Thus, *H6* was supported. In addition, model 2 also indicated that IT had a significant direct positive effect on product innovation (β value = 0.571, $p < 0.01$) and process innovation (β value = 0.629, $p < 0.01$) respectively.

Discussion

This research used a sample of high-tech companies in Taiwan and applied SEM analysis to test the relationships between organizational factors (i.e. IT, learning strategy, trust culture, and flexible structure design); knowledge transfer; innovation capability and organizational performance. The goodness-of-fit testing in concluded that:

- organizational factors had a significant positive correlation with knowledge transfer. IT had the greatest impact on knowledge transfer;
- IT had a significant and positive correlation with innovation capability;
- personalized knowledge transfer (tacit knowledge) had a significant and positive correlation with innovation capability; and
- innovation capability had a significant and positive correlation with organizational performance.

Finally, the following propositions, supported by the findings of this study, are suggested.

Relationships between organizational factors and knowledge transfer

IT had the greatest impact on knowledge transfer. It is generally accepted that an integrated IT system enhances the deposit and transfer of information and knowledge such that organizations invest considerable amounts in knowledge management systems based on integrated IT platforms (Small and Sage, 2005). However, the IT system is only the backbone of knowledge transfer. Human activities such as: willingness to deposit and share information and knowledge; the learning capability of personnel in the firm; and the perceived equity of rewards from transfer can play a significant role in the effectiveness of knowledge transfer. Furthermore, the findings support that the integration of control systems (Turner and Makhija, 2006) to formalize codified knowledge and improvements in multiple social networks (Hansen *et al.*, 2005, Inkpen and Tsang, 2005) significantly increase personalized (tacit) knowledge transfer. Hence, priorities can be set by management to direct their resources better to improve their knowledge transfer capability. These findings are consistent with results provided by Wong (2005), Sarvary (1999), Davenport *et al.* (1998) and O'Dell and Grayson (1998).

Although the learning strategy factor ($\beta = 0.688$, $p < 0.01$) did not have the highest impact on knowledge transfer in this study, it was a close second to the IT system. This indicates that management and leadership support are essential in order to integrate learning strategy into knowledge transfer strategies with the caveat that management must provide equitable reward systems to motivate individuals to share and learn from each other. This finding is consistent with results from Turner and Makhija (2006) and Hansen *et al.* (2005). Hence, organizations should also realize that the process of knowledge transfer from individual to groups and to organizations must be managed effectively by IT systems and social network structures.

The results of this study are consistent with the findings from Crossan *et al.* (1999) study, which discusses the 4I model of organizational learning. The 4Is of organization learning starts from intuition and interpretation of the knowledge and experiences on the individual level, then interpretation and integration on the group level, and finally systemization on the organization level. This process also suggests that knowledge is continually communicated and transferred at all organizational levels and that feedback mechanisms are in place to enable the double loop learning; an important step in becoming a learning organization (Senge, 1990).

Although the trust culture factor did not score highly as compared to IT and Learning strategy, it still remains an important organizational factor to promote knowledge transfer in

organizations. The study findings are consistent with the results provided by McEvily *et al.* (2003) whereby individual and organizational trust can be enhanced by open communication channels; the a culture of trust among individuals has to be cultivated and supported by management (Mayer *et al.*, 1995). Finally, the results in this study are compatible with the issue of competence-based trust, which had a greater impact with personalised (tacit) knowledge transfer (Levin and Cross, 2004).

Despite the flexible structure and design factor showing the least impact on knowledge transfer in this study, the positive link between flexible structure and better information flow was confirmed in this study. Flexible team structures, alliances, and multiple social networks enhance knowledge transfer, which supports the propositions suggested by Greengard (1998).

Relationships between knowledge transfer and innovation capability

Based on the study by Hansen *et al.* (1999) on codification knowledge transfer and personalization knowledge transfer, the results of this study revealed that personalization knowledge transfer ($\beta = 954$) was more important to knowledge transfer than the codification of knowledge transfer($\beta = 751, p < 0.01$); this is compatible with Hansen et al's (1999) findings. Furthermore, the result of personalization (tacit) knowledge transfer demonstrated a significantly higher impact on innovation capability ($\beta = 0.192, p < 0.05$) than codification knowledge transfer. This was consistent with previous findings (Hansen *et al.*, 2005; Inkpen and Tsang, 2005). The findings in this study suggest that good communication and a trust culture among employees enhance tacit knowledge transfer (socialization) and are vital to organization innovation. Thus, management should pay special attention to the use of tacit knowledge transfer in organizations.

Relationship between innovation capability and organizational performance

Finally, the positive relationship between innovation and organizational performance is consistent with previous findings Hurley and Hult (1998), Yamin *et al.* (1999) and Baer and Frese (2003). However the study results revealed an unexpected and interesting finding; non-financial performance had a higher coefficient value than financial performance which indicated that a non-financial index, such as the acquisition of patents, increasing competitive power, and employees' productivity, were the key determinants affecting overall organizational performance. This result may prompt managers to examine a more balanced approach in assessing organizational performance. Furthermore, these non-financial performance indicators can be leveraged to develop key organizational capabilities, which are difficult for competitors to imitate.

Limitations and future research

Although the organizational factors used in this study were based on extant research findings with the rapid change in the business environment, these organizational factors may change over time. Future studies could use time-series analysis to test the reliability and validity of this research. Since tacit knowledge is an important source of knowledge transfer, qualitative data could be used to complement the survey data in future studies.

As discussed previously only High-tech firms based in Taiwan were used in the study sample and the findings may not be extrapolated readily into other industries. Future studies could include comparative studies using other industries to complement the findings in this

"The findings in this study suggest that good communication and a trust culture among employees enhance tacit knowledge transfer (socialization) and are vital to organization innovation."

study. Furthermore this study was based in Taiwan where organizational structure, culture, and HR practices will likely be different than in a Western context. A cross-cultural comparison based on the same model could explore the effect of organizational factors on knowledge transfer in different cultural environments.

Assessment of organizational performance continues to be contentious and has generated multiple diverse debates on the issue of financial (tangible) and non- financial (intangible) performance (Dollinger and Golden, 1992). However, the perceptual and self reporting data from senior management on the financial and non-financial performance of the firm are becoming more acceptable because of the difficulties in obtaining real financial data from various organisations (Delaney and Huselid, 1996). Future studies could use this approach to integrate the Balanced Scorecard approach (Kaplan and Norton, 2002) into a performance management model.

Conclusion

In this paper, we discussed an integrative model explaining the relationship between organizational factors, knowledge transfer, innovative capability and organizational performance. We demonstrated the direct and indirect effect of organizational factors on knowledge transfer and innovation. As summarized in Figure 2, management could use the findings in this study to set priorities for allocating resources better in order to optimize the opportunities for better knowledge transfer and organizational performance. This is a gap that previous studies in knowledge management have not addressed. In conclusion, further testing of this integrative framework is required to establish the predictive attributes of organizational factors in different industries and under different cultural environments

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