

創新的實務與歷程

計畫類別： 個別型計畫 整合型計畫

計畫編號：NSC 96 - 2416 - H - 004 - 047 - MY3

執行期間：96 年 12 月 01日至 99年 07 月 31 日

執行機構及系所：國立政治大學科技管理研究所

計畫主持人：蕭瑞麟

共同主持人：

計畫參與人員：

成果報告類型(依經費核定清單規定繳交)： 精簡報告 完整報告

本計畫除繳交成果報告外，另須繳交以下出國心得報告：

赴國外出差或研習心得報告

赴大陸地區出差或研習心得報告

出席國際學術會議心得報告

國際合作研究計畫國外研究報告

處理方式：除列管計畫及下列情形者外，得立即公開查詢

涉及專利或其他智慧財產權， 一年 二年後可公開查詢

中華民國 99 年 11 月 30 日

摘要

創新的採納、移轉與擴散是科管領域裡的重要課題。目前多數研究是以巨觀的方法來分析這些創新管理議題。但是，近代研究了解到巨觀分析無法讓我們了解創新的內涵，更忽視了使用者所扮演的角色。我們需要一種微觀方法，重新了解這些創新議題。為提供這樣微觀的視角，本研究從工作實務與創新歷程兩個層面來分析創新管理的議題。透過分析實務與歷程，本計畫分析創新者與使用者之間複雜的社會互動關係，發現許多創新的成敗是與這些微觀的脈絡環環相扣。本研究發現包含三大主題：科技意會（Technology Sensemaking）、人本設計（Human-Centered Design）、組織作為（Organizing Practice）。這三大主題凸顯出三個新興學術思潮，也同時也促使產業重新思考如何管理研發活動與引導更具人性化的科技應用。

關鍵字：工作實務、創新歷程、科技意會、人本設計、組織作為

Abstract

The adoption, transfer and diffusion of technology are major issues in innovation research. However, the majority of current research examines technology features, adopter characteristics, and environmental conditions, from a macro perspective. Such macro analyses, employing variable testing methods, often ignore social dynamics of innovation and the role of users is not fully acknowledged. We need a new genre of innovation research that examine the micro-foundation of technology-in-use. To address this issue, this research program investigates users' work practices associated with the process of innovation adoption, transfer and diffusion. By means of practice and process, this research examines the sophisticated social dynamics between the innovator and the user, and explains how a micro-contextual analysis may contribute to the success of innovation adoption, transfer and diffusion. This research program identifies three core themes: technology sensemaking, human-centered design and organizing practices. The three themes encourage a new strand of academic research and force practitioners to rethink how to manage innovation activities and orient technology application with a human centric design.

Keywords: Work Practice, Innovation Process, Technology Sensemaking, Human-Centered Design, Organizing Practice

壹、簡介

近年來，實務與歷程的分析已經在國際管理學界漸漸成為顯學。2010年，國際組織管理學界更籌組一個策略實務研究社群（Strategy-as-Practice, 在Academy of Management下新成立的學術部門）。這群學者強調由組織成員的工作實務與創新過程下手，來檢視組織的創新脈絡。過去，學者對脈絡（context）雖有涉略，但卻未給予足夠的重視。對工作實務雖有分析，但卻不夠深入。然而，若我們不了解創新者的工作實務，不探索使用者的生活情境，我們將不易理解創新者在研發過程中所遭遇的問題，包括：如何理解使用者的隱性需求、如何回應來自機構的壓力以及處理創新移轉過程中所遭遇的困境。

一開始，本研究由兩個案例開始，也就是階梯數位學院以及德國漢莎航空技術，探討使用者在科技採用過程中所遭遇的挑戰。我們在研究過程中發現，創新者不但必須深入探索使用者的特殊需求，更需要回應來自使用者所處機構的壓力。創新者不但要了解科技內涵，更要了解使用者如何理解科技以及如何與科技互動，才能有效地運用科技。我們透過這兩個案例，延伸調查另外十個案例，並逐漸形成本研究的三個主要發現。

第一個主題是「科技意會」，分析使用者如何理解科技，從而影響創新的採納與科技調適（technology adaptation）。第二個主題是「人本設計」，調查主軸是使用者於特定脈絡下的創新需求，其中牽涉到不只是了解使用者的困擾，更包括創新者如何回應機構壓力的巧思。第三個主題是「組織作為」，分析創新者如何理解科技中的機構特質，也就是組織所發展出特定的運作脈絡。本研究發現，精良的科技或是優異的研發團隊，都內嵌一套特殊的組織作為，像是一套例規（routine），引導使用者如何運用科技或成員如何進行團隊合作。理解組織作為的內涵可以幫助我們了解為何有些創新難以移轉，更無法複製。

科技意會、人本設計與組織作為是本研究的三大發現，這些發現源自於脈絡學派，強調由使用者的工作實務、由創新的演化歷程，理解一個創新是如何被採用、移轉與擴散。本研究不但銜接國際上重要的科技管理思潮，更開創出科技意會、人本設計與組織作為三項深富原創性的學術識別，引起國內與大陸學者的重視。這三個相扣的主題逐漸受到國際學術社群的肯定，也鼓勵國內產學界更關切實務與歷程的應用。

貳、重要發現

創新採納必須包含三個要素：創新者、科技（也就是創新物）以及使用者。推出任何創新時，創新者都必須設法讓科技被使用者所接受。但是，使用者所處的工作環境不同，當代企業的工作也越來越複雜，因此創新者也越來越難將科技融合到使用者的工作情境中。採納一項科技時，創新者必須進行一系列不斷調適的過程，絕非一次性的導入。本研究的核心貢獻就在分析這個創新調適過程，可以分三個主題討論。

第一，導入前，使用者會因為不理解科技而抗拒，或因誤解科技所帶來的風險而恐懼。導入後，使用者也會因科技與自己現行工作不契合而排斥。因此，了解使用者如何理解、解讀以及意

會科技，便能構思如何讓使用者配合本身的工作來調適科技。本研究第一階段便是由使用者的認知脈絡來分析人、科技與組織的互動關係，並凸顯使用者的認知如何隨著時間演變。也因此，本研究選擇以「科技意會」來分析創新採納的問題。

第二，了解使用者後，還必須分析使用者所處的工作與社會環境。科技通常是運用於工作場合，所以不了解使用者的工作脈絡就很難了解他們在想什麼，會遇到什麼問題以及對科技會有何期望。使用者導向創新文獻中提到找尋與善用領先使用者的方法。但是，如何配合使用者的工作脈絡來設計科技卻是討論不多。反倒是企業界興起了一陣人本設計的風潮，那是一種以人為本的思維，需要對工作脈絡進行深度的調查，再反思要提供使用者哪些功能與服務。以史丹佛大學（設計學院）為基地的知名的公司IDEO稱這種人本設計的概念為「設計思考」（Design Thinking），並廣為企業所採用。但是，學理上卻還未跟上產業的腳步，而產業的作法也多似是而非。例如，許多公司花巨資導入設計工具，但是忽略了人本的思考。為何企業的創新活動中有「設計」但沒「思考」？這是一項亟待研究的議題。也因此，本研究選擇以「人本設計」來分析創新採納的問題。

第三，一般人以為成功的創新採納，就是設計更新穎的技術功能或流程。但我們常忽略，一個創新之所以在某個特定的脈絡下運作得很好，是因為這個組織經年累月發展出某種能力，建構出某種善用科技的例規，以使科技的運作得以淋漓盡致。這樣的能力是一種組織作為，也是一種機構內涵（institutional properties），不容易被觀察，更難以複製。但創新作為的討論，目前在創新領域是較少的，只在組織管理有較多著墨。本研究認為，若要探討一個組織為何能善用科技，就必須理解到底他發展出什麼樣的能力與組織例規，才能理解創新的採納。而這個過程，組織同樣需要進行調適以善用創新科技。

總結而論，從使用者對科技的意會、人本設計的脈絡到組織作為，背後均涉及到一個更重要的問題，那就是科技的調適。隨著時間的演化，科技、使用者與組織會進行相互調適，從而改變使用者對科技的意會與使用的方式，甚至改變組織的工作例規。這是創新採納的根本問題，而由工作實務與創新歷程正可以幫助我們深入分析脈絡，對科技調適有更深刻的理解，這正是本研究的核心貢獻。以下將針對本研究的三大主題進行說明。各主題下的發表請見本報告第四項說明。

主題一、科技意會

就科技意會的主題下，本研究主要完成了三份著作，也分別獲得國內與國際學術界的肯定。

（一）演化的意會：本文分析臺灣大車隊導入衛星派遣系統的服務創新經驗。本文發現，科技採納並不僅是一次性的導入。往往，使用者在採納科技後還會繼續對科技產生新的意會，並且更新科技的使用方式。這是因為使用者持續進行在地實驗，不斷地磨合科技與自己的工作，進而不斷產生新的意會。實際上，科技導入組織後，不可能只調整一次就停下來；使用者必定會一邊運用科技，一邊持續地調整自己的工作模式。調整一陣子後，使用者又會反過來改變運用科技的方式。現實情況中，科技應該是在持續的調適過程（adaptation process）中演化。本文的重要學理貢獻是，使用者意會隨時間越加成熟時，發展出更多新的科技運用方式，也將會更加了解如何更新自己工作模式，令人驚喜的服務創新也因此嫣然成型。本文發表在國內第一級期刊《資管學

報》(2010年,已接受)。本文更複雜的意會演化分析以英文作品呈現,目前在國際第一級期刊《Organization Studies》第二審中。

(二)敏感的司機:本文分析新加坡康福計程車採納衛星派遣系統的經驗。文中以使用者意會為主軸,分析不同類型新加坡計程車司機如何採納衛星派遣系統(CabLink,獲得亞洲資訊科技創新大獎)。本文發現,司機擁有不同的工作習慣,於科技採用之前便配合在地狀況,發展出各自的工作實務。使用者對科技的意會不只是來自主觀認知的影響,先前的工作習慣會融入新科技的採用而演化出新的工作模式。使用者理解科技的方式會融入科技使用的方式,而發展出創新的調適結果。本研究提供服務創新一個展新的分析觀點,並分別發表於國際會議ICIS(2007,2008)以及《Information & Organization》期刊(備註:本期刊是資管領域於質性研究上的A-期刊,專收納長篇質性研究作品,由該領域著名學者Daniel Robey擔任主編,因為期刊改新版所以還未領取SSCI編號)。

(三)意會的隱形動機:本文由另一個角度來分析使用者對科技意會。案例發生於新加坡、台灣、天津,是一件典型的國際化科技採納事件。一家美國的半導體元件製造廠,亞洲總部位於新加坡,必須處理生產低良率問題,因為已經造成公司龐大損失。該公司外包廠商為一家台灣公司,設計在台北,但是生產基地在天津。為了處理低良率問題,台灣公司決定導入知識管理系統,讓台北與天津兩地的工程師分享維修問題。但是,導入系統後,兩地工程師不但未能分享知識,反而造成激烈衝突,使生產線問題越演越烈,最後公司黯然倒閉。本文發現,於此失敗經驗中,使用者的隱形動機(Hidden Motives)扮演極重要的角色,使得使用者將對公司與同儕的不滿融入了對科技的意會。最後,這樣的結果使得任何善意的改善方案都變成引爆科技失敗的地雷。本文發現,在使用者意會的背後,是更深層的對社會正義、文化偏見與道德制裁等隱性動機的主觀詮釋。這些隱性動機阻礙了知識的有效分享,也阻礙科技的採納。這個研究發表在2010年的國際科管年會(IEEE/ICMIT: International Conference on Management of Innovation and Technology)。

主題二、人本設計

創新需考量使用者所處的脈絡,才能探索使用者隱而未顯的痛點,找到未被滿足的需求。導入任何科技都需要依照使用者的人性考量來「設計」。不管是知識管理系統、數位學習系統、供應鏈科技、電子尋購系統或是防毒軟體,都需要留意使用者的工作脈絡。本主題共產出五項主要作品,對知識管理、新產品開發設計、科技調適、供應鏈管理等領域均提出重要學理貢獻。

(一)知識管理系統設計:本案例分析世界知名會計公司Ernst & Yong如何運用知識管理系統。該公司位於香港的遠東區總部是全球的知識管理重鎮。但是,該公司之所以能夠如此優異的管理企業知識,是因為背後有一套特殊的知識分享機制。本文剖析Ernst & Yong的整合性知識管理體系的設計,說明該系統如何配合知識工作者(會計師)達成知識創生、知識發展、知識再使用、知識轉移四項核心工作。本文發表於MIS Quarterly Executive(2008)。

(二)格物致知的設計問題:本文探討非線性生產系統(如半導體製程)的知識管理問題。積體電路產業是台灣資訊工業的引擎,維持半導體生產機台不故障是最重要的任務。但是,維修

機台牽涉不只是機台的機械問題，更包括複雜的生產製程。一位現場維修工程師通常必須要花七年才能完全上手。許多積體電路製造商，如聯電、台積電，斥資千萬建制知識管理系統，要求工程師寫下維修最佳實務，但是卻未能提昇現場維修工程師的檢修效率，反而因維修延宕造成重大損失。本文分析現場維修工程師的工作實務，說明工程師複雜的調適學習行為（adaptive learning behaviors）。本文發現，資深工程師於維修過程中發展出一種特殊的搜尋與解讀現場物件的方式來診斷系統的故障。這種格物（解讀物件）致知（推理機台故障問題）的作法是過去組織學習理論較少探索的議題，也成為本文最大的貢獻。本文目前投稿至《Journal of Management Studies》期刊，進行第三審過程中（國際第一級期刊，2011）。

（三）柔韌設計：本文分析「階梯數位學院」於2003~2006年推出的數位學習系統，是當時台灣數位學習產業的龍頭，該公司的一年的營業額是整個台灣數位學習產業的八成。這套系統的成功必須剖析其內嵌的設計特質，探索創新者如何策略性地回應機構阻力，並轉化阻力為助力。本文結合機構理論（institutional theory）與設計文獻，分析轉化阻力為助力的設計原則，本文又稱為「柔韌設計」，也就是對來自機構的阻力必須以柔軟的設計回應以及堅韌的態度對抗。本案例分析國中生如何採用數位學習系統來應付基測的壓力，藉此說明階梯數位學院如何察覺使用者痛點，又考慮來自機構（教育體制）的制約，巧妙的將回應策略融入系統設計中，贏得廣大使用者的採納。本文提供新產品與服務創新的另類解讀，分兩系列在2008年發表分別於兩個重要的國際會議，分別是：管理年會（Academy of Management）與國際科管年會（IEEE/ICMIT: International Conference on Management of Innovation and Technology），並於國際科管年會榮獲評最佳論文獎。

（四）調適供應鏈：本文探討知名手機大廠諾基亞在面對供應鏈的需求衝擊時，如何發展產品設計模組以彈性因應市場需求的不確定性。從產品設計的觀點言，創新者除了要應付使用者的需求外，更要因應設計採購上的不確定性，以及時完成設計元件採購及產品製造，滿足使用者需求。本文分析諾基亞的「調適供應鏈」（adaptive supply network）設計，說明該公司如何因應需求震盪。研究發表在2010年的國際科管年會（IEEE/ICMIT: International Conference on Management of Innovation and Technology），並再次榮獲最佳論文獎。

（五）顧客洞見：本文探討使用者導向設計（user centric design）的應用問題，分析趨勢科技（一家國際性防毒軟體公司）在產品開發過程中，如何理解使用者痛點與設計新產品的過程。本文發現，企業設計新產品時，往往忽略使用者所處的工作脈絡與企業環境，因而推出不符合使用者需求的產品。本文透過工作脈絡分析使用者的痛點，並重新省思系統設計原則。這個研究發表在2010年《組織與管理》期刊。這個期刊是目前台灣組織與管理學會（Taiwan Academy of Management）的重點刊物。

第三主題、組織作為

研究組織作為是為了理解科技內含的知識體系，了解創新背後的運作機制。分析組織作為也可以幫助我們理解跨專業的科研社群如何創生知識。組織作為是組織歷經一段調適性學習過程，所發展出來一套特有的例規，其中隱含了某些工作協調的原則，更建構了組織的集體能力。本主題下共發表四項相關作品，以下簡介作品內容。

(一) 越淮為枳：本文分析一項長達十五年的中德科技移轉案，地點在北京。中國航空公司與德國漢莎技術公司進行技術移轉，其中最關鍵的任務便是導入一套後勤資訊系統，以便學習德方的飛航維修技術。本文發現，原有的飛機維修資訊系統，在派工、採購與施工這三大維修內涵，具有特殊的運作模式與設計原則。這種科技內含的結構特質，是一套專屬於該科技的知識體系。現行的組織作為與科技內含的知識體系是否契合，是組織能否成功採納科技的關鍵。兩套知識體系若可互補，科技便很快能發揮功效。但是若兩套知識體系不相容時，科技便會處處干擾工作，使用者自然會逐漸棄而不用。使用者是否採用科技，不只是感覺、意會問題，也不只是科技功能不足，而是組織與科技之間內涵知識體系的衝突。本文延展科技契合理論(technology alignment)，發表於《資管學報》(2010年，國內第一級期刊)。

(二) 市集脈絡：本文探討新加坡科技工程集團(Singapore Technology Engineering)成功採納電子尋購的原由。該公司應用電子尋購系統，創造出驚人的節流績效，讓許多跨國公司紛紛群起複製。但是，複製的結果卻是畫虎不成反類犬，不但沒有達到相似的績效，反而讓採購作業中斷。本文發現，新科採用電子尋購系統的過程中，逐步發展出一套內嵌的組織運作原則，融入到本身的採購體系裡，成為自身特殊的組織作為，包括：事前的精算採購規格、強化支出能見度；事中的採購配額策略、落實公平的尋購機制以及事後對供貨商能力的監管。新科在採用電子尋購的過程中，逐步發展出這套組織作為。但是，光是引進科技而忽略轉移這套組織作為，就像擁有精良的武器，卻不知武器背後的戰術與戰略。本文指出，企業若要善用科技、引導創新，必須先了解科技內嵌的組織例規；在導入科技的同時，更需要融入相配套的組織作為。本研究已分系列作品發表在2008年的國際科管年會(IEEE/ICMIT: International Conference on Management of Innovation and Technology)、2009年的管理年會(Academy of Management Annual Meeting，領域第一級國際會議)以及國內的《中山管理評論》(2010年，國內第一級期刊)。

(三) 供應斷鏈：FreeMarkets是2000-2006年美國最具影響力的電子商務公司。該公司於當時企圖跨足中國市場，鎖定三個產業(資訊電子、電信、製藥)推廣企業間電子市集(Business-to-Business Electronic Marketplace)。但是推出後卻慘遭滑鐵盧。本研究調查電子市集導入資訊電子產業、電信產業與製藥產業中時，為何面臨無一企業採納的窘境。本文發現，電子市集內嵌的組織作為中斷了產業供應鏈的在地運作模式。企業在計畫、採購、生產製造與配銷過程中，不同產業往往有特殊考量。例如製藥業必需嚴格控管從採購、生產製造到配銷環節的品質，以確保藥品的安全符合檢驗標準。在此情況下，電子尋購強調價格透明化的議價機制就不是製藥業者的首要考量。顯然品質的要求遠高於價格的透明與效率。因此，從分析組織作為，我們可以理解科技的運作原則如何會衝撞供應鏈結構，從而找出科技採納問題。這個研究已發表在國際策略管理會議(2010, Strategic Management Society Conference, 領域第一級國際會議)，並榮獲最佳論文獎提名。

(四) 創新作為：本文分析一個國際聞名的台灣科研團隊，無線奈米生醫團隊，由前工研院副院長李世光博士主持(現資訊工業策進會執行長)。該團隊在有限的資源下，交出亮麗的創新績效，除了驚人的專利，其研發成果更是轟動國際，如抗煞一號(體外消滅SARS病毒的噴劑)。本個案分析一個科研團隊如何發展出一套特殊的組織作為，以持續創生知識。這套組織作為不只內涵科研運作例規，更是一套養成集體研發能力的機制，包括培養科研基本功、敏銳探索使用

者需求、中介跨領域研發知識以及經營專業學術社群。本文指出，超凡的科研團隊不是只靠提供獎勵或導入最佳實務，而是一套特殊的科學家培育過程。讓科學家具備不凡的實踐能力，才能夠創生複雜的專業知識，也才能建構優良的研發團隊。本文初稿發表在2010年8月的《組織與管理》期刊（Taiwan Academy of Management，這個期刊是目台灣組織與管理學會的重點刊物），並籌備英文版的發表中。

參、研究成果之學術與應用價值

學術成就上，本計畫共產出十二篇核心作品，每一篇作品都以質性研究，搭配學理，緊緊扣著產業的問題。整體而言，本計畫銜接國際脈絡學派分析創新的理論，同時又開拓國內與大陸對詮釋型質性研究與脈絡分析的廣泛應用，建立獨樹一幟的學術識別，並且在科技意會、人本設計、組織作為三個學術議題上有代表性作品以及原創性發表。

透過這些發表，本計畫主持人（蕭瑞麟博士）在國際學術社群受到普遍的肯定，間接讓台灣的創新管理研究在國際學術圈有更高的能見度。例如，在國際，本計畫主持人受邀成為《Information System Journal》期刊副主編，進入國際編輯群團隊（國際第二級期刊，impact factor正竄生為第一級期刊中）。本計畫主持人也受邀成為《Academy of Management: Learning and Education》期刊的編輯委員，該編輯群只有兩名亞洲學者，其影響力目前全球排名第八。此外，本計畫主持人目前也是管理學會（Academy of Management）OCIS（Organization Communication and Information Systems）的執行編輯，負責審核國際會議入選文章。還有，本計畫主持人受邀成為國際資管年會（International Conference on Information Systems）質性研究領域的執行編輯，以及國際科管年會（IEEE/ICMIT: International Conference on Management of Innovation and Technology）的技術委員。

在國內，本計畫主持人亦受邀成為《組織與管理》、《中山管理評論》於質性研究領域的執行編輯，以及《管理學報》、《資管學報》等第一級期刊於質性研究領域的評審，負責審核作品以及推廣專業規範的質性研究評審方法。本計畫主持人也受邀成為中國案例研究大會的審核委員會，由人民大學主辦，中國自然科學委員會指導，評審中國的管理案例。

實務貢獻上，本計畫較為顯著的有兩項研究成果（技術創新）。第一為協助半導體產業導入調適學習方法（Adaptive Learning Methods）。本計畫之研究成果受到國內半導體領先廠商聯華電子的重視，計畫將本研究所發現的「格物致知」學習機制導入到維修工程師的培訓中，並且研擬一套新的訓練方式，導入半導體維修的FBI（Field-Based Investigator）現場調查方法。本計畫也將根據此實驗結果研擬下一步的產業擴散計畫。第二為協助趨勢科技成立跨領域服務創新研發團隊導入人本設計方法。趨勢科技在美國行銷部門成立顧客洞見研究（Customer Insights Research），試圖以人類學的方式分析使用者需求，改變過去以技術為主導的研發程序。本計畫研究成果受到趨勢科技採用，並試行導入研發過程，結合設計思考方法來了解關鍵企業客戶於資訊需求上的痛點，以研擬新產品方案。未來，本計畫也會協助更多企業了解如何運用人本設計方法，使服務創新與產品研發結合。

肆、學術發表成果摘要

學術專書

1. 蕭瑞麟、侯勝宗，2008.11，《科技意會：衛星派遣系統的人性軌跡》，台灣培生教育出版。
2. 蕭瑞麟，2008.01，《科技福爾摩斯：科技創新與組織變革》，McGraw-Hill Taiwan。(入選科管百大選書第四名，榮獲行政院優良科技叢書數位內容選書)
3. 蕭瑞麟，2007.11，《不用數字的研究》，台灣培生教育出版。(入選科管百大選書，成為國內大專院校與企業廣為流傳之質性研究上課教材)
4. Hsiao, Rueylin, 2005.07, "*Management of information Technology Enabled Change: A Casebook*," McGraw-Hill Singapore.

國內期刊論文

1. 蕭瑞麟、廖啟旭、陳慧芬，2010，越淮為枳：從實務觀點分析跨情境資訊科技移轉，《資訊管理學報》(TSSCI)(即將刊登)
2. 蕭瑞麟、侯勝宗、歐素華，2010，演化科技意會：衛星派遣科技的人性軌跡，《資訊管理學報》(TSSCI)(即將刊登)
3. 蕭瑞麟、許瑋元，2010，資安洞見：由使用者痛點提煉創新來源，《組織與管理》，Vol. 3, No. 2, pp. 93-128. (台灣組織管理學會重點期刊)
4. 蕭瑞麟、歐素華、陳蕙芬，2010.03，市集脈絡：由組織例規分析資訊科技的創新來源，《中山管理評論》(TSSCI)(即將刊登)

國際期刊論文

1. HSIAO, Ruey-Lin; WU, S.W.; HOU, S.T., 2008, "Sensitive Cabbies: Ongoing Sense-making within Technology Structuring," *Information and Organization*, No.18, pp.251-279. (質性研究領域A-等級期刊)
2. HSIAO, Ruey-Lin, 2008, "Knowledge Sharing in a Global Professional Service Firm," *MIS Quarterly Executive*, Vol.7, No.3, pp.71-85. (國際資管領域第二級期刊)
3. HSIAO, Ruey-Lin, 2007, "Misaligned Market: The Importance of Industry Context on Technology Mediated Exchange," *Global Information Technology Management Journal*, Vol.15, No.3, pp.69-87. (國際資管領域第二級期刊)
4. HSIAO, Ruey-Lin; KUO, B.; CHU, C.H., 2006, "A Primer on the Analysis of Technology Mediated Learning Effectiveness," *Journal of Organizational Computing and Electronic Commerce*, Vol.16, No.2, pp.149-175. (國際資管領域第二級期刊)

5. HSIAO, Ruey-Lin; TSAI, D.H.; LEE, C.F., 2006, "The Problem of Embeddedness: Knowledge Transfer, Coordination, and Reuse in Information Systems", *Organization Studies*, Vol.27, No.9, pp.1289-1317. (國際第一級期刊)
6. HSIAO, Ruey-Lin; TEO, R.S.H., 2005.09, "Delivering on the Promises of E-procurement," *MIS Quarterly Executive*, Vol.4, No.3, pp.343-360. (國際第二級期刊)
7. HSIAO, Ruey-Lin, 2003, "Technology Fears: Distrust and Cultural Persistence in Electronic Marketplace Adoption," *Journal of Strategic Information Systems*, Vol.12, pp.169-199. (國際資管領域第二級期刊)
8. HSIAO, Ruey-Lin; Ormerod, R. J., 1998.01, "A New Perspective of the Dynamics of IT-enabled Strategic Change," *Information Systems Journal*, Vol.8, pp.21-52. (國際資管領域第二級期刊, 榮獲High Quality Citation Award)

國際會議論文

1. HSIAO, Ruey-Lin; OU, S. W.; CHEN, H.F., 2010, *Broken Chains: The Insignificance of Electronic Marketplace and Spirit Misfit*, Strategic Management Society Annual International Conference, Theme: Strategic Management at the Crossroads, September 12-15, 2010, Rome, Italy. (領域第一級國際會議, 本文榮獲提名大會最佳論文獎)
2. HSIAO, Ruey-Lin; OU, S.W., 2010, *Hidden Motives: Knowledge-sharing Problems in Supply Chain Collaboration*, IEEE/ICMIT (International Conference on Management of Innovation and Technology), Singapore. (EI會議)
3. HSIAO, Ruey-Lin; CHEN, H.F.; LIAO, C.S., 2010, *Adaptive Supply Network: How Nokia Absorbs Demand Shocks Through RosettaNet and Modularity Design*, The 5th IEEE/ICMIT (International Conference on Management of Innovation and Technology), 2-5 June 2010, Singapore. (EI會議, 榮獲最佳論文獎)
4. HSIAO, Ruey-Lin; OU, S.W.; CHEN, H.F., 2009, *Practices of Market-making for Sustaining Electronic Auction*, International Conference of Information Systems, December 15-18, 2009, Phoenix, Arizona, USA. (領域第一級國際會議)
5. HSIAO, Ruey-Lin; OU, S.W., 2009, *Bon Marche: Sustaining Technology-use and Organizing Principles of Market-making*, Academy of Management Annual Meeting, Theme: Green Management Matters, August 7-11, 2009, Chicago, Illinois, USA. (領域第一級國際會議)
6. HSIAO, Ruey-Lin; OU, S.W.; CHEN, H.F., 2009, *Practices of Market-Making for Sustaining Electronic Auction*, International Conference on Information Systems, December 15-18, 2009, Phoenix, USA. (領域第一級國際會議)
7. HSIAO, Ruey-Lin; HOU, S.T., 2008, *Sensual Cabbies: Senses and Sensitivities towards Technology Structuring with Emergent Innovations*, Academy of Management Annual Meeting, Theme: The Question We Ask, August 8-13, Anaheim, California, USA. (領域第一級國際會議)
8. HSIAO, Ruey-Lin; TSAI, D.H.; LEE, C.F., 2008, *Cross-Boundary Roaming: Coordinating Knowledge in a Dynamic Work Context*, Academy of Management Annual Meeting, Theme: The Question We Ask, August 8-13, Anaheim, California, USA. (領域第一級國際會議)

9. HSIAO, Ruey-Lin; CHEN, H.F., 2008, *When Innovation Blend-in Institutions*, Academy of Management Annual Meeting, Theme: The Question We Ask, August 8-13, Anaheim, California, USA. (領域第一級國際會議)
10. HSIAO, Ruey-Lin; LEE, C.; TSAI, S., 2007, *The Discovery of Boundary: Cross Boundary-spanning for Handling Ill-structured Problems*, Academy of Management Annual Meeting, Theme: Doing Well By Doing Good, August 3-8 2007, Philadelphia, Pennsylvania, USA. (領域第一級國際會議)
11. HSIAO, Ruey-Lin; HOU, S.T.; WU, S.W., 2007, *Critical Curse: Innovation Diffusion and Vagaries of Social Influences in Diverse Communities*, Academy of Management Annual Meeting, Theme: Doing Well By Doing Good, August 3-8 2007, Philadelphia, Pennsylvania, USA. (領域第一級國際會議)
12. HSIAO, Ruey-Lin, 2006, *Failure Trap: Cyclical Failure in Information Systems Implementation*," International Conference of Information Systems, Theme: IT for Under-Served Communities, December 10-13, Milwaukee, Wisconsin, USA. (領域第一級國際會議, 榮獲最佳論文獎)
13. HSIAO, Ruey-Lin, 2006, *Bridging the Digital Divided: Digital Learning Practices in Educational Broadcasting Systems*, Academy of Management Annual Meeting, Theme: Knowledge, Action and the Public Concern, August 11-16, 2006, Atlanta, Georgia, USA. (領域第一級國際會議)
14. HSIAO, Ruey-Lin; CHEN, C.S., 2006, *Technology Obsolescence: Information Systems Sustainability under Supply Chain Migration*, Academy of Management Annual Meeting, Theme: Knowledge, Action and the Public Concern, August 11-16, 2006, Atlanta, Georgia, USA. (領域第一級國際會議)
15. HSIAO, Ruey-Lin; LEI, Y.J., 2005, *Information System Adoption as an Occasion of Knowledge Transfer*, Academy of Management Annual Meeting, Theme: A New Vision of Management in the 21st Century, August 5-10, 2005, Honolulu (On the Island of Oahu), Hawaii, USA. (領域第一級國際會議)
16. HSIAO, Ruey-Lin; HOU, S.T.; WU, S.W., 2005, *Technology Sensemaking: Local Knowledge and Patterns of Technology Adoption*, Academy of Management Annual Meeting, Theme: A New Vision of Management in the 21st Century, August 5-10, 2005, Honolulu (On the Island of Oahu), Hawaii, USA. (領域第一級國際會議)
17. HSIAO, Ruey-Lin, 2005, *Technology Mediated Learning with a Chinese Face: A Case Study on Ladder Digital College*, Academy of Management Annual Meeting, Theme: A New Vision of Management in the 21st Century, August 5-10, 2005, Honolulu (On the Island of Oahu), Hawaii, USA. (領域第一級國際會議)
18. HSIAO, Ruey-Lin; JIANG, L.; TEO, T.S.H., 2005, *Limits to Electronic Sourcing Adoption in Chinese Healthcare Sector: A Contextualist Perspective*, The Ninth Pacific Asia Conference on Information Systems, Theme: IT and Value Creation, July 7-10, Bangkok, Thailand. (領域第二級國際會議)
19. HSIAO, Ruey-Lin; LI, Y., 2005.07, *Technology Transfer in Cross-national Context: Experience of an Online Market Failure in China Food Industry*, The Ninth Pacific Asia Conference on

- Information Systems, Theme: IT and Value Creation, July 7-10, Bangkok, Thailand. (領域第二級國際會議)
20. HSIAO, Ruey-Lin, 2004, *Assessing the Outcome of Technology Mediated Learning: The Significance of Learning Context*, Academy of Management Annual Meeting, Theme: Creating Actionable Knowledge, August 6-11, 2004, New Orleans, Louisiana, USA. (領域第一級國際會議)
 21. HSIAO, Ruey-Lin; LEE, C.F.; TSAI, D.H., 2004.08, *Knowing in Situated Practice: Knowledge Transferring Systems in the Workplace*, Academy of Management Annual Meeting, Theme: Creating Actionable Knowledge, August 6-11, 2004, New Orleans, Louisiana, USA. (領域第一級國際會議)
 22. HSIAO, Ruey-Lin; LEI, Y.J., 2004, *Embedded Knowledge and Situated Context: Exploring the Ground Beneath Information System Adoption*, The Eighth Pacific Asia Conference of Information Systems, Theme: Information Systems Adoption and Business Productivity, July 8-11, 2004, Shanghai, PRC. (領域第二級國際會議)
 23. HSIAO, Ruey-Lin; LEE, C.; TSAI, S., 2003, *The Problem of Embeddedness: Knowledge Transfer, Situated Practice & the Role of Information Systems*, International Conference of Information Systems, December 14-17, 2003, Seattle, Washington, USA. (領域第一級國際會議)
 24. HSIAO, Ruey-Lin, 2003, *Guanxi the Production of Trust in an Electronic Marketplace*, Academy of Management Annual Meeting, Theme: Democracy in Knowledge Economy, August 1-6, 2003, Seattle, Washington, USA. (榮獲部門主題最佳論文獎，領域第一級國際會議)
 25. HSIAO, Ruey-Lin; KUO, B.; CHU, C.H., 2002, *E-learning Difficulties: The Impact of Content, Process and Context on the Outcome of Technology-mediated*, Academy of Management Annual Meeting, Theme: Building Effective Network, Denver, Colorado, USA. (領域第一級國際會議)
 26. HSIAO, Ruey-Lin, 2001, *Technology Fear: The Difficulty of B2B Adoption in SME*, International Conference of Information Systems, Theme: A Digital Odyssey, 16-19 December, 2001, New Orleans, Louisiana, USA. (領域第一級國際會議)
 27. HSIAO, Ruey-Lin, 1999, *Rediscovering Stickiness: The Barriers to Codified Knowledge Transfer*, Strategic Management Society Annual International Conference, Theme: Winning Strategies in a Deconstructing World, October 2-6, 1999, Berlin, Germany. (領域第一級國際會議)
 28. HSIAO, Ruey-Lin, 1999, *A Reflective Path for Knowledge Transfer*, EGOS (European Group of Organization Studies) Colloquium, 4-6 July 1999, Coventry, Warwick University, UK. (領域第一級國際會議)
1. HSIAO, Ruey-Lin; ORMEROD, R., 1998, *Knowledge Transfer: A Discovery-oriented Framework*, Strategic Management Society Annual International Conference, Theme: Tailoring Strategy - One Size Does Not Fit All, November 2-5, 1998, Orlando, Florida, USA. (領域第一級國際會議)
 2. HSIAO, Ruey-Lin; ANTONACOPOULOU, E, 1998.07, *The Dynamic Construction of Change Reality*, EGOS (European Group of Organization Studies) Colloquium, July, 1998, Maastricht, Netherlands (領域第一級國際會議)

伍、學術成果（指導研究學生之發表）

本計畫項下的共培育三位博士生，其個別之發表成果整理如下（無指導老師掛名作品）：

陳蕙芬（2010年4月畢業）

現職：國立台北教育大學教育系暨創新與評鑑碩士班助理教授

Chen, Hui-Fen, "Robust Design: Leveraging Institutional Barriers to Adoption Enablers." Presented at Hitotsubashi G-COE Research Workshop on Innovation and Management, to be held in Tokyo, 15-18 July, 2010. (日本一橋大學主辦之頂尖大學研究論壇，本研究是唯一受邀的亞洲團隊)

Chen, Hui-Fen, and Chu, Tsai-Hsin, "Robust Design and Innovation Diffusion: A Contextual Analysis", presented at IEEE International Conference on Management of Innovation and Technology, Bangkok, Thailand, September 21-24, 2008. (This paper receives the Outstanding Paper Award from the Conference)

陳蕙芬、朱彩馨 (2008) 當創新融入制度：強力設計與創新擴散，發表於中華民國科管年會暨論文研討會。

朱彩馨、陳蕙芬 (2008)，階梯數位學院：遇見學習的幸福。個案編號：AR0000916。收錄於台灣管理個案中心

廖啟旭（2010年7月畢業）

Carugati, A., Liao, R., & Smith, P. (2008), Speed-to-fashion: Managing global supply chain in Zara, IEEE/ICMIT (International Conference Management of Innovation and Technology).

廖啟旭 (2008)，來自關懷的創新——以優樂筆為例。中華民國科技管理學會年會暨論文研討會。（獲得大會最佳論文獎）。

歐素華（2010年11月畢業）

現況：國科會《開放式創新的服務脈絡》三年期計畫，博士後研究員（預計於十二月份任職）。

歐素華（2010）組織的知曉力：科學社群的知識創生。《組織與管理》（即將發表，台灣組織管理學會重點期刊）。

蕭瑞麟、侯勝宗、歐素華(2010)演化科技意會：衛星派遣科技的人性軌跡，《資訊管理學報》。
(即將發表，TSSCI，國內第一級期刊)。

Ou, Su-Hua, 2008. “Practices Make perfect (market): Case of Singapore Technology Engineering,”
presented at IEEE/ICMIT (International Conference on the Management of Innovation and
Technology), Bangkok, 21-24 September。(科管領域EI國際學術會議)

歐素華，吳依凡(2009)跨領域創新的學習脈絡——以先進無線生醫保健監測系統為例。發表
於中華民國科管年會暨論文研討會。

林良陽、歐素華(2008)科技創新組合型態——以無線奈米生醫研發團隊為例。發表於中華民
國科管年會暨論文研討會。

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■達成目標

說明：

一、研究成果在學術期刊發表或申請專利等情形：

論文：■已發表 □未發表之文稿 □撰寫中 □無

已發表

國內期刊論文

1. 蕭瑞麟、廖啟旭、陳蕙芬，2010，越准為枳：從實務觀點分析跨情境資訊科技移轉，《資訊管理學報》(TSSCI，即將刊登，國內第一級期刊)
2. 蕭瑞麟、侯勝宗、歐素華，2010，演化科技意會：衛星派遣科技的人性軌跡，《資訊管理學報》(TSSCI，即將刊登，國內第一級期刊)
3. 蕭瑞麟、許瑋元，2010，資安洞見：由使用者痛點提煉創新來源，《組織與管理》，Vol. 3, No. 2，pp.93-128. (台灣組織管理學會重點期刊)
4. 蕭瑞麟、歐素華、陳蕙芬，2010.03，市集脈絡：由組織例規分析資訊科技的創新來源，《中山管理評論》(TSSCI，即將刊登，國內第一級期刊)

國際期刊發表

1. HSIAO, Ruey-Lin; WU, S.W.; HOU, S.T., 2008, "Sensitive Cabbies: Ongoing Sense-making within Technology Structuring," *Information and Organization*, No.18, pp.251-279. (質性研究領域A-等級期刊)
2. HSIAO, Ruey-Lin, 2008, "Knowledge Sharing in a Global Professional Service Firm," *MIS Quarterly Executive*, Vol.7, No.3, pp.71-85. (國際資管領域第二級期刊)
3. HSIAO, Ruey-Lin, 2007, "Misaligned Market: The Importance of Industry Context on Technology Mediated Exchange," *Global Information Technology Management Journal*, Vol.15, No.3, pp.69-87. (國際資管領域第二級期刊)

國際會議發表

1. HSIAO, Ruey-Lin; OU, S. W.; CHEN, H.F., 2010, *Broken Chains: The Insignificance of Electronic Marketplace and Spirit Misfit*, Strategic Management Society Annual International Conference, Theme: Strategic Management at the Crossroads, September 12-15, 2010, Rome, Italy. (領域第一級國際會議, 本文榮獲提名大會最佳論文獎)
2. HSIAO, Ruey-Lin; OU, S.W., 2010, *Hidden Motives: Knowledge-sharing Problems in Supply Chain Collaboration*, IEEE/ICMIT (International Conference on Management of Innovation and Technology), Singapore. (EI會議)
3. HSIAO, Ruey-Lin; CHEN, H.F.; LIAO, C.S., 2010, *Adaptive Supply Network: How Nokia Absorbs Demand Shocks Through RosettaNet and Modularity Design*, The 5th IEEE/ICMIT (International Conference on Management of Innovation and Technology), 2-5 June 2010, Singapore. (EI會議, 榮獲最佳論文獎)
4. HSIAO, Ruey-Lin; OU, S.W.; CHEN, H.F., 2009, *Practices of Market-making for Sustaining Electronic Auction*, International Conference of Information Systems, December 15-18, 2009, Phoenix, Arizona, USA. (領域第一級國際會議)
5. HSIAO, Ruey-Lin; OU, S.W., 2009, *Bon Marche: Sustaining Technology-use and Organizing Principles of Market-making*, Academy of Management Annual Meeting, Theme: Green Management Matters, August 7-11, 2009, Chicago, Illinois, USA. (領域第一級國際會議)
6. HSIAO, Ruey-Lin; OU, S.W.; CHEN, H.F., 2009, *Practices of Market-Making for Sustaining Electronic Auction*, International Conference on Information Systems, December 15-18, 2009, Phoenix, USA. (領域第一級國際會議)
7. HSIAO, Ruey-Lin; HOU, S.T., 2008, *Sensual Cabbies: Senses and Sensitivities towards Technology Structuring with Emergent Innovations*, Academy of Management Annual Meeting, Theme: The Question We Ask, August 8-13, Anaheim, California, USA. (領域第一級國際會議)
8. HSIAO, Ruey-Lin; TSAI, D.H.; LEE, C.F., 2008, *Cross-Boundary Roaming: Coordinating Knowledge in a Dynamic Work Context*, Academy of Management Annual Meeting, Theme: The Question We Ask, August 8-13, Anaheim, California, USA. (領域第一級國際會議)
9. HSIAO, Ruey-Lin; CHEN, H.F., 2008, *When Innovation Blend-in Institutions*, Academy of Management Annual Meeting, Theme: The Question We Ask, August 8-13, Anaheim, California, USA. (領域第一級國際會議)
10. HSIAO, Ruey-Lin; LEE, C.; TSAI, S., 2007, *The Discovery of Boundary: Cross Boundary-spanning for Handling Ill-structured Problems*, Academy of Management Annual Meeting, Theme: Doing Well By Doing Good, August 3-8 2007, Philadelphia, Pennsylvania, USA. (領域第一級國際會議)
11. HSIAO, Ruey-Lin; HOU, S.T.; WU, S.W., 2007, *Critical Curse: Innovation Diffusion and Vagaries of Social Influences in Diverse Communities*, Academy of Management Annual

Meeting, Theme: Doing Well By Doing Good, August 3-8 2007, Philadelphia, Pennsylvania, USA. (領域第一級國際會議)

專書 (本計畫下出版專書一本)

1. 蕭瑞麟, 2008.01, 《科技福爾摩斯: 科技創新與組織變革》, McGraw-Hill Taiwan。
(入選科管百大選書第四名, 並榮獲行政院優良科技叢書數位內容選書)

審核中作品

HSIAO, R. L.; TSAI, D.H.; LEE, C.F., Collaborative Knowing: the Adaptive Nature of Cross-Boundary Spanning, Journal of Management Studies (國際第一級期刊, 第三審中)

HSIAO, R. L.; HOU, S.T. Making Better Sense: a Process Study of Taxi-Drivers' Sensemaking with GPS-Dispatch Systems, Organization Studies (國際第一級期刊, 第二審中)

二、請依學術成就、技術創新、社會影響等方面, 評估研究成果之學術或應用價值 (簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性)

學術成就上, 本計畫共產出十二篇核心作品, 每一篇作品都以質性研究, 搭配學理, 緊緊扣著產業的問題。整體而言, 本計畫銜接國際脈絡學派分析創新的理論, 同時又開拓國內與大陸對詮釋型質性研究與脈絡分析的廣泛應用, 建立獨樹一幟的學術識別, 並且在科技意會、人本設計、組織作為三個學術議題上有代表性作品以及原創性發表。實務貢獻上, 本計畫較為顯著的有兩項研究成果 (技術創新)。第一為協助半導體產業導入調適學習方法 (Adaptive Learning Methods)。本計畫之研究成果受到國內半導體領先廠商聯華電子的重視, 計畫將本研究所發現的「格物致知」學習機制導入到維修工程師的培訓中, 並且研擬一套新的訓練方式, 導入半導體維修的FBI (Field-Based Investigator) 現場調查方法。本計畫也將根據此實驗結果研擬下一步的產業擴散計畫。第二為協助趨勢科技成立跨領域服務創新研發團隊導入人本設計方法。趨勢科技在美國行銷部門成立顧客洞見研究 (Customer Insights Research), 試圖以人類學的方式分析使用者需求, 改變過去以技術為主導的研發程序。本計畫研究成果受到趨勢科技採用, 並試行導入研發過程, 結合設計思考方法來了解關鍵企業客戶於資訊需求上的痛點, 以研擬新產品方案。未來, 我們也會協助更多企業了解如何運用人本設計方法, 使服務創新與產品研發結合。

市集脈絡：由組織例規分析資訊科技的創新來源

**Organizing Marketplace: Organizational Routines as a Source for
IT-enabled Innovation**

蕭瑞麟

Ruey-Lin Hsiao

政治大學科技管理研究所

台北市文山區指南路二段64號

電話: (02)29393091轉81248 傳真: (02)29363765

rueylin@nccu.edu.tw

歐素華*

Sue-Hwa Ou

政治大學科技管理研究所

台北市文山區指南路二段64號

電話: 0936078060

95359502@nccu.edu.tw

陳蕙芬

Hui-Fen Chen

政治大學科技管理研究所

台北市文山區指南路二段64號

電話: 0939283979

f1217430@gmail.com

政策與管理意涵

本文探討資訊科技如何帶來持續有效的組織創新。本研究鎖定電子競標系統，分析資訊科技中內嵌的組織例規（organizational routine），了解這套系統如何為企業引入尋購服務的創新。特別，為分析組織例規，本研究由實務觀點著手，分析工作脈絡與科技內的組織作為（organizing practices），歸納這些組織作為背後的知識體系。分析科技中內含的組織例規，將有助於了解組織創新的過程與成效。

本研究提供兩點學理上的貢獻。首先，本文由微觀的結構性變化來分析科技使用與組織創新。這有別於過去以科技接受、採納、使用的主導文獻，主要由分析組織的形貌，分析科技不被接受的條件。本研究認為，要了解科技如何促成組織創新，必須分析搭配科技使用的組織例規，了解資訊科技內的結構特質。而要了解組織例規，就必須由工作脈絡著手。本研究提出以組織作為來分析例規的動態內涵。由工作脈絡分析科技使用與組織創新，是本文對資訊管理與組織例規文獻主要貢獻。

其次，本研究填補電子市集文獻的缺口。現今電子市集的討論多強調在拍賣流程的建立、採購流程的重整、技術性信任機制的建置。但是，現有文獻卻少由市集運作（market-making）之機制著手分析。本研究由電子競標著手，分析尋購的流程，再由尋購流程中剖析內嵌的市集運作機制；從而解讀個案公司，新加坡科技工程集團是如何達成持久的組織創新。將電子市集建構過程更完整的呈現出來，是本研究的主要貢獻之二。

在管理實務方面，本研究對企業運用科技進行組織創新有兩項重要啟發。首先，企業導入電子競標系統時，必須搭配完備的市集運作機制。本案例詳細詮釋電子市集如何有效運作的機制，可以作為企業在導入電子競標系統時，建置尋購流程與市集運作機制的參考。本研究發現的七個組織例規，可協助企業建構一套配搭尋購體系，指導導入企業如何考慮買賣雙方利益，以及第三方中介平台所扮演的角色，維運一個公平的交易環境。如此，企業在導入電子競標系統時，方能減低對供應鏈所帶來的衝擊。

更廣義而言，本研究建議在使用資訊科技時，必須先了解科技內嵌特殊的組織例規，那是一套組織作為，一套組織運作的知識體系。導入科技時若只運用技術功能、調整作業流程，只是治標而非治本，還需要引進其配套的知識體系。例如，本案中的電子競標系統看似簡單，但科技之中卻蘊含一套市集經營的知識體系，維持買方、市集營運商、供應商之間的信任，協調採購規劃、活絡市集以及確保供貨品質。若是企業在運用其它資訊科技時，如企業資源規劃系統或衛星車輛派遣系統，也要先了解系統中的組織例規，不可貿然採用卻忽略系統中內嵌的組織運作機制。

總之，本研究認為資訊科技若要帶來組織創新，企業必須深入理解科技內含的組織作為，了解科技中的組織運作脈絡。如此，科技方能充分發揮其潛力。

市集脈絡：由組織例規分析資訊科技的創新來源

Organizing Marketplace: Organizational Routines as a Source for IT-enabled Innovation

摘要

導入資訊科技時，企業多關切接受、導入、採納與應用等議題。但是，我們卻常常忽略，企業導入科技後，往往無法持續地被使用，也始終無法展現創新的效益。如何才能使科技持久發揮效用，並促成組織創新成效？本研究調查電子競標系統如何創新企業中的尋購服務作業，促成有效的供應鏈管理。為深入了解科技的創新結果，我們由組織例規（organizational routines）著手，分析電子競標系統在尋購過程中的工作脈絡，以了解科技如何促發服務創新，並得以持續發揮效益。本研究發現，電子競標系統運作時，必須配合一套環環相扣的組織例規，方能持久有效的運作。組織例規內嵌著一套特定的組織作為（organizing practices），是一套市集營運的知識體系。這套知識體系，正是讓這項科技得以持久有效運用的根本原因。文中最後探討本案例對科技使用、組織例規以及電子市集文獻上的啟示，並點出資訊科技與組織創新的實務意涵。

關鍵字：組織例規、組織作為、電子競標系統、市集營運、質性研究

Abstract

Current literatures on information system and organization innovation emphasize more on how to accept, implement, and adopt technology. However, we know relatively little about why technology-enabled organizational innovation was mostly aborted before a technology reaches its full potential. To address this issue, this research conducts a field-based study and examines how an electronic auction system is used in a given working context. It particularly examines the organizational routine embedded in the technology. To examine organizational routine, this research analyzes work practices and illustrates various activities of market-making in electronic auction. Our findings report that, in the case, the organization routine contains a set of organizing practices. Behind such organizing practices, there are organizing principles illustrating a coherent system of market-making knowledge. The organizing practices offer an alternative way to understand how technology may be deployed effectively and organizational innovation may be sustained. The theoretical and practical implications of organizational routine are discussed.

Key words: organizational routine, organizing practices, electronic auction, market-making, qualitative research.

壹、緒論

現實社會中，企業導入資訊科技並能造成組織創新者，其實如鳳毛麟角、少之又少（Sauer, 1999）。當今文獻多將分析重點放在科技的接受（technology acceptance）與初期採納（initial adoption）問題。但是，我們卻不明白，為何企業對一項資訊科技，例如企業資源管理系統、衛星派遣系統、電子市集、數位學習系統，順利地接受與採納，但過一陣子後，卻棄新科技而不用。「科技為何不能發揮效用？為何不能造成組織創新？」這是當今探討創新，尤其是資訊科技創新文獻中非常關鍵、卻尚未受到足夠重視的議題（Scott-Morton, 1991; Orlikowski, 1996; Robey and Boudreau, 1999）。

要回答這個問題，我們主張從資訊科技的內涵下手。其實，資訊科技本身就是一種複雜的創新。資訊科技除了外顯技術功能外，還鑲嵌著一套組織作為（organizing practices）（Swanson and Ramiller, 1997）。例如，企業資源規劃系統就內嵌一組整合組織資源的方法，協調供應鏈的運作方式（Soh and Sia, 2004）。更深一層來看，科技內的組織作為背後有一套組織運行的知識體系，引導企業該做什麼，又不該做什麼。若我們不了解資訊科技中隱含的組織作為，即使科技有再新穎的技術功能，也無法充分發揮效益；同時，創新的成效也將受到局限（Attewell, 1992）。

換言之，企業在導入一項科技時，如同轉移一套新的知識體系到組織中（Lee and Lee, 2000）。但是，企業中也有一套既存的知識體系，維持其日常運作。因此，科技內含的知識體系與企業內既有知識體系之間的磨合，會導致一連串的結構性變化（Orlikowski and Robey, 1991; DeSantics and Poole, 1994; Orlikowski et al., 1995）。當科技與組織雙方的知識體系有效融合後，新的組織作為將蔚然成貌，形成新的組織例規（organizational routines），成為企業運作的助力，而非阻力（Edmondson et al., 2001）。

由此觀點看來，要了解一套運作良好的資訊系統如何能造成組織創新，不能只看它新穎的技術功能，更要看內含於科技內的組織例規。然而，要了解科技中有哪些組織例規，就不能只看表面的使用規則與作業流程，我們更要分析組織例規中的組織作為（organizing practices），那是一套組織運作的知識體系，含有顯性的工作規範（如標準作業流程），也含有隱性的潛規則；它是一套特定的組織運作邏輯，具有某種指導原則，並含有特定的管理精神（DeSantics and Poole, 1994）。例如，數位學習系統隱含一套特定的教學組織作為，衛星派遣系統內藏一套特定的後勤組織作為，電子市集中有一套特定的市集運作組織作為。

特別值得注意的是，我們不可將組織作為與工作實務（work practices）視為等同，雖然作為與實務的英文（practice）是一樣的。工作實務指的是組織成員做的工作、執行的任務（Schultze and Orlikowski, 2004）。由工作實務上，我們才可以歸納出這個組織有何「作為」。因此，一個企業做了很多工作，並不能代表它就很有所作為，也不代表這些作為背後有令人值得學習的組織例規。舉例來說，保險公司業務的工作實務是稽核保單資料、計算保費等（Schultze and Orlikowski, 2004）。在長期運作後，保險從業人員

對於保單資料的填寫，發展出保險人必須主動告知，其他投保合約或健康事項等具體的組織作為。所以，我們主張，從組織作為分析組織例規，才能真正了解科技如何締造組織創新。

我們的研究問題是：科技中蘊含了哪些組織例規，以支持科技的有效運用。我們選擇電子競標系統（*electronic bidding systems*）為研究對象，也稱為反向拍賣系統（*reverse auction, electronic auction*）、電子採購系統（*electronic procurement*）或電子尋購系統（*e-sourcing systems*）。電子競標屬於電子市集的一種，也是電子採購的一環，它是一種競標平台，在相同採購規格的基礎上，讓買方與賣方能夠透過平台競價（*Emiliani, 2006*）。通常企業（也就是買方）在導入電子競標系統時，會使用軟體廠商的採購平台，然後邀請特定的供應商參與競標。在競標過程中，軟體廠商有時候會提供顧問服務，協助買方解決採購問題，例如尋找新供應商、制定產品採購規格等。*FreeMarkets*以及*Ariba*便是當時市場上兩大品牌（*Anderson and Frohlich, 2001*）。不過，我們需注意，電子競標系統不是單獨存在的，它是尋購流程（*sourcing process*）中的一環。在舉辦競標採購前後，企業也要籌備許多事前作業與事後評估。

電子競標系統是研究科技創新很好的對象。電子競標系統的導入相對簡易，又可以達成顯著節流效益。因此，自1995年起，在企業間蔚為風潮。特別在新加坡，許多跨國性企業競相導入電子競標系統來強化供應鏈、節省成本以及增加效率。但是，許多企業在導入一至兩年後，就棄之不用。更有些企業因為導入電子競標，反而干擾了供應鏈作業，使成本上升。結果，三年後還繼續使用該系統的公司寥寥無幾（*Hsiao and Teo, 2005*）。因此，了解電子競標內有哪些組織例規，支援著科技的使用，將可以協助我們了解組織如何取得創新成效。

本文的架構如下。下一章先說明科技使用與組織例規的理論基礎。接著，我們詳述個案選擇、資料收集與分析等研究方法議題。然後，我們報告研究發現，說明如何由工作實務分析市集經營（*market-making*）的組織作為，以解讀內嵌於科技的組織例規。最後，我們提出本研究的理論與實務意涵。

貳、文獻探討

我們先由科技使用與組織例規的文獻切入，來討論組織創新的議題。過去，資管領域的研究多著重在分析組織成員接受資訊科技的過程、系統本身變化（修訂與適應）的歷程、以及組織轉型的結果等（*Mathieson, 1991; Venkatraman and Koh, 1991; Venkatesh et al., 2003; 郭更生等人, 2003; 張心馨, 2004*）。但是，為何使用者初期接受與採納科技後，過一陣子卻被棄之不用，因而組織的創新也胎死腹中。近代組織學文獻指出，我們必須了解資訊科技的使用（*Boudreau and Robey, 2005; Edmondson et al., 2001; Orlikowski, 1996*）。科技是否被有效的使用、如何使用、使用後是否帶來創新，才是我們應該著重的研究焦點（*林東清、孫培真, 2001*）。*Edmondson*等人（2001）主張，科技使用的好不好、帶來的成效是否創新，必須看科技中內蘊的組織例規。

不過，在當代強調科技的文獻中，組織例規的分析被忽視了。有些學者雖然分析科技採納後不被繼續接受的原因（Karahanna et al., 1999; Bhattacharjee, 2001; Jaspersen et al., 2005），但是這樣的分析只是舊酒裝新瓶，分析採納的變數，還是未能解讀出科技的內涵。另外，科技契合（technology alignment）文獻中（Scott-Morton, 1991; Soh and Sia, 2004; Yetton and Sauer, 1997），學者分析的是科技如何與不同的組織元素調準，諸如組織架構、生產流程、企業策略、員工職能等。不過，這些研究也忽略，要使用科技來創新組織，是會導致組織的結構性變化，同時科技的本質也會隨之改變（technology structuring，見Barley, 1986; Orlikowski, 1996; Orlikowski and Robey, 1991）。當經過調適過程後，科技內的結構被改變，以有效促成某種組織創新。那麼，我們要問，被改變後，科技內含的組織例規是何樣貌呢？由此，若我們能了解科技內含的組織例規，也就能對如何有效使用科技有新的看法。

由表面看，組織例規是一種規範，像標準作業流程，是一種穩定的力量，規範著員工做事方法與行為準則（Hage and Aiken, 1969）。但深一層來看，組織例規也是一種能力的呈現，它提供參考點，讓成員理解工作的內涵，讓員工在遵守規範時又能彈性的應付突發狀況（Nelson and Winter, 1982）。例規也是一種組織記憶，提供一套無形的程式，引導人們應該做什麼，不應該做什麼；該扮演什麼角色，又應該負起什麼責任（Walsh and Ungson, 1991）。組織例規也可以視為一種「樣版」（template），指引員工的行為，讓員工在無形中養成某種工作習慣，並驅使來自不同領域的專家，依據這種工作習慣完成任務（Gersick and Hackman, 1990）。組織例規中更隱含著分散於各部門的知識，是促進成員相互學習的媒介（Cohen, 1991）。組織例規亦會形塑特定的工作協調方式，如爵士音樂一樣，組織例規中有一個固定的主旋律，但是卻可以有不同的詮釋演奏方式。Feldman將這種既有規範、又深具彈性的例規運用，取了一個有趣的名稱：致力之成就（effortful accomplishment）——用來說明例規引導組織活動的多種可能性（Feldman and Pentland, 2003）。

我們需注意，組織例規不是最佳實務（best practice），可以複製後使用。組織例規中含有一套組織作為，是一套組織運作的知識體系。所以，若不知道組織例規背後的知識體系，就算複製組織例規，使用時也將窒礙難行。而且，組織例規是集體能力的呈現（Orlikowski, 2002），非一時可以養成。組織例規中的知識體系必須靠不同部門的專家去運行，才會產生成效。這不只個人要了解例規的運作；集體上，各部門專家更需要對組織例規有純熟的理解與運用，才能如交響樂團般有效的協調運作。這樣的集體智慧不是短期可以學起來的，如果沒有一定時間的集體行動、集體學習，一個企業很難將這些組織例規完全融入。所以，使用科技不只是導入科技功能，更是集體的學習過程，讓例規成為組織記憶的一部分。

當例規融入企業，成為組織記憶的一部分，例規就不再只是法令的依循，或者單純的合法化儀式而已（Hermanowicz and Morgan, 1999）。組織例規會漸漸成為員工合作的默契，引導員工自發性的應用，去處理日常營運事務或回應突發危機（Feldman, 2004）。我們要特別留意，例規個別存在時並不具任何意義，也無法發揮整體成效。雖然轉移組

組織例規所規範的工作實務不會太困難，但是要轉移其中的集體學習、合作默契、共同體會、運作潛規則，卻是不容易的（Hargadon and Sutton, 1997）。

分析組織例規可以由組織作為下手。資訊科技通常內含某種做事的方法、某種合作的型態、某種活動的習慣，學者統稱為組織作為（DeSantics and Poole, 1994）。分析組織作為，可以幫助我們了解組織例規是如何運作。Orlikowski（1996）認為組織作為可以由工作實務脈絡（work practices in situated context）中分析。例如，在保險業，網路交易系統內有一套管理客戶關係的組織作為，協助業務員與保險經紀人合作（Schultze and Orlikowski, 2004）。心臟導管手術科技內含的是跨專業的學習，及協同式的組織作為來協調醫生如何進行手術（Edmondson, Bohmer et al., 2001）。群組軟體內含的是成員溝通方式與知識分享的組織作為（Yates and Orlikowski, 2002）。Orlikowski（2002）則是分析軟體工程師在跨國團隊的組織作為，解讀知識形成的樣貌。另外，Dutton等人（2006）以學校宿舍失火的例子，探討行政人員與各單位，如何以自發性行動激發相關人士的同情心，並有效組織這些活動呈現憐憫的脈絡（compassion organizing）。

我們認為，要了解鑲嵌在科技內的組織例規，必須由工作實務中分析組織作為。然而，上述之研究雖由不同科技中解讀了組織作為，卻仍未能具體地描述這些組織作為之間又是如何相互連結，形成一套知識體系。還有，組織作為內含的知識體系也尚未被詳盡地分析（Swanson and Ramiller, 1997）。這也是當今文獻仍不逮之處。

除了科技創新與組織例規文獻外，本研究也補強電子市集文獻之不足。現有電子市集文獻多強調在拍賣流程的建立（Kambil and van Heck, 1998）、採購流程的重整（Lee and Clark, 1997）、技術性信任機制的建置（Ba and Pavlou, 2002）；但是，卻少有人分析市集的運作機制（market-making mechanism）。本研究由電子競標系統著手，分析尋購的流程；由尋購流程中，再剖析科技內嵌的組織作為，呈現例規的樣貌，解讀該科技如何達到尋購服務的創新。

不過，本研究並不是要分析科技導入後組織的結構性變化歷程，而是要探索一項科技在與組織有效融合後，究竟發展出哪些組織例規，得以支持該科技的持久使用。了解資訊科技內含的組織例規，才是本研究的重點。接下來說明研究設計與資料蒐集分析過程。

叁、研究方法

本研究嘗試由科技的內涵，了解使用資訊科技如何促成組織創新。科技導入組織後，若磨合得當，會漸漸形成一套組織例規，規範、引導並協調成員的合作。不過，組織例規鑲嵌於日常工作實務，展現於成員的重覆性行為態樣（Feldman and Pentland, 2003），不易直接觀察到。我們需深入企業，實地了解成員的工作方式與運作機制。我們需要分析內涵與過程。因此，質性研究是較為合適的作法。總括來說，本研究使用質性研究法的原因有三點，分述如下。

第一，本研究目的在分析科技的內涵，必須剖析其中的組織運作過程（organizing process），了解科技有效使用背後的運作脈絡。因此，以「過程」為主的個案研究法比較適合此類研究（Langley, 1999）。不過，雖然本研究橫跨數年度，但是其重點不在分析科技導入組織的變革歷程（temporal development; 見Pettigrew, 1990之探討），而是探索組織例規運作的過程。

第二，近來，更多學者提倡不應局限於以變數（variables）來分析巨觀的結構性變化（macro structural changes），而鼓勵更多研究投入以分析微觀之行動（micro actions）來補其不足（Barley, 1996; Hargadon and Sutton, 1997; Markus and Robey, 1988）。本研究延續脈絡學派的觀點（Pettigrew, 1987），探索個案的真實情境（context）、員工的工作實務（content），以及科技在組織的運作過程（process），將可以幫助我們由個體的微觀行動推論巨觀的科技內涵。因此，以案例方式來分析組織成員的工作實務是比較合適的。例如，Hargadon and Sutton(1997)便是以質性研究法分析著名設計公司IDEO的創新組織例規。

第三，本研究嘗試透過新科的尋購作業與運行電子競標的工作實務來分析「組織例規」。然而，組織例規並非僅是一套標準作業程序，更包含在成員每日的工作實踐之中（situated action），也鑲嵌在成員隱而未顯的協作行為中。如此，要分析成員如何運行組織例規而使用科技，就不能只由抽樣問卷調查、單次的訪談方法進行。我們也必須運用參與觀察（而不介入），方能洞察成員使用科技的脈絡，釐清科技與使用者的互動機制以及利害關係人（stakeholders）之間衝突。以下分別就個案選擇、資料收集過程與資料分析方法，進行說明。

一、個案選擇考量

本研究所選擇的個案公司是新加坡科技工程集團（以下簡稱新科），為國家級績優企業代表。旗下共分為四大事業群，包括：航太、電子、武器（陸上裝備）以及海洋事業。集團年營收為21億美金，在美國、英國、澳洲、香港、中國、台灣等25個城市設有分公司，擁有員工12,000餘人。新科近年來積極參與亞太國家的交通電子系統專案，包括台北捷運與高雄捷運等工程。新科之規模與業務性質，相當適合運用電子競標，原因有五點。

第一，新科有龐大的採購規模，所採購的商品規格也多能清楚規範，在市場上有多家供應商，不受壟斷。即使是武器事業部所採購的零件也多具共通性，不需靠單一廠商生產。第二，新科銷貨成本（COGS, Cost of Goods Sold）高達65%-85%，有效節流的空間甚大；第三，為強化經營體質，集團採購長要求每年必須大幅節流30%。因此，導入電子競標也就成了新科的策略焦點之一。

第四，在2000年，新科與當時知名系統商FreeMarkets合作建置電子競標系統。藉此合作案，新科逐步導入電子競標的採購流程，包括支出分析、詢價單準備、供應商訓練等。新科移轉這些採購知識，並逐漸內化為例常作業，最後有能力自行舉辦電子競標案。在自行發展出一套市集營運方法後，新科採購部門在集團內也建立起專業能力，由作業性部門轉變成為策略性單位。因此，電子競標在新科所造成的，不僅是作業自動化，

更促成了採購部門的轉型以及供應鏈上的服務創新。這也是我們選擇新科作為個案研究的原因。

第五，自2002年起，新科平均每個月有二至三次的電子競標案，有效成本節流區間在15%至53%；平均每筆交易可省下18-23%的採購成本（過去最多僅能節省5-10%）。新科也將供貨時間由4至12週，降為3至5天。我們選擇新科為案例來分析，也是因為該公司七年來都能穩定使用電子競標，並有卓越成效。因此，新科尋購作業的組織例規，具有高度的研究價值。

二、資料收集方式

自2005年起，我們成立一個小組，展開供應鏈科技之長期研究。本研究包含三位調查員（作者）與三位研究助理，歷時約三年。我們分析新科採購工程師的工作實務（Orr, 1996），以了解市集營運脈絡與例規運作模式。主要的調查方式包括：進行個人深度訪談、參與軟體操作訓練以及觀察電子競標案。

第一，在進行個人深度訪談時，我們主要訪談三類對象：內部買方（buyer）、市集營運者（market-maker）與賣方（supplier）。第一類我們調查的是內部買方，含市場行銷人員與品管工程師等。資料收集重點在了解由買方角度，來探討電子競標採用中所遭遇的挑戰，並分析採購部門發展出哪些例規以逐漸善用科技。

第二類是市集營運者，包括新科尋購部門（集團採購長、採購經理、採購工程師與市集營運小組）與軟體供應商。新科尋購部門分兩大功能，第一是採購部門，負責競標前與競標後的準備工作；第二是市集營運小組，負責競標活動。採訪地點包括新加坡母公司與台灣子公司。調查時，我們先由關鍵採購案談起，逐一釐清採購例規的內涵。特別，我們與集團採購長進行持續性專訪，平均每三個月安排兩次訪談。主要目的有二，一是向採購長探詢例規背後的策略意圖；二是驗證研究發現與實況是否一致。透過長期的互動，採購長也能更精準地反思這些例規的意涵。此外，我們也就教系統廠商（提供軟體與尋購顧問服務），了解其顧問服務內涵。

第三類訪談對象是供應商的採購主管與業務人員。我們特別採訪台灣多家電子廠商，因為他們曾參與新科電子競標案。第四類是其他人員，像集團董事。茲將主要的訪談對象列表整理（請見附錄）。本研究共計訪談46人，平均每次訪談時間在40分鐘至80分鐘，但同一人多有二次以上的訪談記錄。合計訪談時間約達164小時。我們也分析電子競標手冊、內部採購流程等資料，以驗證採訪資料的真實度。

第二，我們也加入軟體操作訓練，一方面藉以了解電子競標的功能，另一方面進行參與式觀察。我們與新進工程師及供應商一起受訓。培訓內容包括規格參數設定、議價評估與線上交易作業。了解這些功能有助於我們在進入田野時，熟悉如何觀察採購人員的在地語言，並理解例規如何與科技相配合。我們也參與使用者研討會，了解企業在運用電子競標時遇到的問題。

第三，為掌握實際狀況，我們參觀新科的「戰情指揮室」，並由此了解電子競標案的

實際作業。例如，我們分析供應商在競標時是如何參酌成本結構、評估管理階層特別補助條件、調整經營策略以及考量潛在商業價值。我們發現，競價時供應商還必須和總公司與上下游廠商同步聯繫，以便分析成本結構並確認遞標金額。在2007年7月至12月間，我們派一位研究助理進入新科的採購部門，實際參與採購作業，有系統的整理維運電子競標系統的相關組織例規，以驗證訪談資料。若該作法不是常態性例規，而僅是偶一為之的作業，我們就不列入考量。

三、資料分析

我們的資料蒐集與分析是同時進行的。我們將蒐集回來的資料，依科技涵蓋範圍、尋購過程、工作實務以及組織作為等四個重點反覆分析、不斷修正，整理出組織例規。我們先找出電子競標使用的涵蓋範圍，釐清不同競標案所會牽涉的相應採購作業。於此，我們整理出尋購過程（sourcing process），可大致分為競標事前、事中與事後三大作業。

接著，我們分析在事前、事中與事後作業中，採購工程師做了哪些事（工作實務）。我們不只分析採購工程師的競標工作實務（市集經營者角色），還包含了與採購工程師一同協作的利害關係人（stakeholders）：買方經理人與供應商。最後，我們分析這些採購工程師如何重覆執行這些工作。也就是，我們由採購工程師的工作中，去分析新科有哪些「組織作為」，引導、規範著任務執行的方法（Orlikowski, 2002）。在每次進行電子競標時，新科不斷忠實奉行這些組織作為。我們共整理出七個組織作為，協助我們了解競標系統背後的組織例規，以及成員如何透過此例規有效運用科技。

這七個組織作為的推理過程細述如後。一開始，我們透過訪談及參與競標作業，了解到系統的議價機制，也整理出買賣雙方必須遵守的市場守則（也就是例規五，見表1）。當中，我們發現新科的事前準備工作與事後維運作業，是攸關電子競標成敗的關鍵。因此，我們便展開向前與向後追溯，分析電子競標前後的例規性籌備工作。

其次，我們密集採訪市集營運小組。在分析過十多個標案後，我們發現新科有一個潛規則：各事業部必須優先考慮以電子競標進行，否則不能採買。但是，我們又發現，實際上拒絕案（評估後決定不使用電子競標）多於接受案，才得知新科使用了一套特殊的評估方法來篩選真正適合電子競標的採購案。我們由此得以分析出例規一。

接著，我們參與培訓，發現系統廠商會在競標前提供尋購服務，研擬採購規格與準備詢價單，也幫助新科整理採購支出、供應商名冊以及商品編碼。我們發現，新科雖付出高昂顧問費，但也逐步內化這些作業，以不讓市集營運小組過度依賴尋購顧問。於此，我們整理出新科彙整採購規格與分析採購支出的作業模式，也就是例規二與例規三。

再者，我們訪談供應商時，了解到原來新科將電子競標案切割為不同份額。新科將一部份配額直接與長期供應商進行議價，不用電子競標。有時，新科還會由新供應商手中拿回未有效履約之採購案，回頭找老供應商追趕貨源。我們因而發現，新科在集結採購需求後，會依照採購重要性、成本效益與供貨時效，配置不同份額給老供應商與新供

應商。由此，我們了解到新科分散風險的策略，因而分析出例規四。此外，我們與採購長多次訪談中發現，他非常堅持親筆署名，寫信告知落榜者未能得標的原因，更會打電話立即恭喜得標廠商。這些「例規」工作並不在作業手冊中，但卻是新科很重要的工作儀式。我們因而分析出例規六。

最後，我們在現場觀察時發現，新科在競標後，還會同尋購人員到供應商工廠訪查。這讓我們了解到，新科在事後更強調供貨以及品管後置作業。我們在台灣訪查新科品管部門時了解整個過程，也了解到新科透過全球25個據點就地查核的作業細節。我們因而整理出例規七。

本研究也運用了詮釋方法來分析資料，以凸顯例規在整體工作脈絡中的意義以及在策略上的隱性動機 (Walsham, 1995)。於詮釋過程中，我們的分析重點是去追蹤新科為什麼會發展出這樣的「組織作為」，最終成為新科的「組織例規」。我們詮釋的重點是組織例規的意涵。也就是，第一階段，我們由這些環環相扣的組織作為中去了解，新科在運用電子競標時，做了些什麼配合工作，又是如何做。

在第二階段詮釋時，我們的重點是去了解為什麼這些組織作為會如此被運作、執行。而當這些組織作為成為新科的「組織例規」後，又有何意義。所以，我們去採訪市集經營者(也是導入者)、買方經理人與供應商(賣方)，鉅細靡遺地調查他們為什麼會安排、貫徹如此的「組織例規」。這樣的詮釋方法，是一種後設的分析法 (meta-analysis)，也就是去反思為何某種作法會在企業中成為組織成員奉行的圭臬 (Hargadon and Sutton, 1997)。

以下就新科每一項組織例規逐一說明，我們由新科的工作脈絡著手，分析這些組織作為，並解讀組織例規的意義。

肆、研究發現

新科在導入電子競標七年的期間，發展出一套尋購例規。這套組織例規貫穿採購的事前準備、事中議價，與事後評估三大流程，含有七項組織作為。我們發現，新科在電子尋購的事前準備流程，主要展現在評估槓桿效益、精算採購規格、與強化支出能見度的例規上；電子競標進行中的例規，則鑲嵌在研擬配額策略、守護市集準則的作法上；至於競標後的事後評估，則有活絡市集參與、及監管供貨能力等重要機制。每一項例規都有一套獨特的作法，每一個作法都有一個根本的運作精神(如表1)。本節將逐一由組織作為分析組織例規；接著，我們解讀新科在運作這套組織例規背後的含意。

一、組織例規一：評估槓桿效益

組織作為：新科要求整個集團貫徹「首選政策」(First Choice Policy)，也就是各事業部的採購作業一律必須採用電子競標，除非事業部主管能舉證該系統不適用。但是，新科真正能實施電子競標的採購案卻不及兩成，約八成的採購案最後被評估為不適用電子競標項目。這是因為，市集營運部門非常重視採購前的評估工作，查驗運用電子競標的必要性。舉辦電子競標前，市集營運部門特別重視評估使用科技的「槓桿效益」，並

據此落實尋購評選制度。

新科依照「對買方的商業價值」與「對供應商的衝擊」兩項因素評估採購案。依此，新科將採購分為四大策略（如圖1）：重點施力（Leverage）、策略聯盟（Partner）、集成便利（Commodity）以及風險控管（Managing Risks）。為什麼新科要如此安排？集團採購長指出：

「並不是每一項產品都適合進行電子競標；但原則上，我們規定每一項產品都必須優先考慮以電子競標進行，除非內部買方可以提出不合用的理由。但是透過這四項評估，我們過濾近八成的電子採購案，使企業資源不會空耗。」

重點施力 (Leverage)	策略聯盟 (Partner)
集成便利 (Commodity)	風險控管 (Managing Risks)
低	高

對供應商的衝擊

圖1：新科運用的「尋購評估矩陣」

資料來源：新加坡工程集團（2007），此架構已經本研究修訂以保護原創意。

表1：新科因應電子競標所發展出的組織例規

作業流程	新科的組織例規	主要檢核點	預期目的	新科組織例規內含的組織作為
事前準備	評估槓桿效益	這項商品真的適合進行電子競標嗎？	避免錯用科技	用的少才能用的巧：以電子競標發揮槓桿效益。雖然電子競標只處理20%的商品，卻可以發揮80%的節流效益。
	精算採購規格	我們是否確切了解採購商品的規格？	降低重置成本	以領域知識精算需求規格：使用電子競標前，新科會鉅細靡遺地分析商品知識、採購風險、跨部門需求，以降低衝突成本、減少採購風險。
	強化支出能見度	若改變支出方式，是否可以不用電子競標？	找出支出浪費	藉支出透明度找出浪費：新科利用五種支出透明度的分析，再次檢核電子競標之必要性，並優先思考以非電子化節流方式減少採購浪費。
事中議價	研擬配額策略	如何降低電子競標的供應風險？	讓新舊供應商間勢均力敵	以新制舊，以老避險：讓新供應商加入電子競標系統以喚醒老戰友。新科的配額策略，在帶動新供應商的競爭行為，也促使舊供應商克服慣性。此外，新科又可以借助老戰友規避風險。
	守護市集準則	如何確保公平的電子競標機制？	約束買賣雙方，預防違規、違約與背信	無信不立：新科以五項守則立信，其中含有「四格」。買賣雙方要確實遵守線上交易的「價格」、與「規格」；要杜絕場外交易才會有「品格」；另外，若因意外買賣不成，雙方要有「風格」來處理交易糾紛。
事後評估	活絡市集參與	如何讓供應商積極的參與市集交易？	加速競標案處理速度，刺激供應商參與市集的積極度	增加市集效率，刺激市集活力：新科設定了份額控制機制，讓競標案快速完成，增加市集效率。競標後新科及時告知贏者簽約，並讓輸者立即了解未能得標的原因，供應商對市集營運例規熟悉後，市集也隨之活絡。
	監管供貨能力	如何留住最佳的供應商？	確保持續的供貨能力，降低未來的履約風險	持續的能力評鑑：新科對供應商進行定期健康檢查。唯有供應商維持品質與運籌能力，電子競標才會有意義。新科內部買方也才會信任供應商，願意參與電子競標案。

第一種採購作法是「重點施力」。原則上，具集購潛力的商品才適合電子競標。這類商品必須包括五項特質：能明確訂出採購規格、有足夠的採購量、在市場上有多家供應商、含有降價空間以及不會受到供應商壟斷價格。因此，舉凡通用機械零件、衛浴設備、保全人員外包、電纜線、筆記型電腦等項目，都適合採用電子競標。這些具有集購潛力的商品可以為新科帶來高價值的節流，而且也不會對供應商的利潤帶來太大衝擊。

第二種採購作法是「策略聯盟」。若採購商品是與策略夥伴一同開發，電子競標則不適用。例如，有些電子零件是新科與台灣的代工廠商共同設計研發。若到了量產階段，買方又另尋其他合作廠商，則不僅會傷害信譽，更可能涉及侵權爭議。第三種採購作法是「集成便利」。新科對大眾化採購商品，例如文具、辦公器材、標準化零件等貨品，採取直接議價採購。雖然這些貨品規格較單純，供應商也不少，但因為這類大眾商品原已在市場上被大量生產，毛利已被壓的很低，所以即使集購後降價空間亦不大。

第四種採購作法是「風險控管」。新科認為工業軟體、客戶服務、特殊生產設備、通訊建設與大型機具是屬於風險性商品。這些商品內含智慧財產權與售後服務等衍生價值，因此議價空間並不高。此外，這類商品往往與公司的日常營運作業密切相關，一旦採購零件臨時出現問題，可能使整條供應鏈中斷，劇增營運風險，因此亦不適合以電子競標進行。

解讀組織例規：在採用電子競標前，採購部門提出第一個關鍵問題是：「這項商品真的適合進行電子競標嗎？」新科先用科技首選政策，這是為了配合公司治理法令，確保採購過程中人員遵循廉潔原則。另一方面，新科也藉由此首選政策確保電子競標在公司的合法性，凸顯高階人員對實施電子競標的決心。不過，雖然100%採購都納入科技採用考量，但是必須經過嚴謹評估後才會使用。最後，真正適合電子競標的商品，只約佔新科整體採購規模的20%。許多企業會質疑，如果才用到兩成，為何還要引進電子競標？一位採購經理解釋：

「雖然平均下來我們只有節流約18%，但如果挑出關鍵採購案，像採購筆記型電腦，就可以有約50%的節流成效。」

畢竟，每次舉辦電子競標案，新科都要付平台供應商數十萬元（新台幣）的費用。況且，若供應商的商品獲利原本就很低，新科卻還要再降價，就會引起反彈。新科的核心想法是「用的少，才能用的巧」，以電子競標發揮槓桿效益（leveraging effect）。雖然電子競標只處理20%的商品，卻可以發揮80%的總體採購節流效益。

二、組織例規二：精算採購規格

組織作為：新科的第二項組織例規是「精算採購規格」。在電子競標的操作培訓過程，我們發現系統廠商會協助新科研擬採購規格並準備詢價單。但新科採購部門在進行採購時，會更仔細分析採購品項、內容、規格、規範（例如要求投標公司必須通過ISO9000認證）、前置時間、品質標準、尺寸大小誤差率、地區採購需求、運輸條件以及服務條款（如保固期間）等因素。新科擔心的是，一旦採買的商品和實際規格有所出入，就必

須花費更多成本重新搜尋、議價、訂約。這不但浪費採購資源，進入量產時，新科還必須停掉生產線重作，付出的代價會更高。

除了收集各部門採購需求外，新科強調，制定規格時必須融入領域知識（domain knowledge）到每一項採購案中。集團採購長會主持一個反向競標委員會，是一個任務編組，將各事業群採購主管、專案工程師、領域技術專家列為必然委員。這些委員會為每一個採購案組成不同任務小組，負責三項工作：籌備集購、協調跨部門作業與偵查特殊需求。每一個標案進行前，任務小組會向各事業群彙整採購資訊，計算出總採購數額，以判定是否值得舉行電子競標。同時，在評估集購總量時，也要找出共同性的採購規格。其次，任務小組會居中協調內部買方，確認所提出的規格沒有遺漏、重複或誤解。一位新科採購部經理說明：

「沒有跨部門合作，我們一定會遺漏某些採購細節。只有當你了解自己真正要什麼，不要什麼，供應商才會知道該給你甚麼，不該給你甚麼。電子競標的成敗都在這些細節中。」

對廠商（賣方）而言，新科精密的需求規劃作業也給了他們信心。一位供應商便指出：

「我們和新科做生意很少因為需求規格吵架。他們的採購規格做的比我們還細，連當地政府法規、價格波動、淡旺季都調查的一清二楚。很多買家常常隨便開了個規格，然後等電子競標完成後，才又要求改規格。可是，改了規格價格就不會再一樣。那麼競標不就沒意義了嗎？」

新科精密的需求規劃，使買賣雙方減少未來後悔的可能性。

解讀組織例規：新科提出的第二個檢核點是：「我們是否確切的了解採購商品的規格？」新科採購的商品，不僅僅是零件，更涉及整體製程與系統相容性問題。若採購部門過於粗心，買到規格不對的零件，就會影響到供應鏈的運作。但是，要清楚地定義採購需求並非易事，商品採購隱含著許多領域知識。有些商品價格會跟著淡旺季波動，有些採購又會因地區政府保護政策而受限。新科的核心作法是：以領域知識精算需求規格。在使用電子競標前，新科會鉅細靡遺地分析商品知識、採購風險、跨部門需求，以降低買賣雙方的衝突成本、減少採購錯誤的風險。所謂失之毫釐，差之千里。對商品知識一知半解，訂出似是而非的採購規格，只會引發買賣雙方衝突，使企業增加重置成本，這是無知（缺乏領域知識）的代價。

三、組織例規三：強化支出能見度

組織作為：制定明確的採購規格後，我們發現新科還是不會貿然進行電子競標。市集營運部門會再進一步評估現行支出運用狀況，了解節流的可能性。新科為徹底了解支出狀況，採購部門會先清理支出資料，彙整目錄、品項與統一採購代碼，讓採購項目一清二楚。採購代碼彙整的越清楚，除有助於集結採購商品外，更可強化品質的追蹤。一旦商品出現問題，新科可以迅速釐清瑕疵貨號，並找尋供應商處理善後。

其次，新科會清理供應商資料，將重複與錯誤的供應商名單刪除。最後，新科開始找出不合理的花費。例如，一項產品可能採購自12家供應商，其中4家供應商是屬於同一集團，新科會改以9家計算，以降低搜尋與議約成本，並有助於精選未來電子競標的供應商名單。資料清理完成後，新科會再運用五種方法檢視支出透明度。

第一種方法是減少高附加價值支出。例如，過去新科要求供應商必須在三天內送達零件，也因而增加運送費用。在釐清訂貨即時性後，新科可以將「限時專送」貨物轉換為「一般送遞」以降低支出。第二種方法為強化履行合約。例如，有些採購未訂定合約，僅以口頭承諾。分析支出後，新科可藉此重整供應商並集中採購，以提高議價能力，也可落實合約之履行。第三種方法是優化供應商。透過分析支出，新科可以找出花費最多的10大採購項目，由其中過濾供應商名單。如此，新科可以大幅提高採購品質，並可讓優質供應商取得更多訂單，創造雙贏。

第四種方法是落實價格一致性。新科因集團子公司有不同的採購權限，不同部門會與同一家供應商有不同的議價結果。新科會先釐清各部門的往來供應商名單，以單一窗口要求供應商給予統一優惠價格。第五種方法是尋找新的節流來源。新科對市場一直維持高敏感度。一旦發現品質較佳的供應商，便積極洽商以爭取折扣優惠。

如此，買方可以減少舉行電子競標的成本。新科一位供應鏈經理指出：

「很多公司往往一頭熱，當下急著去用電子競標，以為電子競標辦的越多，就可以省下越多錢。其實不然，在還沒有辦電子競標前，如果先知道自已的支出盲點，不用電子競標也可以省下很多錢。」

同樣的，賣方也可以將資源投入更高利潤的案子。一位供應商解釋：

「我最討厭買家叫我們一天到晚去投標，好像在玩線上遊戲。有時候，贏到了標才知道這批交易根本沒利潤。這種公司，我們不會去第二次了。新科每次的標案都是大生意，小生意他們會用議價的。這樣標起來才會有勁！」

解讀組織例規：於此，新科提出的檢核點是：「若改變支出方式，是否可以不用電子競標？」新科尋購前會將採購支出透明化，此精神就像是豐田的即時生產系統。如此，新科能追蹤每筆支出，了解什麼錢該省，什麼時候可以省。透過支出透明度，新科還可以預作採購規畫。例如，每年第四季的化學材料會有折扣優惠，新科就可以在第四季進行集中採購，並在隔年的第一、二季再交貨。新科的核心想法是藉支出透明度（spend visibility）找出浪費。如此，不需使用電子競標也能發揮節流效果。雖然新科大力推廣電子競標，但是該公司也極力分析採購內容，試圖避免不必要的採購。

四、組織例規四：研擬配額策略

組織作為：新科認為，多數電子競標案會流產的主要原因是來自於原有供應商，或是「老戰友」（incumbent suppliers）的抵制。因為，電子競標會對老戰友帶來威脅，也會大幅削弱他們的利潤空間。新科的因應作法是採用配額策略（lot strategy）。在導入電子競標初期，新科必定先為老戰友預留保障訂單。例如，在一件航空零件競標案中，新

科先預留50%訂單配額給一家供應商，只要求該公司按合理範圍降價。另外一半的訂單則是讓老戰友與來自中國、印度與台灣等新興國家的「新戰友」一起競標。結果，法國老戰友慘敗，來自台灣的新供應商得標。法國供應商在痛定思痛後，決心重整供應鏈，優化經營體質，後來反而贏得更多標案。這是因為在相同價格下，新科會讓老戰友優先得標。新科採購長就特別指出：

「有時候我們會進一步採用1/3對2/3的策略，把更多訂單給老戰友與新供應商去競爭。萬一，新供應商要是出了問題，交不了貨，你還可以馬上回頭找老戰友幫忙。要知道，訂單在人情在，千萬別把事情作絕了，否則風險一來，你會毫無招架能力。老戰友也會認為你有了新工具，就喜新厭舊。這樣只會打壞自己的名聲。」

解讀組織例規：新科在正式舉行電子競標前，還有一項策略性檢核：「如何降低電子競標帶來的供應風險？」新科的配額策略意在有效分配資源。透過採購配額，新科一則可以維繫長期往來供應商的關係，二則可以降低履約風險。更深一層，新科的謀略在維持新舊供應商間勢均力敵的態勢。而且，新供應商為了搶奪新科的標案，往往必須由供應商的總公司出面，統合內部的採購、工程、行銷部門，同時結合供應鏈上下游夥伴一起競標。換句話說，這是一個「群體的戰爭」，是供應鏈與供應鏈之間的戰爭。

新科的核心想法是「以新制舊，以舊避險」。新科一方面找來生力軍，以電子競標系統的競價行為喚醒舊供應商，讓老戰友提高警覺而不自滿。新科的配額策略，不但帶動新供應商的競爭行為，也會促使舊供應商克服慣性。此外，新科又可以借助老戰友建立一道安全閥門，預留退路，也規避風險。

五、組織例規五：守護市集準則

組織作為：由實際的競標作業與密集訪談中，我們體認到市集營運的成敗，決定於交易機制是否完善，而交易的基礎是信任。在供應商首次參與電子競標時，新科的市集營運小組會為供應商安排先導講習。除了操作上的訓練外，市集營運組會特別要供應商遵守電子交易的「行為準則」(code of conduct)。新科之所以稱它為「行為準則」而非「行動規範」，是因為這些要求必須是自我約束，而難以用法律來規範。也因此，若不遵守這些準則，市集營運者輕則施以局部停止投標處分，例如一段時間不邀請違規的供應商；重則將其列入拒絕往來名單。

就新科而言，交易信任源自於三個層面：買方、市集營運者以及賣方。買方若無誠信，拿了貨卻不付錢，賣方（供應商）便失去了參與交易的動機。市集營運者若不能扮演好中立的第三方角色，讓買賣雙方在透明公正的平台上交易，市集亦很難活絡起來。另外，若賣方心存詐欺之心，拿到錢後不給貨，或者交貨後品質出問題。那麼不用多久，買方也會退出市集、另闢貨源。一位系統供應商總經理亦指出：

「有些買家在電子競標後，還會再回過頭與得標供應商議價。但是這種作法會使電子競標失去公信力。電子競標後，買賣雙方應只能就具體的合約條款內容進行討論才對。但是很少公司會像新科這麼重視營運規矩。」

新科嚴格遵行的競標行為準則有五項，分別規範了買賣雙方。第一守則是杜絕場外交易。買方需承諾只與線上投標的供應商締約；賣方則需承諾絕不進行離線投標，維繫線上競價的公信力。第二守則是依能力競價。買方僅邀請合格的供應商投標；賣方在投標時，需評估自己的出價能力，並盡可能以最低價格投標。第三守則為遵守採購規格。此舉在預防交易糾紛，不得在事後要求額外的交易條件。

第四守則為遵守線上投標價格。買方需以線上投標價締約，賣方則需承諾所有的線上投標均是合法的報價。第五項守則為遵守最低價訂約原則。買方不可有偏頗之心，要讓最低價廠商有機會取得合約。另一方面，供應商亦需了解，雖原則上是由低價取標，但仍可能有例外管理，如買方發現供應商的品質不符、供貨時間過長等，便可能與價格次低者締約。

解讀組織例規：在這個階段，新科關心的檢核點是：「如何確保公平的電子競標機制？」這五項市場守則，就是「約法三章」式的信任。這是口頭約定，並沒有實際的法律規範。若我們進一步解讀新科立下的五項市場守則，就會發現其中有深層含意。第一和第二守則是在防弊。如果場外交易一再發生，供應商就會知道這是「出詭標」(ghost bidding)，他們就不會認真競價。長此以往，優良供應商不再參與。沒有「品格」的交易，最終則產生「劣幣驅逐良幣」的效果。第三與第四守則主要是立信。這是要買賣雙方對競標結果負責，這是對貨品「規格」與競標「價格」負責。第五守則的精神是體諒。對買方來說，理應將訂單給最低價得標廠商。但供應商也要體諒買方可能會出現非預期的特殊情況，例如在交貨時，突然發生三氯氫胺毒奶粉事件。遇到這些特殊狀況導致交易不成時，買賣雙方仍需維持自己的「風格」，以體諒之心處理交易問題。

新科的核心想法是無信不立。這五項守則可以用「四格」來歸納。買賣雙方要確實遵守線上交易的「價格」與「規格」；要杜絕場外交易才會有「品格」；另外，若因意外買賣不成，仁義也應猶在，雙方要有「風格」來處理交易糾紛。新科以此四格規範市集之營運。如此，買賣雙方與市場營運商才不會格格不入，市集營運機制才能健全，電子競標也才能有格調的完成。

六、組織例規六：活絡市集參與

組織作為：新科採購長非常重視市集的參與熱度。新科認為一個市集要活絡，必須達成高度的運作效率與參與積極度。一位資深採購部門主管表示：

「有利可圖的市集才會熱絡。我們每一個標案對單一的中小型企業來說，幾乎等於是一年的營業額。這些廠商為了大餅，一定會施展混身解數來競標；此外，我們每次分組都會邀請一、兩家市場上比較沒有聽過的新廠商。這些黑馬會刺激原本穩坐江山的廠商，逼他們施出壓箱寶。」

新科認為，市集運作效率會影響參與者的意願。若要提升運作效率，市集營運者必須依照優先順序分配資源。新科將電子競標案分為兩類。第一類是以專案方式 (project-based item) 進行；這類採購案金額約大於50萬美金，屬於策略性大型工程，

例如捷運工程、國家級交通號誌系統以及智慧型建築系統。新科稱之為高價值標案(High Value Actions)。第二類電子競標案處理標準化貨品，採購金額在50萬美元以下。新科稱為低價值標案(Low Value Actions)。例如，筆記型電腦的規格就非常標準化，市場上的供應商只有幾家大廠，如惠普、東芝、戴爾以及IBM等公司。這類較低額標案只要在一週內即可完成。

除效率外，新科還必須維持賣方的參與度。新科讓市集活化的方式，就是讓供應商立刻擁抱勝利。對於低額採購案，新科規定必須在決標後48小時內，以書面通知得標廠商，隨之立刻簽約。至於高額採購案，則規定在一到三週內要通知廠商締約。由於新科簽約爽快，付錢準時，所以只要一有標案，廠商都會爭先恐後參加。一位台灣的供應商主管就指出：

「新科的採購案大，又能很快訂約，有助於降低我們在供貨上的不確定性，預先規畫出貨的時程。」

除了立刻與贏家簽約外，新科集團採購長也會以書面報告回覆未得標的供應商，說明這次沒合作的原因。因此，沒得標的廠商不但不怨恨新科，反而感激新科讓他們知道未來如何改善。

解讀組織例規：因此，新科提出的第六個問題是：「如何讓供應商積極的參與市集交易？」新科的核心想法是藉由區分高價值與低價值標案以增加市集效率，並輔以即時締約以刺激市集的活絡。這樣的作法背後隱含兩種建立信任的方法。新科設定了幾項控制機制。第一是控制採購份額大小，大小決定了「時效」；大的標案因為需經過內部較多的審核程序，需要較慎重的確認工作，而「慎重」本身也是一種控制機制。時效與慎重都讓供應商有信心。

第二個控制點是「成敗」。競標之後及時告知贏者簽約，並讓輸者了解未能得標的原因。新科對於競標後的通知義務相當慎重，也建立供應商的信心。這項控制點會讓供應商很快明瞭如何參與標案。簡單的遊戲規則會使供應商產生熟悉感，熟悉感則產生信任。無論得標與否，供應商也不會有無謂的猜測。對市集營運規則熟悉後，供應商變的更具行動力，市集也隨之活絡。

七、組織例規七：監管供貨能力

組織作為：新科在舉行競標案後，市集營運部門還與品管部門協同評估交貨狀況以及持續評估供應商的能力，包括運籌能力、退貨率與服務水準等。運籌能力是依供應商送貨準時率來評分。新科將遲交或提早交貨的供應商分五個等級(100、80、50、30、0)，分別給予扣分與加分。新科很重視交貨時效，因為會影響到生產進度，衝擊到供應鏈運作。新科採購部門設有品質驗證組，計算每單位的配額退貨率(lot rejection)。交貨品質若超過容忍範圍或者不穩定，供應商都將會被列入觀察名單中。新科品質驗證組主管就指出：

「我們除了依交貨時間進行點評外，每一季至少都會親自走訪主要供應商，進行一

次以上的工廠實地訪查；除了解出貨狀況外，還要打探市場最新動態與新產品的口碑。」

新科也根據供應商籌備標書的反應時間、回覆確認時間、推薦替代供應商與及時供貨彈性四項標準來檢驗其服務水準。對評比高的優良供應商，新科每年會頒獎表揚，並列入優惠名單中。新科也會推薦該供應商到關係企業，協助績優廠商擴展客戶群。反之，若表現不佳的供應商則會被列入黑名單。一位新科採購部門主管說明：

「市集要運作的好，我們需要好手。但要找出真正的好手，一定要很仔細的評估，而且要常常評估，供貨時效、商品品質、反應能力，都非常重要。今天很強的供應商，明天不一定還會這麼強，說不定還會成為你的風險。所以我們品管部門會定期到供應商那裡檢核，也不定期抽查，並且藉這個機會掌握當地法規的最新動態。」

解讀組織例規：新科的績效評估隱含著一個策略動機：如何留住最佳供應商。評估交貨時間是為了解供應商的運籌能力；評估退貨率看的是供應商的品質管理能力；評估供貨彈性與售後服務水準看的是支援能力。供應商的能力不一定會與時俱進。新科透過持續性的稽核，可以追蹤供應商的能力，以確保來競標都是好手，也避免供貨期間可能出現的疏失。新科的核心想法是透過持續的能力評鑑，對供應商進行定期健康檢查。唯有供應商能持續維持一定的品質與運籌能力，電子競標才會有意義。新科內部買方也才會信任供應商，願意參與電子競標案。有積極的買方與賣方，電子市集才可能持久。

伍、討論

一、理論意涵

本研究分析科技內含的組織例規，以了解科技使用如何能達到創新的成效。我們分析電子競標系統如何在新科公司發揮出卓越績效。這項科技不只具備買賣雙方線上即時議價的功能，背後更包含了一整套市集營運的知識體系。本研究歸納出七項尋購的組織例規，這些例規蘊含了獨特的組織作為。

於此，本研究提出三個學理上的貢獻。第一，要觀察科技能否促使組織創新，必須了解科技的內嵌結構。近代文獻過度強調科技採納條件（Jasperson et al., 2005; Bhattacharjee, 2001; Karahanna et al., 1999）以及科技契合（Scott-Morton, 1991; Soh and Sia, 2004）。雖然開始有學者分析科技內結構變化（Barley, 1986; DeSantics and Poole, 1994; Orlikowski, 1996），但是他們卻尚未具體的描述其結構內涵。Edmondson等人（2001）提出組織例規可以協助我們了解科技中的結構內涵，但是她們的研究卻偏重科技導入過程，而未分析支援科技運用的組織例規。

為銜補此缺口，本研究延伸此觀念，以組織例規分析科技的內涵。本研究指出，當科技導入組織，不能僅是以科技功能引導作業程序。科技的使用必須搭配一套特定的組織作為，方能有效組建工作方式與分配資源。透過市集運作脈絡，本研究呈現科技內的組織例規，藉此說明科技如何促成持久組織創新（Swanson and Ramiller, 1997; Attewell, 1992; DeSantics and Poole, 1994）。

第二，過去研究指出，組織例規不只是一套靜態的標準作業流程（the ostensive aspect），更包含成員的工作行為模式（the performative aspect）。這些行為態樣（behavior patterns），往往和組織形式上的作業規範有所出入，但卻是型塑組織成員有所為、有所不為的「潛規則」（Feldman and Pentland, 2003）。過去文獻研究組織例規，看的是組成元素與功能（Cohen, 1991; Edmondson et al., 2001; Gersick and Hackman, 1990）。本研究以「作為」（organizing practice）來分析組織例規，使例規更具有動態的內涵（Feldman, 2000）。於此，本研究更強調組織例規是一種集體能力的呈現，不是靜態的作業守則（Hage and Aiken, 1969; Hermanowicz and Morgan, 1999）。

第三，本研究也提供電子市集管理一項新的思考點。當今文獻多探討電子市集的運作機制，如搜尋、評價、訂約、監控與履約付款等各項交易作業（Bakos, 1998; Clark and Stoddard, 1996; Kambil and van Heck, 1998）。或者，學者會由議價權力的消長，來分析電子市集效率之優化，以及市集參與者溝通方式的改變（Soh et al., 2006）。更多文獻則分析買方與賣方之間的信任問題，以探討制約電子市集運作的原因（Ba and Pavlou, 2002; Hart and Saunders, 1997; Knights et al., 2001）。但是，我們仍不知是什麼樣的組織例規使得買賣雙方得以建立信任，來維持電子市集的運作。

本研究分析市集運作的組織例規，重新解讀市集經營的內涵（White, 1981），也重新詮釋信任的建構與維持過程（Zucker, 1986）。這些事前、事中、事後的組織例規安排，環環相扣，缺一不可，建構出市集經營的「信任價值鏈」，支持電子競標的有效使用。例如，缺少尋購前的採購評估與規格精算，可能根本錯置科技，徒增採購的重置成本；而未能嚴守尋購中的市場準則，會造成資訊科技的使用不當，破壞買賣方之間的信任關係；若未能強化市場的參與熱度，留住好的供應商，科技功能再好，仍會乏人問津。我們甚至可以說，透過這套組織例規，我們才真正看到電子競標系統可以帶來的「市集營運」服務創新。

總之，本研究指出解讀科技內涵的重要性。科技之所以能有效創新並持久發揮效益，組織例規是關鍵要素。但是，我們切不可將這些例規，視為靜態的工作流程或最佳實務，以為導入後就可以讓科技發揮效用。這些例規背後隱含的是科技與組織長期磨合的結果，與集體學習所建構出來的知識體系。這些例規是磨合後的成果，也是長期養成的能力（Orlikowski, 2002）。

二、實務意涵

過去實務界認為，電子競標應用之所以困難重重，是因為客觀條件不佳（如缺乏經費）、供應商衝突、後勤支援未逮或交易機制不健全（Kwak, 2002; Hartley, Lane et al., 2004; Emiliani, 2006）。本研究發現，電子競標用的好不好，不只於平台的科技功能強不強，企業還必須發展出一套適合自己的組織例規，才能讓科技發揮功效。或許有企業會希望複製新科管理電子競標的作法。但是，我們認為這樣的想法是有待商榷的。為什麼？讓我們由組織轉型、供應商關係與信任機制三個層面來討論這個問題。

首先，新科採購部門職員，因科技採納而成功轉型其職能。他們不再只是執行功能

性庶務的工程師，而是成為了「尋購顧問」，由勞力密集轉變為腦力密集的服務工作。這是服務創新，而背後是整個組織的轉型。採購人員在此變革過程中學得了嶄新的技能—由「採買貨品」變成「經營市集」(market-making)。不過，一般企業能如此盡心盡力，有紀律的完成這樣的組織轉型者，大概屈指可數。例規隱含了長期培養的能力，無法輕易複製。

其次，在維繫供應商關係時，新科知道如何分散風險，將熟識的供應商與新的供應商巧妙的組合。採購部門以策略配額方式，對熟識供應商既懷柔，又很有技巧的逼迫其降價，讓他們不致安逸度日。反觀一般企業在應用電子競標時，往往過於莽撞，一下子就把老戰友都得罪了。買方將訂單全數交給新供應商負責，也常常會發現問題重重，結果反而要花更多時間去磨合新夥伴。缺乏風險的概念，讓多數企業導入電子競標後，反而成為每多掣肘的主因之一。這是一種對風險處理的態度，也是無法輕易複製。

最後，在市集信任機制建立上，新科要求自己的事業部門（內部買方）與供應商嚴守分際，遵循市集交易行為準則。大多數企業都會犯下「買方直覺」(Buyer Instinct)的老毛病，總是為了省錢而忘了道義。所謂「無信而不立」，於市集營運亦然。所以，要複製新科的模式，不能只是導入電子競標系統，更要轉移新科整套的市集營運知識，才能享受科技所帶來的成果，而不被科技反噬。此中，企業要建構起一套市集營運機制，也要讓買賣方與市集營運者恪守交易行為準則。這需要長期培養出的紀律，更是無法輕易複製。

特別提醒，導入電子競標系統不是將這些例規視為最佳實務，原封不動移植到企業中。不同的企業情境，科技採納會有不同的調適過程。這些例規只是提供科技運用時的一個參考點。雖然本案例分析的是一家買方主導的市集(buyer-centric marketplace)，但是其中市集經營的作為，亦可運用於各類電子市集的經營。

三、研究限制與未來方向

本研究存在一些限制，未來的研究工作仍須繼續改善，約可分為三個方向。第一，在不同的產業中，電子競標的市集營運模式會不會有所不同，是值得我們繼續追蹤的議題。第二，我們需要進一步分析科技內含的組織作為，了解科技是如何經過一系列結構性變化，發展出一套組織例規。我們若能了解科技是如何融入組織的，探索其中的調適過程，或許可以從中尋找其他服務創新的機會。此外，我們也可以解析組織例規如何被做為「儀式」來取得合法性，並進行採購部門的轉型(Feldman and Pentland, 2003)。最後，我們建議延伸「組織作為」的研究。組織作為在管理學領域是相對新的概念，為組織創新提供了一個新的分析視角。分析一套運用精良的科技，以及其內嵌的組織作為，我們將可以了解科技運行的脈絡，也就是支援科技運作的知識體系。如此，企業在導入資訊科技時，才能減低其學習曲線，讓科技更快的發揮其創新潛力。

陸、結論

電子競標不僅包括技術功能，更內含一套市集運作的機制。透過組織例規，我們得

以一窺市集運作的脈絡。本研究指出，若要善用科技、引導創新，企業必須先了解科技內嵌的組織例規，使用科技時同時也需要融入相配套組織作為。本案例以電子競標說明，善用科技的原則不是多用科技，而是「巧用」科技。電子競標所帶來的不只是線上議價的功能，這套系統更帶來一套組織的市集營運機制。使用電子競標，就像在打一場採購戰役。在進行電子競標案前，企業必須鉅細靡遺地做好備戰工作。競標時，企業要做到每戰必勝，每次都省下可觀的採購成本。競標後，還要做許多鞏固工作。每場戰役都需耗費龐大資源，也都需要取得參與者的合作。用的不巧，會破壞供應商關係、失去內部買方的信任，結果得不償失。新科案例中的組織例規是一套電子市集的運行邏輯，更協助我們了解如何在市集交易中建立信任機制。

科技如何能發揮持久的組織創新呢？本研究主張，了解科技的結構特質，才能善用科技。不同科技必須配合獨特的組織作為，協調著集體的學習與行動。電子競標之所以能持續發揮節流效益，是因為融入一套精煉的市集營運知識到企業中，成為組織之例規。

附錄

訪談對象整理表

訪談對象	訪談人數	訪談時數
內部買方		
行銷經理	1	2
事業單位採購代表	7	24
市集營運者		
集團採購長	1	36
副採購長	1	4
採購部門經理	3	10
採購工程師	6	15
市集營運小組成員	6	18
供應鏈管理經理	1	3
技術支援人員	4	8
軟體廠商主管	5	13
賣方		
供應商採購主管	6	20
供應商品管工程師	3	6
其它		
集團董事	2	5
合計	46人	164小時

參考文獻

林東清、孫培真，2001，「系統使用調適過程對Web遠距合作學習系統成功使用之影響：一個以調適性結構化理論為基礎之研究」，資訊管理學報，7卷2期：193-214。

郭更生、別蓮蒂、商倩鳳、張洪瑞，2003，「企業採用創新技術之影響因素—以WAP應用為例」，台大管理論叢，14卷1期：217-262。

張心馨，2004，「ERP系統架構支援B2BEC之實質營運管理—混合定性和定量分析研究」，中山管理評論，12卷1期：93-134。

Anderson, J., and Frohlich, M., 2001, "FreeMarkets and online auctions." **Business Strategy Review**, Vol. 12, No. 2, 59-68.

Attewell, P., 1992, "Technology diffusion and organizational learning: The case of business computing." **Organization Science**, Vol. 3, No. 1, 1-19.

Ba, S., and Pavlou, P. A., 2002, "Evidence of the effect of trust building technology in electronic markets: Price premium and buyer behavior." **MIS Quarterly**, Vol. 26, No. 3, 243-268.

- Bakos, Y., 1998, "The emerging role of electronic marketplaces on the Internet." **Communications of the ACM**, Vol. 41, No. 8, 35-44.
- Barley, S. R., 1986, "Technology as an occasion for structuring: Evidence from observations of CT scanners and the social order of radiology departments," **Administrative Science Quarterly**, Vol. 31, No. 1, 78-109.
- Barley, S. R., 1996, "Technicians in the workplace: ethnographic evidence for bring work into organization studies," **Administrative Science Quarterly**, Vol. 41, No. 3, 404-441.
- Bhattacharjee, A., 2001, "Understanding information systems continuance: An expectation-confirmation model." **MIS Quarterly**, Vol. 25, No. 3, 351-370.
- Boudreau, M.-C. and Robey, D., 2005, "Enacting integrated information technology: A human agency perspective." **Organization Science**, Vol. 16, No. 1, 3-18.
- Clark, T. H. and Stoddard, D. B., 1996, "Interorganizational business process redesign: Merging technological and process innovation." **Journal of Management Information Systems**, Vol. 13, No. 2, 9-29.
- Cohen, M. D., 1991, "Individual learning and organizational routine: Emerging Connections." **Organization Science**, Vol. 2, No. 1, 135-139.
- DeSantis, G. and Poole, M. S., 1994, "Capturing the complexity in advanced technology use: Adaptive structuration theory." **Organization Science**, Vol. 5, No. 2, 121-147.
- Dutton, J. E., Worline, M.C., Frost, P.J., Lilius, J., 2006, "Explaining Compassion Organizing," **Administrative Science Quarterly**, Vol. 51, 59-96.
- Edmondson, A. C., Bohmer, R. M., and Pisano, G. P., 2001, "Disrupted routines: Team learning and new technology implementation in hospitals." **Administrative Science Quarterly**, Vol. 46, 685-716.
- Emiliani, M. L., 2006, "Executive decision-making traps and B2B online reverse auctions." **Supply Chain Management: An International Journal**, Vol. 11, No. 1, 6-9.
- Feldman, M. S., 2004, "Resources in emerging structures and processes of change." **Organization Science**, Vol. 15, No. 3, 295-309.
- Feldman, M. S., 2000, "Organizational routines as a source of continuous change." **Organization Science**, Vol. 11, No. 6, 611-629.
- Feldman, M. S., and Pentland, B. T., 2003, "Reconceptualizing organizational routines as a source of flexibility and change." **Administrative Science Quarterly**, Vol. 48, 94-118.
- Gersick, C. J. G., and Hackman, J. R., 1990, "Habitual routines in task performing groups." **Organizational Behavior and Human Decision Processes**, Vol. 47, 65-97.
- Hage, J., and Aiken, M., 1969, "Routine technology, social structure, and organization goals." **Administrative Science Quarterly**, Vol. 14, No. 3, 366-376.
- Hargadon, A., and Sutton, R. I., 1997, "Technology brokering and innovation in a product

- development firm." **Administrative Science Quarterly**, Vol. 42, No. 4, 716-750.
- Hart, P., and Saunders, C. 1997, "Power and Trust: Critical Factors in the Adoption and Use of Electronic Data Interchange." **Information Systems Research**, Vol. 8, 23-42.
- Hartley, J. L., Lane, M. D., and Hong, Y., 2004, "An exploration of the adoption of e-auctions in supply management." **IEEE Transactions on Engineering Management**, Vol. 51, No. 2, 153-161.
- Hermanowicz, J. C., and Morgan, H. P., 1999, "Ritualizing the routine: collective identity affirmation." **Sociological Forum**, Vol. 14, No. 2, 197-214.
- Hsiao, R.-L., and Teo, T. S. H., 2005. "Delivering on the promises of e-procurement." **MIS Quarterly Executive**, Vol. 4, No. 3, 343-360.
- Jaspersen, J., Carter, P. E. and Zmud, R.W., 2005, "A comprehensive conceptualization of post-adoptive behaviors associated with information technology enabled work systems." **MIS Quarterly**, Vol. 29, No. 3, 525-557.
- Kambil, A., and van Heck, E., 1998, "Reengineering the Dutch Flower Auctions: A framework for analyzing exchange organizations." **Information Systems Research**, Vol. 9, No. 1, 2-19.
- Karahanna, E., Straub, D. W. and Chervany, N. L., 1999, "Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs." **MIS Quarterly**, Vol. 23, No. 2, 183-213.
- Knights, D., Nobel, F., Vurdubakis, T. and Willmott, H., 2001, "Chasing shadows: Control, virtuality and the production of trust." **Organization Studies**, Vol. 22, No. 2, 311-336.
- Kwak, M., 2002, "Potential pitfalls of e-auctions." **Sloan Management Review**, Vol. 43, No. 2, 18-18.
- Langley, A., 1999, "Strategies for theorizing from process data," **Academy of Management Review**, Vol. 24, No. 4, 691-710.
- Lee, H. G., and Clark, T. H., 1997, "Market process reengineering through electronic market systems: Opportunities and challenges," **Journal of Management Information Systems**, Vol. 13, No. 3, 113-137.
- Lee, Z., and Lee, J., 2000, "An ERP Implementation Case Study from Knowledge Transfer Perspective." **Journal of Information Technology**, Vol. 15, No. 4, 281-288.
- Mathieson, K., 1991, "Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior." **Information Systems Research**, Vol. 2, No. 3, 173-191.
- Markus M. L., and Robey. D., 1988, "Information technology and organizational change: casual structure in theory and research." **Management Science**, Vol. 34, No. 5, 583-598.
- Nelson, R. R., and Winter, S. G., 1982, **An Evolutionary Theory of Economic Change**.

Belknap, Cambridge, MA.

- Orlikowski, W. J., 1996, "Improvising organizational transformation over time: A situated change perspective." **Information Systems Research**, Vol. 7, No. 1, 63–93.
- Orlikowski, W. J., 2002, "Knowing in practice: Enacting a collective capability in distributed organizing." **Organization Science**, Vol. 13, No. 3, 249-273.
- Orlikowski, W. J., and Robey, D., 1991, "Information technology and the structuring of organizations." **Information Systems Research**, Vol. 2, No. 2, 143-169.
- Orlikowski, W. J., Yates, J., Okamura, K., and Fujimoto, M., 1995, "Shaping electronic communication: The metastructuring of technology in the context of use," **Organization Science**, Vol. 6, 423-444.
- Orr, J. E., 1996, **Talking about machines: An ethnography of a modern job**. Ithaca, NY., ILR.
- Pettigrew, A. M. 1987. "Context and Action in the Transformation of the Firm." **Journal of Management Studies**, Vol. 24, No. (6), 649-670.
- Pettigrew, A. M., 1990, "Special Issue: Longitudinal Field Research on Change: Theory and Practice." **Organization Science**, Vol. 1, No. 3, 267-292.
- Robey, D., and Boudreau, M., 1999, "Accounting for the contradictory organizational consequences of information technology: Theoretical directions and methodological implications," **Information Systems Research**, Vol. 10, No. 2, 167-185.
- Sauer, C., 1999, "Deciding the future for IS failures: Not the choice you might think." In W. Currie, B. Galliers, eds. **Rethinking management information systems: An interdisciplinary perspective**. Oxford University Press, Oxford, 279-309.
- Schultze, U., and Orlikowski, W. J., 2004, "A practice perspective on technology-mediated network relations: The use of internet-based self-serve technologies." **Information Systems Research**, Vol. 15, No. 1, 87-106.
- Scott-Morton, M., Ed., 1991, **The corporation of the 1990s: Information technology and organizational transformation**. Oxford, Oxford University Press.
- Soh, C., Markus, M. L., and Goh, K. H., 2006, "Electronic marketplaces and price transparency: Strategy, information technology and success." **MIS Quarterly**, Vol. 30, No. 3, 705-723.
- Soh, C., and Sia, S., 2004, "An institutional perspective on sources package–organization misalignments of ERP." **Journal of Strategic Information Systems**, Vol. 13, 375–397.
- Swanson, E. B., and Ramiller, N. C., 1997, "The organizing vision in information systems innovation." **Organization Science**, Vol. 8, No. 5, 458-474.
- Venkatraman, N., and Koh, J., 1991, "Joint venture formations and stock market reactions: an assessment in the information technology sector," **Academy of Management Journal**, Vol. 34, No. 4, 869-892.

- Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D., 2003, "User acceptance of information technology: toward a unified view." **MIS Quartley**, Vol. 27, No. 3, 425-478.
- Walsh, J., and Ungson, G., 1991, "Organizational memory." **Academy of Management Review**, Vol. 16, 57-91.
- Walsham, G., 1995, "The emergence of interpretivism in IS research." **Information Systems Research**, Vol. 6, No. 4, 376-394.
- White, H., 1981, "Where do markets come from?" **American Journal of Sociology**, Vol. 87, 517-547.
- Yates, J., and Orlikowski, W., 2002, "Systems: Structuring Interaction through Communicative Norms," **Journal of Business Communication**, Vol. 39, No. 1, 13-35.
- Yetton, P. W., and Sauer, C., 1997, "The paths ahead." C. Sauer, P.W. Yetton, eds. **Steps to the future: fresh thinking on the management of IT-based organizational transformation**. Jossey-Bass, San Francisco, 279-304.
- Zucker, L. G., 1986, "Production of trust: Institutional sources of economic structure, 1840-1920." **Research in Organizational Behavior**, Vol. 8, 53-111.

致謝：本研究特別感謝新加坡國立大學商學院對早期研究工作之贊助。本研究乃國科會項下「創新實務與歷程」研究計畫之經費贊助（NSC 96-2416-H004-047-MY3）。此外，我們也感謝亞太運籌研究中心（新加坡國立大學與美國喬治亞理工學院合設的研究機構）、溫世仁基金會以及國立政治大學創新與創造力研究中心在研究過程中之大力協助。我們特別感謝新加坡科技工程集團的長期協助，集團副總裁與採購長吳本源持續的支持，更是我們完成此研究最大的助力。最後，感謝Carol Saunders教授給予論文完稿的諸多建議。

KNOWLEDGE SHARING IN A GLOBAL PROFESSIONAL SERVICE FIRM¹

Ruey-Lin Hsiao
National Cheng-Chi
University and The
Logistics Institute
– Asia Pacific (NUS-
GeorgiaTech)

Executive Summary

Managing knowledge within firms is becoming increasingly important as they expand their global presence. Professional service firms have been on the leading edge of the use of information technology (IT) in the past, and they have experimented with how to manage knowledge for years. This article describes the knowledge management practices of the Far East Asia office of a global professional service firm.

Knowledge management can be viewed as involving four processes, each with associated challenges. Knowledge creation requires determining what knowledge should be captured from a pursuit of a client or a client engagement. However, employees may not share their knowledge for fear it will be exploited or contaminated. Knowledge development requires motivating employees to share what they know. A common challenge, though, is that because new hires do not have the knowledge of existing employees, there is a knowledge gap between the two that needs to be closed as quickly as possible. Knowledge reuse requires putting knowledge in the most reusable form, standardized or localized. Deciding when standardized knowledge will or will not suffice can be a challenge. Knowledge transfer requires disseminating knowledge effectively. But transferring knowledge across national borders is a challenge. The Far East Asia office of this professional service firm is addressing all four of these knowledge management challenges.

MANAGING KNOWLEDGE GLOBALLY

Knowledge management systems (KMSs) have created incentives for promoting knowledge sharing among organizational members and for fostering innovation within enterprises. Professional service firms, such as accounting, law, and management consulting companies, in particular, consider knowledge a key driver of their business growth. In a sense, professional service firms function as knowledge brokers, exploiting knowledge within or across organizational fields by deploying knowledge for clients.² Their competitive advantage lies in how much better and faster than their competitors they deliver innovative services by creating, developing, reusing, and transferring knowledge.

Three Knowledge Management Strategies

Enterprises often employ one or more of three knowledge management strategies: knowledge hierarchy, knowledge market, and knowledge community.³ Firms adopting a *knowledge hierarchy strategy* consider knowledge as an organizational resource. These firms use a formal institution to create and maintain a knowledge repertoire. For example, Xerox built a knowledge repertoire known as Eureka to give its maintenance

MISQE is
Sponsored by



1 Cynthia Beath is the accepting Senior Editor for this article.

2 For more information on knowledge sharing in professional service firms, see Empson, L. "Introduction: Knowledge Management in Professional Service Firms," *Human Relations* (54:7), 2001, pp. 811-817; and Morris, T. "Asserting Property Rights: Knowledge Codification in the Professional Service Firm," *Human Relations* (54:7), 2001, pp. 819-838.

3 For a detailed discussion of the three knowledge strategies, see Dennis, A. R., and Vessey, I. "Three Knowledge Management Strategies: Knowledge Hierarchies, Knowledge Markets, and Knowledge Communities," *MIS Quarterly Executive* (4:4), 2005, pp. 399-412.

Figure 1: Four Knowledge Management Processes

1. Knowledge Creation	Organizational members produce knowledge for internal consumption. This creation step requires members to contribute their understanding of certain management routines or technical know-how. An information system is often used to store these valuable organizational assets. Certain screening mechanisms are used to ensure the quality of the contributions.
2. Knowledge Development	Knowledge is most useful when it is widely retrieved, shared, and deployed. Therefore knowledge development requires motivating organizational members to share what they know and promoting company-wide dissemination. The shared knowledge needs to be continually validated, revised, and maintained.
3. Knowledge Reuse	Organizational members often need to adapt knowledge content to fit it into their specific work conditions. Firms need to decide what knowledge can be reused globally (standardized knowledge) and what knowledge must be adapted to local conditions.
4. Knowledge Transfer	Different regional offices face different problems. Knowledge is most useful when the local condition is fully recognized. Knowledge that spans boundaries facilitates effective sharing and exploitation.

technicians a means to share maintenance tips with each other.⁴ Through Eureka, Xerox has formalized organizational practices, fostered uniformity, and diffused good practices effectively throughout the enterprise.

Firms adopting a *knowledge market strategy*, on the other hand, manage knowledge as a decentralized individual resource. The knowledge stored at these firms is less structured and receives little sanction from formal institutions. Google and Yahoo represent typical models of firms that use a knowledge market strategy. They offer a platform on which contributors can freely add content into the knowledge repertoire. The knowledge management team places more emphasis on the system platform than on the knowledge content.

Firms adopting a *knowledge community strategy* manage their knowledge as a communal resource, with like-minded members sharing within their specific expert communities.

Four Knowledge Management Processes and Their Challenges

In sharing knowledge, the challenge is to understand the pattern of knowledge distribution—that is, who knows what and where the expert can be found. Technologies such as groupware can be used to find relevant people or as discussion forums to establish virtual communities that facilitate personal

communications. Among the three knowledge strategies, there are four common knowledge management processes: knowledge creation, knowledge development, knowledge reuse, and knowledge transfer.⁵ These processes are explained in Figure 1.

However, most senior executives frequently express dissatisfaction with their knowledge management strategies, even when they have been enabled by innovative knowledge management systems. Many of these technology-enabled knowledge strategies have been deployed to spawn innovation in organizations. But they have failed to live up to expectations.⁶ Thus these systems have been marginalized and under-used, mainly because the firms have been insensitive to the knowledge management problems hidden in each knowledge management process. Firms need to anticipate these problems and develop specific practices to support the effective use of knowledge management systems.

Professional service firms currently face four common challenges in their knowledge management

4 Eureka is described more fully in Brown, J. S., and Duguid, P. "Balancing Act: How to Capture Knowledge without Killing It," *Harvard Business Review* (78:3), 2000, pp. 73-80.

5 For a detailed discussion of knowledge management processes, see Alavi, M., and Leidner, D.E. "Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues," *MIS Quarterly* (25:1), 2001, pp. 107-36.

6 For a description of the evidence of unmet expectations, see McDermott, R. "Why Information Technology Inspired but Cannot Deliver Knowledge Management," *California Management Review* (41:4), 1999, pp. 103-17.

processes.⁷ First, *knowledge creation* must enable consistent service levels; otherwise, firms will not be able to retain their global clients. To achieve high company-wide service quality, employees must disseminate best practices and share knowledge with employees in other regions. However, professionals can be reluctant to share their knowledge because they fear that others will appropriate it, and they (the knowledge originators) will lose personal influence in their organization and not be fairly rewarded for their intellectual contributions. Similarly, professionals are also wary that their contributions will be misinterpreted, misapplied, or even contaminated, and that they might be held liable. Professionals who hold these beliefs do not share their valuable knowledge.

The second challenge for professional service firms is in *knowledge development*: to close the knowledge gap between new hires and existing employees. Newcomers must acquire organizational knowledge quickly to effectively work with other employees on client projects. Firms need mechanisms that systematically help new members accelerate their organizational learning.

The third challenge is in *knowledge reuse*: adapting existing knowledge to local uses. Effective knowledge reuse saves time and costs when dealing with recurring problems and catering for customers' unique needs. But senior executives often do not make it clear which knowledge can be reused intact and which must be adapted locally.⁸

The fourth knowledge management challenge for top management is in *knowledge transfer*: how to transfer knowledge across national borders. To serve multinational clients, professional service firms need global coverage and effective knowledge transfer. Best practices need to be transferred from headquarters (parent) to country offices (child) across the globe. Transfers across national borders are challenging.⁹

The professional service firm (PSF) that is the subject of this case is successfully addressing all four of these challenges.

7 Challenges in knowledge management processes were first explored in Lovelock, C. H., and Yip. G. "Developing Global Strategies for Service Businesses," *California Management Review* (38:2), 1996, pp. 64-86.

8 This knowledge-sharing problem is discussed in Suddaby, R., and Greenwood, R. "Colonizing Knowledge: Commodification as a Dynamic Jurisdictional Expansion in Professional Service Firms," *Human Relations* (54:7), 2001, pp. 933-953.

9 For a discussion of knowledge transfer, see Kostova, T. "Transformational Transfer of Strategic Organizational Practices: A Contextual Perspective," *Academy of Management Review* (24:2), 1999, pp. 308-324.

KNOWLEDGE MANAGEMENT AT PSF

PSF operates worldwide and provides clients with a broad array of services relating to audit and risk-related services, tax and transactions. Knowledge management has been a significant force in shaping PSF's past and setting its future direction, and has impacted PSF's quality, growth, and people. PSF's knowledge-sharing programs have improved customer service by, for example, allowing employees to be well informed about a client's business.

In many professional service firms, income-per-employee is a common productivity measure. By reusing knowledge objects in its knowledge bases, PSF had increased this measure. From 1993 to 2002, revenue grew 600%, while headcount grew only 350%. Knowledge management helped PSF retain its professionals and their knowledge assets.

PSF has developed advanced knowledge management practices and has garnered high respect and awards for its work. Its effective knowledge management comes not only from its use of IT, but also from its innovative organizational design, its knowledge-sharing processes, and its practices that address knowledge management challenges. These three aspects of knowledge management are now discussed in turn.

THE BUSINESS KNOWLEDGE CENTER IN PSF'S FAR EAST ASIA ORGANIZATION

The focus of this article is PSF's Far East Asia organization (hereafter called PSF) and its business knowledge center (BKC), which facilitates knowledge management within the firm.

The Knowledge Organization

The BKC provides an integrated knowledge management framework and supports the firm's geographically distributed business units. The BKC's role is to ensure that every key account team has the resources and infrastructure to share knowledge so that it can deliver a knowledge-rich service to clients.

The BKC's core knowledge support team consists of several hundred people worldwide. Their activities include:

- Identifying and tracking subject matter experts and ensuring their presence in sufficient numbers on industry and client teams.
- Organizing knowledge users into different communities of interest.
- Setting up databases.
- Developing a knowledge architecture and taxonomy.

Knowledge management is a joint responsibility between the BKC and those parts of PSF that own and use the knowledge content—that is, the service lines, industry groups, and the sales and marketing teams. Knowledge champions (typically senior managers or junior partners) serve as liaisons between the BKC and business units. Subject matter specialists are sponsored by a “practice chair”—a senior manager from a community of practice within a service line or industry group. The organizational chart of the BKC and its relation to the user community, service lines, and industry groups are shown in Figure 2, and the roles and responsibilities of the three units in the BKC,

and of individuals both in the BKC and the business units, are described in Figure 3.

The BKC uses different technologies to enable knowledge to be shared anytime, anywhere. It employs two types of KMSs. The first type supports teams and includes a storage tool (document library), a collaboration tool (with engagement team and pursuit team databases), and a communication tool (a discussion forum with a discussion database). These KMSs contain content available only to a team.

The second type of KMS supports the enterprise as a whole and includes PSF’s best practice tool and its competence-building tool. Both contain content available throughout the firm. The content and value of these systems are explained in Figure 4.

The Knowledge Management Processes

To manage knowledge effectively, an organization needs appropriate knowledge processes. PSF’s BKC

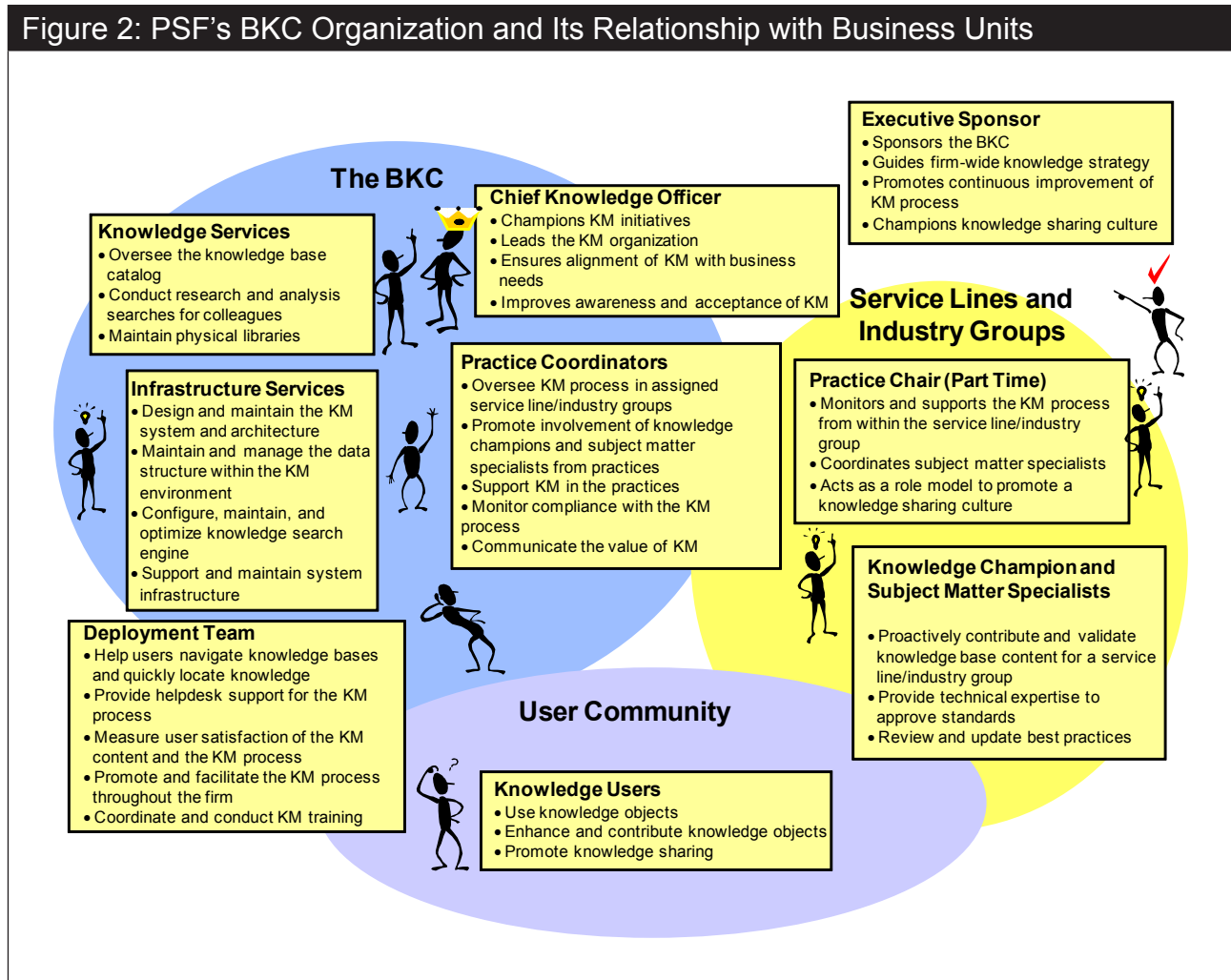


Figure 3: Knowledge Management Roles and Responsibilities at PSF	
Business Knowledge Center	
Chief Knowledge Officer	A chief knowledge officer (CKO), one in each region, works with senior executives to promote awareness and gain commitment to a learning environment throughout the company. A CKO champions knowledge management initiatives, establishes strategic priorities, and maintains the knowledge processes.
Practice Coordinators	A practice coordinator oversees the knowledge process in one or more assigned functions. He or she supports knowledge-sharing activities, monitors sharing compliance, and encourages the involvement of knowledge champions and subject matter specialists.
Knowledge Services	This team maintains familiarity with various knowledge sources, performs technical research for employees on request, and maintains physical libraries.
Infrastructure Services	This team is responsible for the design, configuration, and maintenance of the knowledge management infrastructure. On a regular basis, the team updates the technical architecture, improves the alignment of the technical and business process, maintains data structures, and optimizes the search engine.
Deployment Team	The deployment team helps users navigate through knowledge bases. This team provides help desk support, monitors user satisfaction, and maintains the integrity of knowledge content.
Service Lines and Industry Groups	
Executive Sponsor	An executive sponsor guides the overall knowledge strategy for the company, ensures the continuous improvement of the knowledge management process, and nurtures a knowledge-sharing culture.
Practice Chair (Part Time)	A service line or industry group practice chair monitors and supports the knowledge process within a business unit.
Knowledge Champions	A knowledge champion assists subject matter specialists in knowledge-sharing responsibilities. In daily operation, he or she acts as a role model to promote a knowledge-sharing culture.
Subject Matter Specialists (Part Time)	A subject matter specialist is a discipline expert, recognized as a world-class authority on a subject within the company. He or she contributes and validates content for a discipline and updates best practices, and is also responsible for helping to develop future subject matter specialists.
User Community	
Knowledge Users	Knowledge users are the employees who make use of the knowledge bases in their daily work. They participate in the knowledge-sharing process by using the current knowledge in the system and recommending additions, enhancements, and modifications to existing practices.

has adopted the following four basic knowledge management processes.

1. Knowledge Creation: Proactively Determining What Knowledge Should Be Captured from a Pursuit or an Engagement. In this creation process, BKC staff members ask, “Who will create the potentially beneficial knowledge? When and how? What formats are needed?” The knowledge creation activities are built into the project plan.

To help answer these questions, BKC staff members identify the groups of stakeholders associated with

each project (see Figure 5). They also categorize the different types of knowledge that might benefit each group of stakeholders.

2. Knowledge Development: Establishing the Value of Knowledge. Created knowledge needs to be valuable and in a reusable format. Stakeholders are the knowledge consumers, so they are in the best position to decide on potential future consumption.

At PSF, stakeholders decide which knowledge to keep in the knowledge repository and which to discard by asking about value and reusability. To assess value,

Figure 4: Technology Architecture for Knowledge Management at PSF

	Tool and Type	Description	Content	Value
Team-based Systems	Document Library (Storage Tool)	A document repository used by a team; every member can contribute	Determined by the group; often contains both internal and external materials	Provides a single repository for a team to store useful materials
	Engagement Team Database (Collaboration Tool)	A communication tool for multi-location engagement teams, keeping each team member up to date with team issues	Documents and information related to an engagement	Encourages the discovery and sharing of knowledge and information
	Pursuit Team Database (Collaboration Tool)	A common platform for communicating and sharing of information within a pursuit team	Documents, discussions and information related to the pursuit	Provides a direct link among members of a pursuit team
	Discussion Database (Communication Tool)	A forum in which members can air or respond to ideas, thoughts, and suggestions	Thoughts, concepts, ideas, and observations among a defined group	Encourages exchanging of ideas and opinions
Firm-wide Systems	Best-Practice Tool	A repository of “best of the best” standardized documents. It is reviewed by subject matter specialists and is easy to navigate.	Learning resources Social network communications Technical standards	Accelerates problem solving and productivity
	Competence-Building Tool	Provides useful information to the desktops of new hires	Company policies Technical terms and acronyms	Enhances learning capacity

they ask, “Is this knowledge valuable? Can it support revenue generation and profit creation?” For example, if the knowledge can secure sales or differentiate PSF from competitors, then the knowledge is deemed valuable. Similarly, if the knowledge can save time in delivering an engagement or enhance service quality, it is deemed valuable.

To assess reusability, stakeholders ask, “Is this knowledge reusable? How big is the target audience?” Ideally, a large number of individuals within one audience type—an account team, engagement team, or service line—should want to reuse the knowledge.

3. Knowledge Reuse: Putting Knowledge in a Reusable Form. Once stakeholders have identified knowledge as valuable, BKC staff members package the knowledge into its most reusable form. The stakeholder groups decide whether local users may

adapt the knowledge to their local context. Figure 6 provides some examples of how different types of knowledge can be packaged to make them more reusable.

4. Knowledge Transfer: Disseminating Knowledge Effectively. Once valuable knowledge has been captured and packaged in suitable formats, it must be transferred effectively. Practice coordinators are responsible for ensuring that pursuit and engagement knowledge are transferred to the account team via its engagement team database. In addition, to ensure that knowledge spans the firm, the chief knowledge officers hold regular conferences where they discuss how to transfer knowledge among the various regions.

Figure 5: Knowledge Type by Stakeholders Matrix

	Type	Value	Format	Where
Account Team	Competitor intelligence Client agenda	Improved relationship management and sales approach	Case study	Pursuit team database
	Key individuals	Sell-on opportunities	Contact profile	BKC competitor intelligence database
Service Line	Service line improvements	Continuous innovation	Methodology	Service line best-practice repository
	New products and services	New revenue stream	Service offering	Document repository
	Learning from the way client works	Comparison with other clients		
	Benchmarking data	Comparison	Benchmarking data	
Industry Group	Industry trends	Deep industry knowledge	Report	Industry best-practice repository
	Market research	Deep market knowledge	Research report	Document Repository
	New products and services	Improved industry offering	Industry offering	
	Learning from the way client works	Comparison with other clients	Industry specific component/ tool / template	
Project Team	Phase improvements	More effective delivery	Methodology	Engagement team database
	Teamwork lessons learned	More effective teamwork	Team communication	
	Client agenda	Personal development	Client hot topics list	
Sales Team	Pursuit approach	Improved pursuit capability	Leading practice deliverable	Best practice repository
	Pursuit lessons learned	New pursuit ideas	Hints and tips	
Knowledge User	Lessons learned	Improve role of knowledge on projects	Prospective new products	Knowledge user engagement team database and best practice repository
	Client knowledge transfer deliverables	Leading practice deliverables	CD ROM/Web site	

Figure 6: Examples of Packaging Knowledge For Reuse in PSF	
Knowledge Type	How This Type of Knowledge is Formatted for Reuse
Standardized Knowledge	
Service Line Improvements Route Map/Phase Improvements	Methodology Hints and Tips; “How to guides”: Bring a methodology to life; provide feedback “from the coal face” Updated Training Materials: For methodology or competence
New Products and Services	New Products/Services Description: Approach can be packaged and sold to clients as an offering in its own right or as part of a program Business Case: Structured overview of costs and benefits associated with specific developments in a service line
Knowledge Objects	Tools: Diagnostics; assessments; decision support systems—tools that can be reused to tackle issues, accelerate work, and so on Templates, Agendas: Provide a pattern or structure for others to reuse
Competitor Information	Client Hot Topics: “Top ten” lists of issues that are troubling particular clients; input to Industry Hot Topics list
Localized Knowledge	
Learning from Clients	Case Study: Provides the “look and feel” of the project; gives overview of approach and summary of benefits achieved New Product/Service Description: Approach can be packaged and sold to clients as an offering in its own right or as part of a program
Client Agenda	Case Study: Provides the “look and feel” of the project; gives overview of approach and summary of benefits achieved
Influence/Relationship Maps	“Yellow Pages”: An electronic “who’s who” for an engagement Account Management Relationship Map: Indicates the client’s decision maker/influencer and indicates the strength of relationship between client and PSF individuals

PSF’S APPROACHES TO THE FOUR KNOWLEDGE MANAGEMENT CHALLENGES

All professional service firms face the four knowledge management challenges described earlier:

1. Allaying employees’ fears of being exploited or their knowledge being contaminated in the knowledge creation process.¹⁰
2. Quickly closing the knowledge gap between new hires and existing employees in the knowledge development process.

3. Choosing standardized versus localized knowledge in the knowledge reuse process.
4. Transferring knowledge across borders in the knowledge transfer process.

PSF is using a combination of IT systems and knowledge management practices to address all four challenges.

The Knowledge Creation Challenge: Fear of Exploitation and Knowledge Contamination

Effective knowledge sharing is important for maintaining consistent services across PSF. But professionals are often reluctant to share their knowledge with colleagues, fearing that others will exploit them and that they will not receive credit for being the knowledge originator. Originators also worry that their contribution to a knowledge repository might

¹⁰ *Knowledge exploitation* means that the knowledge stored in the database is used by others to the originator’s peril. So the originator is exploited. *Knowledge contamination* means that the information put into the database may be incomplete, inaccurate, or misinterpreted, and may result in misinformed actions. Contamination can also be to the originator’s peril.

become contaminated—that is, become incorrect or incomplete, or be misinterpreted. Such contributions might be misused, or worse still, the originator may be held liable for the contributions. Such fears of exploitation and contamination can discourage people from sharing and contributing knowledge. As a result, service quality can suffer.

Take, for example, the case of a senior executive who joined PSF as a partner and established a research unit in a major Chinese city. His team carried out high-quality research on the corporate finance industry in China. The team's impressive work soon caught the attention of a regional chief knowledge officer (CKO), who encouraged the partner to share his unit's findings with the rest of the firm. As the CKO explained,

“I commended the quality of research and encouraged him to share the research so that everyone could utilize these excellent results. But he was afraid that people might pass the information on to those within and outside the firm and exploit them inappropriately. I tried my best to convince him otherwise and told him about our sharing culture and the value that the research could add to our service quality. But he didn't want to share the results. He was not ready to adapt to the sharing culture at PSF.”

In another incident, a BKC manager prepared a competitive intelligence report on the positions of PSF's main competitors in China in a given year. Using publicly available data, the report indicated the performance and rank of each firm (and PSF) based on several criteria, including audit fees. This report infuriated the Chinese partner responsible for marketing and sales because it positioned PSF below several of its competitors in the Far East. He stated that the BKC report failed to include sales revenue from a large client that year. He accused the BKC manager of publishing false information and wanted the report to be corrected. The author of the report feared losing her job.

Practices for Assuring Knowledge Sharing. PSF has alleviated fears of exploitation and contamination by instituting a company-wide policy for knowledge sharing. Every employee must sign an agreement that outlines a knowledge-sharing code of conduct. PSF aims to use the firm's knowledge to serve clients, avoid disclosure of confidential client information outside the firm, and protect the firm's intellectual capital. This challenge of balancing these three goals is exacerbated by the technology-enabled environment,

which makes knowledge sharing easier but knowledge security more difficult.

The agreement sets out guidelines for knowledge sharing, maintaining client confidentiality, observing copyright laws, protecting intellectual capital, sharing across international borders, and maintaining knowledge bases. This agreement has been effective in reducing fears of exploitation and contamination. Compliance has led to a corporate culture in which knowledge sharing has become the norm. With the agreement in place, employees are assured that they can contribute to and learn from others freely, without worrying about whether or not they will be penalized.

There are two other ways in which PSF alleviates knowledge-sharing fears. First, it has given the BKC the role of promoting and encouraging knowledge sharing. BKC team members act as agents of change in promoting knowledge sharing, especially among different communities of interest. For example, the BKC gives several knowledge-related awards each year. Professionals who contribute their knowledge and gain company-wide visibility and recognition from this sharing can be designated subject matter experts. Subject matter specialists are regarded as experts in their field (see Figure 3).

The second is PSF's review process, which aims to minimize knowledge contamination. Practice coordinators maintain content integrity. In the knowledge creation process, for instance, a multi-stage review ensures that the content deposited into knowledge bases is accurate and up to date (see Figure 7).

In the first stage of this review, BKC provides a team with a secure workspace for storing and retrieving its documents. A BKC knowledge manager also joins client-facing teams to ensure that the knowledge-sharing policies are followed. For example, a proprietary document cannot be stored in the database unless it is “sanitized,” as a CKO explains:

“We take in a lot of third-party content. We have to make sure that we give due recognition when we take a chart from a report. We follow tight copyright rules and regulations to require mentioning the source.”

The second review stage takes place after the engagement is complete. Functional knowledge champions, subject matter specialists, practice coordinators, and competence-building tool services staff review the content in the team's workspace.

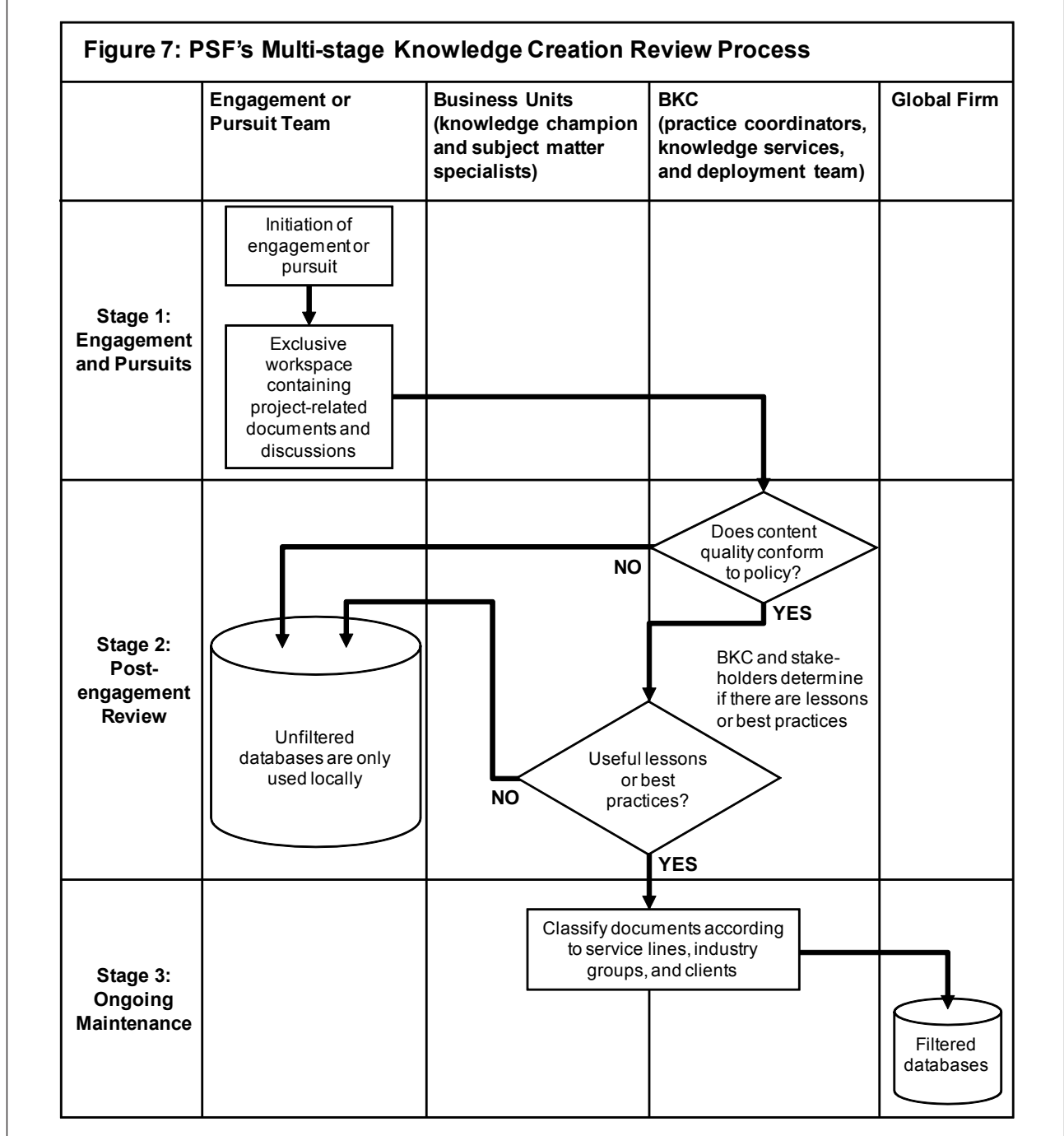
They identify lessons learned and best practices, and then categorize and store the selections in unfiltered databases available company-wide.

The third stage of the review involves stakeholder evaluations of value and reusability. Subject matter specialists and practice coordinators analyze the content to classify information by business unit, service line, and industry group. The categorized content is then put into filtered databases, which are made available globally. PSF minimizes knowledge

distortion by putting each piece of information through these multiple examinations, by business units as well as by knowledge management specialists.

In the case of the senior partner mentioned above who was unwilling to share his research team’s knowledge, the CKO brought the matter to the attention of other senior partners, and he approached the team members and persuaded them to share. He reminded them of the knowledge-sharing agreement they had signed. He argued that their efforts deserved recognition. And he

Figure 7: PSF’s Multi-stage Knowledge Creation Review Process



pointed out that their materials were valuable to the organization. The partner continued to resist sharing and later left the company.

In the case of the competitive intelligence report, the report author (a knowledge manager) approached the CKO for help. The CKO explained to the Chinese partner that every report generated by the BKC followed strict quality and copyright guidelines. He emphasized that the audit fee for a particular client had been shown to be zero for the year 2003 because the client had accounted for the fee in the next fiscal year.

The CKO justified the actions of the knowledge manager and made it clear that employees who follow procedures would not be held accountable for any perceived discrepancies. This enforcement has created a risk-free environment in which employees can exchange knowledge.

The Knowledge Development Challenge: Lack of Shared Knowledge Among New and Existing Employees

Businesses often lack a set of common terms that form the basis for effective communications and knowledge sharing. Different departments use different words to describe and record their practices. Employees may be willing to share, but without a set of common terms, a business cannot efficiently record its collective know-how. When teams with new hires and experienced employees are assigned to client projects, knowledge gaps become painfully evident. These gaps can cause conflict within the team and keep the new hires from blending into the company culture. Organizational learning is hampered.

Practices for Bridging Knowledge Gaps. An organization's knowledge level is constrained by the knowledge level of each of its members. For example, when a recent university graduate joined PSF in China as an intern, she was invited to join a meeting of experienced auditors on her second day. The auditors were discussing an ongoing engagement and using a string of undecipherable company-specific three-letter acronyms. After a few minutes, the intern, exasperated at not being able to follow the discussion at all, yelled,

"S-T-O-P! Stop! Just stop! I have no clue what you are talking about! I am new here and don't understand all the three-letter acronyms! Could someone please speak in plain English?"

To help new employees learn quickly, the BKC provides a company-wide knowledge portal, the competency-building tool. The numerous knowledge repositories in this tool cross-reference content by service line, industry group, client, and external sources, making the tool easy to navigate. Members of the knowledge services team in the BKC help employees, particularly new hires, in making sense of the vast amount of information they are exposed to daily.

To ensure continuous individual learning, PSF has also created training programs for employees at all levels, from recent university graduates to partners. The entry-level program is given during an employee's first year. It starts with the basics, from how to turn on the desktop computer, to learning all the acronyms, to understanding the numerous strategies for searching the filtered and unfiltered databases.

Over the following five years, the training programs help employees become well-versed in the PSF culture and service lines. These programs are delivered by the deployment team with support from the knowledge services team. By the fifth year, the focus of the training programs shifts to helping employees lead complex engagements. The programs involve training in supervising global engagement or pursuit teams and acting as single points of contact for clients.

The highest level of training program is for senior managers who specialize in particular industries. These programs are conducted by experienced practice chairs. With assistance from BKC's knowledge services group, the practice chairs create relevant training materials and conduct ad hoc, one-on-one training with partners. This continuous advancement of individual knowledge propels organizational learning within the firm.

The Knowledge Reuse Challenge: Choosing Standardized Versus Localized Knowledge

Dissemination and reuse of knowledge objects are crucial for professional service firms with globally distributed operations and clients. Knowledge objects can be in two forms: standardized and localized. The standardization process abstracts knowledge from its context and reduces it to a generalized form that can be easily used elsewhere. The localization process, on the other hand, adapts standardized knowledge to a local business need.

Professional service firms can improve their work quality, add value, and reduce delivery time by reusing their intellectual assets. Maximizing reuse hinges on effectively combining the standardization and localization processes. In the competitive audit market, quality, value, and delivery time greatly influence a client's choice of audit service provider.

Practices for Fostering Knowledge Redeployment.

To sustain its market share, PSF realized it needed innovative ways to enhance its services by leveraging its existing knowledge. Doing so would also improve service efficiency and quality. The question was, "When can we use standardized knowledge, and when must we localize it?"

The BKC has categorized standardized and localized knowledge into the seven types that were listed in Figure 6 (four standardized, three localized). To determine which knowledge to standardize, the BKC forms a team of people with similar professional interests, spearheaded by a practice chair, knowledge champion, subject matter specialist, or practice coordinator. The team exchanges ideas, experiences, and information to identify which knowledge objects could be standardized. The team members often come from different industry and service lines. The BKC then organizes regular meetings to address topics of common interest and to give the team members a forum for exploring how they can benefit from each other's knowledge. A senior knowledge manager describes the process in this way:

"Use of specific knowledge is limited to a small group of people. Generalizing it can effectively convert it into a standardized object that can be used and applied broadly throughout the firm. During these meetings, the objective is to identify what knowledge PSF can begin to standardize. Attendees identify specific knowledge objects that they feel might be useful for others present in the meeting. Then they collectively brainstorm how this knowledge can be applied to all service lines. In this process of "stripping" knowledge back to its generic form, they produce a knowledge object that everybody, irrespective of service line, can use and apply."

Regularly receiving new knowledge enriches professionals' existing competencies and enhances their interactions with clients. In turn, these interactions enhance professionals' understanding

about various local issues, thus enriching their local knowledge.

The Knowledge Transfer Challenge: Transferring Knowledge Across Borders

Professional service firms need intimate client relationships to build and sustain their business.¹¹ To build and sustain relationships with clients that have operations around the world, professional service firms need global coverage and the capability of sharing knowledge across borders. Thus every PSF office must stay abreast of, and ensure compliance with, international laws and regulations. A senior PSF executive emphasized the need to do this:

"In the post-Andersen era, the authorities have come down very strictly on audit firms. For example, Securities and Exchange Commission (SEC) guidelines dictate that any firm auditing a U.S. company cannot provide other services to that firm or any of its subsidiaries anywhere in the world. When a client opens shop in one corner of the world, all PSF offices need to know about it immediately. There have been cases of firms being fined for providing financial services to small subsidiaries of big multinationals."

Practices for Transcending Geographic Borders.

In PSF, global knowledge sharing begins at the top. For example, at the company's annual global knowledge meeting in 2004, the regional CKOs met to identify, discuss, resolve, and implement solutions facing the business across regions. The issue of ever-changing SEC guidelines was high on their agenda. The CKOs realized that a small subsidiary of a large U.S. client might contract with a local PSF office at any time for a business service. A knowledge champion described how the firm complies with the SEC guidelines:

"PSF tracks all relationships with clients in every region. A central database is set up to capture this information. Access to this system is given to all relevant client-facing and [BKC] personnel. Before committing to a project, the client-facing personnel run a query through this system to make sure that no PSF office is providing audit services for the parent company of the prospective client."

11 McCann, J. E., and Buckner, M. "Strategically Integrating Knowledge Management Initiatives," *Journal of Knowledge Management* (8:1), 2004, pp. 47-63; Krill, P. "Embracing the Other CRM," *InfoWorld* (23:46), 2001, pp. 36.

PSF's IT infrastructure and its knowledge-sharing culture help transfer this "parent-child" knowledge across borders. The competence-building tool lets globally distributed client-facing teams access local knowledge repositories. To enhance cross-border knowledge sharing, team-based discussion forums have developed into "virtual neighborhoods," where individuals interact with colleagues and retrieve content from the knowledge repertoire. In these neighborhoods, different communities of interest have developed across business areas and country offices. Each such community of interest includes subject matter specialists responsible for transferring knowledge across PSF's offices.

Cross-border knowledge sharing has helped PSF extend new services to clients. For example, PSF's office in China was aware of a client's intention of investing in the U.S. market. Before the client approached PSF with a request for advice, the company presented the client with a proposal detailing U.S. market penetration strategies. It contained an assessment of the pros and cons of the investment project and the regulatory requirements the client would need to follow to enter the U.S. market. This proactive service was possible because the team could integrate knowledge from PSF's Chinese and U.S. offices.

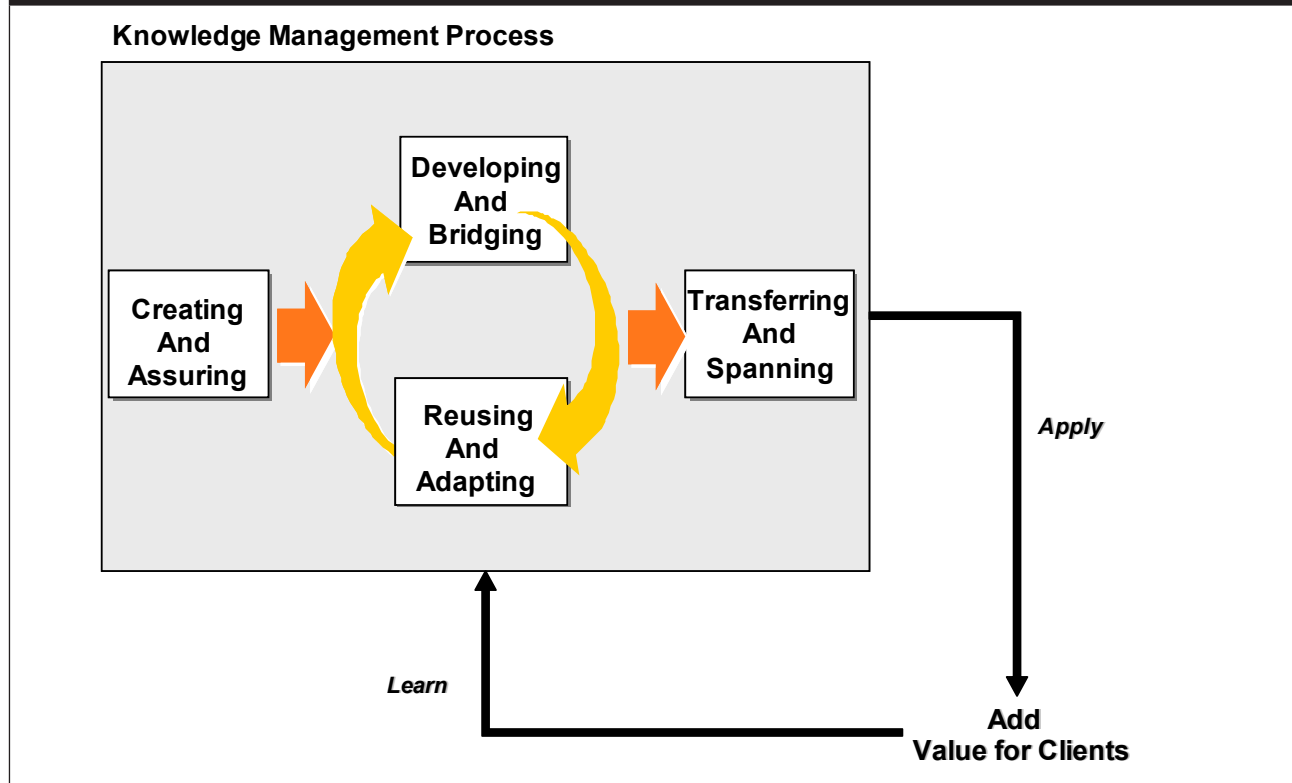
MANAGING ORGANIZATIONAL KNOWLEDGE

Effective knowledge sharing requires more than implementing the three different knowledge strategies (knowledge hierarchy, knowledge market, and knowledge community) and deploying advanced IT systems. As the case of PSF shows, global knowledge sharing also means an organization must have effective practices and mechanisms to:

- Overcome employees' fear of knowledge sharing.
- Bridge knowledge gaps between experts and novices.
- Learn when to localize and when to standardize knowledge.
- Promote cross-border knowledge transfer.

At PSF, knowledge management processes aim to add value for clients. And by learning from clients, the firm continually renews its organizational knowledge (PSF's knowledge management framework is shown in Figure 8). PSF believes that, through knowledge management, it can provide high-quality services to its global clients.

Figure 8: PSF's Framework for Managing Organizational Knowledge



Executives who aspire to manage knowledge effectively must manage four processes:

1. *Knowledge Creation*: Establish collective sharing mechanisms that encourage employees to contribute their knowledge and alleviate fears that they will be exploited or that their knowledge contributions will be contaminated.
2. *Knowledge Development*: Enhance organizational knowledge by bridging the knowledge gaps between newcomers and experienced employees and by installing systematic competence-building programs.

3. *Knowledge Reuse*: Disseminate knowledge in standardized forms and localize some for local consumption.
4. *Knowledge Transfer*: Facilitate global knowledge sharing by promoting cross-border use of knowledge.

Figure 9 summarizes how PSF has successfully managed these four processes. To make knowledge management systems work, a firm needs to envision the entire picture of practices and technologies in use. PSF's knowledge management initiatives offer an admirable model for firms in search of effective knowledge sharing.

Figure 9: How PSF Met the Challenges of the Four Knowledge Management Processes

Knowledge Process	Knowledge Management Challenges	Knowledge Practices	Systems Used	Practical Points
Knowledge Creation	Fear of exploitation or contamination of knowledge contribution	BKC organization, with designated roles and responsibilities (Figure 3) Knowledge-sharing policy specifies the scope of knowledge sharing (Figure 7) Multi-stage review ensures trust in knowledge content (Figure 8)	Team-based and firm-wide systems (Figure 3)	Assuring employees, to overcome their worries on sharing knowledge
Knowledge Development	Lack of shared knowledge among new hires and existing employees	The BKC team helps professionals in making sense of the vast amount of information (Figure 5) Comprehensive knowledge worker training programs	KMSs	Bridging the knowledge gaps between novices and experienced members so they can acquire new knowledge effectively
Knowledge Reuse	Choosing standardized versus localized knowledge	Standardize knowledge for general reuse and adapt standardized knowledge to local needs (Figure 6) Practice coordinators facilitate distribution of local knowledge	Document library Engagement/pursuit team database Best-practice repository	Adapting knowledge to local professionals' work practices
Knowledge Transfer	Transferring knowledge across borders	Organize CKO cross-region conferences Facilitate communities of interest activities	KMSs Discussion forums	Spanning knowledge across different functional professionals for effective transfer of organizational know-how

ABOUT THE AUTHOR

Ruey-Lin Hsiao

Ruey-Lin Hsiao (rueylin@nccu.edu.tw) is an associate professor in the Graduate School of Technology and Innovation Management, with an adjunct appointment in NUS Business School, at the National University of Singapore, and a fellow of The Logistics Institute – Asia Pacific (NUS-GeorgiaTech). He completed his Ph.D. at the Warwick Business School, University of Warwick. His research interests include IT-enabled change, global technology transfer, and supply chain innovation. He has conducted in-depth case studies in major firms on their technology and innovation practices in Asia. His articles have appeared in the *Journal of Organizational Computing and Electronic Commerce*, *Journal of Strategic Information Systems*, *Information Systems Journal*, *Information & Organization*, and *Organizational Studies*.

Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>



Sensitive cabbies: Ongoing sense-making within technology structuring

Ruey-Lin Hsiao^{a,*}, Se-Hwa Wu^{a,1}, Sheng-Tsung Hou^{b,2}

^a *Graduate Institute of Technology Innovation Management, National Cheng-Chi University, Business School, 64 Chih-Nan Road, Section 2, Taipei 116, Taiwan, ROC*

^b *Graduate Institute of Management of Technology, Feng Chia University, 100 Wenhwa Road, Seatwen, Taichung 407, Taiwan, ROC*

Received 5 May 2007; received in revised form 1 January 2008; accepted 7 January 2008

Abstract

How may users make initial senses around new technology? This question requires an investigation beyond initial sense-making and into ongoing sense-making. An important research agenda is how users may make more senses from ongoing work structuring around technology. The previous studies largely examine how users make initial kinds of sense so as to form certain attitudes towards technology adoption. However, less known to current literature is that users also make ongoing senses as they extensively interact with technology in practice over time. This article presents a qualitative study of the ongoing adoption of CabLink, a Global Positioning System (GPS) which enables vehicle dispatching, implemented by one of the world's largest taxi fleets, based in Singapore. It analyzes how additional new senses may emerge from a vagary of technology enactments. As a result, users become more sensitive towards adopting technology differentially as they continue to appropriate technology in their work context. This longitudinal research illustrates how local meanings ascribed by different user-groups to a technology may evolve and induce intended as well as unanticipated work transformation. Theoretical and practical implications on ongoing sense-making are discussed.

© 2008 Elsevier Ltd. All rights reserved.

Keywords: Ongoing sense-making; Technology enactments; Global Positioning System; CabLink; Qualitative study; Longitudinal research; Work transformation

* Corresponding author. Tel.: +886 2 29393091x81248; fax: +886 2 29363765.

E-mail addresses: rueylin@nccu.edu.tw (R.-L. Hsiao), sehwa@nccu.edu.tw (S.-H. Wu), our.lord@msa.hinet.net (S.-T. Hou).

¹ Tel.: +886 2 29393091; fax: +886 2 29363765.

² Tel.: +886 935301076.

“Complex systems make both limited sense and many different kinds of sense. They make limited sense because so little is visible and so much is transient, and they make many different kinds of sense because the dense interactions that occur within them can be modeled in so many different ways. Because new technologies are equivocal, they require *ongoing structuring and sense-making* if they are to be managed.” (Weick, 1990, p. 2; emphasis added)

1. Introduction

Decades ago, Weick (1990) reminded us that the use of new technologies is more equivocal than we could anticipate. Technology is equivocal because users of all genres could make multiple senses towards the same technology and shape how the technology is exploited (Bijker, Hughes, & Pinch, 1987). Unless we keep track of how senses are evolved around technology, we are unable to manage technology effectively. However, current literature on technology sense-making has yet to fully explore Weick (1990) heedful insights.

Existing literature on technology sense-making is concerned with how technology adoption may be affected by users' socially-constructed meanings. Sense-making is a social process in which users interpret their environment through interaction with others, construct accounts which allow them to comprehend the world, and respond to events collectively (Weick, Sutcliffe, & Obstfeld, 2005). As users may make 'many different kinds of sense' around technologies, their attitudes and actions will inevitably be influenced by these senses in accepting, rejecting, or using a particular technology (Karsten, 1995; Prasad, 1993; Schön & Rein, 1994). By looking into the cognitive processes of the human mind, current research has largely examined how users make new senses of technology at the initial period of technology adoption (e.g. Fulk, 1993; Gopal & Prasad, 2000; Orlikowski & Gash, 1994). Thus far, we know relatively little about the effect of ongoing sense-making occasioned by technology structuring in unexpected ways (Spicer, 2005; Weick, 1990).

Most studies largely examine initial technology sense-making. Overwhelmingly, prior studies analyze how inexperienced users may ascribe different meanings to a novel technology. Less attention has been paid to sense-making that occurs among users adopting technology to their diverse work practices over a period of time, and also before technology is institutionalized into organizations (Edmondson, Bohmer, & Pisano, 2001; Tyre & Orlikowski, 1994). Therefore, one issue worth investigating is: *In the transitional period of technology adoption, how may new senses continue to be made as users interact extensively with technology in practice?* This research question requires an integration of sense-making and technology structuring literature. Viewed from the technology structuring perspective, a novel technology could enact new work structures in an ongoing fashion, and interactively the use of technology could be re-structured too (Barley, 1986; Orlikowski, 1996). In this way, technology would not only change users' work structures in the way the implementer expected, but also could enact innovative practices in the most unexpected way (Boudreau & Robey, 2005). A question that requires our attention is: Beyond initial sense-making around technology, how may users make new senses during the process of technology structuring, when users become more *sensitive* to technology (here 'sensitive' does not mean aware, sympathetic or vulnerable; but rather we re-interpret it as having to do with becoming more experienced in figuring things out; Weick, 1988)? Given the equivocal nature of technology, to fully understand sense-making, we need to examine the multiple

potentials of technology enactments in local practices so as to understand how new senses continue to evolve, in both anticipated and unanticipated ways (cf. Hutchby, 2001; Markus, 1994; Pentland, 1992).

The emergent nature of sense-making within technology structuring is the core of our investigation, which is an issue yet to be fully explored by previous studies (e.g. Gopal & Prasad, 2000; Henfridsson, 2000; Orlikowski & Gash, 1994). The paper is structured as follows. The next section reviews literature on technology sense-making to establish its theoretical basis. Following this, Section 3, explains the method used to collect and analyze qualitative data. Section 4 presents findings by showing sense-making patterns identified over two periods of technology adoption. Situated in the context of Singapore, the case examines how a GPS-based taxi-dispatch system induces innovative practices to work with/around the technology in different ways. The last section discusses the theoretical and practical implications.

2. Literature review

Information systems are equivocal because they are complex, abstract, uncertain, esoteric and recondite (Weick, 1990). They hold multiple meanings for different people, reflecting their hopes, anxieties, dreams and inadequacies (Prasad, 1993). The lens of sense-making helps us analyze how people may attribute meanings to new technologies by examining the symbolic and non-instrumental dimensions of technology adoption (Fulk, 1993; Gopal & Prasad, 2000). This lens examines the social construction of technology, and considers technology as texts which are *written* in certain ways by their developers, producers and marketers, and have to be *read* by their users (Bijker et al., 1987). The writer may seek to impose certain meanings on the technology artifact, and to constrain the range of possible interpretations open to users. At the same time, users may also seek to produce readings of the technology-text which best suit the purpose they have in mind for the artifact (Hutchby, 2001, p. 445). By revealing the expressive world of users, we come to understand how technology could be handled within a given social context (Prasad, 1993, p. 1402).

The process of sense-making around technology generally follows three major stages of technology adaptation (Gephart, 2004; Orlikowski, Yates, Okamura, & Fujimoto, 1995; Tyre & Orlikowski, 1994; see the summary in Table 1) namely: (1) sense-making in the initial adoption, i.e. when users begin to make initial senses toward a novel technology; (2) sense-making in the transitional adoption, i.e. when users become more sensitive to the technology as they incorporate it into their practices and become familiar to the technology, and (3) senselessness in the post-adoption stage, i.e. when users make no more sense of technology. Orlikowski et al. (1995) offered an excellent illustration of this technology adaptation process. First, when users encounter a new technology, they begin to make initial senses. They then ascribe meanings to the new technology, as well as their own self-image, and the influences of other social forces on their senses (Gopal & Prasad, 2000). Gradually, new technology becomes 'sensible' to users. In turn, users *establish* new meanings, routines, and practices around technology.

Secondly, by experimenting with technology over time during the transitional adoption, users *reinforce* their practices, and *adjust* new rules into their work. As they gain a deeper understanding of how to assimilate technology into their work practices, users develop different ongoing senses of technology. In this stage, both the organization and technology

Table 1
Sense-making within the technology adaptation process

	Initial adoption stage	Transitional adoption stage	Post-adoption stage
Technology adaptation	New technology is introduced into the organization	Technology may be enacted in many ways	Technology is institutionalized into the organization
Technology sense-making	Users make initial senses towards technology. Technology becomes <i>sensible</i> to users	Users make more new senses during many potentials of technology enactment. Users become more <i>sensitive</i> to various technology capabilities	Technology becomes commonsense and unnoticed; users become <i>senseless</i> toward technology
Outcome of technology use	Users form decisions to adopt or reject technology	Technology enacts intended as well as unanticipated work innovations	Technology is embedded into work routines
Related research	The analysis of initial sense-making includes groupware adoption (Henfridsson, 2000; Karsten, 1995; Orlikowski & Gash, 1994), the electronic marketplace (Barrett, 1999), the group-decision support system (Griffith, 1999), technical service work (Pentland, 1995), educational computing (Schön & Rein, 1994, chap. 5), the electronic mail system (Fulk, 1993; Markus, 1994), and information systems for healthcare (Prasad, 1993)	How may more senses be enacted from technology structuring? This is a less examined area (cf. Bansler and Havn, 2004; Henfridsson, 2000; Siino and Hinds, 2004; however, these studies focus more on cognitive analysis rather on the interplay of technology structuring and sense-making)	It is rather difficult to alter established routines and norms (Edmondson et al., 2001; Kling & Iacono, 1989; Orlikowski et al., 1995; Tyre & Orlikowski, 1994; Zuboff, 1988)

undergo dramatic changes in structure and function (Orlikowski & Robey, 1991). The role of the human agency is active in this stage. Users may enact technology in different ways: they could resist it totally, deploy it minimally, invoke it collectively, or improvise it in unintended ways (Boudreau & Robey, 2005). Through improvisation, new ways of organizing may enact new ways of technology use, which further enact intended and unintended practices (Orlikowski, 1996). Moreover, every engagement with a technology is temporally and contextually provisional. The trajectory of technology enactments is oriented by the interplay of human intentions and technology features, and is further mediated by extensive user-involvement in a diverse range of work practices. In the use of every technology, there is always the possibility of a different structure begin enacted (Orlikowski, 2000). As such, ongoing senses around technology may also be made alongside the process of technology structuring (Gephart, 2004; Weick, 1990).

Thirdly, in the post-adoption period, when technology is fully institutionalized in the organization, users take technology for granted and become 'senseless' toward it (Edmondson et al., 2001; Kling & Iacono, 1989; Zuboff, 1988). At this stage, the technical, cognitive and behavioral aspects of technology become stabilized and no more new senses may be made. Technology becomes commonsense to users and unnoticed until *episodic change* (such as system breakdown) once again triggers new senses (Orlikowski et al., 1995; Tyre & Orlikowski, 1994).

Current literature on technology sense-making largely examines initial sense-making and has fewer opportunities to analyze ongoing sense-making during the transitional

adoption stage. Two inter-related theoretical issues require further investigation: (1) what senses are made, and (2) how senses may affect technology use.

What different kinds of senses are made. Initial senses could be triggered by technology features under three conditions (Louis & Sutton, 1991) namely: (1) when the situation of technology use is *novel*, (2) when there is a *discrepancy* between what is expected and what is observed in the new technology, and (3) when there are *deliberate initiatives*, such as when the user is asked to make choices through technology. Under these triggering conditions, users make initial senses of the new technology, generate local interpretations, decide whether to accept or reject the technology, and consider how to appropriate the technology (Orlikowski & Gash, 1994).

When senses are triggered by technology, users begin to make multiple interpretations of technology. Current literature has examined many patterns of initial sense-making in various technologies, such as the adoption of groupware (Henfridsson, 2000; Karsten, 1995; Orlikowski & Gash, 1994), the electronic marketplace (Barrett, 1999), the group-decision support system (Gopal & Prasad, 2000), technical service work (Pentland, 1995), educational computing (Schön & Rein, 1994, Chapter 5), the electronic mail system (Fulk, 1993; Markus, 1994), and information systems for healthcare (Prasad, 1993). A typical example is illustrated by Prasad's (1993) analysis of computerization in a healthcare maintenance organization, which observes how nurses, clerks and clinical doctors make multiple senses of computers. Three patterns of sense-making were identified: (1) *pragmatic symbolism*: nurses considered computers as efficient, professional, inevitable, and linked to organizational survival; (2) *romantic symbolism*: clinical doctors considered computers as intelligent brainpower, loyal partners, and reliable employees; and (3) *pessimistic symbolism*: clerical staff considered computers as control mechanisms which might lead to physical hazards, organizational turmoil, and social alienation. Prasad (1993) observed that the pragmatic and romantic interpretations outweighed the pessimistic interpretation. Consequently, the first two interpretations created a favorable climate for technology use, ensuring long-term commitment from users. A similar sense-making pattern regarding automated robot adoption in another healthcare administration is also identified by Siino and Hinds (2004).

These patterns offer a rich understanding of initial sense-making around new technology. But, how may users' senses around technology evolve, when users continue to experiment with technology? The current studies seem to be reticent in answering this question, which gives rise to the issue of human agency. As discussed earlier, users' sense-making may evolve when they interact with technology in their work practices in the transitional stage (Boudreau & Robey, 2005; Weick, 1990). In this regard, many potentials of technology enactment may surface new senses. Phrasing it differently, when users come to employ technology in new ways, their understanding of the technology could also be changed.

Therefore, we are unable to gain a full picture of technology sense-making, if we do not analyze how senses evolve. For example, Faraj, Kwon, and Watts (2004) found that users' senses could evolve and reshape the ongoing designs of web browsers. Spicer (2005) offered another case in point by examining electronic commerce adoption in an Australian broadcaster. He discovered that web-based technology had been appropriated differently at four different stages of sense-making: as new media, as a commercial resource, as an information corral, and as a global advertising lever. However, his analysis was based on how different political agendas shape users' sense-making of e-commerce. Both the studies of Faraj et al. (2004) and Spicer (2005) emphasized solely the cognitive aspects of actors,

and neglected the fact that users' sense-making is inevitably situated in a diverse range of work. When users' practices are transformed through multiple technology enactments, they may make new senses around the technology.

Therefore, we need to examine not only the initial sense-making (when new technology is just introduced) but also the ongoing sense-making (when users assimilate technology into their local practices). Although several studies have attempted to examine how senses may be made from technology structuring, they largely analyze users' perceptions rather than users' actual work (e.g. Bansler & Havn, 2004; Faraj et al., 2004; Spicer, 2005). As Griffith (1999, p. 485) urged, an area requiring immediate research effort is to consider how users come to make sense of technology in relation to their working knowledge in a given context.

How sense-making outcomes affect technology use. By examining different patterns of sense-making, current literature is able to explain why a particular technology is adopted. If the sense-making outcome is positive, productive technology use is anticipated, or otherwise rejected. For example, Orlikowski and Gash (1994) analyzed the early use of a groupware system by targeting two primary user-groups: technologists and users. They identified conflicting sense-making patterns between the two user-groups, leading to misaligned expectations and contradictory actions. Likewise, Schön and Rein (1994) identified conflicting sense-making patterns among policy-makers, technologists, and users in a university setting. On their part, Edmondson et al. (2001) analyzed conflicting sense-making patterns between implementers and users in the adoption of cardiac surgery technology. Eventually, the conflicting sense-making patterns resulted in skepticism, resistance, and spotty adoption.

More often, users' senses are not so predictable, and technology may be adopted in unintended ways (Barrett, 1999; Henfridsson, 2000; Karsten, 1995). For example, Karsten (1995) found that multiple senses may be made around the same technology which are unanticipated by the implementer. Her study examined groupware adoption in three different organizations. In the first case, groupware was implemented to increase efficiency in job dispatch. However, the tester perceived it as a 'faster calculator', while the department head considered it as a 'soft typewriter'. Eventually, the subject of efficiency was forgotten. In the second case, groupware was adopted to accelerate information delivery. But, the librarian perceived it as a 'bulletin board', while the manager worried that personal knowledge might be exploited. The original goal was ultimately deviated. In the third case, groupware was introduced to enhance process quality. But, while the production engineer was fascinated with its collocation features and the secretary praised its documentation systems, no one paid serious attention to quality matters.

Moreover, Henfridsson (2000) examined the adoption of communication systems in Swedish social service departments, which were designed for promoting learning organization. Although the systems were fully utilized, users' limited senses eventually constrained technology use. While managers perceived the systems as 'communication boosters', group leaders perceived them as 'interaction builders', and social workers perceived them as 'collaboration platforms', few people actually engaged the systems for developing learning organization. By examining multiple sense-making patterns, we are able to understand why technology may be improvised and adopted in the most unexpected ways.

However, thus far we have learnt relatively little about how technology may be blended into users' everyday work (Boudreau & Robey, 2005). We may ask: How may technology bring about intended and unanticipated innovative practices, so that users come to

understand technology differently? Given that technology is equivocal, it is possible that users could develop different local practices to exploit the full potential of technology, as well as to work around technological surveillance. By understanding such local practices, we may trace the reasons why users make more senses of, and adopt technology, in certain ways.

In summary, to advance the current stage of theoretical development, there is an immediate need to move beyond initial sense-making and explore ongoing sense-making – i.e. to examine how more senses may emerge from multiple potentials of technology enactment (cf. the study of [Dutton & Dukerich \(1991\)](#); in which ongoing sense-making occurred without technology). Our research attempts to fill up this theoretical gap through a field study of the GPS-enabled taxi-dispatch system, known as CabLink, which is based in Singapore. This study traces how cabbies have constructed meanings around CabLink in two time-periods. The findings explain why emergent senses could be made from users' extensive interaction with technology.

3. Research methods

A qualitative, naturalistic methodology is well suited to our goal of generating theory in a context consisting of users' ongoing interpretations towards technology use ([Lincoln & Guba, 1985](#)). Especially, individuals' sense-making in technology involves an intricate interaction of people, technology, and work context. In this article, a field study is used for 'theory elaboration', drawing on and extending theories from technology sense-making at the user level ([Gopal & Prasad, 2000](#); [Henfridsson, 2000](#); [Orlikowski & Gash, 1994](#)). Theory elaboration is often used when pre-existing theories offer a sound foundation for an emergent study and obviate the need for building theories through a purely inductive analysis.

Process analysis is used for analyzing technology sense-making ([Pettigrew, 1990](#)). In the tracing of the process, we examined users' sense-making around technology and their work practices to guide our efforts in data collection and analysis. In so doing, we considered that actors' sense-making serves as a springboard for actions which enact new practices and are constrained by their work environment ([Hutchby, 2001](#)). For our study, 'practices' are defined as recognizable patterns of action and improvised activities responding to specific situations in a work context ([Orlikowski, 1996, 2000](#)). These practices are developed into 'local knowledge' within a community of users, and which even people engaging in them find difficult to fully comprehend.

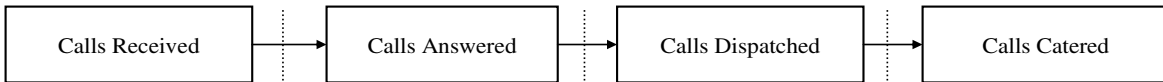
3.1. Research context

Our fieldwork was based at Comfort-Delgro Transportation (hereafter referred to as Comfort), which is the second largest land transportation group globally and has the largest computer-mediated taxi fleet in the world using CabLink. The S\$32 million (circa US\$20 million) satellite-based taxi-dispatch system was launched in Singapore in 1996, and managed 11,800 taxis with 25,000 contracted cabbies who are self-employed. CabLink consists of an automated taxi-dispatch facility integrating an Interactive Voice Response (IVR) and the GPS, which together coordinate 350,000 trips for 600,000 commuters daily. Through CabLink, taxi drivers' booking fares amount to US\$62.5 million per year, and the collections from booking fees have peaked to US\$20 million per year.

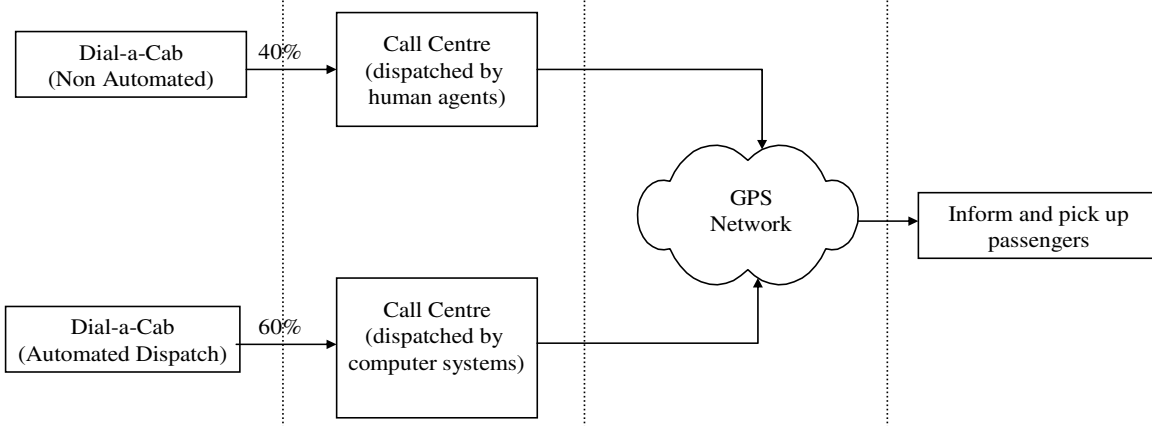
Replacing the earlier radiophone paging system, CabLink offers an optimal transportation resolution. All incoming booking calls are connected directly to Comfort's dispatch system, which is capable of tracking vehicle location in real-time with great accuracy. Customers can call the dispatch centre or use the automated phone system known as Speed-Call, which is a text-to-voice, computer-mediated booking system implemented in 2003, to make requests for vehicles (see Fig. 1a). In a typical situation, a commuter calls Comfort's

a. CabLink-enabled Dispatch Process

Process of Taxi Dispatch



Modes of Booking



b. MDT and In-vehicle Devices

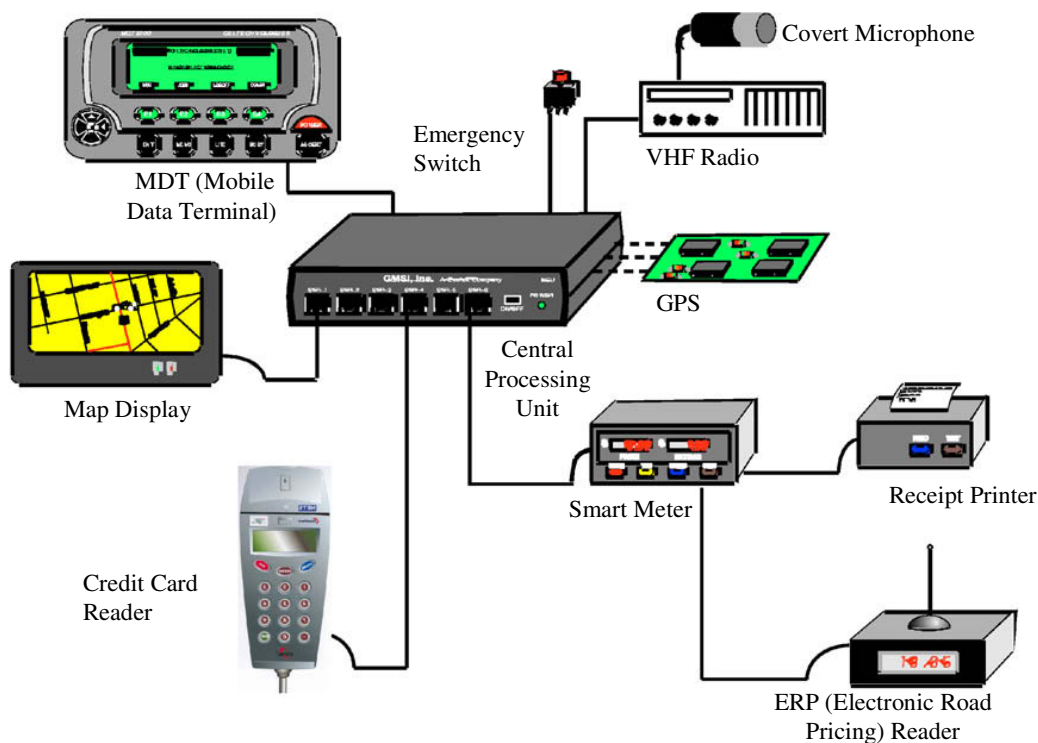


Fig. 1. CabLink-enabled dispatch process and in-vehicle MDT devices (Source: Comfort Transportation).

dispatch centre; and once the operator enters the destination and location of the commuter, CabLink automatically detects the nearest vehicle and sends messages to the Mobile Data Terminal (MDT) which is installed in the taxi (see Fig. 1b). The automated phone system then reads out the latest booking record from the database. If the address in the record matches the caller's latest pick-up point, the passenger can immediately confirm the booking through the telephone. When the task is confirmed, the system informs the customer of the registration number of the vehicle and the proximal time of arrival. Cabbies also receive the passenger information from the MDT, which can locate vehicles in case of an emergency in real-time.

CabLink offers two main technical functions: automated and manual. In the automated mode, a task will be dispatched to the nearest taxi without negotiation. If no taxi which is in the automated mode is available, the system will detect nearby taxis which are linked to the MDT in the manual mode within a two-kilometer range. The invited cabbies can bid on a particular task using predefined choices of Estimated Arrival Time (EAT), with four arrival-time choices: 5, 7, 10, and 15 min, respectively. On a first-come-first-served basis, the cabby who submits the shortest EAT will win the bid. In the manual mode, cabbies can choose to reject the call, should they find the task unfeasible. Once the task is assigned, the cabby cannot reject the task, except in urgent situations. If the cabby breaks his promise regarding more than two tasks within a single day, their MDT will be shut down for two hours. If he refuses more than four tasks in a day, his MDT will be disconnected for 24 h.

In its business model, CabLink is a compulsory adoption for cabbies. Comfort leases vehicles to 'hirers' for a rental fee of approximately US\$75 per day. Hirers can decide whether they want to find 'relief drivers' to share vehicles with. The cost of CabLink services is included in the vehicle rental fee. In general, a cabby would need to make at least 7–10 trips daily to cover the rental cost, and the average income varies around US\$650–2000 per month. Over an adoption period of eight years, the average incoming booking calls had climbed from 2005 to 30,000 per day of which 60% were through computer systems and 40% were through human agents. CabLink was considered as a highly successful system in terms of accuracy, efficiency, communications, user acceptance, and productivity, by the general public. In the 2003/4 period, Comfort won the Management Information Systems (MIS) Innovation Awards, which are measured by innovation, value to customers and employees, and financial benefits. It subsequently won the Intelligent 20 Award, and was elected as one of Asia's top 20 companies that are recognized for employing information systems to drive operational excellence.

To Comfort, CabLink provided an important way of ensuring the quality of customer services, reducing maintenance costs, boosting revenue from dispatch surcharges, improving fleet management, and confronting the rising competition, as three new taxi companies were incorporated during the 2004/2005 period. This brought the total number of taxi companies in the market to five, including Comfort/CityCab (CityCab was merged with Comfort), Premier, SMART, Transcab, and SMRT.

3.2. *Data collection*

We adopted two data collection strategies to increase the authenticity of this naturalistic inquiry (Golden-Biddle & Locke, 1993). First, we had a prolonged engagement at the research site and undertook longitudinal observations to sensitize us to the social context

of the cabbies. The first and third researchers conducted fieldwork spanning a period of more than three years (June 2003 to August 2006). Informants were drawn from three source groups: (1) Comfort's managers, the engineers of Singapore Technologies Electronics (the technology provider), who helped us understand CabLink's technological functions, dispatch-centre operations, and company policies; (2) Comfort's contracted cabbies, consisting of the largest group of our informants; and (3) independent experts such as a hospital doctor who specializes in taxi drivers' healthcare problems and government officials who were in charge of transportation, who helped us understand the institutional environment in which the taxis operate. As a whole, we conducted open-ended interviews with more than 150 persons on various occasions (see Table 2) which were based on accepted theoretical sampling principles (Glaser & Strauss, 1967; Lee & Baskerville, 2003).

Second, we collected descriptive data through triangulation in data sources and methods. Three sources of data were gathered using different methods. The first was to conduct free-flow personal interviews with cabbies when they were on the job (actual practices). From various locations, we hailed taxis either at different taxi stands, or on the streets, and through CabLink by means of fixed lines or mobile phones. Using ethnographic

Table 2
Sources of data collection

Source/method	Number of people interviewed	Frequency
<i>Formal interviews</i>		
Managers (Comfort and Singapore Technology)	4	4
Drivers	16	25
<i>Informal interviews (during cruising)</i>		
Cabbies who employed Radio-dispatch	5	7
Sailor Cabbies	7	7
Hunter Cabbies	35	38
Fighter Cabbies	32	45
Traveler Cabbies	37	39
Dweller Cabbies	48	48
<i>Non-participant observation</i>		
Drivers' community-related activities	15	30
Shadowing of drivers (observation in situ)	12	18
<i>Other ways of obtaining data</i>		
	Mixing with taxi drivers in their canteens on a biweekly basis	
	Participating in their community activities (approximately five times) on a monthly basis	
	Conducting onsite audit with drivers in Comfort's service centers	
	Observing dispatch centre operations onsite	
	Interacting with six selected drivers (July–December 2004)	
<i>Documentaries</i>		
SARS period travel itinerary	Examining drivers' daily itineraries	
CabLink technical manual	Studying 60 copies of related technical documents, amounting to 300 pages	
Other sources of documentation	Minutes of Comfort technical meetings	

methods, we began our interviews in an informal manner. As we boarded a taxi, we began to chat with the cabby, introducing ourselves as researchers, and quickly started our interviews en route to our destinations. The cabbies in Singapore use a mix of three languages: English, Mandarin and local dialects. As a general principle, they use English to communicate main ideas, Mandarin to elaborate concepts, and local dialects to talk about personal matters. The first and third researchers are fluent with the three languages and use the different languages in various social situations to collect data, although none of the researchers are Singaporeans. We invited cabbies to describe their daily work routines, to explain why they preferred a particular routine, and to express their views on CabLink within their working context. We asked them to give plenty of examples during the journey, so as to minimize the effect that they were giving us an idealized account of how they made sense of CabLink. During the research period, we took different taxis to different places in order to maximize our understanding of the cabbies' daily practices and local transportation conditions.

The second data source was the communities and habitual sites of the cabbies. To enhance our understanding of their social contexts, we visited the company headquarters as well as the cabbies' stopover canteens and specific locations such as the customs checkpoint next to the Malaysian border, and the food court in Ayer Rajah. Data collection and analysis were conducted concurrently so as to unearth thematic coding for technology sense-making. We mingled with the cabbies at their sites; and when trust had been built, we began questioning them. This data gathering method allowed us to interact with the cabbies without the pressures of time-constraints. The cabbies were exceptionally open and receptive to our questions. With his permission, we participated in a cabby's family gatherings and church activities to get a feel of his daily interactions, lifestyle and occupational values. Following each observation and interview, we prepared stenographic notes.

The third source came from non-participant observation and archival data. At a later stage, we observed four additional user-groups (see [Table 4](#)), and presented our findings to opinion leaders. On their part, these opinion leaders helped us identify cabbies who best characterized each category. We selected four cabbies from each user-type and hired their taxis for half-day onsite observations. These cabbies were aware of our research intentions and drove us through their daily routines. From these onsite observations, we gained deeper insights into their work practices and the way in which they perceived CabLink.

Our understanding of the cabbies' practices was enhanced by archival data. The computer-generated itineraries helped us verify the routines detailed by the cabbies. Through this long-period observation, we came to learn about cabbies' local terms. For instance, cabbies often used the local languages to describe their destinations within the communities, that is, they often referred to the city centre as 'bow-die' (downtown area), and to technology limitations, such as many street locations (many with localized and hence unofficial names) which cannot be captured accurately by CabLink's satellite systems.

3.3. *Data analysis*

Although data analysis generally consisted of four stages, data was examined simultaneously with ongoing data collection following a dialectical rather than linear process (see [Table 3](#)). At the first stage of our research, most of the cabbies interviewed were less-experienced users of CabLink. Our purpose was to understand how cabbies made initial senses of CabLink during the initial adoption period. At the second stage, between 2000 and

Table 3
Data analysis and coding scheme

	Data analysis	Tasks	Outputs
Stage 1	Initial sense-making triggered by CabLink (period: first two years of adoption) Source: Retrospective interviews with senior drivers and senior business executives	(1) Analyzing how cabbies made sense of CabLink through the three triggering conditions (novelty, discrepancy and deliberate initiative) to understand the motivation of technology use (2) Analyzing how CabLink re-structured cabbies' work practices (3) Analyzing how new local knowledge was enacted by cabbies	Initial sense-making around CabLin
Stage 2	Technology enactments and ongoing sense-making (period: the third to eighth year of adoption) Sources: Interviews with taxi drivers, onsite observation, and historical data obtained from CabLink	(1) Analyzing a variety of users' driving routines and identifying four types of work innovations (2) Analyzing cabbies' capabilities in appropriating CabLink into their work practices, which allowed us to observe the drivers' local knowledge enacted as a result of using CabLink (3) Analyzing how different groups of users became more sensitive to the use of CabLink, in different ways (4) Analyzing how users employed CabLink differently	Four types of new work practices enacted by CabLink Four new senses enacted from ongoing use of CabLink
Stage 3	Refining coding schemes by examining users' work changes enacted by CabLink, new senses enacted from such work changes, and different modes of technology use	(1) Gathering more of cabbies' practices to test and enrich the robustness of the coding scheme (i.e. four patterns of technology sense-making) (2) In the reiterative process, performing the four coding procedures stated in Stage 2 to enhance the authenticity of the data	Revision of sense-making patterns and modes of technology use
Stage 4	Triangulation and verification	(1) Sending the findings to drivers, technology vendors and business executives of Comfort for further improvement of the coding scheme's plausibility (2) Presenting the findings to three groups of selective passengers for a plausibility test of the findings (3) Proposing a theoretical framework for understanding ongoing technology sense-making	Revision of sense-making patterns and modes of technology use Table 4

2006, as users had become more familiar with CabLink, we traced how they appropriated CabLink differentially to enact new work practices. Consequently, we identified four patterns of new work practices emerging from distinctive user-groups. These new practices helped us understand how cabbies became more 'sensitive' to the capability and constraints of CabLink. At the third stage, we refined the categorization of sense-making by interview-

Table 4

Ongoing sense-making: Cabbies become more sensitive to CabLink differentially

User-groups	Innovations in work practice		Ongoing technology sense-making (illustrative quotes)	Technology uses
<i>Time 0: Before CabLink Adoption (<1998)</i>				
Nomadic	<i>Moving</i> : Searching for passengers by moving around the city. Cabbies cruised around familiar streets and queued at taxi stands, occasionally receiving radio-dispatches	No sense	‘Driving a taxi is a time-critical job. The more you work, the more you earn. On lucky days, I could take in passengers to recover my rental in half a day. On bad days, I would cruise the streets searching for passengers and praying for radio-dispatches’	Use with hope
<i>Time 1: Initial Adoption of CabLink (1999–2000) – initial sense-making</i>				
Sailor	<i>Optimizing</i> : CabLink provided an optimal dispatching method to search for passengers. At peak hours, cabbies could earn more income through CabLink dispatches. Vehicles’ redundant time was significantly reduced	CabLink as <i>Beacon</i>	‘Before CabLink was available, I drove around familiar areas to find passengers. It was very difficult to plan my days. CabLink is like a beacon; it guides me as to where and when to go and reduces my vehicle vacancy time’	Experimental use
<i>Time 2: Transitional Adoption of CabLink (2001–2006) – ongoing sense-making</i>				
Hunter	<i>Preying (focus on precision)</i> : Finding passengers at dispatch hot-spots. The <i>hunter</i> cabbies developed technology-induced knowledge and were familiar with ‘zero-points’, which identified the caller’s location as defined by the GPS-based electronic maps	CabLink as <i>Detector</i>	‘CabLink is a bit like radar. I can locate passengers. All I need to do is to drive to these places and wait for their booking calls. It reduces my fuel expenses and gives me more time for lunch’	Efficient appropriation
Fighter	<i>Battling (focus on speed)</i> : Snatching passengers at crowded and high-traffic areas. The <i>fighter</i> cabbies were street-wise in developing rich geography-related knowledge. They were familiar with streets and shortcuts to accomplish jobs quickly	CabLink as <i>Navigator</i>	‘To compete with so many taxi-drivers, I must fight for a living. So, when you see one; you kill one (i.e. get the passenger). CabLink helps me to identify all possible incoming jobs. With CabLink, I can detect more passengers and snatch them at once’	Aggressive exploitation
Traveler	<i>Encountering (focus on screening)</i> : Selecting the right passengers. The <i>traveler</i> cabbies developed substantial people-related knowledge (e.g. when people will visit the aviation show at the Expo). They preferred to select passengers through CabLink so as to avoid potential risks and achieve some form of self-cultivation through learning from passengers	CabLink as <i>Explorer</i>	‘I wish I could take every booking; but I cannot. Sometimes you might get the wrong people from a night club throwing up in your car. Or, you might take the wrong job and get stuck in traffic. The best way to use CabLink is to ferry the expatriates from the black-and-white bungalows. They give good tips and teach you a lot’	Selective application
Dweller	<i>Dodging (focus on safety)</i> : Sticking to a routine and trying to avoid CabLink. The <i>dweller</i> s developed substantial location-based knowledge. They perceived that CabLink brought about more trouble than convenience. But they liked CabLink because it could help locate lost and stolen vehicles	CabLink as <i>Guardian</i>	‘The more booking calls you get from CabLink, the more trouble you have. The words shown on the MDT are so tiny. I might bump into a tree while reading them. Even if I could read the words, I might not be able to find the address. It’s better to queue at the airport’	Perfunctory adoption

ing more cabbies. At the fourth stage, triangulation and verification were conducted to enhance authentic interpretations of cabbies' practices.

Stage 1: Initial sense-making around CabLink. The focus at this stage was to analyze: (1) cabbies' general work practices before the adoption of CabLink, and (2) cabbies' initial sense-making and new working practices induced by CabLink. Users' initial senses toward CabLink were analyzed through three triggering conditions – novelty, discrepancy, and deliberate initiative (Griffith, 1999; Louis & Sutton, 1991), which explained the motivation of managers and cabbies in adopting CabLink (as in Beacon; see Table 4).

Stage 2: Ongoing technology enactments and new sense-making patterns around CabLink. At a later stage, with the addition of real-time longitudinal analysis, we began to discern different work practices enacted by CabLink, and observed additional sense-making patterns. Using inductive coding (Miles & Huberman, 1994), we found that, through the daily use of CabLink, cabbies became more experienced in exploiting CabLink in the course of their work and developed different understandings around CabLink. In addition, new senses were made by users who gained more experience with the technology, i.e. they viewed CabLink as detector, as navigator, as explorer, and as guardian (see Table 4). At this stage, we engaged in real-time tracing of cabbies' practices to examine their actual usage of CabLink. The first and third researchers conducted independent coding, while the second researcher served as a facilitator to negotiate tensions between two different sets of sense-making patterns. In a reiterative process, these four sense-making patterns were emerged as we coded data by grouping similar user-groups (hunter, fighter, traveler, and dweller), and these were validated by cabbies in each category.

Stage 3: Refining the coding scheme. Our focus at this stage was to extend our understanding of how the cabbies' emergent work practices might lead to new patterns of technology sense-making. We conducted more fieldwork in tandem with the analysis of the four new senses, so as to test the robustness of the categorization. As we learnt more about the cabbies' concerns in their everyday work, we began to explore their various tactics of using CabLink. In each user-group, we tried to understand how different categories of cabbies used CabLink to cope with their hectic routines, deal with risks, and avoid the company's punishment mechanism. We asked cabbies to explain their interpretations and appropriation of CabLink. Such data sets allowed us to refine the coding and improve data reliability.

Stage 4: Triangulation and verification. At the last stage, the findings were presented to managers and cabbies for testing their generalizing power (Table 4 provides a summary). To address the reflexivity issue and prevent the interpretation of the social realities from merely being the researchers' monologues, we conducted 'member-checking' (Lincoln & Guba, 1985 p. 314). The analytical categories, interpretations, and conclusions were tested with members from whom the data was originally collected. Their feedback was incorporated into our ongoing analysis. Moreover, we discussed our findings with the technology vendor in order to keep abreast of the changes in CabLink's features.

4. Research findings

This section is divided into five subsections. The first subsection explains the existing conditions before CabLink was implemented. It analyses how cabbies made initial sense of CabLink and how the work practices were changed by CabLink. Sections 4.2–4.5 examine how four distinctive groups of cabbies enacted new work practices with/around

CabLink during the transitional adoption period. Each subsection elaborates what work transformations CabLink enacted and how cabbies made new senses from their ongoing use of technology. Table 4 describes the ongoing sense-making around CabLink. However, we must note that the four patterns of sense-making represent the ideal types; they are neither mutually exclusive nor exhaustive.

4.1. Initial sense-making: CabLink as 'Beacon' (Time 1)

The period before CabLink adoption: Before CabLink was implemented, most cabbies cruised on the streets or waited at taxi stands to look for passengers. Since Singapore is a relatively small city, cabbies often use the city centre as a hub to seek passengers traveling to different regions. Due to information asymmetry, the cabbies' practices were largely inefficient, their productivity was not maximized, while Comfort's vehicle maintenance costs remained high, and passengers wasted time finding taxis. Cabbies were like 'nomads' trying to move around the city to maximize vehicle exposure in order to attract passengers. The earlier tool used for assisting vehicle dispatch was radiophone technology. Typically, passengers would ring the dispatch centre and the service staff would broadcast the booking to all cabbies. Cabbies would bid for the task by stating their estimated arrival time (EAT) to the dispatch centre.

However, the radio-dispatch method incurred four main problems. First, the radiophone could only disseminate messages regionally. During this period, a critical mass of users was unavailable. Passengers were frustrated with long waiting times and ineffective dispatches. Second, to maximize economic gains, more and more cabbies were competing on dispatch tasks by underbidding the EAT. A cabby who was 10 blocks away from the passenger would bid a 5-min arrival time to wrest the job from another cabby who was just one block away. This practice was a potential cause for accidents as the cabby tended to rush to the destination. Worse still, cabbies could collude with the service staff to receive more calls. Hence, most cabbies perceived that radio-dispatch was not entirely a fair dispatching method. Third, the service staff frequently broadcast wrong destinations to cabbies due to poor reception or human error. Even when the cabbies were given the passenger's pick-up point distinctly, they were likely to forget the destination en route. Fourth, it was difficult for the radio-dispatch centre to provide a passenger's exact location due to technological limitations, such as broadcasting range and sketchy location identification. The general public perceived radio-dispatch as noisy (causing unpleasant experience during the journey) and that it posed health hazards (because of the concern with exposure to radiation from radio-transmission).

Initial sense-making towards CabLink: The initial adoption of CabLink triggered new perceptions of vehicle-dispatch among cabbies. First, the *novelty* of CabLink made many cabbies think that the technology would bring them a professional identity and enhance their social status. For Comfort executives, CabLink would offer a new operational model for managing its taxi fleet and improving supply chain efficiency. Secondly, cabbies could easily see the *discrepancies* between radio- and computer-mediated dispatch, in terms of better technical capabilities (CabLink was capable of covering the entire island of Singapore); improved communications (the pick-up address could be displayed on the screen and spelled out by a computer-generated voice); and enhanced customer services (CabLink is capable of locating any specific vehicle in real-time while the electronic signal is perceived to be not hazardous). Lastly, by using the MDT, cabbies are able to interact with

CabLink by switching between the automatic and manual modes, as well as to press buttons to bid for tasks, and retrieve pick-up addresses. Through these *deliberate initiatives*, CabLink was perceived by cabbies as a fairer dispatching method because they felt that they were working with computers rather than the potentially colluding human agents. “Computers won’t cheat”, was a general impression perceived by most cabbies. Cabbies perceived that, the more they used CabLink, the higher would be their incomes because booking surcharges would be added to their bank accounts through the computer. CabLink was thus swiftly adopted by cabbies.

As a whole, cabbies perceived CabLink as a ‘Beacon’ while they considered themselves as ‘sailors’ in the ocean. With CabLink, they could discover whether there was a passenger nearby. Cabbies felt that CabLink would bring them to customers one after the other as “a beacon guiding sailors to the shore during the dark night”. This computer-beacon could also show them the exact way to reach customers as they could retrieve addresses from electronic maps. CabLink was also a ‘beacon of hope’ in troubled times too. These included times when they worry about vehicle vacancy, which means no income is being generated. At times when they worry about vehicle security, CabLink is capable of locating their taxis in real-time through satellite tracking. Moreover, when they worry about robbery, they can use CabLink’s emergency button to call for immediate help.

Optimizing practices: The driving practices of the cabbies were altered by CabLink. Before CabLink was introduced, cabbies drove around areas with which they were more familiar and mostly near where they lived. With CabLink, more cabbies went beyond their ‘comfort zones’ as dispatch tasks forced them to become familiarized with other places in Singapore. The cabbies established new work routines and gained new spatial and temporal knowledge, when they accumulated heuristics on passengers’ pick-up points through CabLink. For example, one cabby initially plied the routes chosen by his passengers. Using CabLink, he began to develop a driving routine: in the morning, he moved between Changi Business Park on the east coast and a particular residential area, because he was able to pick up frequent dispatches from expatriates living in this area. In the early afternoon, he drove to the city centre to pick up people going out for lunch in the downtown district. Later in the afternoon, he took a break in a car park near a commercial building to wait for ‘call bookings’ in order to earn the late afternoon surcharges.

Through CabLink, cabbies moved beyond their initial geographical boundaries to explore more business opportunities. They came to learn more about passengers’ temporal movements in different locations. For example, some cabbies found frequent dispatch jobs in the Orchard Road area, i.e. a shopping and commercial hub, and at the Woodlands Shopping Centre in the north. In these places, passengers would book taxis to avoid the long queues. An alternative routine was exhibited by another cabby’s practices: picking up office ladies from 6 to 8 pm at Raffle City (an office tower complex in the city); professionals from Raffles Place (the financial district) at lunch time; late-night crowds going home from night clubs and cinemas. Previously, such customer information was not fully made available to most cabbies. With CabLink, cabbies became more effective in seeking passengers and reducing their vehicle redundancy. They worried less about ill-intended competition, enlarged their cruising territories, and found CabLink useful in generating more revenues.

The early adoption of CabLink has led to a visible improvement in supply chain performance. For Comfort, CabLink provided an effective way to govern its taxi fleet and normalize cabbies’ practices. Using CabLink, the management could supervise vacancy

rates, monitor vehicle routes, and prevent vehicle misuse. Comfort managers could have full control of cabbies and identify any problem at the earliest time.

Over the years, as we observed, new types of work practices began to spring up as a result of different user-groups' ongoing interaction with CabLink. Hence, four types of work transformations have emerged and cabbies have come to make more new senses around CabLink and perceive it as *detector*, *navigator*, *explorer*, and *guardian*. The next four subsections elaborate on the four patterns of technology enactment to account for why these four new senses evolved.

4.2. Sense-making #1: CabLink as 'Detector' (Time 2)

Emerging work practices – preying: The cabbies of the first group exhibit a 'preying' type of work practice and may be called 'hunters'. The hunter cabbies had a thorough understanding of CabLink's functionalities. They investigated technology features and developed rich technology-related knowledge. These cabbies established a mental map of 'hot-spots' (i.e. places where they would have a high probability of receiving dispatch jobs). A typical practice was to wait in hot-spots, such as industrial parks, industrial districts, commercial centers, and areas where public transportation is unavailable.

Hunter cabbies used 'zero-point' locations to find their hot-spots. When CabLink receives a call, the system searches for the location, and sends the axis position back to the dispatched taxi's MDT. When the taxi arrives at the caller's premises, the MDT would then indicate '0-0' (i.e. a zero-point location) on the screen. However, it is quite likely that the GPS-based electronic map may not match the exact geographical location. For example, the 'zero-point' of a chemical company in the Jurong Industrial Park in the western zone of Singapore was actually three blocks away from the main building. In another case, the caller's office was located in newly-reclaimed land, which had not yet been programmed into the electronic map by the computer system, and thus the zero-point was in a different location. This also explains why, when a dispatch job is received, the hunter cabbies will drive around the area to find the zero-point of the caller's location before picking up the passenger.

Typically, the hunter cabby's traveling routine was between the zero-points and the dispatch destinations. Once a cabby had completed a job assignment, he would cruise around the nearby area to search for passengers en route to his next hot-spot. Otherwise, he would return directly to the nearest 'hot-spot' to wait for the next dispatch while taking time to catch up with news or take a tea break. As a cabby explained, this practice resembles that of a wolf preying in front of a hare's cave: once the hare is out, the wolf will catch the prey and return to the same cave (or other familiar caves) to wait for the next hare to come out.

The hunter cabbies were based at particular condominiums and industrial parks. In each area, they occupied specific 'turfs'. In the industrial parks, the hunter cabbies preferred to take 'bow-die' callers, i.e. passengers who needed to commute to the 'city centre' on business. This is because the cabbies could easily collect US\$10–15 on each trip, and also because generally such passengers were more gentle so that fewer inflammatory situations would be encountered. Other hunter cabbies chose to habituate nearby factories so that they could pick up callers needing to buy dinner for night-shift staff. They could easily collect up to US\$20 for each round-trip. During peak hours, such as from 2 to 4 pm, they could pick up 10–18 calls in one location for short-distance traveling within industrial parks. This explains why the 'hunters' are sensitive to temporal practices. They pay attention to booking

calls during peak hours: during the morning rush hours (from 7 to 9 am), at lunch time (11 am to 12 pm), during afternoon in-town meetings (from 1 to 3 pm), during home-bound hours (from 5 to 7 pm), night shifts (from 11 to 12 pm), and on rainy days. The surcharges from these 'peak hours' could comprise 30% of a hunter cabby's daily income, thus providing an escalated commitment to the use of CabLink. A hunter cabbie commented:

I know at what time and where I can receive booking-calls. It's a waste of time, money and energy if you always cruise around the streets. I would rather wait in 'hot-spots', such as the Jurong East industrial parks, and, guess what, I could always receive 15–20 booking-calls a day, on average. The secret is: if your vehicle stays in specific areas and is always in 'auto mode', the satellite system will 'recognize' you and route dispatches to you first. So, you will keep receiving booking-calls from CabLink.

Emerging technology use – efficient appropriation: The hunter cabbies in general employed an *efficient* mode for technology use. They switched the MDT to automatic mode at specific hot-spots in anticipated time slots to pick up passengers making booking calls. For them, the economic incentive was to earn the booking call surcharges and achieve minimal operational costs, including the lowering of maintenance costs; a reduction in traffic accidents (thus saving on insurance costs); and considerable saving on fuel costs brought about by cruising in fewer traffic jams. One hunter cabby even designed a 'golden finger' to help him capture booking calls. This device is a long wooden stick, with a hook at one end. With this, a cabby can make contact with the MDT while taking a nap, without having to lean forward.

Making new sense: CabLink as a detector. The hunter cabbies perceived that survival in this competitive environment requires precision. They have come to regard CabLink as a 'detector', which identifies precise zero-points. With this 'detector', the 'hunters' have developed a sense of satisfaction with their occupation, as they feel that they are *capturing* customers, rather than *waiting* for them. CabLink is perceived as a 'radar detector' which seeks prey in the wild. This is the noteworthy observation of one hunter cabby:

As a cabby, I would feel very nervous if my car is empty. I need to find passengers in the most efficient way – with minimal waste of fuel and by bringing in money quickly. I need to compete with more than 20,000 cabbies in the city to catch limited 'fish'. CabLink is a 'detector' and helps me reach the 'fatties' (rich people) in the condominiums and business parks. These passengers are wealthy and are less sensitive to surcharges.

As a 'detector', CabLink was perceived by the hunters as bringing about a reduction in uncertainties concerning scheduling of their jobs. Three motives were frequently mentioned: (1) the system is fully exploited to justify the rental; (2) the operating costs of vehicles are minimal; and (3) incomes are maximized through receiving surcharges for each dispatch job, while they enjoy longer breaks. Another hunter cabby explained how he uses this 'detector':

CabLink helps me to find zero-points and bring in 'smart money'. In Singapore, every booking-call surcharge fetches S\$3.20 (US\$2). That's a major source of income for me. Since the rentals for CabLink are rather high, there is no reason why we should not fully exploit the system.

4.3. Sense-making #2: CabLink as 'Navigator' (Time 2)

Emerging work practices – battling: The second group of cabbies can be called 'fighters', i.e. they are like fighter/aircraft pilots. Many of them face financial pressures for various reasons, such as bankruptcy, job redundancy, family problems, and debts; and they are ready to take risks in order to generate more income. The fighter cabbies are concerned with speed and vehicle mobility. They prefer not to queue at taxi stands but to cruise around the city centre or nearby commercial districts to maximize their chances of finding passengers or receiving dispatches from CabLink. Unlike the hunter cabbies, the fighter cabbies were less sensitive to time-related costs (i.e. income per hour) and were better at improvising their routines. They perceived that maximum exposure in the 'open space' would increase the chances of being selected by the satellite system. Especially, they worked closely with their 'relief drivers' (part-time partners sharing the vehicle rental) to ensure that their cabs were fully utilized. Even though the fighter cabbies spent an average of 12–16 working hours, their average monthly income of approximately US\$1200–1600 was still lower than that of the hunter cabbies who fetched an income of approximately US\$1800.

CabLink helped the fighter cabbies develop a rich geographical understanding of the city, from the main streets to small alleys. Through CabLink, the fighter cabbies extended their reach to different places in the city. They knew many tourist spots, landmarks, architectural highlights, and places that few other cabbies knew of, such as specific residential areas where certain celebrities dwelt. The fighters were more sensitive to turnover rate, aiming at picking up passengers one after another. To maximize their incomes, they were sensitive about prime time slots, i.e. from 7 to 9 am and from 5 to 7 pm when the surcharge could be as high as an extra US\$4 per trip. They carefully monitored travel during the hours when the Electronic Road Pricing (ERP) tolling system was operational to minimize operational costs. Unlike most toll systems in the US and other places which operate 24/7, in Singapore, ERP tolls vary according to the time of day or day of the week so as to regulate traffic conditions (the highest tolls being from 8 to 9 am and from 5 to 6 pm).

The fighter cabbies were not afraid of ferrying passengers to unpopulated places. In fact, they welcomed challenges and were excited about driving to unfamiliar destinations. We often heard comments similar to this one, made by a fighter cabbie: "I'm very familiar with the city. There is no place within it which I cannot find." Many fighter cabbies also habituated nightclubs, Karaoke TV lounges and riverside bars on weekend nights. Although they might risk encountering unpleasant passengers, such as drunkards throwing up in the car, they enjoyed both the adventures and premium tips given by such passengers.

Emerging technology use – aggressive exploitation: The fighter cabbies adopted maximum use of CabLink's system. Most of the time, they chose to set CabLink in the automatic mode while cruising. Their motive was to increase the chance of being 'selected', either by serendipitous passengers or by CabLink dispatch. Since the fighter cabbies were familiar with geographical conditions even in the manual mode, they showed great confidence and were competitive in bidding for any dispatch task. For instance, CabLink allowed cabbies to use the 'can-bid' function to receive the next booking call, under the automatic mode, while they were fulfilling the current job dispatch. However, a risk was involved. If there were two passengers in the same taxi traveling to different destinations, and the cabby received another automatic dispatch under the 'can-bid' mode, the

fighter cabbie might have to ‘abandon’ the second passenger in order to avoid punishment for missing the second job he had accepted. Although the second passenger might lodge a complaint, the fighters were prepared to take such a risk which, for them, was relatively lower than not arriving at the next destination on time.

Making new sense – CabLink as a navigator: CabLink made the fighter cabbies street-wise and sensitive to locations of high population intensity. One street-wise fighter cabby remarked confidently, while he was cruising and observing both sides of the road for potential clients:

I drive around the island. I know the place inside out. If I take a passenger to the airport, I will cruise around Changi Industrial Estate [near the airport] because I can run into commuters going to the city centre for business purposes. If the job takes me to Bukit Batok, I will then drive around Choa Chu Kang [where there is no MRT – Mass Rapid Transportation]. You bet I can easily get a dispatch call or pick up the area’s residents.

The fighter cabbies considered CabLink as a ‘navigator’ guiding them to find passengers through heuristic pick-up points. A fighter cabby thus describes his connection with CabLink: “I’m like a fighter jet pilot cruising in the sky; CabLink can quickly direct me to the enemies and shoot them down.”

While driving, the fighter cabbies were not keen to engage in social conversation with their clients, but focused on scanning the surroundings with the aim of spotting the next passenger. Their belief was that taking risks is necessary to save time, to increase vehicle mobility, and to maximize income. For instance, one fighter cabby had just reached a highway exit when he received a dispatch (Note: on the highway, most cabbies normally would switch the MDT to the manual mode). He accepted the job, reversed the vehicle back onto the highway, thus offending many drivers at the exit, before driving to the next exit point to reach the caller. The fighter cabbies were willing to take such risks knowing that they could be punished by the company, if customers should lodge complaints against them for failing to turn up.

4.4. Sense-making #3: CabLink as ‘Explorer’ (Time 2)

Emerging work practices – encountering: Cabbies in the third group can be termed as ‘travelers’ who value the freedom of organizing their work routines and dislike being monitored by technology. Through CabLink, the traveler cabbies have target customers in mind and have developed people-related knowledge. For instance, they are sensitive to cruising around specific residential areas in the morning to pick up office-goers; driving to hospitals in the afternoon to pick up outpatients; to exhibitions halls during specific events to pick up audiences or visitors; as well as to the zoo (near Woodlands) or the bird park (in Jurong) on Saturdays and Sundays to pick up tourists and family visitors. One traveler cabbie described a typical routine:

Between 7 and 9 am is the peak period; everyone is going to office. I can drive to Sunset Avenue [a residential area] and easily find people going into town to work. Between 11 am and 1 pm, many outpatients are leaving the hospitals; I can drive to any of the five major hospitals in Singapore to pick up patients. On Saturday or Sunday, people will sleep late and it’s time for family get-togethers. I will go to

residential areas around 11 am to pick up people going out for ‘Dim-Sum’ [Chinese brunch]. Driving is all about ‘people’ business!

Many traveler cabbies were found to be fond of learning new things from different walks of life. They were inquisitive and exploited every encounter to learn about passengers’ riding behavior and potential business opportunities. For example, a 45-year-old cabby who was a retrenched engineer, had a wide-ranging knowledge of the various exhibitions held at the Singapore Expo, an exhibition mall on the east coast; and of art museums as well as the Singapore Exhibition Centre in the downtown area. He knew of the major events of each month, such as a fashion show held at the Singapore Expo in early November. Accordingly, he scheduled his driving routines around the major events. Another cabby, who was in his early 40s and a former civil servant, was sensitive to special events for different ethnic groups. He knew when to pick up Japanese families from the Changi Senior School on Sundays (at 11:30 am), after their children’s Kendo (Japanese fencing) lessons. He also knew when to pick up ethnic Malay passengers on Fridays (at 2 pm) from nearby Muslim mosques, and to head for the turf club to pick up gamblers on late Saturday afternoons. Although the traveler cabbies had known some of these routines before technology adoption, CabLink helped them become more sensitive to ‘people’ oriented knowledge.

For instance, in picking up a caller, a traveler cabby (a retired policeman) initiated a conversation with the passenger to learn more about his lifestyle and learnt that he was a regular golfer. From the conversation, he heard about the golf club’s activities and golfers’ routines. He added the golf club to his list of favorite pick-up points. Thereafter, when he happened to drive by the area, he would park in a nearby building to wait for dispatches. Another traveler cabby, with a tour guide’s license, installed a Karaoke set (with more than 500 VCDs) in his taxi. When he sensed that the passenger might like the idea of singing along in the car as a way to ‘release stress’, he would offer the Karaoke service immediately. As a result, he made many friends and had regular customers.

Emerging technology use – selective application: The traveler cabbies employed a *selective mode* of using CabLink in response to their relation-based tendencies and risk-avoidance attitude. They usually set their MDTs to the manual mode and cruised around ‘golden-places’. With people-related knowledge, they used CabLink selectively so as to choose the ‘right’ passengers – by knowing where they were, how they worked, and when they moved. Since the traveler cabbies were more concerned with the penalty mechanism and unexpected incidents, they would bid on dispatch tasks with great discretion. A traveler cabby defined his stand:

When CabLink dispatches an ‘on-call’ task to me, I pay extra attention to reading the message. I will be cautious to take calls that don’t specify any pick-up location and destination, or calls from the main streets. These customers may easily cancel the booking without prior notice to save their on-call surcharges. But if a caller is based in areas like Newton (where there are many private villas) or from the universities (which mostly are far removed from the city centre), I’ll definitely bid for these tasks.

Making new sense – CabLink as an explorer: The traveler cabbies perceived CabLink as an ‘explorer’, or a people-finder. They liked the idea of having the choice of not having to do something, of selecting the destinations and the passengers. For instance, traveler

cabbies would not like to bid for a task requiring them to fetch children from schools, because of the long queues outside the schools during peak-traffic times. They were selective about the type of passengers to pick up. A cruising traveler cabby explained:

You see, right now there is an 'on-call' job coming. The MDT shows that a passenger is booking a cab to go to Sunset Avenue with an animal. I will certainly not take this booking because the animal will leave a strange smell in my car (for him, another less preferred thing is the durian, which is an odiferous fruit emitting an odor which is offensive for some). It will cost me more money to get rid of the odor.

The traveler cabbies were inquisitive about their passengers' preferences. In being inquisitive, they had two purposes in mind. First, they could assess the risk of being robbed or verbally abused by passengers. Second, through social conversations, they could obtain important information about the prospective passenger's routines and predict the likelihood of getting other customers in the same location. The traveler cabbies were sensitive to the kind of passengers who boarded the taxi, and tried to remember the 'golden-places' such as the previously-mentioned golf club.

The traveler cabbies scheduled their itineraries with their people-bank in mind. When they drove a passenger to a specific location, they thought of it as another chance to make friends, learn about novel experiences, and gather business intelligence. For them, CabLink serves as an 'explorer', like search engines Google or Yahoo, to guide them to the right (golden) place, to meet the right people or avoid meeting the wrong people, and to achieve some form of self-cultivation through learning from passengers.

4.5. Sense-making #4: CabLink as 'Guardian' (Time 2)

Emerging work practices – dodging: Cabbies in the fourth group can be described as 'dwellers' and many of them are senior citizens, aged between 60 and 70 years. The dweller cabbies expected little from the dispatch system, constantly setting the MDT in the manual mode, and disabling the sound system of the MDT. They were not competitive enough to queue in the taxi stands in the city centre. Therefore, they preferred to queue at taxi stands in specific locations under 'institutional protection' such as airport taxi depots, the Malaysia–Singapore border checkpoints, and taxi stands in industrial parks on the outskirts of the city. They perceived that their chances of getting business would thus be secured. The surcharges at these points were higher, i.e. approximately US\$3.5 at the airport; while the average fare was about US\$13–22 for long-distance trips. Hence, even though there might be a longer queuing time, the dwellers could make a reasonable income. This is the opinion of a dweller cabby:

I only commute between the airport and hotels, apart from other familiar places. The business that appears on the MDT screen seems remote to me – I regard them as something to be watched but not to be touched. I am too old to compete for the bidding jobs. Well, if I can get 6–8 trips from the airport, getting the surcharge is better than bidding for CabLink-dispatched jobs.

Their practices were not directly enacted by CabLink, but resulted from the competitive pressure induced by CabLink. The dwellers based themselves in specific habitats where competition was less intensive. For instance, one cabby operating at Changi Airport preferred to stay in Terminal 2 because it would be more likely for him to pick up international

passengers going to downtown hotels. He did not like Terminal 1 because he often picked up domestic passengers traveling to residential areas which he might not be familiar with. Another cabby shuttled domestic passengers between residences and shopping-tour bus stops in nearby Chinatown, a popular pick-up destination for shopping tours taking passengers to nearby Malaysian cities for weekend shopping; a popular pursuit as most items in Malaysian supermarkets are sold at half the prices of those in Singapore. This is because of the high Singapore dollar.

Emerging technology use – perfunctory adoption: The ‘dwellers’ were more conservative towards technology and exhibited a *perfunctory* use of CabLink. They were afraid of booking calls that went beyond their comfort zones, i.e. places they were unfamiliar with. They were especially fearful of Comfort’s credit-deduction mechanism. As part of this mechanism, Comfort deposited US\$125 into every cabby’s account as an incentive. For every customer complaint a cabby received, Comfort would make a deduction of US\$13 from his account. Once cabbies’ accounts were empty, the firm would deduct money directly from their bank accounts. This is the key reason why the dwellers preferred fewer dispatch calls and less interaction with CabLink. Comfort closely monitors every cabby’s CabLink usage and a policy stipulates that each cabby must use CabLink at least 90 times within a month. Although CabLink was designed to rationalize cabby activities through required use, the dwellers also developed tactics of perfunctory responses to calls just to meet their quotas. They would switch to the manual mode and habitually bid for the 15-min ‘EAT’ at the latest possible moment. In this way, they deliberately lost every bid. CabLink was often set in the manual mode for optional use. This is the frank opinion of a dweller cabby:

I dread using the ‘auto mode’ because most of the time I may be unable to commit to the task. If a customer lodges a complaint against me, because of delay or no-show, I would have to go to the company for a ‘coffee time’ (i.e. for an investigation). This is not just a waste of time; it’s a risk not worth taking.

Making new sense – CabLink as a guardian: For the dwellers, CabLink was perceived more as a ‘guardian’, protecting both their personal safety and their vehicles from theft. The texts shown in the MDT screens were too small for their feeble eyesight and the computer-generated voices were too noisy and distracting, and regarded as potential triggers for road accidents. The dwellers were concerned that if they failed to find a caller’s location, they would have to be penalized by the company. They were also afraid that CabLink might disrupt their customary routines. This is the concern of a dweller cabby:

CabLink is less useful to me. I only take the airport jobs. If I set the MDT on ‘auto mode’ while I’m in the airport queue, a dispatch job could mean big trouble. I may not know the caller’s address and, even if I do want the job, I cannot get out of the long queue at the airport.

Frequently, the dwellers were familiar with the main streets and did not monitor road conditions. Their main interest in CabLink centered around the ‘emergency button’ hidden in the MDT, which helps them to locate missing cars or inform the dispatch centre if they are in trouble. Generally, the dwellers had developed a good knowledge of the places sheltered by certain institutions, such as checkpoints, airports and shopping centre taxi stands as well as the incentives attached such as extra surcharges, routine pick-ups and long-distance transportation. They were sensitive to technology surveillance and developed ways to work around the technology. For them, CabLink served more as a lucky charm.

5. Research implications

The lens of sense-making offers a useful way of understanding how the use of technology may be shaped by users' socially-constructed meanings. This article extends this line of inquiry and suggests an investigation of ongoing sense-making towards technology (echoing Weick, 1990). By examining the ongoing structuring of technology and habitual practices, our study explains how vagaries of technology use could surface and why more senses could be made by users. Our detailed analysis of ongoing technology enactments, changing work practices, and emerging senses around technology provides theoretical and practical insights.

5.1. Theoretical implications

This article adds to current theoretical development in at least three aspects. First, concerning *technology sense-making* literature, our study highlights that, if we want to gain a holistic picture of technology sense-making, we need to examine the whole technology adaptation process: initial adoption (making initial senses toward technology), transitional adoption (making more senses around/with technology) and post-adoption (technology becomes commonsense and users become senseless). Prior studies have extensively examined different initial sense-making patterns (e.g. Gopal & Prasad, 2000; Prasad, 1993; Siino & Hinds, 2004). We know in what way technology may become more sensible to users, and why users may adopt or reject that technology (Barrett, 1999; Henfridsson, 2000; Karsten, 1995; Orlikowski & Gash, 1994; Schön & Rein, 1994). On the other hand, to a certain extent, the previous studies have also suggested how technology may be institutionalized within organizational routines and how in the long-term users become senseless to technology use (Edmondson et al., 2001; Kling & Iacono, 1989; Orlikowski et al., 1995; Tyre & Orlikowski, 1994; Zuboff, 1988).

But, we understand relatively little about how additional senses may be made from ongoing structuring of technology during the transitional adoption stage. As Weick (1990) queried decades ago, when users interact with technology in practice and become more sensitive to the full potential of technology, how may they make more new (rich and limited) senses? Although several studies have attempted to investigate sense-making during the work structuring stage (Bansler & Havn, 2004; Henfridsson, 2000; Siino & Hinds, 2004), these studies have largely examined initial sense-making while paying insufficient attention to work practice in situ. Several studies also suggest that the enactment, selection and retention of people's sense-making cannot be detached from their work environment (Griffith, 1999; Hinds, Roberts, & Jones, 2004; Weick et al., 2005). However, little evidence to press home this point is found thus far.

Our study offers a seminal analysis and explains how ongoing sense-making can be further fashioned by different users' preferred work routines. As different groups of users become more familiar with the technology, they begin to appropriate technology according to their own habitual practices, surface new ways of technology use, and make new patterns of senses that interact with dissimilar types of work practices, which designers did not anticipate. An important contribution of our study is to suggest why cabbies become more sensitive in adapting technology in many different ways, by analyzing many potentials of technology enactment (echoing Orlikowski, 1996; Orlikowski, 2000).

Our study also offers a processual view of sense-making. Previous studies are limited by observing initial technology sense-making and not examining how users' senses could

evolve with the progress of time (cf. Dutton & Dukerich, 1991). Two exceptional studies are illustrated by the Australian broadcaster's adoption of web technology (Spicer, 2005), and five 'images' of enterprise systems diffusion (Ramiller, 2001). However, these studies failed to take into account sense-making within technology structuring. Our study makes additional observations and traces sense-making within the process of ongoing work structuring (cf. Barley, 1986). Users may adopt limited initial sense-making at the beginning; however, different types of users, with different abilities of appropriating the technology, will inevitably make different senses with/around the technology. Such new insights become more crystallized as users begin to discover the technology's new capabilities in their work context. With this knowledge, we could understand, for example, why dweller cabbies might not be able (or unwilling) to adopt work practices employed by hunter or fighter cabbies (and vice versa).

More significantly, by analyzing sense-making during technology structuring, our findings illustrate the equivocal nature of technology use. Initially, a new technology could induce intended changes in work practices. However, as users become more sensitive through situated use of technology, different users with various working habits could enact multiple work transformations and technology uses in ways that surprise the implementer (Barley, 1986; Boudreau & Robey, 2005; Markus, 1994). By analyzing the four interesting patterns of work transformation, our study illustrates ongoing sense-making during emergent technology enactments. This kind of sense-making is still ongoing, which illuminates why different user-groups could make limited senses and many different kinds of senses around technology as intense interactions that occur between users, and technology can be modeled in so many different ways (Weick, 1990, p. 2). Comfort initially implemented CabLink to minimize vehicle redundancy and optimize service operations. However, through ongoing structuring, cabbies became more sensitive to the limitations and capabilities of technology in their respective local contexts. The emergent work transformations enacted by technology are unanticipated and surprising for the management. In this regard, our findings elaborate an alternative nature of 'technology equivoque'.

Furthermore, this study brings to the surface an additional set of sense-making patterns in the new technology context: GPS adoption. This adds to prior studies of various sense-making patterns observed in a variety of technology contexts, such as groupware adoption in consulting services in the US (Orlikowski & Gash, 1994), campus-wide computing in a US university (Schön & Rein, 1994), group-decision support systems for teachers in the US (Gopal & Prasad, 2000), computerization in a healthcare organization in the US (Prasad, 1993), and automation robots in a US hospital (Siino & Hinds, 2004), geographical information systems in Indian land administration (Puri, 2007; Walsham & Sahay, 1999), and breakdowns in automation technology in the car manufacturing industry in Italy (Patriotta, 2003). Our research on GPS further surfaces multiple sense-making patterns resulting from the restructuring of spatial and temporal practices (cf. Sahay, 1998).

Secondly, our study contributes to *technology structuring* literature by elaborating on the dynamics of human agency. For example, in Orlikowski (2000) work, there is only a general commitment to the idea of human agency being linked to technology enactment. Building on this literature, our study examines technology structuring to unpack sense-making and to elucidate a different dynamics of human agency (cf. reinventing and improvising technology-in-use suggested by Boudreau & Robey, 2005). Moreover, our analysis of sense-making and practice also adds to the existing research on work transformation (Barley, 1986; Orlikowski, 1996; Schultze & Orlikowski, 2004). The latter strand of literature examines

how work practices may be shaped and be reshaped by ongoing technology use. However, these studies have yet to incorporate sense-making into their analyses. Although we understand how a technology may occasion new work practices, we know little about how users may develop emergent insights around the technology as work transformation occurs. Our analysis examines various technological senses through ongoing work transformation (cf. Henfridsson, 2000; Hutchby, 2001; Orlikowski & Gash, 1994).

Thirdly, our study enriches research on the management of taxi organizations. Previous studies have focused more on the issue of trust (Gambetta & Hamill, 2005), employment relationship (Sherer, Rogovsky, & Wright, 1998), technical evaluation (Liao, 2001), service operation (McAfee, 2005; Skok & Kobayashi, 2007), and strategic change (Elaluf-Calderwood & Sørensen, 2006; Georgano, 2000; Skok & Tissut, 2003). A series of studies also cover the adoption of knowledge management systems and non-dispatch Global Positioning Systems in taxi companies in Bangkok, New York, London, and Tokyo (Skok, 2003, 2004; Skok & Baird, 2005). However, none of these studies have yet examined GPS-*dispatch* systems used for taxi fleet management or provided any comprehensive analysis of cabbies' work practices in the context of technology structuring (cf. Orlikowski, 1996). Our study offers not only a new context (Singapore) but also delineates the likely changes in the modern cabby's job brought about by emergent technologies.

5.2. *Practical implications*

Our study suggests two practical lessons. First, our findings suggest that technology designers should consider the work transformation and ongoing senses made around technology. An emergent problem is evident in Comfort's experience. In implementing the next generation of CabLink by 2006, Comfort imposed a set of compulsory dispatching rules to enforce dispatch efficiency. However, without knowing cabbies' new senses, CabLink might end up disrupting different user-groups' behavioral routines, rather than enabling efficient work practices (echoing Edmondson et al., 2001).

In addition, our findings offer practical implications for technology adoption. In recent years, Comfort has transferred CabLink to Asian cities such as Taipei (in 2004) and Beijing (circa 2008). During our fieldwork, we learned that the system faced great difficulties over a period of six years, beginning from its inception, while being adopted in Taipei by a large taxi company. In this context, we could ask: How may the persistent resistance to CabLink be brought to the surface by analyzing Taipei cabbies' ongoing senses? Furthermore, in September 2007, New York cabbies collectively resisted adopting the GPS and filed suit to block new rules requiring the installation of GPS (ABA Journal).³ As New York cabbies perceived, such surveillance mechanisms would jeopardize their personal freedom and infringe on their intellectual property rights, since they felt that each traveling pattern is unique. By making work more visible (Suchman, 1995), we might be able to understand these cabbies' persisting senses around technology rejection.

As a whole, although technology is equivocal, our studies suggest that the equivocal nature can be better understood, if not managed, by examining ongoing structuring and sense-making around technology.

³ http://www.abajournal.com/news/cabbies_sue_say_gps_risks_trade_secrets/.

5.3. Future directions

Two lines of investigation may offer potential avenues for future studies. First, this study could further investigate other sense-making patterns among different user-groups. For instance, in Singapore, there are 2125 women cabbies; 627 yellow-top cabbies who have full ownership of their cars; luxury car cabbies, who drive white Mercedes Benz cars and charge a fixed rate of US\$30 per trip; as well as different ethnic groups such as Malay and Indian cabbies. These patterns are worth investigation. Secondly, the analysis of sense-making could also consider power and social influence (Dawson & Buchanan, 2005; Lin & Silva, 2005; Spicer, 2005) when it is examined in a different work context which is not as regulated as the Singaporean environment, such as in Taipei.

There is a word of caution for those trying to generalize our research findings. It is not wise to generalize these sense-making patterns normatively in different societal contexts, for instance, by looking for the same patterns across different cabby communities in Taipei. It is also inappropriate to consider patterns as static which are frozen in time. We should recognize that, in a different work context, different user-groups could make new senses which may be in stark contrast to those observed in our research at different time-periods.

6. Conclusion

Our study examines why cabbies may become more sensitive to technology in different ways. As Weick (1990) suggests, sense making never really ends during ongoing structuring. Our study suggests that such ongoing structuring and sense-making should take into account the variations in different users' tendencies to exploit technology. Our findings illustrate how multiple groups of users may exploit technology in response to their local practices, leading to distinct work transformation over time. Essentially, users' senses are oriented towards technologies by means of their habitual activities, which help them develop further different 'sensitivities' through ongoing work transformation. This article widely elaborates on this core issue.

Acknowledgements

The authors gratefully acknowledge the research support offered by the senior managers of Comfort-Delgro Transportation as well as the warm reception and kind assistance provided by many of Singapore's taxi drivers. Financial support was provided by the National University of Singapore (RP: 314-000-031-112), Taiwan Intellectual Capital Center (94-EC-14-A-31-S1-021), and National Science Council (Taiwan).

References

- Bansler, P., & Havn, E. (2004). Technology-use mediation: Making sense of electronic communication in an organizational context. *The Scandinavian Journal of Information Systems*, 16, 57–84.
- Barley, S. R. (1986). Technology as an occasion for structuring: Evidence from observations of CT scanners and the social order of radiology departments. *Administrative Science Quarterly*, 31(1), 78–109.
- Barrett, M. I. (1999). Challenges of EDI adoption for electronic trading in the London Insurance Market. *European Journal of Information Systems*, 8(1), 1–15.

- Bijker, W. E., Hughes, T. P., & Pinch, T. (1987). *The social construction of technological systems*. Cambridge, MA: MIT Press.
- Boudreau, M. C., & Robey, D. (2005). Enacting integrated information technology: A human agency perspective. *Organization Science*, 16(1), 3–18.
- Dawson, P., & Buchanan, D. (2005). The way it really happened: Competing narratives in the political process of technological change. *Human Relations*, 58(7), 845–865.
- Dutton, J. E., & Dukerich, J. M. (1991). Keeping an eye on the mirror: Image and identity in organizational adaptation. *Academy of Management Journal*, 34, 517–554.
- Edmondson, A. C., Bohmer, R. M., & Pisano, G. P. (2001). Disrupted routines: Team learning and new technology implementation in hospitals. *Administrative Science Quarterly*, 46, 685–716.
- Elaluf-Calderwood, S., & Sørensen, C. (2006). Organizational agility with mobile ICT? The case of London Black Cab work. In *Agile information systems: Conceptualization, construction, and management*. Butterworth-Heinemann.
- Faraj, S., Kwon, D., & Watts, S. (2004). Contested artifact: Technology sense-making, actor networks, and the shaping of the Web browser. *Information Technology & People*, 17(2), 186–209.
- Fulk, J. (1993). Social construction of communication technology. *Academy of Management Journal*, 36(5), 921–950.
- Gambetta, D., & Hamill, H. (2005). *Streetwise: How taxi drivers establish customers' trustworthiness*. Russell Sage Foundation.
- Georgano, G. N. (2000). *The London taxi*. Shire Publications.
- Gephart, R. P. (2004). Sense-making and new media at work. *American Behavioral Scientist*, 48(4), 479–495.
- Glaser, B. C., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago: Aldine.
- Golden-Biddle, K., & Locke, K. (1993). Appealing work: An investigation of how ethnographic texts convince. *Organization Science*, 4, 595–616.
- Gopal, A., & Prasad, P. (2000). Understanding GDSS in symbolic context: Shifting the focus from technology to interaction. *MIS Quarterly*, 24(3), 509–546.
- Griffith, T. (1999). Technology features as triggers for sensemaking. *Academy of Management Review*, 24(3), 472–488.
- Henfridsson, O. (2000). Ambiguity in IT adaptation: Making sense of First Class in a social work setting. *Information Systems Journal*, 10, 87–104.
- Hinds, P. J., Roberts, T. L., & Jones, H. (2004). Whose job is it anyway? A study of human-robot interaction in a collaborative task. *Human-Computer Interaction*, 19, 151–181.
- Hutchby, I. (2001). Technologies, texts, and affordances. *Sociology*, 35(2), 441–456.
- Karsten, H. (1995). It's like everyone working around the same desk: Organisational readings of Lotus Notes. *Scandinavian Journal of Information Systems*, 7(1), 3–32.
- Kling, R., & Iacono, S. (1989). The institutional character of computerized information systems. *Information Technology & People*, 5(1), 7–29.
- Lee, A. S., & Baskerville, R. L. (2003). Generalizing generalizability in information systems research. *Information Systems Research*, 14(3), 221–243.
- Liao, Z. (2001). Taxi dispatching via Global Positioning Systems. *IEEE Transactions on Engineering Management*, 48(3), 342–347.
- Lin, A., & Silva, L. (2005). The social and political construction of technological frames. *European Journal of Information Systems*, 14, 49–59.
- Lincoln, S., & Guba, G. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage.
- Louis, R., & Sutton, I. (1991). *Switching cognitive gears: From habits of mind to active thinking* *Human Relations*, 44(1), 55–76.
- Markus, M. L. (1994). Finding a happy medium: Explaining the negative effects of electronic communication on social life at work. *ACM Transactions on Information Systems*, 26(6), 119–149.
- McAfee, A. (2005). *MK Taxi: Private chauffeur service*. Harvard Business School Case (9-605-029).
- Miles, B., & Huberman, M. (1994). *An expanded sourcebook qualitative data analysis*. London: Sage.
- Orlikowski, W. J. (1996). Improvising organisational transformation over time: A situated change perspective. *Information Systems Research*, 7(1), 63–93.
- Orlikowski, W. J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science*, 11(4), 404–428.

- Orlikowski, W. J., & Gash, D. C. (1994). Technology frames: Making sense of information technology in organizations. *ACM Transactions on Information Systems*, 12(2), 174–207.
- Orlikowski, W. J., & Robey, D. (1991). Information technology and the structuring of organizations. *Information Systems Research*, 2(2), 143–169.
- Orlikowski, W. J., Yates, J., Okamura, K., & Fujimoto, M. (1995). Shaping electronic communication: The meta-structuring of technology in the context of use. *Organization Science*, 6, 423–444.
- Patriotta, G. (2003). Sensemaking on the shop floor: Narratives of knowledge in organizations. *Journal of Management Study*, 40(2), 349–375.
- Pentland, B. (1992). Organizing moves in software support lines. *Administrative Science Quarterly*, 37, 527–548.
- Pentland, B. (1995). Read me what it says on your screen: The interpretative problem in technical service work. *Technology Studies*, 2, 50–79.
- Pettigrew, A. (1990). Longitudinal field research on change: Theory and practice. *Organization Science*, 1(3), 267–292.
- Prasad, P. (1993). Symbolic processes in the implementation of technological change: A symbolic interactionist study of work computerization. *Academy of Management Journal*, 36(6), 1400–1429.
- Puri, S. K. (2007). Integrating scientific with indigenous knowledge: Constructing knowledge alliances for land management in India. *MIS Quarterly*, 31(2), 355–379.
- Ramiller, N. C. (2001). The ‘text attitude’ and new technology. *Information and Organization*, 11, 129–156.
- Sahay, S. (1998). Implementing GIS technology in India: Some issues of time and space. *Accounting Management and Information Technology*, 8(2–3), 147–188.
- Schön, D. A., & Rein, M. (1994). *Frame reflection: Toward the resolution of intractable policy controversies*. New York: Basic Books.
- Schultze, U., & Orlikowski, W. J. (2004). A practice perspective on technology-mediated network relations: The use of Internet-based self-serve technologies. *Information Systems Research*, 15(1), 87–107.
- Sherer, P. D., Rogovsky, N., & Wright, N. (1998). What drives employment relationships in taxicab organizations? Linking agency to firm capabilities and strategic opportunities. *Organization Science*, 9(1), 34–48.
- Siino, R., & Hinds, P. (2004). *Making sense of new technology as a lead-in to structuring: The case of an autonomous mobile robot*. Paper presented at the Best Paper Proceedings of the Academy of Management, New Orleans, LA.
- Skok, W. (2003). Knowledge management: New York City taxi cab case study. *Knowledge and Process Management*, 10(2), 127–135.
- Skok, W. (2004). Knowledge management: Taxis Parisians case study. *Knowledge Management Research and Practice*, 2(3), 147–154.
- Skok, W., & Baird, S. (2005). Strategic use of emerging technology in the taxi cab industry. *Strategic Change*, 14, 295–306.
- Skok, W., & Kobayashi, S. (2007). Strategic management of the Tokyo taxi cab industry: An exploratory study. *Knowledge and Process Management*, 14(1), 37–45.
- Skok, W., & Tissut, M. (2003). Managing change: The London taxi cabs case study. *Strategic Change*, 12, 95–108.
- Spicer, A. (2005). The political process of inscribing a new technology. *Human Relations*, 58(7), 867–890.
- Suchman, L. (1995). Making work visible. *Communications of the ACM*, 38(9), 56–65.
- Tyre, M., & Orlikowski, W. J. (1994). Windows of opportunity: Temporal patterns of technological adaptation in organizations. *Organization Science*, 5, 98–118.
- Walsham, G., & Sahay, S. (1999). GIS for district-level administration in India: Problems and opportunities. *MIS Quarterly*, 23(1), 39–66.
- Weick, K. E. (1988). Enacted sense-making in crisis situations. *Journal of Management Studies*, 25(4), 305–317.
- Weick, K. E. (1990). Technology as equivoque: Sensemaking in new technologies. In *Technology and organizations* (pp. 1–44). San Francisco: Jossey-Bass.
- Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science*, 16(4), 409–425.
- Zuboff, S. (1988). In *In the age of the smart machine: The future of work and power*. New York: Basic Books.