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台灣地區國際物流中心安全氣候與安全績效關聯性之研究
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台灣地區國際物流中心安全氣候與安全績效關聯性之研究

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中文摘要

本研究採用問卷調查法，針對台灣地區三家共190位國際物流中心從業人員為調查對象，在探討其安全氣候與安全績效之關聯性。經由因素分析，本研究共可萃取出五個安全氣候因素，分別為主管對安全的認知、安全訓練的認知、工作伙伴對安全的認知、安全管理認知、安全態度對風險績效之影響。而安全績效則萃取出二個構面，分別為風險績效及意外績效。經由迴歸分析僅得到工作伙伴安全認知會與風險績效成負向的關係。結果建議提高工作伙伴安全認知能降低傷害與意外。

關鍵詞： 安全氣候、安全績效、國際物流中心

英文摘要

This study empirically examined the effects of safety climate on international logistics center employees' perceptions of safety performance in Taiwan using the regression technique. Factor analysis and a series of validity and reliability tests were conducted, which resulted in the identification of five critical safety climate dimensions, namely, supervisor safety behavior management, safety training programs, co-workers' safety behavior, safety management, and safety attitude. There was a negative significant relationship between co-workers' safety behavior dimension and safety performance. Results suggest that international logistics center' management can enhance and refine these firms' safety climate by focusing especially on co-workers' safety behavior, thereby reducing injuries and accidents.

關鍵詞 (keywords) : Safety climate, Safety performance, International logistics center.

1. 前言

近年來國內經濟情勢遭受愈來愈多的內外在環境變數的衝擊，諸如兩岸加入世貿組織、油價上漲、台商大陸業務發展的成長、國際恐怖主義的盛行、及亞太各國積極發展經濟與運籌基礎環境建設，促使台灣政府與企業無不絞盡心思，構思因應之道。國內企業開始引進供應鏈管理的觀念與模式，期望在企業發展上，可以結合供應鏈上下游關鍵成員的力量，共同建構更強大的競爭力，以降低經營管理上的成本及風險。在如此的產業趨勢下，製造業、零售業與貿易商便開始將運籌活動委外，交由第三方物流公司 (Third party logistics, 3PL) 來執行與管理，以便將重要的資源投入在公司的核心競爭力上，而其中最有代表性的產業之一便是國際物流中心。

目前政府規劃之海關監管國際物流中心是為配合亞太營運中心政策之一環，為配合國際化及爭取亞太轉運中心之競爭力，國際物流中心必須達到電腦軟體、資訊管理及進儲配

銷服務之國際化水平；如果只是為了國內配銷之進儲轉送，則以成立保稅倉庫經營即可。國際物流中心主要提供的服務包括國際海空運輸安排、報關、保稅、提貨、理貨、入庫、庫存管理、訂單處理、撿貨、裝箱、物流加工、JIT及時配送和退貨的逆物流處理等「一站式」及「客制化」的整合型物流服務，在全球供應鏈管理中扮演一個重要的角色。

然而在整個國際物流中心處理相關貨品的過程中，除了將貨物準時送達目的地之外，貨物的安全性亦是託運人及收貨人最關注的焦點。當託運人將貨物交國際物流中心處理時，所有現場的理貨作業人員即為維護貨物安全最重要的把關者，然因在整個貨物的作業過程中又需要各種不同的機具設備來輔助作業，如作業人員操作機具不當或溝通不良時，隨時都可能導致貨物損害、或甚至造成人員傷亡等。

根據行政院勞委會(民 96)最新一年(民 95 年)的勞動檢查年報中有關之職業災害統計數據顯示，就已結案之失能傷害次數而言，運輸、倉儲及通信產業職災發生的比率位居所有產業的第二名，約佔 11%，僅次於製造業的 60%，但遠高於第三名之批發零售業的 5%。而運輸、倉儲業與通信業發生職災的媒介物以裝卸搬運機械(含起重機械、動力搬運機械與交通工具) 發生次數為最高，共有 485 人次。

由此可知，運輸、倉儲及通信產業是個意外事故發生率頗高的場所，對同屬本產業的國際物流中心經營業來講，更需要去避免任何意外事故的發生，若因人為疏失而造成任何意外事故發生，不論是發生在人或是貨物上，對該國際物流中心整體營運及信譽都將有一定程度的影響。

有鑑於此，本研究將針對台灣地區國際物流中心，以人為疏失為重點的安全氣候來研究，企圖了解國際物流中心的安全氣候的構面有那些，並試圖了解這些構面與安全績效之關係，期望藉由研究之結果對國際物流中心提出安全管理的相關建議，供業者或政府做為制定政策的參考。

根據前述之研究背景與動機，本研究目的分述如下：

一、 分析國際物流中心安全氣候及安全績效重要之構面。

二、 試建立一模式，探討國際物流中心安全氣候與安全績效之關係。

三、 根據研究結果，提出國際物流中心安全管理決策上之建議。

2. 文獻回顧與假設

2.1 安全氣候

最近十年間，安全文化與安全氣候的相關研究已漸漸在討論安全或意外的文獻中扮演一個重要的角色 (Dìaz and Cabrera, 1997)。 安全氣候就是「..員工對分享安全認知的總和」，能夠影響公司安全的行為 (Zohar, 1980: 96)。安全氣候也是「…個人對工作環境安全的價值的描述」(Neal et al., 2000: 100)。雖然研究者常常將「安全氣候」與「安全文化」兩個專有名詞交替來使用，但一般而言，「安全文化」的領域較「安全氣候」來的大 (Neal and Griffin, 2002)，且「知覺 (perceptions) 是較與安全氣候連結，而態度 (attitudes) 是視為文化的一部份」(Guldenmund, 2000: 229)。此外，「傳統上研究文化比較採用質性研究的方法；而氣候的研究則較採用量化研究的方式」(Håvold, 2000: 81)。本研究焦點放在國際物流中心現場作業人員的對工作環境的「知覺」，且採用「定量」的研究方法，因此，本研究將以安全氣候做為主要的研究名稱。

雖然有些研究者企圖去找出一致的安全氣候因素，但由於研究的國家及產業不同，因此會有不同的國家文化及產業特性(Cox and Flin, 1998; Glendon and Litherland, 2001; Guldenmund, 2000, Merritt and Helmreich, 1998)，即使構面相同，也可能因為研究者的命名或解釋的不同，而有者不同的構面存在(Flin, et al., 2000; Guldenmund, 2000; Zohar, 2002)。也造成研究者對於安全氣候的構面並沒有一定的答案存在 (Flin et al., 2000; Coyle et al., 1995; Neal and Griffin, 2002; Mearns et al., 2003)。如 Zohar (1980) 針對以色列工業組織的勞工從事安全氣候之研究，使用因素分析方法萃取出 8 個安全氣候構面如安全訓練方案之重要性、管理階層安全態度、安全行為對升遷的影響、工作場所風險水準、要求工作場所安全的效果、安全人員之地位、安全行為對社會地位的影響、及安全委員會之地位。Cohen and Cleveland (1983) 認為管理者的承諾是安全氣候研究中最主要的因素。而 Flin et al. (2000) and Marsh et al. (1995) 在其研究中也認同這樣的說法。Hayes et al. (1998) 評估員工對安全的知覺得到五個因素包括工作安全、同事安全、督導安全、管理安全實務及安全規範等。

國內在交通運輸領域也有許多以安全氣候當作主要的研究主題，如曹湘雲(民 96)針對航空公司(國泰與華航)運務人員來探討安全氣候及安全績效間的關係，結果顯示安全氣候包括管理價值、安全相關教育與訓練、安全溝通與安全系統。盧競嫻(民 96) 則從航空公司空服員的角度來探討安全氣候，結果顯示安全氣候包括、主管對企業資源管理(CRM)的支持、

主管對飛安的支持、對未來飛安的看法、標準作業程序、資訊傳遞與訓練。林蘭雀(民 92) 則針對高雄港貨櫃碼頭裝卸從業人員的角度來觀察安全氣候，結果顯示安全氣候包括安全管理、個人對安全態度與風險知覺等構面。

2. 2 安全績效

績效的衡量對研究者而言，常常是個挑戰，因為組織有多重且常是衝突的目標。績效一般可區分為結果導向的績效（outcome-based performance）與行為導向的績效（behaviour-based performance）(Haytko, 1994)。結果導向的績效常被使用在實證研究上，但因僅能衡量過去的成功或失敗，且不能解釋為何此結果發生及未來要如何去做，因此常被學者批評(Haytko, 1994; Spriggs, 1994)。然而，行為導向的績效指標可提供一些補充的資訊(Roger et al., 1996; Stank and Lackey, 1997)，因而，學者推薦在績效衡量上，採用兩種混合的績效指標較為合適（Haytko,1994）。

績效從其測量方式而言，又可分為硬式(客觀)的績效與軟式(知覺或回應)的績效(Dalton et al., 1980; Chow et al., 1994; Maltz, A. and Maltz, E., 1998)。硬式績效包含原始的財務統計、成本統計、佣金等；而軟式績效包括組織主管的評估及自我知覺相對於其競爭對手等質性的衡量。雖然軟性指標不像硬性指標一樣客觀、易於量化，但是其重要性，不小於財務性指標。尤其是這些軟性績效指標深深影響著組織長期營運的優劣、關係著企業是否能永續發展與經營；因此軟性指標對組織有其重要性。

就安全領域的研究，評估安全績效是一個不容易的任務。傳統的安全績效測量常從意外或傷害的實際資料 (硬式績效) 來著手 (Glendon and Mckenna, 1995) ，但卻有「…敏感度不夠、質疑其正確性、已過時的與忽視風險暴露問題」(Glendon and Litherland, 2001: 161)。此外，Arezes and Miguel (2003:22) 提出採用實際安全績效當作測量指標的問題，「…即使測量安全績效的結果為較低的意外發生率，也無法保證所有的風險已被控制」。因此，許多學者推薦知覺性的測量較意外或傷害實際資料較能反應出個人的風險知覺 (Neal et al. 2000; Lu and Shang, 2005)，本研究將以知覺性的測量(軟式指標)來做為主要的安全績效測量方式。

2. 3. 安全氣候與安全績效之關係

許多先前的研究已經證實了安全氣候會正向的影響安全績效在不同的個人、群體或組

織層級中，如 Smith et al. (1978)認為有安全概念的員工與安全承諾會與產生較低的意外率；Guastello and Guastello (1988)與 Harrell (1990) 則提出若員工認為他們的工作是安全的則較認為工作是危險的員工傾向會有較少的意外發生的概念；Tomás et al. (1992)認為工作者的態度、同事反應、安全行為、危險及督導安全與安全的行為有關。Smith et al. (1978) 則提出重視安全的員工、安全承諾及安全的訓練常會導致較低的意外發生率。Hayes et al. (1998)發現督導安全與管理安全實務最能預測工作滿足，而同事安全和督導安全與員工的安全行為有關。Lu and Shang (2005) 從貨櫃碼頭作業人員的角度來評估安全氣候，結果顯示安全訓練及安全管理群的碼頭人員會有較好的安全績效；Varonen and Mattila (2000) 證實了公司若有較正面的安全氣候則相對的會產生較低的意外發生率；Siu et al. (2004) 採用 SEM 來評估安全氣候、心理壓力與安全績效間的關係，結果認定安全態度與職業傷害有正向的影響關係存在。Huang et al. (2007) 證實了安全氣候能預測個人的工作傷害風險。

就以上研究結論所述，安全氣候均與安全績效有正向的影響關係。因此，提出以下的假設：

H1：台灣地區國際物流中心的安全氣候會正向的影響安全績效。

3. 研究方法

3.1 研究架構

本研究根據先前研究目的與所回顧相關文獻，來建立概念性的架構圖(如圖 2)。首先根據文獻與業者訪談後的問項，提出安全氣候及安全績效的構面，並探究其彼此間的關係。並且依國際物流中心背景變項(員工特性、組織特性)探討對此安全氣候構面是否有顯著差異，以瞭解國際物流中心作業安全氣候型態與安全績效的成效情形。

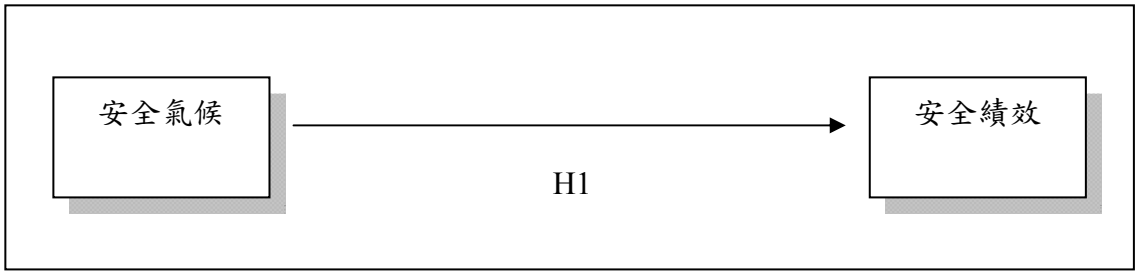

圖 2　本研究概念性架構圖

3.2 研究變項之操作性定義及構面

本研究所探討的構面分別為安全氣候與安全績效等二大構面，參考以往文獻資料，並配合本研究之需要而決定以下各構面因素之衡量變數與操作性定義，為使意義明確，茲將各變項之定義及構面分述如下：

1. 安全氣候

本研究將以國際物流中心現場從業人員對於組織內部安全管理、個人對安全態度與風險知覺等相關構面來衡量安全氣候。其中所謂的安全管理是指公司上層主管透過各種管道或方式，表達其對員工工作安全支持與關心的程度；風險知覺即是員工本身對其所從事的工作性質與工作場所安全性的感受與看法；安全態度則是員工對工作安全所抱持之想法與行為表現。

2. 安全績效

所謂安全績效乃是指「組織安全管理系統在安全運作上的整體表現」(吳聰智，民90)。藉由對安全績效的評估與衡量，可促使公司改善組織安全績效表現不佳之處，增強員工工作安全水準，進而提升公司營運績效。故本研究擬以安全績效構面探討其與組織安全氣候之關係，藉由填答者對其所服務公司之安全氣候的同意程度與安全績效表現成果的優劣，瞭解目前國際物流中心現場作業工作安全方面的運作情形。

3.3 問卷與抽樣設計

本節將檢視問卷設計之方式，依據這些標準作為本研究問卷設計之準則，此外，並也針對調查樣本抽樣與選取加以討論。

本研究主要採用問卷調查來從事資料蒐集，資料蒐集的方法有許多種，舉例來說深入訪談、郵寄問卷及觀察法等(Babble, 1998)。 然而，並沒有一種最好的蒐集資料的方法存在；每一種方法均有它的優缺點，必需視研究的目的而定(Brenner et al., 1985; Hussey, J. and Hussey, R., 1997; Saunders et al., 2000)。本計畫資料的蒐集則以量化的問卷調查法為

主，並輔以質化的深入訪談法。問卷的形成是以深入的文獻回顧，整理出主要的問卷題項，再輔以國際物流中心業界的意見，以反應台灣目前對國際物流中心安全氣候的現況。

在問卷問項設計方面，主要依據 Hayes et al., 1998、 Flin et al., 2000、Mearns et al., 2003、Dedobbeleer & Beland(1991)、Williamson et al. (1997)及 Lu and Shang (2005) 等人之文獻，將安全氣候以 45 個問項來予以衡量，對於安全績效構面方面，基於若單以事故率作為安全績效衡量準則有失偏頗情況，決定以 20 個安全績效相關問項予以衡量。

3.4 樣本回收狀況與樣本結構分析

3.4.1 樣本回收狀況

研究問卷經過數位國際物流中心現場作業督導或課長修正後，開始進行問卷發放及管理程序，分別將問卷交給三家國際物流中心之聯絡人，再由他們去做問卷發放及回收的動作。問卷發放時間 98 年 8 月 20 日 5 起至 9 月 10 止，共寄發 190 份問卷，最後總共回收 156 份，其中無效問卷為 16 份。在回收率方面，有效回收率為 73.68%（140/190），其問卷回收概況如表 1 所示。由於問項 E 部份為反項題, 故再進行分析之前已先進行調整，反轉其反向的因素。

表 1 問卷回收概況

國際物流中心	發放問卷 (1)	回收問卷 (2)	無效樣本 (3)	有效樣本 (7)=(5)-(6)	有效回收率 (8)=(7)/(5)
A	60	45	5	40	66.67%
B	100	90	8	82	82.00%
C	30	21	3	18	60.00%
總份數	190	156	16	140	73.68%

3.4.2樣本結構分析

以樣本基本資料之次數與比重分析(如表2) 我們可以得知受測者，以30-39歲者居多，工作職位為現場工作人員較多，佔了46.4%，在教育程度方面以大學(專)以上居多，佔77.1%；在公司服務年資方面，5年內最多佔42.9%；在公司一年內參與安全教育訓練的次數以1-2次最多，佔54.3%；約有27.8%因公受傷最多。另外在庫區內作業環境中最容易發生的

災害風險前二名為被撞及物體飛落。

表 2 樣本結構次數分配表

基本資料		次數/人數	百分比
年齡	30歲以下	37	26.4
	30-39歲	64	45.7
	40-49歲	25	17.9
	50-59歲	14	10.0
職稱	非現場人員	47	33.6
	現場督導	28	20.0
	現場工作員	64	46.4
教育程度	高中職	28	20.0
	大學（含專科）	108	77.1
	研究所以上	4	2.9
目前公司服務年資	5 年以內	60	42.9
	6~10 年	50	35.7
	11~15 年	17	12.1
	16~20 年	11	7.9
	20 年以上	2	1.4
過去一年參加教育與訓練次數	未曾	8	5.7
	1 次~2 次	76	54.3
	3 次~5 次	39	27.9
	6 次~10 次	13	9.3
	10 次以上	4	2.9
因工作出事/受傷次數	未曾	101	72.1
	1次~2次	31	22.1
	3次~5次	8	5.7
公司名稱	A	40	28.6
	B	82	58.6
	C	18	12.9
場區內作業環境容易發生那些職災	墜落	48	—
	被撞	89	—

(複選題，限選三項/每人)	跌倒	47	—
	物體飛落	82	—
	物體倒塌	63	—
	被夾	58	—
	觸電	6	—
	高溫有害物體	23	—
	火災	11	—
	其他	1	—

4. 研究結果與分析

4.1 安全氣候因素分析及信度分析

本節針對國際物流中心對安全氣候所認同程度進行因素分析，從 45 個問項中萃取重要獨立因素，再對因素命名，加以分析。因素萃取與評估適合度之萃取方法是以主成份分析法(Principal Components Analysis)，萃取標準是採特徵值(Eigenvalue)大於 1 以上，選取因素負荷量的標準是以回收樣本數決定，Hair et al (2006)所建議的因素負荷量，採因素負荷量 0.5 以上。而因素轉軸是採用最大變異法(Varimax)。

再根據每一項萃取的因素做整體構面的命名，Hair, et al.(2006)認為，命名可以用負荷值越高的做為重要考量，而命名的結果也會對整個因素更具影響力。本研究對於安全氣候的 33 項構面中，其結果有 31 個因素負荷量值大於 0.5 以上；特徵值皆大於 1 以上，總累積變異量為 71.73%，分析結果如表 3。

本研究整理將安全氣候整理成因素分析表，且將安全氣候分成了 6 個構面說明如下：

1. 因素一：包含六個因素，命名為『**主管對安全的認知**』。Cronbach's Alpha 值為0.92，表示各因素之衡量變數的內部一致性程度很高。
2. 因素二：包含五個因素，命名為『**安全訓練的認知**』。Cronbach's Alpha 值為0.94，表示各因素之衡量變數的內部一致性程度很高。

3. 因素三：包含五個因素，命名為『**工作伙伴對安全的認知**』。Cronbach's Alpha 值為0.92，表示各因素之衡量變數的內部一致性程度很高。
4. 因素四：包含五個因素，命名為『**安全管理認知**』。Cronbach's Alpha 值為0.91，表示各因素之衡量變數的內部一致性程度很高。
5. 因素五：包含五個因素，命名為『**安全態度**』。Cronbach's Alpha 值為0.92，表示各因素之衡量變數的內部一致性程度很高。

表3 安全氣候因素分析表

安全氣候	因素一	因素二	因素三	因素四	因素五
A6 我的主管會與員工討論日常的作業安全問題	**0.801**	0.134	0.351	-0.025	0.126
A7 我的主管會提供員工有關在現場工作安全的規定	**0.749**	0.166	0.227	-0.088	0.250
A5 我的主管會參與員工安全目標的設定	**0.746**	0.272	0.361	-0.106	0.139
A2 我的主管會關注員工的安全	**0.744**	0.165	0.020	-0.123	0.375
A4 我的主管會稱讚員工的安全行為	**0.742**	0.123	0.400	-0.075	0.213
A3 我的主管會督促員工遵守安全工作守則	**0.731**	0.115	-0.050	-0.181	0.357
C3 我的工作夥伴很重視工作安全	0.176	**0.872**	0.197	-0.169	0.098
C2 我的工作夥伴會保持工作場所的安全	0.149	**0.859**	0.113	-0.081	0.188
C5 我的工作夥伴會注意他人的安全	0.090	**0.844**	0.167	-0.197	0.232
C1 我的工作夥伴會鼓勵他人遵守安全工作守則	0.243	**0.833**	0.172	-0.060	0.023
C4 我的工作夥伴會遵守公司的安全規則	0.112	**0.798**	0.199	-0.198	0.238
D5 我的公司會提供良好的安全設備	0.141	0.211	**0.828**	-0.106	0.238
D6 我的公司會提供足夠的安全設備	0.055	0.136	**0.805**	-0.226	0.272
D8 我的公司會儘速回覆安全相關問題	0.281	0.108	**0.805**	-0.065	0.065
D7 我的公司會注重安全的作業環境	0.215	0.215	**0.741**	-0.213	0.211
D4 我的公司會鼓勵績優的安全人員	0.289	0.270	**0.724**	-0.091	0.227
E8 我認為防護設備的使用不會減少工作意外的發生	-0.228	-0.119	-0.081	**0.848**	-0.075
E7 我認為安全的操作方式不**會**減少工作意外的發生	-0.080	-0.086	-0.073	**0.847**	-0.075
E11 我認為配帶個人安全護具(安全帽、手套…)使人感覺不舒適，可以**不必**使用	-0.068	-0.105	-0.119	**0.838**	-0.113
E10 我會接受別人對我在工作安全上的建議	-0.143	-0.170	-0.122	**0.833**	-0.157
E9　為了趕出貨，我會違反作業安全規定	0.063	-0.135	-0.180	**0.786**	-0.191
B4　我認為公司的安全教育訓練對預防意外有幫助	0.240	0.205	0.249	-0.181	**0.783**

B3 我認為公司的安全教育訓練是值得實施	0.389	0.157	0.032	-0.196	**0.747**
B5 我認為公司的安全教育訓練是容易瞭解的	0.279	0.169	0.278	-0.134	**0.746**
B6 我認為公司的安全教育訓練可以發揮好的作用	0.226	0.131	0.380	-0.189	**0.727**
B2 我認為公司的安全教育訓練可應用在我的工作上	0.270	0.221	0.288	-0.094	**0.708**
特徵值	**11.37**	**2.92**	**2.40**	**1.96**	**1.41**
變異百分比 (%)	**43.74**	**11.23**	**9.22**	**7.53**	**5.44**
Cronbach's Alpha	**0.92**	**0.94**	**0.92**	**0.91**	**0.92**

4.2 安全績效因素分析及信度分析

本研究整理將安全氣候整理成因素分析表，且將安全氣候分成了 6 個構面說明如下：

6. 因素一：包含六個因素，命名為『**風險績效**』。Cronbach's Alpha 值為0.95，表示各因素之衡量變數的內部一致性程度很高。
7. 因素二：包含五個因素，命名為『**意外績效**』。Cronbach's Alpha 值為0.93，表示各因素之衡量變數的內部一致性程度很高。

表3 安全績效因素分析表

	因素一	因素二
P5 我覺得在此工作是充滿風險的	**0.879**	0.269
P4 我覺得在此工作是不安全的	**0.878**	0.300
P1 我覺得我的工作是有危險性的	**0.844**	0.318
P3 我覺得此工作是很容易受傷的	**0.844**	0.337
P6 我覺得在此工作是令人提心吊膽的	**0.815**	0.355
P2 我覺得在此工作對健康有害	**0.810**	0.279
P10 就我所知，與這二年相比，公司發生工安意外的嚴重程度(如重殘或死亡等) 有增加的趨勢	0.269	**0.914**
P8 就我所知，與這二年相比，公司發生工安意外的次數有增加的趨勢	0.284	**0.902**
P9 就我所知，與這二年相比，公司發生工安意外的損失金額有增加的趨勢	0.479	**0.799**
特徵值	**6.38**	**1.16**
變異百分比 (%)	**70.93**	**12.85**
Cronbach's Alpha	**0.95**	**0.93**

4.3 安全氣候與安全績效相關研究變項之迴歸分析

本節採用迴歸分析，以探討由特定變項預測另一變項的預測力大小，共為兩部分，第

一部份探討安全氣候與風險績效的預測力；第二部分安全氣候對意外績效的預測力。本研究採用逐步迴歸分析法(Stepwise Regression)來分析。

4.3.1 主管對安全的認知、安全訓練的認知、工作伙伴對安全的認知、安全管理認知、安全態度對風險績效之影響

從表 4 中得知，此項分析中對風險績效的 F 值為 28.60，達顯著水準；而調整後的 R^2 為 0.17。這五個安全氣候的因素僅有工作伙件對安全的認知有達到顯著水準且是負向相關。

4.3.2 主管對安全的認知、安全訓練的認知、工作伙伴對安全的認知、安全管理認知、安全態度對意外績效之影響

由於逐步迴歸分析法(Stepwise Regression)來分析並無法達成顯著水準，表示此條方程式並不成立。

表4 安全氣候對安全績效之影響分析表

依變數 / 自變數		安全績效	
		工作風險(Y_1)	工安意外(Y_2)
標準迴歸係數 β	主管對安全的認知(X_1)	-0.05	—
	安全訓練的認知(X_2)	-0.13	—
	工作伙伴對安全的認知(X_3)	-0.41***	—
	安全管理認知(X_4)	-0.04	—
	安全態度(X_5)	0.01	—
F 值		28.59	—
P 值		0.00	—
R^2		0.17	—
調整後 R^2		0.17	—

註：***p<0.001、**p<0.01、*p<0.05

而在共線性檢定部分，允差(Tolerance)為：1，而在 VIF (variance inflation factor)為 1，故本研究之自變數並無嚴重的共線性存在。

從迴歸分析我們可以得知，安全氣候與安全績效存在因果關係。所以 H1：台灣地區國際物流中心之安全氣候與安全績效有顯著的負向影響關係存在之假設部份成立；也就是當工作伙伴對安全的認知增加時，風險績效的認知會降低。

5. 結論與建議

在國際物流中心的現場作業環境中較易發生災害風險的前二項為：被撞及物體飛落。而經由對安全氣候及安全績效兩大變項作因素分析後，安全氣候可以萃取出五個構面，包括主管對安全的認知、安全訓練的認知、工作伙伴對安全的認知、安全管理認知、安全態度對風險績效之影響。而安全績效則萃取出二個構面，分別為風險績效及意外績效。

經由迴歸分析僅得到工作伙伴安全認知會與風險績效成負向的關係，工作伙伴安全認知包括我的工作夥伴很重視工作安全、我的工作夥伴會保持工作場所的安全、我的工作夥伴會注意他人的安全、我的工作夥伴會鼓勵他人遵守安全工作守則、與我的工作夥伴會遵守公司的安全規則。

由本研究結果可知，夥伴安全可透過由下而上的人性化、自主性安全管理，提供工作人員參與的機會，建議國際物流公司唯有讓基層員工關心自己的安全，自發性地執行改善工作，安全才會落實，零災害才能實踐。例如公司可舉辦各種安全活動並廣邀一般員工及其家屬朋友參加，利用安全獎頒獎或假期舉辦各種安全園遊會、安全郊遊等活動，可凝聚每個人對安全的共識。

6. 計畫成果自評部份

(1) 由於本研究預期會發放較多的國際物流中心，但由於經濟不景氣，願意參與的家數並不多，因而影響到回收情況。

(2) 再者由於回收問卷數較少(不滿150)，若採用本研究原先計劃使用的結構方程式，可能會有一些誤差，因此改用迴歸方法來分析。

(3) 但分析結果五個安全因素僅有伙伴安全的認知有顯著，其他四個因素並沒有顯著的影響關係，很可惜的結論。

(4)由於結論並不好，可能採用策略群組的方法來分析，看是否會有較好的成果，才能對投稿國際期刊有助益。

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行政院國家科學委員會補助國內專家學者

出席國際學術會議報告(Part One)

98 年 3 月 30 日

報告人姓名	桑國忠	服務機構及職稱	國立台灣海洋大學運輸與航海科學系/所 副教授
會議時間 會議地點	2009 年 3 月 19-21 日 深圳大梅沙喜來登度假酒店	本會核定補助文號	NSC 97-2410-H-019-020-SSS
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報告內容包括下列各項：

1. 新聞報導
2. 與會心得
3. 報告論文

國科會出席國外研討會心得報告

2009 第七屆兩岸三地航運物流研討會

時間：2009 年 3 月 19(四)-21(六)日

研討會與住宿地點：深圳大梅沙喜來登度假酒店

1.新聞報導

CKYH聯盟四月起調整美東航線

中華日報 航運版 CHINA DAILY NEWS

兩岸三地航運物流研討圓滿閉幕

萬海港高航首輪春興 TPS入加航線

東方海外集團去年營收成長16%淨賺2.7億美元

關網RFID加值應用旗艦示範成果發表

亞洲/南美西岸運協BS四月中調降

中華日報創刊63週年慶

華岡船務股份有限公司

2. 與會心得

本次研討會二岸三地共提出二十一篇論文，由於時間不多，二岸三地各選出二篇報告，其中台北海洋技術學院航管系張淑滿主任發表「兩岸海空運直航對臺灣經濟之影響」，經過 GTAP 進行初步的模擬分析，得出開放兩岸空運直航之經濟影響爲：(1)對臺灣總體經濟影響：實質 GDP 增加 25.25 百萬美元，約 0.0090%；社會福利增加 215.8 百萬美元。(2) 對個別產業影響：產值增加幅度最大的是化學及塑(橡)膠製品，增加 0.593%，約 243.371 百萬美元；產出減少的產業中以電子業減少約 0.400 % (277.844 百萬美元) 最多。因此得到一個初步的結論，兩岸大三

通後對台灣總體經濟有朝向好的方向進行。

此外，國立台灣海洋大學航管系倪安順教授發表「兩岸直航港埠貨櫃量預測與分配之研究」。根據研究結果顯示，直航前由於只開放廈門、福州爲境外航運中心，所以運量集中分佈於上海、深圳、廈門、福州；直航後無須繞道而行，運輸行爲改變，運量集中分佈於上海、深圳、青島、廣州。因此兩岸直航後，廈門港及福州港的地理位置將不再那麼重要，貨櫃運量將會呈現緩慢成長。

而香港方面的論文多由實務面探討，如「香港旗應否採納雙重國籍註冊」，該作者提出大膽的想法讓香港船採雙重國籍註冊，希望能對香港得到些利益。而中國大陸其中一篇論文用 swot 的方法來討論金融海嘯下, 深圳港口的“危”與“機”，該篇作者認爲，深圳港與歐美關係密切，這次受金融海嘯的影響也很大，在此之下，深圳港應如何因應，也提供了一些想法。

整體而言，台灣作者的論文較爲學術，並以嚴格的方法爲基礎，而香港較以實務與海上保險爲探討，也與時事相結合，如一位作者就分析了海盜行爲算不算共同海損；中國作者而言，仍較多的敍述，方法用的較少，但已在持續進步中，感謝 貴會給本人補助，使我能多了解兩岸三地物流與航運的相關議題，及認識一些學者或業者，有助於日後的研究。

3. 發表論文

國際港埠知識管理能力與績效關聯性之研究

The effects of knowledge management competence on performance for international ports in Taiwan

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摘要

隨著港埠間競爭日愈激烈，港埠要在競爭激烈的市場中維持生存並創造利潤，港埠單位若能培養知識管理能力，提升對市場與顧客的回應速度、設備與經營效率、決策品質與創新能力，是維持長期競爭優勢的方式之一。本研究目的在探討台灣地區國際港埠(包括高雄港、基隆港、台中港及花蓮港) 的知識管理資源、知識管理能力與個人工作績效關聯性之研究，透過訪問暨問卷調查方式，藉由結構方程式模式(Structural Equation Model, SEM)的建立，來分析此三構面彼此間之關係。結果顯示，知識管理資源會對知識管理能力暨個人工作績效有顯著的正向影響關係存在；但知識管理能力對個人工作績效的關係並不顯著，表示在台灣地區國際港埠管理機構中知識基礎建設能力扮演著相當重要的角色。

關鍵字: 知識管理、國際港埠、結構方程模式

Abstract

Knowledge management competency is an important dimension for international ports to retain their competitive advantages. This research used structural equation modeling (SEM) to examine the effect of knowledge management competency on performance in international ports, including Kaohsiung port, Keelung port, Taichung port and Hualien port in Taiwan. The results were supposed that knowledge management resource will positively influence knowledge management capability and work performance, Moreover, the result was not sufficiently significant to support meaningful positive relationships between knowledge management capability and work performance. The results will be helpful for the improvement of operational strategies

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for international port authorities.

Keywords: Knowledge management, International port, Structural equation modeling

壹、前言

經濟合作暨發展組織(OECD)在 1996 年提出了一項「以知識爲基礎的經濟」(The knowledge-based economy）的概念，簡稱爲「知識經濟」，即「將知識視爲一種經濟資源，以知識創造、擴散、與應用爲重心的經濟型態，創造知識與應用知識的能力與效率，將超越土地、資本等傳統生產要素之上，成爲支持經濟不斷發展的動力來源。」我國政府亦順應時代潮流發展，於民國 89 年 7 月擬定「知識經濟發展方案」，極力推動與發展知識經濟所需的各項基礎建設。Peter Drucker(1999)亦曾在”後資本主義社會”一書中提到：我們正邁入知識型社會，主要的經濟資源已由知識取代了過去的資本、自然資源和勞力等實體資源，知識將是企業優勢的唯一來源。

知識逐漸被大家視爲重要的資源，Zack(1999)認爲知識是一種策略性資源，知識取得、整合、儲存、分享和應用的能力將成爲企業建立競爭優勢的重要能力。亦有其他研究者認爲知識管理是爲組織創造持久性競爭優勢的來源之一（Lado & Wilson, 1994; Grant, 1996; Johannessen & Olsen, 2003; Chaung, 2004）。由此可見知識管理已被視爲是競爭力量的主要來源，當知識逐漸變爲企業重要的核心資源時，如何培養知識管理能力以有效地管理知識資源，進而提升知識管理績效，已成爲相當重要的議題。

近年來，知識管理議題在當代逐漸受到各方重視，吸引許多國內外的研究者投入知識管理領域的研究，至今亦累積了不少豐碩的研究成果。回顧知識管理能力方面的相關文獻， Gold et al.(2001)從潛能的觀點探討組織基礎建設、知識流程潛能對於組織效能的影響，發現組織基礎建設與知識流程潛能，對組織效能均有正面影響。Lee and Choi(2003)試圖以整合性架構探討知識管理促動因子對知識創造流程和知識管理績效的影響。Chuang(2004)從資源基礎理論的觀點，利用迴歸分析的方法探討知識資源對於競爭優勢之影響，實證結果發現社會性資源會對競爭優勢產生正向影響，而科技資源則會產生負向影響。傅清富(民 91)探討知識管理能力對新產品績效之影響，發現知識管理能力各項指標對新產品績效均產生顯著影響。鄭安裕(民 92)對知識管理能力與知識管理績效之關連性進行研究，探討了組織基礎建設對知識流程效率的影響，以及兩者對知識效能的影響，結論發現知識管理能力對知識效能會產生正向影響。歸納上述各研究，可發現主要在探討有助於知識管理推行的要素、知識流程與組織效能等構面之間的影響關係。

就知識管理的研究對象而言，可發現不論國內外的文獻，所進行實証的對象較側重高科技產業(e.g.. Jih, et al., 2005, Lee, and Chen, 2005)與製造業(e.g. 譚大純, 民 89)，少部分則爲金融業與服務業，而以運輸業爲研究對象的相關研究較爲缺乏，且探討主題多著重於知識管理對個人層面影響，對組織層面的探討則較爲缺

乏。然而知識管理應是目前所有產業欲升級或轉型可採行的理想方法，不應只著重在高科技產業或製造業。

從國際港埠的觀點而言，港埠的競爭已由早期只是鄰近港口的競爭轉爲各洲際間的競爭，如國內港埠早期以彼此競爭爲目標，如今卻需面對大陸興新港口的競爭，然面對激烈競爭以及市場之成長，早期港埠有關單位在提昇港埠競爭力上均以擴充港埠能量、增添現代化設備等供給面爲主軸；而隨著顧客導向抬頭以及航商或貨主對物流之需求，港埠經營策略已有專向需求導向爲主，因此，港埠角色已由傳統轉運角色演變爲提供附加價值的物流港，甚至朝所謂自由港發展。而這一連串港埠競爭活動的基礎主要建構在服務質量與設備和經營效率上(林光與張志清,民 90)，港埠業者以透過增加投資、策略聯盟、多角化等方式以降低成本進行競爭爲主，但卻也造成港埠之間缺乏差異性(Midoro & Pitto, 2000)，故彼此間的競爭仍然十分激烈，且以有形資產作爲競爭手段易被競爭對手模仿，不易取得持久性的競爭優勢。若港埠管理單位具備培養知識管理能力應能提升對市場與顧客的回應速度、提昇設備與經營效率、決策品質與創新能力，與市場價值(Huang, et al., 2006)等，尤其知識資源不容易被其他企業模仿，因此以知識管理能力所建立的競爭優勢是較能夠長期維持的(Chuang, 2004)，故探討我國國際港埠的知識管理能力有其必要性存在。

從亞太區域國際港埠的角度來看，高雄港在亞太其他五大港埠（新加坡、香港、東京、上海、馬尼拉）間的航行平均時間最短，約 53 小時；世界貨櫃裝卸量的排名雖有下滑的趨勢，但現仍爲世界第六大貨櫃裝卸港口，在世界港口中，依然扮演著重要的角色。特別在今天高雄港還需面對上海洋山港啓用的潛在威脅及台北港貨櫃儲運中心貨櫃碼頭完工使用。近來爲了提升高雄港埠的競爭力，已有許多學者針對高雄港埠效率來做研究(如葉立婷,民 94)；包括申請人也在　貴會的支助下針對高雄港貨櫃碼頭間的策略聯盟來研究，採用 AHP 的方法，結果證明碼頭間的策略聯盟能提高效率(桑國忠與呂錦山,2004)。但或許如資源基礎的觀點的主要論述(Barney, 1991; Barney et al., 2001; Wernerfelt, 1984)，認爲公司異質的資源與能力是有價值的、稀少的、不易被模仿等特點，所以是企業持久性競爭優勢的來源 (Lynch, 2000; Hoskisson et al., 1999; Oliver, 1997; Autry et al., 2005)。而知識管理能力正具有這些特質。

同樣的，我國的基隆港、台中港及花蓮港較高雄港更早面臨競爭的壓力，特別是台北港興起後，對基隆港的營運更是雪上加霜，如何利用知識管理的能力來提升其競爭力，更爲重要。爲了填補在學術上與實務上之缺口，因此引發了本研究之動機。本研究擬從資源基礎理論之觀點，探討知識管理資源之內容爲何？其如何影響組織的知識管理能力？以及知識管理資源、知識管理潛能與知識管理績效之間的關連性，以提供有關當局作爲改善績效的參考。

貳、 文獻回顧與假設

2.1 知識管理資源與能力之探討

實行知識管理的成功及失敗因素的關鍵，在於是否了解和衡量讓組織對於知識管理的努力能夠付諸實現的先決條件(Gold et al., 2001)。這些先決條件在組織行爲的文獻中可廣義地描述爲資源(resource)和潛能(capability)(Leonard, 1995; Law et al.,1998)，本研究將知識管理視爲是一種能力(competence)，而根據資源基礎理論，能力正是由資源與潛能不斷相互影響而得，故本節旨在探討知識管理能力是由哪些資源與潛能所構成。

回顧知識管理能力方面的相關文獻，Gold et al.(2001)從潛能的觀點探討組織基礎建設、知識流程潛能對於組織效能的影響，其研究認爲組織基礎建設係由資訊技術、組織結構與文化所構成；知識流程潛能包括知識獲取、知識轉化、知識應用、知識保護等活動。Lee et al.(2003)試圖以整合性架構探討知識管理促動因子對知識創造流程和知識管理績效的影響，其認爲知識管理促動因子包括資訊技術、組織結構、組織文化與人員所構成。Chuang(2004)從資源基礎理論的觀點，利用迴歸分析的方法探討知識管理能力對於競爭優勢之影響，實證結果發現社會性資源會對競爭優勢產生正向影響，而技術資源則會產生負向影響，其所指的社會性資源包括組織結構、文化、人員，技術資源即資訊科技的實體設施與潛能。

劉常勇(民 89)探討知識管理能力對新產品績效之影響，發現知識管理能力各項指標對新產品績效均產生顯著影響。其研究將知識管理能力定義爲組織的知識管理流程在組織環境中所表現出來的效能和效率，組織的知識管理能力會受到組織本身的知識流程的效率以及與組織環境的互動的影響，故知識管理能力包括知識管理流程的效率，以及組織環境對知識管理的支援能力，前者包括合適的激勵機制、組織溝通與團隊運作的效率、對知識友善且利於創新的組織文化、IT 技術的有效應用、人力資本的維持；後者則包括知識獲取能力的水準、知識流通機制的效率、知識創新能力的水準、知識存量的質與量水準、對知識保護的重視程度、應用知識的能力。

鄭安裕(民92)對知識管理能力與知識管理績效之關連性進行研究，探討了組織基礎建設對知識管理程序的影響，以及兩者對知識效能的影響。其研究認爲組織基礎建設包括資訊技術、文化與組織結構；知識管理程序則包括知識獲取、知識轉化、知識運用等構面。

綜合以上回顧之文獻，可發現知識管理能力深受知識管理資源與知識管理流程效率的影響。本研究採取Pan and Scarbrough(1998)所提出的社會性－技術性觀點，將這些資源區分爲技術性資源與社會性資源，前者主要是指資訊科技的運用，後者則包括組織文化和組織結構；知識管理潛能則是能夠以正確而有效率的方式將資料轉化成知識，以及執行知識管理流程的活動。能否善用知識管理資源，發揮知識管理之潛能，對於知識管理能力之建立有重大的影響，接下來將進一步探討知識管理資源與知識管理程序的內涵。

一、知識管理資源

(一) 資訊科技

資訊科技係指組織所擁有的實體資訊通訊科技設備、資料庫及其潛能，是組織溝通與行動的潛在基礎Chuang(2004)。透過資訊和通訊系統的連結，可以將組織原本散佈的資訊流與知識流加以整合，這些連結也可以消除組織內部門之間的溝通藩籬(Teece, 1998)。由於科技是多方面的，因此組織必須針對能夠支援各種不同知識和溝通類型的基礎設施進行必要的投資，科技構面是確保有效實行知識管理的一部分，包括企業智慧、協同作業、知識發掘、知識地圖等工具(Gold et al., 2001)。

資訊技術包括實體的資訊科技設備、資料庫和能夠有效發揮這些設備效能的潛能。資訊技術能夠讓員工更有效率地使用編碼後的顯性知識，並有助於彼此的溝通提升創造新知識的機會，協助組織創造、分享、儲存、使用知識(Chuang, 2004)。因此，資訊技術的建置有助於提升知識管理流程的效率，故要推行知識管理，公司必須要充分應用現行的IT 技術，建立一個能有效增加知識管理效率的科技基礎架構。這個架構必須要有一個對所有員工來說都是易於使用的操作介面，而且在功能上必須要能充分支援公司的工作流程。

雖然資訊科技能夠讓知識管理流程的運作變的更有效率，但資訊科技並不是培養知識管理能力的主要目的，而且資訊科技的建置需花費鉅額的資金，又較容易被競爭對手模仿，因此，必須了解資訊科技扮演的角色，避免陷入盲目投資的陷阱，策略性地選用適合的資訊科技技術。

(二) 組織文化

影響組織是否能順利推行知識管理最大的因素就是組織文化了，塑造文化是組織是否能夠有效地管理知識的重要能力之一(Davenport et al., 1998; Gold et al., 2001; Holsapple and Joshi, 2001)。個人之間的互動是創新的基礎，透過對話常常能夠激發出新的想法，所以可以視爲創造新知識的潛在來源之一，而這種方式對於轉換隱性知識，或將隱性知識轉換成顯性知識特別有用。然而，推行知識管理最常碰到的問題就是員工不願意和他人分享知識，不願採用他人想法甚至拒絕與別人合作，因此組織若缺少一個願意分享和嘗試創新的文化，知識管理是不可能成功地推行。

文化中有個重要的組成要素就是公司的願景，透過明確的公司願景可以讓組織的所有成員能夠了解未來的方向，也將組織價值的系統具體化，讓組織的成員產生參與感與貢獻。在願景中明確地陳述公司對於知識管理的重視，宣揚知識與信任對於公司的重要性，並持續地向所有組織成員溝通，有助於推廣知識管理，Davenport et al.(1998)認爲高階主管的支持在宣揚願景的部分扮演重要的角色。

(三) 組織結構

組織結構包括組織內部針對工作建立的規章、政策、流程、層級報告關係、獎酬系統與部門疆界(Gold et al., 2001)。過去有許多文獻指出組織結構能幫助亦能阻礙知識管理流程的效率(Hedlund, 1994; Leonard-Barton, 1995; Nonaka et al., 1995; Lee and Choi, 2003)。組織結構對於是否能夠讓科技更順利地發揮應有的功能亦有相當的重要性。有時候組織結構的目的是想要每個部門發揮最大的效益，但有時

候反而會出現反效果，使知識要跨越部門進行分享或交流產生障礙，僵化正式的結構將造成部門間或個體間不會主動傳遞高價值的知識而遲滯知識流通速度。因此在組織的設計上應盡量縮減組織層級並破除部門的藩籬，以促進組織成員之間個溝通與協同合作。

組織的獎酬系統與誘因對於知識的分享與創造也會產生影響，組織應提供誘因讓員工願意將時間用於獲得新知識（例如：學習進修等）、分享知識。組織的獎勵制度能夠決定知識「獲得途徑」及「如何流動」，並建構了鼓勵員工追求、創造與分享知識的合作環境(Leonard-Barton,1995)。所以，就組織的角度而言，應該建構激勵機制彌補正式結構的不足處，以激發知識工作者，願意創造新知識、學習、分享他們的知識與協助其它部門的成員(O'Dell and Grayson,1998)。

本研究認爲有助於知識管理流程發揮潛能的組織結構應能夠幫助組織成員進行溝通、協同合作、容易取得必要的知識，並提供適切的獎勵制度與績效評估準則，鼓勵員工進行知識創造與分享的行爲。

二、知識管理流程

現行管理典範係針對有形資源管理，而對具無形本質的知識尚難以規範管理，促成各領域投入新興的研究議題，理論與實務現仍持續發展中，許多研究從程序觀點提出關鍵性構面 (Leonard-Barton, 1995; Nonaka and Takeuchi, 1995; Teece, 1998; Zack, 1999, Henley, 2000; Gold et al, 2001; Arthur 2000)。然而，本研究認爲Gold et al.(2001)所提出的知識管理流程能夠涵蓋大部分學者所提出的知識管理活動，而且較爲簡潔扼要，故根據其所提出的知識管理流程，作爲本研究知識管理流程的分類方式，分別爲：知識獲取活動（外部知識的選擇、取得、學習，與內部的知識創造）、知識轉換活動（精鍊、建構、整合、組織、儲存）、知識應用活動（分享、使用、試驗）與知識保護活動。各知識管理活動的內容說明如下：

(一) 知識獲取

組織的知識本身並不會憑空出現，知識獲取的主要目的即在於取得知識，累積組織的知識存量。知識獲取流程主要有兩個觀點：創新與改善，前者是利用現有的知識用以創造新知識；後者則是改善現有知識的運用與更有效地取得新知識，例如：標竿管理與協同作業（Gold et al., 2001）。

關於外部知識取得的文獻部份，Leoarned-Barton(1995)將外部知識之來源分爲七種：(1)顧問公司、(2)顧客、(3)國家實驗室、(4)供應商、(5)大學、(6)其它競爭性公司和(7)其它非競爭性公司。Teece(1997)認爲知識吸收對公司創新能耐的培養是很重要的，能否有效地利用外界的知識與公司原有的技術基礎有關，組織先前累積知識的基礎會影響新知識所能發揮的效用。

內部的知識創造部份，Nonaka and Takeuchi(1995)將知識創造區分爲四個轉換模式：包括從內隱到內隱（共同化）、從外顯到外顯(連結化)、從外顯到內隱（內化）及從內隱到外顯（外化）。以上四種知識轉換方式將不斷互動，共同化與企

業文化有關、連結化　與資訊處理有關、內化與組織學習有關。而外化則需透過三個過程：隱喻(Metaphors)、類推(Analogy)、原型(Prototype)來完成。

本研究認爲知識獲得，係指企業依據需求、搜尋與選擇適當知識來源，加以學習、吸收，或由組織內部自行創造新知獲得外部、內部知識的過程。就實務上而言：（1）外部獲得：可利用標竿管理或協同合作的方式向外搜尋有用的知識，透過本身學習與吸收能力取得新知識。（2）內部創造： 應塑造有利於員工溝通互動的環境，促使員工將其內隱知識轉化爲對組織有用的外顯知識。

(二) 知識轉化

知識轉換流程主要目的在於讓現有的知識變得有用，知識轉換的能力是指公司能夠組織、整合、結合、結構化、協調與分配的能力(Gold et al., 2001)。

組織必須發展能夠將知識組織化或結構化的架構，否則缺乏共同的表現方式，就無法進行知識的交流，將會阻礙知識資產的有效管理(Davenport and Klahr, 1998; O'Dell and Grayson,1998)。建構知識時，應先依知識之特性予以妥適分類，以方便後續之知識儲存。而知識的分類方法有多種，可依據內隱-外顯程度分類；可依據實體-抽象度分類；可根據知識的深度、廣度與難度來分類；可根據知識在組織中隸屬之不同層級來分類；可根據其可成文化-不可成文化之程度來區分。知識應以何種方式進行建構，應考量組織與知識本身之搭配。包括組織之經營策略，組織人員之素質、組織的作業流程，以及組織本身(目前)的技術水準。任何組織擁有之資訊在儲存成爲組織記憶之前，常被成員將這些資訊以某種型態轉化成易於儲存的狀態，例如工廠將繁複之作業程序予以手冊化，或將創辦人的理念整理成文獻，這便是知識的建構。經過建構之知識，不論是可與不可文字化的內容，均能便利傳授者和被傳授者。

(三) 知識應用

知識應用流程主要是以實際使用知識爲目的，這也是知識管理最主要的目的，知識應用流程的特性在文獻中的討論包括知識的儲存、更新、應用、貢獻和分享等。

企業在營運上常會遇到若干相似的問題，若每次都要重新尋求解決之知識，重複性的工作將造成組織不必要的浪費，因此，組織將知識重新組織、整合之後，必須將這些結構化的知識融入到組織中，使得組織外引或內創之知識形成「組織記憶」，以方便組織內的成員能夠參考與應用，以節省其他成員遇到相似的問題，需要同類知識時的時間與成本，並方便日後知識的修正，因此，知識的有效應用能夠幫助企業增進效率和降低成本(Davenport and Klahr, 1998)。

從實務面而言，儲存知識的方式可分爲兩大類型，即(1)以資料庫來儲存知識；(2)以教育訓練的方式來深入知識於員工腦海之中。其中前者儘管多數和資訊科技，網路有關，但亦有非屬此類，而以傳統文件化爲切入點者；而後者則主要討論如何以人際間流傳爲主。而知識分享最有效的方法是透過資訊科技的方式來傳

遞知識，然而，如何創造一個利於知識分享的環境，才是讓知識發揮最大價值的關鍵。這主要是因爲外顯知識雖能透過資訊科技共享，但在內隱知識的分享上，主要卻還是要透過人際網絡才能有效分享。因此擁有最先進的資訊科技，並不能確保知識分享的效率提升。資訊科技並不能改變人們對知識共享的價值觀，這也是目前的一大障礙。因此對組織來說，如何透過激勵制度、價值共享等方式去建立員工知識分享的價值觀，將是促進組織內部知識擴散效率的最重要課題。

(四) 知識保護

以保全爲導向的知識管理活動係指設計來保護爲了產生與維持競爭優勢。（Gold et al., 2001）知識保護對知識型企業來說是非常重要的，因爲這能保障知識創造者的權益，鼓勵他們繼續從事知識的創造，避免組織內部的知識被非法、不當使用或竊取，保護組織的知識是必要且有益的。許多公司透過專利權、商標權、著作權等法律上的方式保護公司的知識資產，但不是所有的知識都能夠被財產法與財產權的定義涵蓋在內，例如：公司內部的資訊系統，此部分在實務上多以檔名、使用者名稱以及密碼等方式保護資料庫中的知識，只有被授權的使用者才能取得或使用這些知識，許多公司還會和員工簽訂許多和機密資訊有關的契約，如一般最常見的競業禁止約定。雖然知識的保護並不容易，但有其重要性，不可以輕易忽視。

本研究將知識管理視爲一種能力，係由知識管理資源和知識管理潛能所構成，稱之爲知識管理能力，其定義如下：知識管理能力定義爲：「能夠系統性地協調與整合組織中的知識管理資源，培養知識管理潛能，以適切而有效率的方式管理知識的能力。」

知識管理資源係指能夠創造有利於推動知識管理的重要資源與潛能，包括資訊科技、組織文化、組織結構和人員；知識管理潛能則是指能夠有效率地將資料轉化成知識，並進行知識獲取、知識轉化、知識應用與知識保護等知識管理活動。

經由對知識管理資源與知識管理流程的探討，我們可以發現要發揮知識管理潛能，必須要有適配的知識管理資源作爲輔助，而本研究認爲主要的知識管理資源包括資訊技術、組織結構、組織文化和人員。經由之前各別項目的討論，可發現適配的知識管理資源對於知識管理潛能的發揮有很大的幫助，例如：資訊科技技術、彈性的組織結構有助於組織成員進行溝通，輔以知識導向文化、激勵機制能夠促使員工進行知識創造、分享等活動，因此本研究認爲知識管理資源會對知識管理潛能產生影響，因此提出第一項假設：

H1：適配的知識管理資源（資訊技術、組織結構、組織文化）對於知識管理潛能（知識獲得、轉換、應用、保護）有正向影響。

2.2 工作績效

由於本研究是以港務局爲研究對象，除了營利目標外，其中也扮演了部份非

營利目標，再加上只有四個港務局，因此一般的財務績效或組織績效並無法完全適合的本研究，故擬從個人工作績效著手作爲本研究的績效指標。

績效是指對於特定目標達成程度的一種衡量指標，而工作績效是指員工在某特定期間內，執行工作時所達成結果的紀錄。所以，工作績效乃指部屬或群體達成目標的效益項目，如生產力、營收成長率、利率成長率、提昇服務品質、降低成本、及客戶滿意度等(Kane, 1986)。Campbell(1990)認爲工作績效是個人作爲一個組織成員，而完成組織所期望、規定或正式化的角色需求時所表現的行爲。Borman and Motowidlo(1993)將工作績效定義爲：所有與組織目標有關的行爲，且此行爲可依據個人對於組織目標貢獻度的高低。

Borman and Motowidlo(1993)依據Campbell(1990)之研究架構，提出工作績效分爲任務績效(task performance)及情境績效(contextual performance)二種。

（1）任務績效：爲一種個人工作上的結果，而此結果直接關係到工作者完成組織所指定任務的程度，其判斷準則在於是否合乎正式角色的要求，因此，任務績效之概念類似角色內行爲，直接影響組織的技術核心效能。

（2）情境績效：自願執行非正式規定的活動、堅持完成任務的熱誠、與別人合作並幫助別人、犧牲小我以遵從組織規則與程序，以及贊同、支持與防衛組織目標的相關行爲，因此，情境績效並不直接支持組織的技術核心效能，相對地比較支持一般性組織的、社會的及心理的環境，而此環境則是技術核心運作的背景，有賴於員工自由心證式的表現，組織無法強制要求。

任務績效以及情境績效爲兩個獨立的構面，可以用來評估全面性的工作績效，並已受到許多研究廣泛的支持(Moorman and Wells, 2003; Conway, 1999; McManus and Kelly, 1999)。因此，本研究採用Borman and Motowidlo(1993)的分類模式，將工作績效區分爲「任務績效」與「情境績效」作爲評估員工工作績效的構面

若企業採用「結合激勵機制的彈性組織結構」，並依據需求籌建資訊技術，更快、更精確完成任務，建立知識導向文化透過價值觀、規範、慣例等三個途徑影響個人行爲，進而影響知識創造、分享與運用，使得企業能藉由掌握、運用豐沛的知識，以提昇個人工作效能。依此提出第二項假設：

H2：知識管理資源（資訊技術、組織結構、組織文化）對於工作績效具正向影響。

知識管理能力，意指以有正確而有效率的方式執行知識管理流程中的活動，組織若能持續獲取知識，並加以轉化爲組織可用的知識資產，並有效地加以應用，深植於組織的經營活動中。若能發揮知識管理潛能，應能提升個人、組織的學習能力，以持續創造新知識，並讓員工在知識分享與應用的過程中激發創意，對公司的服務或內部的作業流程提出創新或改善性的建議。因此提出第三項假設：

H3：知識管理能力（知識獲得、轉換、應用、保護）對工作績效具正向影響。

本研究根據先前研究目的與所回顧相關文獻，來建立概念性的架構圖(如圖1)。提出知識管理資源、能力及績效的構面，並探究其彼此間的關係。

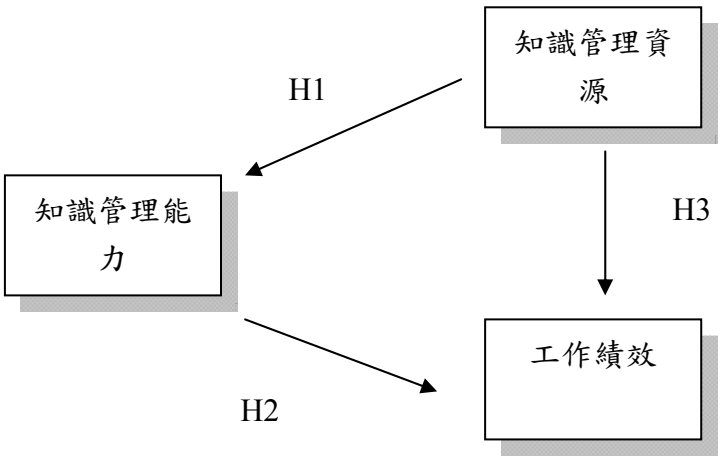


圖 1　本研究概念性架構圖

參、研究方法

3.1 分析方法與流程

本研究在方法上主要利用結構方程模式來驗證知識管理資源、知識管理能力及工作績效之影響關係，一個完整的研究模式，其理論驗證必須同時通過測量模式與結構模式分析兩個階段，因此，本研究在分析流程上(如圖 2)將其分述如下：

(1)研究衡量變項之研擬：主要係依據資源基礎的觀點，透過相關企業能力的文獻回顧及實務界專家訪談，對本研究問卷進行研擬發展。

(2)驗證性分析：在進行結構方程模式分析前，一般建議先利用驗證性因素分析檢定測量模式是否合適，除須檢定整體模式之適合度外，亦針對模式之獨一性(Unidimensionality）、收斂效度 (Convergent validity）、鑑別效度 (Discriminant validity)、及信度 (Reliability）等進行檢定，待模式合適後，再進行結構方程模式之假設驗證。其中在整體模式方面可利用卡方值、p 值、χ2/df、CFI(Comparative Fit Index)、TLI (Tucker-Lewis Index)與 RMSEA(Root Mean Square of Approximation)等指標來判斷整體模式之優劣 (Byrne 2001; Arbuckle, 1997; Garver and Mentzer, 1999; Koufteros, 1999; Hu and Bentler, 1999; Baumgartner and Homburg, 1996; Hair et al., 1998)；獨一性與收斂效度則是透過因素負荷之顯著性來檢驗；鑑別效度則可利用比較限定模式(Constrained)與非限定模式(Unconstrained)之卡方差異性檢定（χ2 different test）來檢驗 (Anderson. and Gerbing, 1988)；而信度則是採用 Cronbach's alpha 係數值來檢定 (Garver and Mentzer, 1999)。

(3)結構模式驗證：待測量模式經過驗證合適後，最後即是進行結構模式與假設驗證，有關整體結構模式適合度之檢定，可利用卡方值、p 值、χ2/df、CFI、TLI

與 RMSEA 等指標來判斷整體模式之優劣；假設驗證則根據 t 值與 p 值來驗證路徑係數是否顯著。

3.2 問卷設計

本研究分析資料的取得，是以問卷調查方式來進行。知識管理資源指標及知識管理能力問項的來源，主要是依據過去學者的研究 (Gold et al., 2001; Lee and Choi, 2003; 譚大純, 民 89) 所發展的問卷爲主，並加以修正適合港務局的實際情況而成。而問項是採用李克特七點尺度，由「非常不同意」到「非常同意」分別給予 1 分到 7 分的分數。

本研究另外的工作績效指標問項也是依據過去學者的研究 (Motowidlo and Van Scotter, 1994; Moorman and Wells, 2003; Befort and Hattrup, 2003; 余德成, 民 85) 而來，並加以修正適合港務局的實際情況而成，問項同樣採用李克特七點尺度法，由「非常不同意」到「非常同意」分別給予1分到7分。

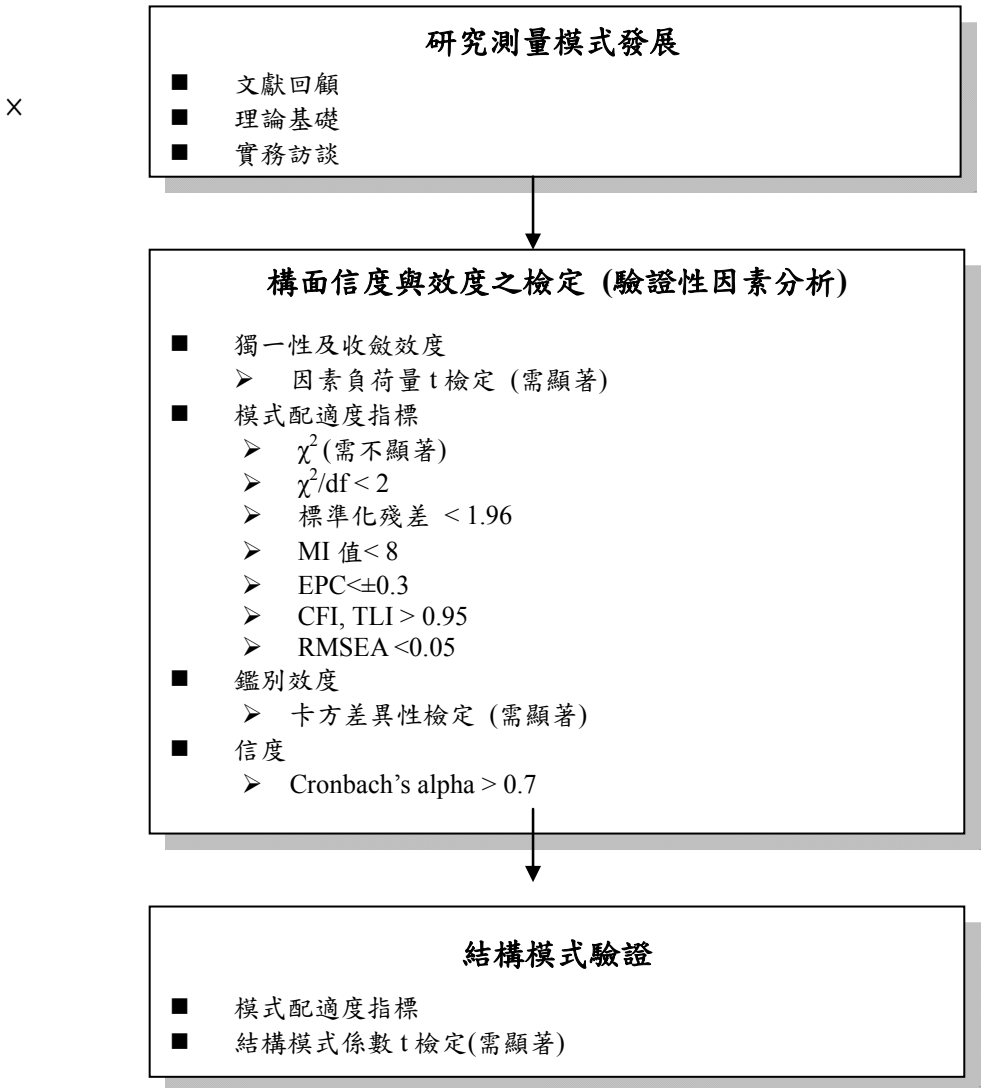


圖 2 分析流程圖

表 1 受測者的背景資料

填答者的特性		頻率	百分比
港務局	高雄港務局	104	36.6
	基隆港務局	67	23.6
	台中港務局	94	33.1
	花蓮港務局	19	6.7
性別	女	103	36.3
	男	180	63.4
	25 歲（含）以下	1	.4
	26~30 歲	7	2.5
	31~35 歲	11	3.9
	36~40 歲	18	6.4
	41~45 歲	55	19.4
	46~50 歲	61	21.6
	51 歲以上	130	45.9
年資	5 年之內	29	10.3
	6～10 年	16	5.7
	11~15 年	22	7.8
	15~20 年	65	23.0
	20 年以上	150	53.2
職稱	局長/副局長	1	.4
	港務長/主任秘書/總工程師	2	.7
	組長/處長(一級主管)	2	.7
	課長/主任/科長(二級主管)	47	17.5
	課員	105	39.0
	其他	110	40.9
職等	副長級以上	9	3.4
	高員級	148	55.4
	員級	44	16.5
	佐級	25	9.4
	士級	41	15.4
工作部門	港務組	27	9.5
	航政組	24	8.5
	業務組	45	15.8
	棧埠管理處	59	20.8
	港埠工程處	1	.4
	人事室	17	6.0
	秘書室	34	12.0
	資訊室	4	1.4
	研發組	8	2.8
	員工訓練組	1	.4
	其他	12	4.2

3.3 抽樣對象與樣本回收

本研究主要針對台灣四個港務局的員工，主要以聯絡人來發放，高雄港共發120 份，基隆港 100 份，台中港 100 份，花蓮港 50 份，四大港務局共發放 370 份。二週後，請聯絡人回收，高雄港共回收 104 份、基隆港回收 67 份，台中港回收 94 份，花蓮港回收 19 份，四個港務局共回數 284 份。回收率約 76.8%

3.4 回收樣本與基本資料分析

受測者基本資料如表 1 所示，約有近六成三爲男性，四成六大於 50 歲，年資二十年以上的佔五成三，表示填答者有足夠的年資以了解港務局知識管理相關問項，更增強本研究的可信度。受測者的職稱以二級主管爲最多，佔三成九。職等以高員級爲最多，約佔五成五。

肆、研究結果

本研究以圖 3 流程圖之步驟，來完成知識管理資源、知識管理知識與工作績效關係之驗證：

5. 1 認定各別因素構面：驗證式因素分析

本研究針對知識管理資源、知識管理知識及工作績效等三個構面，以先以驗證式因素分析法，來衡量此三個構面的信度與效度，並進行適當的修正，以符合相關的指標。最後再針對各因素加總，以成爲新的因素。

一、知識管理資源構面：

依據文獻整理知識管理資源構面包括了三個因素，分別是知識管理文化、組織結構及資訊科技的支援。本階段首先以驗證性因素分析法來檢測文獻中的三個因素所組成的測量模式之信度與效度。模式鑑定 (Identification)結果滿足最小需求 (Chi-square = 90.39; df = 51, p=0.001)，且因爲 (1)三種的適合度 (Goodness-of-fit indexes) 檢驗指標 (CFI=0.97>0.95; the Tucker-Lewis index, TLI=0.97>0.95; the root mean square error of approximation, RMSEA=0.05<0.08)均達到最小標準；(2)沒有任何一對的標準殘差值（Standardised residual values）大於 ±1.96；(3)沒有任何特別大的修正指標值（Modification indices, MI）需要修正；(4) 所有的期望參數的改變值（Expected parameter change, EPC）均小於±0.3；及(5) 所有變數檢定的 t 值是顯著的（t-values > ±1.96），因此可推論本測量模式滿足獨一性與收斂效度 (Byrne 2001; Arbuckle, 1997; Garver and Mentzer, 1999; Koufteros, 1999; Hu and Bentler, 1999; Baumgartner and Homburg, 1996; Hair et al., 1998) 。

本研究採用比較限定模式與非限定模式之卡方差異性檢定，來判別鑑別效度，結果顯示所有比較模式均達到統計上的顯著(p<0.05)，表示鑑別效度存在 (Anderson. and Gerbing, 1988)。

信度可經由檢測 Cronbach’s alpha (α) 係數值來達成，本研究所有研究構面的

Cronbach's alpha 值均大於 0.7 (參見表 2)，證明本測量模式的各構面具有信度 (Garver and Mentzer, 1999)。

表 2 知識管理資源統計分析表

題號	變數與題項	平均數	標準差	因素負荷量
	T1 組織文化 (α=0.79)			
A3	我認爲本局員工願意互相合作、支援以解決問題.	3.78	0.74	0.767
A4	我認爲本局鼓勵員工去參加外部的進修活動以學習新知	3.95	0.78	0.662
A5	我認爲本局員工都是值得信賴的	3.57	0.78	0.705
A6	我認爲本局員工的行爲會以本局的整體利益爲優先	3.60	0.85	0.678
	T2 組織結構 (α=0.84)			
A10	我認爲本局大部分的員工對於新的方法採取較開放的態度，會願意改變舊有的做事方法…	3.30	0.81	0.724
A14	我認爲本局的組織結構有助於新知識的創造與分享	3.55	0.79	0.709
A15	我認爲本局的員工可以很容易地取得他們所需要的知識，不會受到組織層級或部門的限制	3.39	0.75	0.694
A17	我認爲本局有將員工知識創造與分享的質與量納入績效評估的指標內	3.30	0.86	0.706
A18	我認爲本局的獎勵制度能夠鼓勵員工提出創新和改善方案	3.50	0.93	0.735
	T3 資訊科技的支援(α=0.82)			
A19	我認爲本局所使用的資訊設備有助於組織內員工的溝通與協調	3.73	0.71	0.734
A21	我認爲本局所使用的資訊設備能夠提供管理者必要的知識與資訊以做決策之用	3.65	0.74	0.793
A22	我認爲本局所使用的資訊設備提供員工即時學習的功能	3.64	0.80	0.795

本構面是依據李克特七點量表, 從低到高分別給與 1-7 分，而 1 表示非常不同意；7 表示非常同意。

二、知識管理能力

知識管理能力則包括了四個因素，分別是知識獲取、知識轉換、知識應用及知識保護。本階段首先以驗證性因素分析法來檢測文獻中的四個因素所組成的測量模式之信度與效度。模式鑑定 (Identification)結果滿足最小需求 (Chi-square = 201.54; df = 84, p=0.000)，且因爲 (1)三種的適合度 (Goodness-of-fit indexes) 檢驗指標 (CFI=0.97>0.95; the Tucker-Lewis index, TLI=0.96>0.95; the root mean square error of approximation, RMSEA=0.07<0.08)均達到最小標準；(2)沒有任何一對的標準殘差值（Standardised residual values）大於 ±1.96；(3)沒有任何特別大的修正指標值（Modification indices, MI）需要修正；(4) 所有的期望參數的改變值（Expected parameter change, EPC）均小於±0.3；及(5) 所有變數檢定的 t 值是顯著的（t-values > ±1.96），因此可推論本測量模式滿足獨一性與收斂效度 (Byrne 2001; Arbuckle,

1997; Garver and Mentzer, 1999; Koufteros, 1999; Hu and Bentler, 1999; Baumgartner and Homburg, 1996; Hair et al., 1998) 。

本研究採用比較限定模式與非限定模式之卡方差異性檢定，來判別鑑別效度，結果顯示所有比較模式均達到統計上的顯著($p<0.05$)，表示鑑別效度存在(Anderson. and Gerbing, 1988)。

信度可經由檢測 Cronbach's alpha (α) 係數值來達成，本研究所有研究構面的 Cronbach's alpha 值均大於 0.7 (參見表 3)，證明本測量模式的各構面具有信度(Garver and Mentzer, 1999)。

表 3 知識管理能力統計分析表

題號	變數與題項	平均數	標準差	因素負荷量
	T4 知識獲取(α=0.94)			
B1	我認爲本局能定期蒐集與競爭港口相關的知識與訊息	3.70	0.81	0.926
B2	我認爲本局能定期蒐集其他港務局的相關知識與訊息	3.72	0.76	0.906
B3	我認爲本局能定期蒐集與航商相關的知識與訊息	3.76	0.76	0.901
	T5 知識轉換(α=0.90)			
B6	我認爲本局能夠將知識傳遞給各部門與員工	3.53	0.78	0.843
B7	我認爲本局能將過去的錯誤與成功的經驗，詳加整理紀錄，以做爲日後決策之參考	3.46	0.88	0.888
B8	我認爲本局能定期更新過時的知識	3.53	0.81	0.825
B9	我認爲本局能將員工的工作心得或經驗透過文件化、教育訓練、軟體技術或資料庫等方法完整保存在組織中	3.50	0.80	0.798
	T6 知識應用(α=0.91)			
B11	我認爲本局能應用過去的錯誤或經驗學到知識去解決新問題	3.54	0.79	0.843
B12	我認爲本局能夠運用知識於工作效率的改善之上	3.63	0.73	0.882
B13	我認爲本局能夠運用知識，滿足顧客的需求	3.70	0.72	0.865
B14	我認爲本局能夠運用知識以調整本局的策略方向	3.66	0.79	0.827
	T7 知識保護(α=0.88)			
B17	我認爲本局員工都有保護公司知識資產的觀念	3.57	0.84	0.786
B18	我認爲本局能夠防止外部人士不當使用或竊取公司的知識	3.66	0.79	0.801
B19	我認爲本局對於知識有明確的分級與控管	3.50	0.81	0.816
B20	我認爲本局能夠防止內部員工不當使用或竊取公司的知識	3.56	0.77	0.809

本構面是依據李克特七點量表, 從低到高分別給與 1-7 分，而 1 表示非常不同意；7 表示非常同意。

而工作績效則包括了二個因素，分別是任務績效及情境績效。本階段首先以驗證性因素分析法來檢測文獻中的二個因素所組成的測量模式之信度與效度。模式鑑定 (Identification)結果滿足最小需求 (Chi-square = 74.51; df = 43, p=0.002)，且因爲 (1)三種的適合度 (Goodness-of-fit indexes) 檢驗指標 (CFI=0.97>0.95; the Tucker-Lewis index, TLI=0.97>0.95; the root mean square error of approximation,

RMSEA=0.05<0.08)均達到最小標準；(2)沒有任何一對的標準殘差值（Standardised residual values）大於 ±1.96；(3)沒有任何特別大的修正指標值（Modification indices, MI）需要修正；(4) 所有的期望參數的改變值（Expected parameter change, EPC）均小於±0.3；及(5) 所有變數檢定的 t 值是顯著的（t-values > ±1.96），因此可推論本測量模式滿足獨一性與收斂效度 (Byrne 2001; Arbuckle, 1997; Garver and Mentzer, 1999; Koufteros, 1999; Hu and Bentler, 1999; Baumgartner and Homburg, 1996; Hair et al., 1998) 。

本研究採用比較限定模式與非限定模式之卡方差異性檢定，來判別鑑別效度，結果顯示所有比較模式均達到統計上的顯著(p<0.05)，表示鑑別效度存在(Anderson. and Gerbing, 1988)。信度可經由檢測 Cronbach's alpha (α) 係數值來達成，本研究所有研究構面的 Cronbach's alpha 值均大於 0.7 (參見表 4)，證明本測量模式的各構面具有信度 (Garver and Mentzer, 1999)。

表 4 工作績效統計分析表

題號	變數與題項	平均數	標準差	因素負荷量
	T8 情境績效(α=0.84)			
C1	我經常規劃與安排自己所負責的工作進度	3.98	0.56	0.598
C3	我能按照優先順序處理工作，並在截止期限內完成	4.14	0.58	0.746
C5	我總能將任務從頭到尾圓滿完成	3.99	0.63	0.772
C6	工作上任何的小細節，我都能注意到並且妥善處理	3.85	0.57	0.675
C7	整體而言，我可以做好公司所要求的任務	4.06	0.57	0.791
	T9 任務績效(α=0.86)			
C8	我在團隊內經常跟其他同事保持合作	4.11	0.55	0.746
C9	當我遇到工作上的障礙時，仍堅持設法克服，以完成任務	4.06	0.54	0.731
C10	我在工作上經常表現出適當忍讓的態度	4.00	0.54	0.687
C14	我總是會支持主管的決定	3.98	0.68	0.670
C17	我在工作場所，會自我克制而且遵守紀律	4.20	0.55	0.775
C19	我會熱心地著手處理一個困難的工作指派	3.98	0.62	0.694

本構面是依據李克特七點量表, 從低到高分別給與 1-7 分，而 1 表示非常不同意；7 表示非常同意。

5. 2 結構模式分析：結構方程式法

由於本研究之三個構面中之九個因素，在驗證性因素分析方法中均達到可接受的信度與效度，因此將其題項合併。知識管理資源包括組織文化(t1)、組織結構(t2)與資訊科技的支援(t3)；知識管理能力包括知識獲取(t4)、知識轉換(t5)、知識應用(t6)與知識保護(t7)；工作績效包括情境績效(t8)與任務績效(t9)。

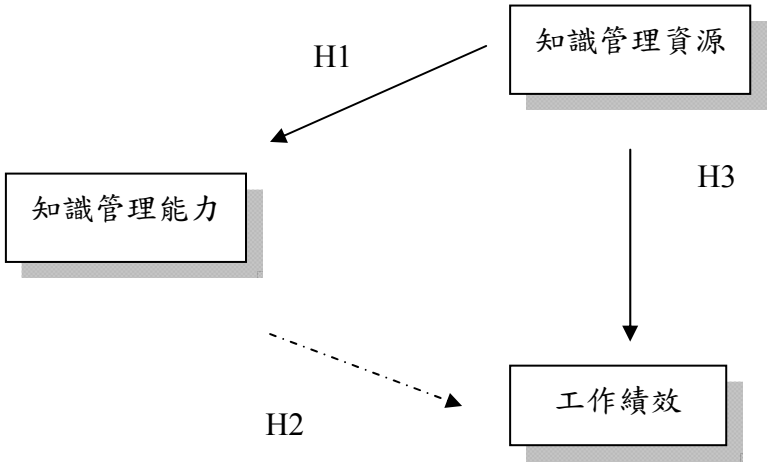
本階段測試整體結構模式，結果顯示，模式鑑定結果滿足最小需求(Chi-square = 44.05 df = 24, p=0.007)，本模式的三種適合度指標達到滿意的水準 (CFI=0.99; TLI=0.97; RMSEA=0.05)，沒有特別大的標準殘差值(value > ±1.96)、修正指標值及期望參數改變值。

表 5 結構方程式分析結果

假設	標準迴歸權重	T 值	結果
H1 適配的知識管理資源（資訊技術、組織結構、組織文化）對於知識管理潛能（知識獲得、轉換、應用、保護）有正向影響	0.923	0.000**	成立
H2：知識管理能力（知識獲得、轉換、應用、保護）對工作績效具正向影響。	-0.006	0.808	不成立
H3：知識管理資源（資訊技術、組織結構、組織文化）對於工作績效具正向影響。	0.613	0.017*	成立

*p<0.05; **p<0.01

由表 5 之最終結構模型顯示，研究結果支持假設 H1 及 H3，表示適配的知識管理資源（資訊技術、組織結構、組織文化）對於知識管理潛能（知識獲得、轉換、應用、保護）有顯著的正向影響關係存在。而知識管理資源（資訊技術、組織結構、組織文化、員工）對於工作績效有顯著的正向影響關係存在。但比較可惜的是而並沒有顯著的證據證明知識管理能力（知識獲得、轉換、應用、保護）對工作績效具正向影響。表示 H2 假設不成立(如圖三所示)。



註: 虛線表示假設不成立

圖 3　研究結果

陸、結論與建議

本研究主要以結構方程式來探討台灣地區國際港埠知識管理資源、知識管理能力及工作績效三者間的關係。經過問卷調查得到 284 份問卷，並經過驗證式因素分析後產生九個因素，均符合信度與效度。

知識管理資源包括組織文化、組織結構與資訊科技的支援；知識管理能力包括知識獲取)、知識轉換、知識應用與知識保護；而工作績效包括情境績效與任務績效。再經過結構方程式分析，支持假設 H1，表示適配的知識管理資源（資訊技術、組織結構、組織文化）對於知識管理能力（知識獲得、轉換、應用、保護）有顯著的正向影響關係存在。表示港務局的資訊技術、組織結構及組織文化，將對港務局在知識的獲得、轉換、應用及保護有相當大的助益。表示各港務局要提升內部的資訊技術、塑造良好的組織結構及文化，將有助於知識管理能力的提升。相同的，本研究也支持假設 H3，知識管理資源（資訊技術、組織結構、組織文化、員工）對於工作績效有顯著的正向影響關係存在。表示各港務局要提升內部的資訊技術、塑造良好的組織結構及文化，將有助於港務局員工工作績效的提升。但比較可惜的是本研究沒有明確的證據支持假設 H2 知識管理能力（知識獲得、轉換、應用、保護）對工作績效具正向影響。這個結論是與資源基礎的理論有些不合的地方，很可能表示，員工將港務局的知識管理能力提升，包括知識獲得、轉換、應用與保護，並無法與個人績效相結合，值得後續再加以研究。

本研究建議港務局應多加強投資在知識管理資訊軟硬體的投資，塑造員工願意互相合作、支援以解決問題的氣氛，培養信任彼此及以本局的整體利益爲先的文化，並鼓勵員工去參加外部的進修活動以學習新知，此外，還需加強獎勵制度能夠鼓勵員工提出創新和改善方案，並將員工知識創造與分享的質與量納入績效評估的指標內。如此便能提升或塑造港務局在資訊設備、組織文化及組織結構對相關知識友善的環境，便可提升個人在工作上的表現。

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行政院國家科學委員會補助國內專家學者

出席國際學術會議報告（Part Two）

98 年 7 月 20 日

報告人姓名	桑國忠	服務機構及職稱	國立台灣海洋大學運輸與航海科學系/所 副教授
會議時間 會議地點	98 年 6 月 24 日至 6 月 26 日 丹麥 Copenhagen 市	本會核定補助文號	NSC 97-2410-H-019-020-SSS
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報告內容包括下列各項：

1. 參加會議經過
2. 與會心得
3. 攜回資料
4. 發表論文

行政院國家科學委員會補助國內專家學人

出席國際學術會議報告

報告人　：　桑國忠 副教授

國立台灣海洋大學運輸與航海科學系/所

會議名稱　：　2009 國際海運經濟年會研討會

International Association of Maritime Economists

2009 Annual Conference

會議地點　：　丹麥 Copenhagen 市

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中華民國九十八年七月二十日

行政院國家科學委員會補助國內專家學人

出席國際學術會議報告

桑國忠

國立台灣海洋大學運輸與航海科學系/所

本次 2009 國際海運經濟年會研討會(International Association of Maritime Economists 2009 Annual Conference, IAME)是由丹麥 Syddansk University, University of Gothenburg, Maritime Development Center of Europe 與 Copenhagen Business School 等大學共同主辦。會議地點在丹麥哥本哈根市舉行，研討會內容主要分為航運市場分析(Shipping Market Analysis)、物流與港埠經濟(Logistics and Port Economics)、航運與環境保護(Shipping and the Environment)、海事人力資源管理(Managing Maritime Human Resources)、海運產業的競爭(Competition in the Maritime Sector)與國際海運貿易與財務(International Maritime Trade and Finance)等五大分類。

本次 2009 海運經濟年會研討會，大會主題在於強調「如何因應全球性的金融風暴」(Maritime Economics and the Economic Crisis)與「海運所面臨的挑戰與未來國際海運」(Maritime Challenges and Prospects for the Future)。包括 Keynote speakers，共有 134 篇在研討會發表。台灣方面，只有三位受國科會補助的教師參加，除本人外還包括成功大學交通管理科學系呂錦山教授及國立東華大學公共行政系魯炳炎老師參加。此外，聯合國貿易發展委員會(UNCTAD)與 Transportation Research Part E-Logistics and Transportation Review(SSCI)的主編 Professor Wayne K Talley 與 Transportation Research Part A: Policy and Transportation 副主編 Professor Kevin Cullinane 等世界海運知名學者與專家亦有參加，大家齊聚一堂，發表高見。以下就所參加該研討會之內容與心得簡述如後:

二、與會心得

本次研討會共舉行四天，論文研討自 98 年 6 月 24 日(星期三)至 6 月 26 日(星期五)止，6 月 23 日為註冊並有歡迎會，大會將論文發表分為 21 個場次舉行，每篇論文發表與研討時間約為 15 分鐘，由於主持人控制得當，發表人與在場人士大多有充裕的時間討論，早上與下午並有茶點時間，對來自不同國家的專家學者有更深入的認識、交換意見與情誼擴展。個人此次研討會，與東華大學魯炳炎老師共同發表一篇論文，題目為 EVALUATING CORE CAPABILITIES FOR FORWARDER-BASED 3PL FIRMS IN TAIWAN。由於是在丹麥舉行，丹麥藉 Maersk Line 是世界第一大貨櫃船公司，與海運、運輸與物流主題較相關，因此，吸引當地許多師生及海運相關背景的教授參與討論，受益良多。但比較可惜的是大會有安排至 maersk line 公司參訪，但因訊息錯誤，就沒有參訪到。

由於本會是海運領域的重要研討會，大多在歐洲辦理，華人較少，因此也把握機會與不少航運物流相關的主編交談。

三、攜回資料

本次會議攜回之資料如下:

1. Conference Proceedings of International Association of Maritime Economists 2009, IAME 200, USB 一只。

四、發表論文

EVALUATING CORE CAPABILITIES FOR FORWARDER-BASED 3PL FIRMS IN TAIWAN

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ABSTRACT

A survey of 1,011 forwarder-based third-party logistics (3PL) firms in Taiwan was carried out in order to examine the core capabilities, using cluster analysis approach. Based on factor analysis, six core capability factors were identified: external integration, transportation and consulting, organizational learning, internal integration, warehouse, and information tracking. Cluster analysis was subsequently performed and respondents were assigned to four groups on the basis of their factor scores in core capability factors, namely warehousing oriented firms, transportation and consulting oriented firms, intensive core capability oriented firms, and integration capability oriented firms. Results showed that intensive core capability oriented firms, which had excellent capability in all five capabilities, had better performance. The findings suggest that core capabilities should not exist in a vacuum, but should leverage each other to create sustained competitive advantage.

Key Words：***Capabilities, 3PL, Cluster analysis, Performance***

1. INTRODUCTION

Logistics and supply chain management have been elevated to a strategy level whereby many firms can simultaneously achieve difference and low cost for sustained competitive advantage (SCA). Further, in order to gain benefit from value-added maximisation and cost minimization, executives are becoming increasingly aware of the importance of outsourcing their logistics activities to third-party logistics (3PL) providers (Lu and Yang, 2006). A relatively recent study by Lieb and Bentz (2005) indicated that 80% of Fortune 500 firms surveyed were using 3PL services, which were marking up an increasing percentage of their logistics budget. Thus, 3PL providers are playing a very important role in the current business environment.

A review of the managerial literature reveals that the 3PL industry is becoming an increasingly important topic for researchers and has received a great deal of attention (Halldóresson and Skjøtt-Larsen, 2004; Knemeyer and Murphy, 2005; Lai et al., 2004; Malone and Carter, 2006; Yeung et al., 2006). For instance, Lu and Yang (2006) evaluated key logistics capabilities for international distribution center operators in Taiwan. More recently, Lieb and Butner (2007) have surveyed chief executive officers of major logistics service companies in order to provide insight into important market dynamics, opportunities and problems in the North American 3PL industry. As Maloni and Carter (2006:23) have pointed out, “given this conjecture of continuing maturation

in the 3PL industry, it is important that academic research continues to expand and advance to support practitioner needs".

3PL providers can be separated into two categories: asset-based 3PL and not-asset based 3PL providers (Maloni and Carter, 2006). Some 3PL providers have their own assets (e.g. cargo aircraft, warehouse, trucks, etc.) while others have no assets (e.g. air forwarders, freight forwarders, customer brokers, etc.). Most not-asset-based 3PL providers are small and medium-sized enterprises (SMEs), with limited resources and capabilities, therefore, effort is required to identify and develop core capabilities in order to create sustained competitive advantage. Thus, the identification of core capabilities for improved firm performance has become a very important topic with regard to non-asset based 3PL providers (Cheng and Yeh, 2007).

Core capability refers to 'a combination of complementary skills and knowledge-bases embedded in a group or team that results in the ability to execute one or more critical processes to a world-class standard' (Coyne et al., 1997: 43). The competence is the "core" when it is linked to customers' needs (Petts, 1997). Core competency must satisfy three prerequisite: (1) provides potential access to a wide variety of markets; (2) makes a significant contribution to customer satisfaction; and (3) is difficult for competitors to replicate (Prahalad and Hamel, 1990).

There are several important capabilities-based studies for 3PL. Most of them only focus on 3PL' service capability (Lai, 2004; Cheng and Yeh, 2007, Lu, 2007; Lu and Yang, 2006). But limited studies focus on other 3PL provider' core capabilities including integration and organization learning capability that can enforce firm, logistics, or service performance (Stank et al., 1996; Stank and Lackey, 1997; Bowersox et al., 1999; Zhao et al., 2001; Kim, 2006; Jiménez-Jiménez and Cegarra-Navarro, 2006; Real et al., 2006; Panayides, 2007)

Accordingly, the present research examines core capabilities (such as supply chain integration, organization learning, and service capabilities) for non-asset based providers, namely, air forwarders and ocean freight forwarders, in Taiwan as core strategic resources for acquiring sustained competitive advantage. The research focuses on the provider perspective to address the gap in the literature.

In the following section, the existing literature is reviewed to build the theoretical base presented in Section 2. Section 3 describes the questionnaire design and responses. The collected data were examined using factor analysis and cluster analysis. The results of the statistical analysis are detailed in Section 4. Section 5 concludes the paper. It providers an overall review of study findings', indentifies the contributions' of the study to the literature, explains the implications and limitations of the study, and proposes suggestions for future research.

2. LITERATURE REVIEW

2.1 Integration Capability

Integration may be the most important issue in logistics and supply chain management because '[t]he most fundamental shift in logistics thinking is to view functional excellence in terms of performance that enhances overall supply chain integration' (Bowersox et al., 1999: 19). Integration is central to logistics (Chow et al., 1995) and the key to supply chain management (Oliver and Webber, 1992).

Zailani and Rajagopal (2005) identified integration as capability including four factors: information sharing, internal integration, external integration with suppliers, and external integration with customers. Droge et al. (2004) grouped integration into external strategic design integration, which reaches across firm boundaries to involve suppliers and customers, and internal design-process integration, which comprises more tactically oriented, integration practices that match design requirements and process capabilities. In this study, integration capability is identified as supply chain integration capability, which includes internal integration and external integration (Germain and Iyer, 2006; Kim, 2006).

Several researchers have demonstrated a positive relationship between integration capability and performance. Firms that are willing to integrate have been shown to demonstrate higher logistics and firm performance (Bowersox et al.1996; Kim, 2006; Stank et al., 1996; Stank and Lackey, 1997; Zhao et al., 2001).

2.2 Organizational Learning Capability

Organizational learning capability has been viewed from a strategic perspective, as a basis for increasing SCA (Grant, 1996; Hult et al., 2003; Bhatnagar, 2006). For example, Ernst (2000) indicated that the key factor determining small Taiwanese firms' ability to compete in the computer industry is cross-organizational coordination of knowledge creation and learning.

Although topics related to learning capability have received a great deal of attention in the business management literature, it is difficult to find an explicit definition and type of the concept. There is agreement that learning capability is a multidimensional construct. For instance, Jerez-Gómez (2005) proposed four organizational learning capability dimensions: managerial commitment, systems perspective, openness and experimentation, and knowledge transfer and integration. Jiménez-Jiménez and Cegarra-Navarro (2007) reviewed most key organizational learning literature and concluded that organizational learning capability includes four primary constructs: information acquisition, distribution, interpretation, and memory. In this paper, we hold to the view that organizational learning capability is a multidimensional dimension that can be separated into two concepts: knowledge (what is learned) and learning processes

(how is learned) (Prieto and Revilla, 2006). Several researchers have indicated that organizational learning capabilities are critical sources by which to leverage greater firm performance and increase SCA (Real et al., 2006; Panaides, 2005).

2.3 Logistics Service Capability

According to the RBV of the firm, the enhancement of logistics service capabilities can be considered a potential source of SCA. Logistics service capabilities are complex bundles of individual skills, assets and accumulated knowledge exercised through organizational processes, that enable firms to co-ordinate logistics activities and make use of their resources. Recently, studies focusing on logistics service capabilities have received a great deal of attention in the 3PL literature.

Lai (2004) used logistics service capability to classify different types of logistics services providers (LSPs) in Hong Kong. The study identified three key logistics service factors, namely, value-added logistics services, technology-enabled logistics services, and freight forwarding services using exploratory factory analysis and suggested that there are four discernable LSP types and that differences in service performance exist between the types.

Lu and Yang (2006) focused on the logistics service capabilities of international distribution centers in Taiwan. Their study identified four key logistics capabilities: customer response, innovation, economic scale, and flexible operation and logistics knowledge. The findings suggest that customer response capability is perceived as the most important logistic capability.

More recently, Lu (2007) evaluated key resources and capabilities in the liner shipping industry in Taiwan. Based on factor analysis results, seven capability dimensions were identified: purchasing, operation, human resource management, customer service, information integration, pricing, and financial management. The findings indicated that operation capability was perceived as the most important dimension. Also recently, Cheng and Yeh (2007) evaluated core resources and capabilities in the air cargo forwarding industry. From factor analysis, six logistics service dimensions were identified: providing logistics information, customized delivery service, transportation quality and quantity, upstream and downstream industry, providing integrated logistics services, and price flexibility.

Several researchers have indicated that logistics service capabilities are critical sources of SCA. For example, Cheng and Yeh (2007) found the logistics services of air cargo forwarders positively influenced SCA. Lai (2004) classified four LSP types according to their service capability. He found each of the four LSP types achieved different service performance according to their logistics service capability.

3. METHODOLOGY

3.1 Sample

A questionnaire survey was administered to a two-industry sample of logistics service providers in Taiwan. The sample comprised 361 freight forwarder and 650 air freight forwarder drawn from their councils' membership roster.

Questionnaires were sent to the offices of the presidents or chief executive officers of the 1,011 firms targeted, since such people were considered appropriate respondents to provide information on cross-departmental objectives due to their knowledge of firms' integration, organizational learning, and service capabilities.

Those items selected as measures of integration, organizational learning, and logistics service capabilities were based upon past studies (Calantone et al., 2002; Lai 2004; Lu, 2002; Jerez-Gómez et al., 2005; Murphy and Poist , 2000; Rodrigues et al., 2004; Stank et al., 2001; Wang et al., 2004). Five-point Likert-type scale anchors were used. Respondents were asked to indicate their level of agreement with each item, where 1 represented "Strongly Disagree" and 5 represented "Strongly Agree".

Service and financial performances have also been frequently measured by logistics researchers (Calantone et al., 2002; Lu and Yang, 2006; Kim, 2006). Accordingly, in this study, respondents were asked to rate their firm's performance relative to its major competitors by indicating their level of agreement with items on a five point scale, where 1 represented "Much Worse" and 5 represented "Much Better".

The questionnaire was translated into Chinese and a pilot study was carried out by interviewing five academic experts, one consultant in organizational learning, two managers in ocean freight forwarders, and two managers in air cargo forwarders, in order to obtain their valuable suggestions for questionnaire improvement. Some minor revision was necessary after the pilot study.

The revised survey instrument was mailed to 1,011 respondents. The initial mailing elicited 51 usable responses. After two weeks, follow-up mailings were sent to those respondents who had not returned questionnaires in the first wave survey. An additional 85 usable responses were subsequently returned. The total response rate was therefore 14.17%[(51+85)/1,011], an acceptable response rate for logistics empirical studies of the manufacturing industry (cf. 11.5% and 17.1% achieved by Bowersox et al., 1999, and Michigan State University Global Logistics Research Team, 1995, respectively).

To avoid significant differences in responses between air forwarders and ocean forwarders, a *t* test was conducted to compare their responses towards all 26 capability indicators. No significant differences were found in the test. Thus, there was not a problem combining the data derived from respondents from these two different industries.

To detect any potential non-response bias, Armstrong and Overton (1977) and Lambert and Harrington (1990) recommend assuring that the last quartile or second wave of respondents' responses is similar to that of non-respondents. T-test analysis results revealed no significant differences (at $p<0.05$) as regards all capability variables analysed and non-response bias was therefore not a problem.

In order to ascertain whether respondents actually understood or appreciated integration, organizational learning, service capability, and performance, they were asked to indicate how long they had worked in the firm. Table 1 shows that nearly 50 per cent had worked in the firm more than 9 years, suggesting they had abundant practical experience to answer the questionnaire accurately and reliably. Further, 82% of questionnaires were filled in by vice-presidents or above (32.6%), managers or assistant managers (17.4%), department managers (27.3%), and presidents' assistants (4.5 %), which further reinforced the reliability of the survey's findings.

Table1 also shows respondents' age. More than a quarter (27.2%) were aged over 50, whereas 9.6% were less than 30 years of age. Table 3 also indicates that respondents' firms' sales varied considerably. Over 40% of respondents' firms' sales were between 10 and 100 million NTD, nearly 12% had sales over 101 million NTD, while 47.8% had sales less than 10 million NTD. Almost half of respondents were from the air freight forwarder industry (64: 47.1%) while just over half were from the ocean freight forwarder industry (72: 52.9%).

Table 1 Profile of respondents (n=136)

Characteristics of respondents		**Frequency**	**%**
Industries	Air cargo forwarder	64	47.1%
	Ocean freight forwarder	72	52.9%
Job title	Vice president or above	43	32.6
	Manager/ Assistant manager	23	17.4
	Department manager	36	27.3
	President's assistant	6	4.5
	Other	24	18.2
Length of Service in the Company	Less than 1 year	9	6.6
	1~ 4 years	34	25.0
	5~8 years	26	19.1
	9~12 years	24	17.6
	More than 12 years	43	31.6
Employees	Less than 50 people	100	73.5
	50~ 200 people	25	18.4
	201-400 people	5	73.5
	401-1000 people	6	4.4
Age	Less than 30 years	13	9.6
	31~39 years	34	25.0

	40~49 years	52	38.2
	More than 50 years	37	27.2
Sales (Hundred Million New Taiwanese Dollars)	Less than 10	64	47.8
	10~100	54	40.3
	101~200	64	3.7
	201~300	7	5.2
	More than 300	4	3.0

3.2 Research methods

The research was accomplished by conducting a questionnaire survey. The research steps included questionnaire design and various analysis methods as described below.

- Step 1: Selection of capability attributes and content validity test.

The first step was the selection of 3PL capability attributes by reviewing capability and 3PL provider research presented in the literature, followed by the design of the questionnaire, conducting personal interviews with ocean and air cargo forwarder practitioners, and a content validity test. The questionnaire design stages followed the seven stages outlined by Churchill (1991). Information to be sought was first specified, and then the following were determined: questionnaire type and its method of administration, the content of individual questions, form of response to, and wording of each question, the sequence of questions, and physical characteristics of the questionnaire. The questionnaire was pre-tested and revised where necessary.

In the process of determining questionnaire items, it is crucial to ensure the validity of their content, since this is an important measure of a survey instrument's accuracy. Content validity confirms the correspondence between theoretical constructs and items measured. (Dunn et al., 1994; Mentzer and Flint, 1997), because 'if a measurement scale does not possess content validity, it cannot possess construct validity, no matter what the statistical analysis indicates' (Garver and Mentzer, 1999: 35). Ahire et al. (1996) stated that if various items' measured constructs are derived from a comprehensive analysis of relevant literature, content validity can be attested. It provides a methodologically rigorous assessment of a survey instrument's validity. The content validity of the questionnaire employed in this study was assured through a literature review and interviews with practitioners, that is to say, questions in the questionnaire were based on previous studies and discussions with a number of 3PL executives and experts, who judged them relevant, and only minor modifications were considered necessary to wording and examples provided in some measurement items. Refined measurement items were included in the final version of the survey questionnaire, which was viewed as possessing content validity.

- Step 2: Determining core capability factors

Since firms' capability dimensions comprised a large number of embedded

activities this could have led to an exhaustive list in the second step, therefore, factor analysis was conducted to summarize and reduce the large number of capability attributes into a smaller set of underlying factors or dimensions. A reliability test was conducted to assess whether the capability dimensions were reliable. Such test confirmed their reliability.

- Step 3: Evaluating perceived differences in core capabilities according to firm characteristics.

This step sought to identify perceived differences in core capabilities based on firm size, industry, and sales. One-way analysis of variance (ANOVA) was used to test whether significant differences existed between 3PL providers.

- Step 4: Cluster analysis and linking clusters to performance outcomes

To develop the empirical taxonomy of core capabilities, a two-stage procedure was employed to take advantage of the strengths of hierarchical and nonhierarchical clustering approaches (Hair et al., 2006; Ketchen and Shook, 1996). A hierarchical algorithm (Ward's method) was first used to define the number of clusters and cluster centroids, which then served as the starting points for subsequent nonhierarchical cluster analysis.

It was difficult to determine how many clusters were appropriate. Hair et al. (2006) recommend a relatively simple stopping rule, that is, to look for large increases in the average within-cluster distance. Because of the large increases in the agglomeration coefficient, the Ward's hierarchical clustering results indicated that a two-cluster solution was adequate and the cluster centres became the initial starting point for subsequent nonhierarchical cluster analysis.

One-way analysis of variance was then performed between the clusters and performance outcomes in order to identify differences between clusters.

All analyses were carried out using the *SPSS 12.0 for Windows* package and results are presented in the next section.

Table 2 Respondents' agreement with capability attributes

NO.	Capability variables	Mean	S.D.
C1	Managers basically agree that our organization's ability to learn is the key to our competitive advantage.	3.99	0.86
C2	The sense around here is that employee learning is an investment, not an expense.	3.90	0.97
C3	All parts that make up this firm (departments, sections, work teams, and individuals) are well aware of how they contribute to achieving overall objectives	3.95	0.87
C4	All parts that make up this firm are interconnected, working together in a coordinated fashion.	4.02	0.84
C5	This firm promotes experimentation and innovation as a way of improving the work processes.	3.61	0.86
C6	Experiences and ideas provided by external sources (advisors, customers, training firms, etc.) are considered useful instruments for this firm's learning.	3.46	1.00
C7	Errors and failures are always discussed and analyzed in this firm, on all	3.89	0.87

	levels.		
C8	The firm has instruments (manuals, databases, files, organizational routines, etc.) that allow what has been learnt in past situations to remain valid, although the employees are no longer the same.	3.90	0.98
C9	My firm maintains an integrated database and access method to facilitate information sharing.	3.68	0.98
C10	My firm has increased operational flexibility through supply chain collaboration.	3.86	0.87
C11	My firm's compensation, incentive, and reward systems encourage integration.	3.86	0.86
C12	My firm effectively shares operational information externally with selected suppliers and/or customers.	3.87	0.87
C13	My firm effectively shares operational information between departments	3.77	0.84
C14	My firm has supply chain arrangements with suppliers and customers that operate under principles of shared rewards and risk.	3.45	0.92
C15	My firm successfully integrates operations with customer and/or suppliers by developing interlocking programs and activities.	3.56	0.96
C16	We have strong skills in integrating customers' innovative ideas into final products and services.	3.78	0.87
C17	My firm has good capability to provide a freight forwarding service.	4.13	1.03
C18	My firm has good capability to provide a warehousing service.	2.99	1.51
C19	My firm has e good capability to provide a bonded warehousing service.	2.18	1.40
C20	My firm has good capability to provide consulting services.	3.28	1.47
C21	My firm has good capability to provide a customs clearance service.	3.53	1.45
C22	My firm has good capability to provide a freight consolidation service.	3.50	1.39
C23	My firm has good capability to provide intermodal services.	3.62	1.26
C24	My firm has good capability to provide an overseas distribution service.	3.30	1.43
C25	My firm has good capability to provide a legal affairs advisory service.	3.09	1.36
C26	My firm has good capability to provide an online real-time information tracking/racing service	3.10	1.47

Note: The mean scores are based on a 5-point Likert scale (1= strongly disagree to 5= strongly agree) S.D. = standard deviation.

4. RESULTS OF EMPIRICAL ANALYSES

4.1 Perceptions of capability

Based on their aggregated scores for agreement with the 26 capability attributes, respondents' responses ranged from neutral to strongly agree (the mean average was 3.4).

The top three core capability attributes were: my firm has good capability to provide a freight forwarding service, all parts that make up this firm are interconnected, working together in a coordinated fashion, and managers basically agree that our organization's ability to learn is the key to our competitive advantage. (see Table 2). In contrast, respondents showed lowest agreement with the following: my firm has good capability to provide a bonded warehousing service, and my firm has good capability to provide a legal affairs advisory service (their mean scores were below 3.5).

4.2 Factor analysis

Factor analysis was used to reduce the 26 capability attributes of 3PL providers to smaller sets of underlying factors (dimensions). This helped to detect the presence of

meaningful patterns among the original variables and to extract the main capability factors. To aid interpretation, only variables with a factor loading greater than 0.4 were extracted, a conservative criterion based on Hair et al. (2006). Principal components analysis with VARIMAX rotation was employed to identify core capability factors as shown in Table 3. The data were deemed appropriate for analysis, according to the Kaiser-Meyer-Olkin measure of sampling adequacy value of 0.840 (Hair et al., 2006). The Bartlett Test of Sphericity was significant [$\chi^2 = 1382.3$, $p < 0.01$], indicating that correlations existed among some of the response categories. Scree plots and eigenvalues greater than one were used to determine the number of factors in each data set (Churchill, 1991). The six core capability factors identified accounted for approximately 60 % of the total variance. Core capability factors extracted were labeled and are described below:

(1) Factor 1, an external integration capability factor, consisted of seven items, namely, my firm has increased operational flexibility through supply chain collaboration; my firm has supply chain arrangements with suppliers and customers that operate under principles of shared rewards and risk; my firm successfully integrates operations with customer and/or suppliers by developing interlocking programs and activities; my firm effectively shares operational information externally with selected suppliers and/or customers; this firm promotes experimentation and innovation as a way of improving the work processes; my firm maintains an integrated database and access method to facilitate information sharing; and we have strong skills in integrating customers' innovative ideas into final products and services. Most items are related to external integration with suppliers and customers. My firm has increased operational flexibility through supply chain collaboration and my firm has supply chain arrangements with suppliers and customers that operate under principles of shared rewards and risk had the highest factor loadings on this factor. This factor accounted for 28.08 % of the total variance.

Table 3 Factor analysis to extract core capability factors

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
C10 My firm has increased operational flexibility through supply chain collaboration	**0.70**	0.25	-0.13	0.27	-0.09	0.07
C14 My firm has supply chain arrangements with suppliers and customers that operate under principles of shared rewards and risk	**0.70**	0.00	0.19	0.03	0.13	-0.01
C15 My firm successfully integrates operations with customer and/or suppliers by developing interlocking programs and activities.	**0.61**	-0.06	0.25	0.27	0.02	0.28
C12 My firm effectively shares operational information	**0.58**	0.15	0.17	0.44	0.02	0.07

externally with selected suppliers and/or customers.						
C 5 This firm promotes experimentation and innovation as a way of improving the work processes.	**0.54**	0.14	0.48	0.04	-0.17	-0.06
C 9 My firm maintains an integrated database and access method to facilitate information sharing	**0.51**	0.02	0.20	0.31	-0.04	0.31
C16 We have strong skills in integrating customers' innovative ideas into final products and services	**0.50**	0.14	0.49	0.13	0.01	-0.31
C24 Overseas distribution service	-0.08	**0.74**	-0.13	0.18	-0.03	0.06
C25 Legal affairs advisory service	0.20	**0.74**	0.08	-0.19	0.04	0.18
C20 Consulting services	0.09	**0.67**	0.06	0.04	0.33	0.16
C23 Intermodal services	0.04	**0.66**	0.37	0.22	0.13	0.01
C17 Freight forwarding service	0.11	**0.57**	0.17	0.39	0.08	-0.24
C21 Customs clearance service	0.14	**0.52**	0.09	-0.14	0.41	-0.04
C22 Freight consolidation service	-0.11	**0.44**	0.41	-0.15	0.36	0.28
C 2 The sense around here is that employee learning is an investment, not an expense.	0.11	0.09	**0.73**	0.19	0.06	0.08
C 1 Managers basically agree that our organization's ability to learn is the key to our competitive advantage.	0.14	0.21	**0.73**	0.20	-0.16	0.15
C 7 Errors and failures are always discussed and analyzed in this firm, on all levels.	0.45	-0.04	**0.59**	0.24	0.04	0.02
C 6 Experiences and ideas provided by external source (advisors, customers, training firms, etc.) are considered useful instruments for this firm's learning	0.39	-0.18	**0.44**	0.28	0.27	-0.24
C 3 All parts that make up this firm (departments, sections, work teams, and individuals) are well aware of how they contribute to achieving overall objectives	0.41	0.07	**0.42**	0.32	-0.08	-0.02
C13 My firm effectively shares operational information between departments	0.22	0.10	0.24	**0.74**	0.01	0.11
C 8 The firm has instruments (manuals, databases, files, organizational routines, etc.) that allow what has been learnt in past situations to remain valid, although the employees are no longer the same.	0.20	0.04	0.08	**0.63**	0.17	0.08
C 4 All parts that make up this firm are interconnected, working together in a coordinated fashion.	0.27	-0.06	0.42	**0.60**	-0.02	-0.08
C11 My firm's compensation, incentive, and reward systems encourage integration.	0.32	0.27	0.25	**0.45**	-0.32	0.07
C19 Bonded warehousing service	-0.04	0.17	-0.13	0.05	**0.79**	0.14
C18 Warehousing service	0.04	0.40	0.06	0.19	**0.63**	-0.14
C26 Online real-time information tracking/racing	0.16	0.18	0.06	0.14	0.07	**0.78**
Eigenvalues	7.30	3.30	1.41	1.31	1.13	1.01

Percentage variance	28.08	12.68	5.41	5.03	4.31	4.06

(2) Factor 2, a transportation and consulting capability factor, comprised seven items, namely, overseas distribution, consulting, intermodal, freight forwarding, customs clearance, freight consolidation, and legal affairs advisory services. These items are transportation and consulting related activities in logistics operations. Overseas distribution service had the highest factor loading on this factor. Factor 2 accounted for 12.68% of the total variance.

(3) Factor 3, an organizational learning capability factor, consisted of five items: the sense around here is that employee learning is an investment, not an expense; managers basically agree that our organization's ability to learn is the key to our competitive advantage; errors and failures are always discussed and analyzed in this firm, on all levels; experiences and ideas provided by external sources (advisors, customers, training firms, etc.) are considered useful instruments for this firm's learning; and all parts that make up this firm (departments, sections, work teams, and individuals) are well aware of how they contribute to achieving overall objectives. These are organizational learning capability related activities. The sense around here is that employee learning is an investment, not an expense had the highest factor loading on this factor. Factor 3 accounted for 5.41 % of the total variance.

(4) Factor 4, an internal integration capability factor, comprised four items: my firm effectively shares operational information between departments; the firm has instruments (manuals, databases, files, organizational routines, etc.) that allow what has been learnt in past situations to remain valid, although the employees are no longer the same; all parts that make up this firm are interconnected; working together in a coordinated fashion; and my firm's compensation, incentive; and reward systems encourage integration. These are related to internal integration activities. My firm effectively shares operational information between departments had the highest factor loading on this factor. Factor 4 accounted for 4.31 % of the total variance, slightly less than factor 3.

(5) Factor 5, a warehouse capability factor, consisted of two items, namely, bonded warehousing and warehousing service. These two items are warehousing services related activities, therefore, the factor was identified as a warehousing capability factor. Bonded warehousing service had the highest factor loading on this factor. Factor 5 accounted for 4.12 % of the total variance.

(6) Factor 6, an information tracking capability factor, consisted of only one item: Online real-time information tracking/racing. Factor 7 accounted for 4.06 % of the total variance.

4.3 Reliability test

A reliability test based on Cronbach's Alpha was used to examine whether the extracted these factors were consistent and reliable. The reliability value was well above

0.7, indicating adequate internal consistency (Churchill, 1991). Cronbach Alpha values for each factor are presented in Table 5, which shows that apart from the Cronbach Alpha value of 0.543 for "warehouse capability", which is marginally acceptable, Cronbach's Alpha values for all the other factors ranged from 0.718 to 0.816.

Table 4 also shows respondents' level of agreement with the importance of each core capability factor in the current situation. Results revealed the internal integration factor was considered the most important (factor 4), followed by the organizational learning factor (factor 3), then the external integration factor (factor 1), transportation and consulting factor (factor 2), information tracking factor (factor 6), and warehouse factor (factor 5).

Table 4 Cronbach alpha values for each core capability factor

Core capability factor	Number of items	Cronbach Alpha	Mean	Standard Deviation
1. External integration	**7**	**0.816**	3.67	0.62
2. Transportation and consulting	**7**	**0.803**	3.49	0.91
3. Organizational learning	**5**	**0.778**	3.84	0.67
4. Internal integration	**4**	**0.718**	3.91	0.66
5. Warehouse	**2**	**0.543**	2.59	1.21
6. Information tracking	**1**	**N**	3.10	1.47

4.4 One-way analysis of variance

To evaluate the relationship between capability factors and respondents' firm characteristics, i.e. industry, number of employees, and sales, one-way analysis of variance (ANOVA) was performed. Table 5 shows respondents were divided into two groups, namely, air cargo forwarders and ocean forwarders. Respondent groups' perceptions of the importance of core capability factors did not significantly differ at the 5% significance level for number of employees and sales, however, groups' perceptions significantly differed regarding the importance of the information tracking factor for industry type. Air cargo forwarders rated this factor significantly higher than ocean forwarders. This is not surprising because air cargo forwarders belong to a more time sensitive industry than ocean forwarders. An online real-time information tracking service is the basic service provided by air cargo forwarders but not by ocean forwarders.

4.5 Two-stage cluster analysis results

In addition to identifying whether differences existed between the two groups' perceived importance of core capability factors, the 136 respondents were assigned to four groups on the basis of their factor scores in core capability factors. Fifty-three were assigned to group 1, 19 to group 2, 41 to Group 3, and 23 to Group 4. Canonical discriminant functions (Klecka, 1980) demonstrated the nature of segment differences, and explained 100 per cent of the variance.

Table 5 Comparison of air forwarder and ocean forwarder groups' perceptions of core capability factors

Core capability factors	Air cargo forwarder		Ocean forwarder		Statistical Index	
	Mean	S.D	Mean	S.D	F Ratio	Sig. of F
External integration	3.77	0.60	3.58	0.63	3.298	0.07
Transportation and consulting	3.64	0.91	3.56	0.90	3.330	0.07
Organizational learning	3.92	0.62	3.77	0.70	1.859	0.17
Internal integration	4.04	0.62	3.80	0.67	4.722	0.03
Warehouse	2.71	1.20	2.47	1.21	1.324	0.25
Information tracking	3.59	1.39	2.67	1.41	14.813	**0.00

Note: Mean scores based on a 5-point scale (1 = strongly disagree, 5 = strongly agree); S.D. = standard deviation; *represents significance level $p < 0.05$; **represents significance level $p < 0.01$.

4.6 Interpretation of clusters

One-way analysis of variance (ANOVA) was used to examine whether the six core capability factors differed among the four groups. Table 6 shows ANOVA test results in terms of factor score coefficients. With the exception of the organizational learning factor, the remaining five capability factors were found to significantly differ among the four groups at the $p < 0.05$ significance level.

Table 6 One-way ANOVA analysis of core capability factor differences among the four groups

Core Capability factors	1 (53)	2 (19)	3 (41)	4 (23)	F Value	F Prob	Scheffe Test
External integration	-0.70	0.50	0.32	0.64	21.62	**0.00	2>1; 3>1; 4>1
Transportation and consulting	0.16	0.68	0.05	-1.01	14.73	**0.00	1>4; 2>4; 3>4
Organizational learning	-0.14	0.16	0.01	0.17	0.72	0.54	None
Internal integration	-0.09	-1.43	0.45	0.58	30.89	**0.00	4>1>2; 3>1>2
Warehouse	0.14	-0.68	0.49	-0.63	11.92	**0.00	1>2; 1>4; 3>2; 3>4
Information tracking	-0.56	0.58	0.86	-0.71	40.68	**0.00	2>1; 3>1; 2>4; 3>4

Note: a. the description of groups is based on factor scores with a mean of zero and standard deviation of one. For instance, the negative value of the factor score coefficient, -0.7 (see first column, first row), indicates that respondents placed less emphasis on factor one.
b. factor scores were derived from data pooled across the four groups.
c. *Significance level $p < 0.05$; **Significance level $p < 0.01$

A comparison of factor score coefficients shows Group 1 had their highest centroid scores on the transportation and consulting factor and warehouse factor, and their lowest centroid score on the external integration factor. Group 2 had their highest centroid

score on the transportation and consulting, followed by information tracking and external integration factors. However, this group had a negative score on the internal integration factor. Group 3 had positive scores on all five capability factors. Group 4 had their highest centroid score on the external integration factors and their lowest scores on the transportation and consulting factor. From cluster analysis, four groups emerged based on core capability factors, namely: warehousing oriented firms, transportation and consulting oriented firms, intensive core capability oriented firms, and integration capability oriented firms.

One-way ANOVA analysis was used to test differences in performance among the four groups based on Scheffe tests. Respondents were also asked to provide information relating to their firm's performance in terms of comparing it with a main competitor, the degree of customer loyalty, customer satisfaction, sales, market share, profit, and ROI (see Table 7). Since the statistically significant level was less than 0.05, it was concluded that performance significantly differed among the four groups. Intensive core capability oriented firms had the best performance and warehousing oriented firms had the worst performance.

Table 7 One-way ANOVA analysis of performance differences among the four groups

Performance Index	Groups				Significant test		
	1	2	3	4	F Ratio	Comparison	Scheffe Test
Customer loyalty	3.49[a] (0.91)[b]	4.00 (1.05)	3.95 (0.84)	4.04 (0.66)	*3.57 (p=0.02)	4>2>3>1	
Customer satisfaction	3.54 (0.72)	3.63 (0.83)	4.02 (0.69)	3.96 (0.56)	**4.41 (p=0.01)	3>4>2>1	(3,1)
Sales	3.15 (0.69)	3.68 (0.67)	3.86 (0.87)	3.46 (0.78)	**7.04 (p=0.00)	3>2>4>1	(3,1)
Market share	3.11 (0.75)	3.58 (0.77)	3.77 (0.91)	3.37 (0.83)	**5.24 (p=0.00)	3>2>4>1	(3,1)
Profit	3.14 (0.79)	3.68 (0.82)	3.69 (0.84)	3.20 (1.12)	4.23 (p=0.10)		

Note: a. represents mean.; b. represents standard deviation.
** represents significance level $p < 0.01$.; * represents significance level $p < 0.05$.

5. CONCLUSIONS AND DISCUSSION

This study has examined core capabilities for 3PL providers in Taiwan. The study's main findings are summarized below.

Factor analysis was conducted to reduce the 26 identified capability attributes into six core capability factors labeled external integration, transportation and consulting, organizational learning, internal integration, warehouse, and information tracking factors. Two-stage cluster analysis subsequently assigned respondents' firms to four groups, namely, warehousing oriented firms, transportation and consulting oriented

firms, intensive core capability oriented firms, and integration capability oriented firms, based on their factor scores in the six core capability factors. With the exception of the organizational learning capability factor, the five remaining core capability factors differed significantly among the four groups.

Subsequent ANOVA analysis indicated that intensive core capability oriented firms, which had positive scores in all five capability factors, had the best performance, and warehouse oriented firms had the worst performance. Thus, overall, findings suggest that core capabilities should not exist in a vacuum, but should leverage each other to create sustained competitive advantage. The more core capabilities are combined together, the more difficult it will be for competitors to imitate them. This viewpoint is the central theme of resource-based theory.

Accordingly, 3PL core capabilities should be regarded as core strategic resource for acquiring sustained competitive advantage. 3PL firms' top managers should constantly seek to enhance and refine their firms' five core capabilities over and above those of their competitors in order to acquire and maintain long-term superior performance.

From a theoretical perspective, this study is one of the first to evaluate core capability factors and performance, and identify different groups in the 3PL context. It provides a framework for understanding capability requirements from the 3PL manager's perspective. However, it suffers from several limitations. First, all participants responded within a particular time frame and were only given a single opportunity to respond. It cannot therefore be reliably stated that such data will hold true over time, especially in dynamic business environments. Moreover, different firms have distinct strategic goals in the short term, such as customer satisfaction, market share, growth, etc. Further, firms may enhance market share by sacrificing short-term profit in order to acquire long-term profit. The performance items in this study could not reflect these varying situations. Second, although a low response rate has been reported in similar studies (Michigan State University Global Logistics Research Team, 1995; Bowersox et al, 1999), and non-respondent bias was demonstrated not to be a problem, nevertheless, the conclusions still need to be cautiously inferred and generalised to a whole population.

Several important issues for further research can be identified and are detailed below. First of all, structural equation modeling (SEM) applications may also be helpful for identifying cause and effect relationships between core capability factors and performance and confirmed by studies in the future.

Second, the resource-based view (RBV) of the firm is an excellent theory for application in the 3PL field, however, 'due to the intangible nature of important firm resources, researchers have used detailed field-based studies, longitudinal case studies, outlier samples, and case surveys…to test RBV hypotheses' (Hoskisson et al., 1999: 447). More qualitative-based methodologies are possible alternatives for exploring

firms' core capabilities.

Third, in this study, we focused only on the asset-based 3PL industry. Future in-depth consideration could be given to the non asset-based 3PL industry.

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