行政院國家科學委員會專題研究計畫 成果報告

應用模糊認知圖探討整合供應鏈管理對雜誌經銷商績效之影響
研究成果報告(精簡版)

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應用模糊認知圖探討整合供應鏈管理對雜誌經銷商績效之影響

THE EFFECTS OF AN INTEGRATED SUPPLY CHAIN MANAGEMENT ON MAGAZINE DEALER PERFORMANCE BY USING FUZZY COGNITIVE MAP

中文摘要

便利商店在台灣分佈密集，並提供顧客 24 小時甚至是假日的購物環境，使得便利商店也成為許多人購買雜誌的主要管道。發展至今，便利商店的文化性出版品經銷商與物流系統已形成一個新的供應鏈模模型，供應鏈管理(Supply Chain Management, SCM)也被廣泛的研究討論並且應用在實務上。然而，卻只有少部份的研究是針對雜誌經銷商的績效表現。

本研究著重在利用模糊認知圖(Fuzzy Cognitive Map, FCM)來探經銷商的績效表現做為決策者的參考依據。模糊認知圖是以認知圖為基礎，其中系統變數(如概念、專案、資源)之間的關係程度可用來計算彼此的影響程度。在本研究中，我們提出一個具體的計算方式來處理變數間的影響關係並解釋 FCMs 的基本規則。

首先，本研究討論有關便利商店物流業與經銷商的績效表現、資訊系統、議價能力與銷售量，接著建構系統的關聯模式圖；第二部份我們利用模糊認知圖的來模擬運算此關聯模式；最後，提出初步的研究結果與研究工具的可行性評估。在本研究中的結果可提供決策用來改善雜誌經銷商的服務品質與擬定評估管理策略。

關鍵字：模糊認知圖、供應鏈管理、經銷商

英文摘要

In Taiwan, convenience stores, which are widely distributed, provide a 24-hour even on holidays purchasing environment for customers, there are many people who became familiar with the idea of a main channel for purchase magazine. Up to date, the convenience stores have integrated magazine dealer with logistics system to form a new supply chain model. The supply chain management (SCM) has been widely studied in the academic as well as practical fields. However, there are fewer studies about the performance of magazine dealer.

This paper is concerned with proposing a fuzzy cognitive map (FCM) driven approach for implementing expert decision support in the area of magazine dealer performance. A Fuzzy cognitive map is a cognitive map within which the relations between the elements (e.g. concepts, events, project resources) of a mental landscape can be used to compute the strength of impact of these elements. In this research, we propose a specific algorithms for interpreting the logic-based rules to FCMs as well as specific algorithms and formulas for calculating the values of multi-branch map hierarchies.

First, the study discusses the relationship of convenience stores performance logistics, performance dealer, information system, power of negotiate and sales volume. Then construct the system relationship model. Second, we use Fuzzy Cognitive Maps to simulate the system relationship model. Finally, this paper presents preliminary experiments and comments on the usefulness of the proposed methodology tool. The results obtained in this study can be used to improve the service quality for magazine dealer and evaluate the management strategies.

Key words: Fuzzy Cognitive Maps, Supply Chain Management, Dealer

壹、前言

隨著零售通路的日趨成熟（消費者越來越容易在零售通路上購買雜誌），加上整體經濟的不景氣（零買可以根據當期雜誌內容決定是否購買，因此較長訂來的有彈性），因此零售戶已成為雜誌經營業者相當重要的營收類型。另一方面，雜誌經營與一般商品的獲利模式還有一個主要的不同點，那就是雜誌經營基本上不是藉由銷售雜誌而直接獲利，相對的，向廣告客戶收取廣告費用才是雜誌經營的主要獲利來源。由於廣告客戶不但會關心雜誌的閱讀客層（包含讀者數量與性質），更會在意該雜誌是否能在通路中的顯著位置中進行曝光銷售。因此，店鋪數多且具有 7×24（全年無休、每天營業 24 小時）經營型態的便利。在本研究的研究對象主要為全家便利商店的文化性出版品供應鏈，從文化性出版品從出版社出貨給經銷商「如翊行銷」，再由旗下的物流公司「日翊文化」配送到全家、萊爾富與 OK 便利商店的各個門市上架販售給消費者所組成的供應鏈模式，在整個供應鏈模式中任何一個環結都會影響供應鏈的運作與績效表現。因此，探討供應鏈中各個環節對供應鏈的影響將有利於供應鏈成員的運作，也可以讓供應鏈管理者在做決策時降低不確定因素的風險。

貳、研究目的

目前國內尚無以系統關聯與模糊認知圖的模式來探討便利商店文化性出版品供應鏈的研究。因此，本研究將整合全家便利商店文化性出版品的供應鏈，並以經銷商與物流商的績效為研究的主軸，先分析哪些重要因素是會影響經銷商與物流的績效表現，並以影響因素為系統關聯之變數，利用系統關聯分析的方法完整考量系統內各變數之間相互關聯影響，來模擬全家便利商店文化性出版品供應鏈各個因素對供應鏈成員的影響，這將有利於企業高階主管與供應鏈管理人員在做決策時考量的依據。

基於上述研究動機與背景，本研究的目的如下：

1. 以全家便利商店文化性供應鏈為對象，建構出供應鏈的關聯圖，探討便利商店文化性商品供應鏈中哪些會影響供應鏈之因素。並探討系統關聯模式中各個變數之間的影響關係。

2. 依據第一部份所建立之系統關聯模式架構，套用至模糊認知圖，並歸納專家意見，建立便利商店文化性商品物流成立經銷商之系統關聯模式，以作為系統分析之工具，並提出會影響成立經銷商之因素與因素的變動情形。

3. 以模擬情境的方式，透過改變系統關聯之影響值與變數的權重值，或是加入新的關聯值來觀察系統的動態，並預測系統關聯與變數的變動情形對整體供應鏈之影響，提供管理者進行決策的參考依據。

參、文獻探討

商品從源頭到顧客的流程，傳統上都稱之為實體流通（physical distribution）。實體流通源自工廠，管理人員選擇倉庫和運輸公司在指定的時間內及最低總成本的前提下，將製成品送到最終目的地。因此，商品或服務通路需藉不同的上下游廠商，將此商品或服務送達最終消費者，並供其使用與享受。而在通路中，各企業的關係及互動特性又有許多型態，有的十分鬆散，有的十分緊密。事實上，供應鏈（supply chain）是目前通路型態中密合強度最高的一種型態，因為企業間已形成了所謂「鏈」的關係（chain relationship），是相互依賴很深的一種商業甚至超過商業上的互動合作模式。

美國供應鏈協會（Supply Chain Council，SCC）將供應鏈管理定義為：涵蓋生產與配送最終產品所作的努力，其對象從供應商到顧客，乃始於原物料的採購、製造到成品的運輸配送，最終送至顧客手中整個過程的管理活動，其目的在透過順暢、及時的資訊流動，以及鏈上所有成員之間密切的協調配合，使顧客獲得滿意的產品與服務，廠商獲得應有的利潤並且健康地成長。Charles 及 Stephen（1996）則認為供應鏈是組織將其產品服務傳遞給其顧客的一種系統。供應鏈網路體系是由包括供應商、製造商、配銷商、零售賣場、消費者之相互連結的組織所組成。每一成員間對整體供應鏈的運作都有重大的影響。蘇雄義（1998）認為供應鏈管理即為流通通路中相關企業間有效整合以提昇競爭力所必備的新型態管理系統，其基本精神在於高度專業分工一群企業間的有效整合，使企業內部及外部之商業流通達到超高績效水準。當企業與其顧客及供應商形成供應鏈合作關係時，即形成了所謂完全通路或供應鏈。David 等人（2000）認為供應鏈管理係一連串的方法以有效率的運用來整合供應商、製造商、倉庫與商店，使商品能以正確的數量，送達正確的地點，並在正確的時間內來製造並且流通，並希望以最低的成本，滿足服務水準的要求。

　　Harland（1996）認為供應鏈管理的研究主題與概念性發展可包括底下不同的系統層次：關係（Relationship）、鏈（Chain）、網路（Network）。以往的研究通常都是著重在某個特定層次的分析，而不是跨層次的分析。在「網路」層次的部份，較為熱門的研究主題為多重資源（Multiple-source）與單一資源（Single-source）之優劣取捨。至於在「鏈」的層次部份，大部份的研究都來自產業動態學 （Industrial Dynamics）與後勤學（Logistics）。產業動態學的重點在於探討滯延效果對於供應鏈上游活動的影響，而滯延效果則會發生在「資訊的批次處理」、「安全存貨準備」、「溝通上的問題」與「不正確的預測」等，上述的狀況會對上游企業的排程產生起伏與不規則的狀況（Forrester, 1961）。

　　從上述的定義可以引導出下列數個觀點。首先，供應鏈管理是考慮到供應商和製造設施，經由倉庫及配銷中心，然後到達零售商和商店的所有配送需求。其次，供應鏈管理的目標是使整個系統及成本能具有效率，而整個系統的成本，也就是將產品從原料到在製品，以至於最後的製成品的運輸成本以及配銷成本最小化。最後，由於供應鏈管理是以有效整合供應商、製造商、倉庫及商店為目的，所以它包含了許多企業活動的層次。

　　唯有經由供應鏈的整合，企業才能將成本減少，改善服務水準，並且提升企業競爭力。然而供應鏈整合並不容易，在供應鏈裡，不同成員間可能會有不同的和相互衝突的目標，而且供應鏈是隨著時間所發展出來的動態系統，不但顧客的需求和供應商的能力是隨著時間而改變的，供應鏈的關係也是隨著時間而演變的。該如何妥善應用供應鏈管理模式是面對激烈競爭的企業刻不容緩的議題。

肆、研究方法

　　考慮到雜誌經銷商的整合供應鏈管理之決策變數，其相互關係可能存在的複雜性與非線性，因此本計畫將以模糊認知圖來模擬此複雜決策系統中各變數之因果關係，除考量回饋作用外，並透過動態分析的結果推測系統之變化趨勢，藉此進一步研擬相關的營運策略以及各策略的調控分析。模糊認知圖是「系統關聯模式」中的一種研究方法，該模式結合心理學之認知圖法以及模糊關係概念，在架構上以認知圖法的概念將影響變數之關係以正向、負向關係串連，變數選取方法為專家問卷法，以此建立系統架構。在關係處理上則是以數字區間之方法來界定兩變數中之關係，並以矩陣運算之方式，來模擬因素間變動之關係，以及影響程度之變動。

　　模糊認知圖操作程序首先需建立起具因果關係之各關聯變數間的結構，並將各變數間

因果關係進一步轉化為足以表達各變數角色之流程圖，進而以函數定義質化與量化之作用關係，最後加以運算並進行動態變化之模擬。以往應用系統動態學的困難處在於系統內變數相互關係過於複雜，且變數間之關係也難以明確之關係表示之，為克服這些限制，1976 年 Axelrod 提出認知圖（Cognitive Maps）理論，主要目的在於解決非結構性問題。其方法為利用因果圖建立變數間之相關性，變數即為系統設定中之節點，相關性以連結變數之弧線表示。認知圖之架構為一系統網絡而非單向樹狀圖，建構步驟先以不同變數及其連結來表示事件的情況，在以有連鎖關係之因素及影響強度來構成網絡，僅以正負號展示各變數間之正負向關係。

FCM 則是引用模糊集理論 （Fuzzy Set Theory），主要目的在於解決非結構性問題。其方法為利用因果圖建立變數間之相關性，變數即為系統設定中之節點，相關性以連結變數之弧線表示。認知圖之架構為一系統網絡而非單向樹狀圖，建構步驟先以不同變數及其連結來表示事件的情況，在以有連鎖關係之因素及影響強度來構成網絡，僅以正負號展示各變數間之正負向關係（吳信輝，2001），其特色在於可處理認知圖中不易定義的變數關係，強調只需知其變數之間的約略關係即可，而變數之間的關係程度可以用（-1, 1）區間的有理數表示之（Kosko, 1992）。

模糊認知圖係用以分析不確定因素間的因果圖，它連結事實、程序、價值與目標等，據以分析複雜事件如何互動和產出。模糊認知圖架構中變數間之相互影響具模糊特性及正負因果關係，故模糊認知圖為具回饋性的非線性動態系統。模糊認知圖加強認知圖之應用領域，特色在於模糊認知圖可處理認知圖中難以定義之變數間關係，強調只要獲得其大概關係即可（Kyung and Soung，1995）。

伍、結果與討論

本計畫經由瞭解台灣便利商店文化性商品供應鏈之概況後，並透過專家訪談建立出 14 項對文化性商品供應鏈有影響的變數，其核心為探討供應鏈成員物流商「日翊文化」成立經銷商「如翊行銷」的過程中，有哪些影響變數會對經銷商與物流的績效造成影響，再進行系統之動態模擬。表 1 為本研究所建構之 14 項變數與說明，所建構之認知圖如圖 1。

建構出圖 1 之系統關聯圖並且模擬運算無誤後就可以進行第二次專家訪談，第二次專家訪談將以問卷調查的型式，給與專家填寫變數之權重值與變數之間的影響值。本研究所採用之訪談對象為全家便利商店文化性商品供應鏈成員管理者，為求建構模糊認知圖時可以有較周全的考量，訪談對於需要是供應鏈成員不同部門之管理者，這樣才可以依法不同部門之角度來審視所建構系統之完整性。第一次訪談對象為日翊文化與如翊行銷的業物部、行銷部等課長級以上管理人員共三位。確認變數與建構出模糊認知圖並且進行模擬運算無誤後進行第二次訪談，第二次訪談對象為日翊文化與如翊行銷的業物部、行銷部等課長級以上之管理人員與全家便利商店之高階管理人員，分別以問卷調查之型式取得變數之權重值與關聯數據。

變數的權重值我們將範圍限制在 $\{0\sim1\}$ 之間小數點兩位以下之有理數，而變數與變數之間的影響值遵照模糊認知圖將範圍限制在 $\{-1\sim1\}$ 小數點以下兩位之有理數，並且利用 Excel 設計下拉式選單給予受訪者選填，如受訪者覺得某些變數之間存在著影響關係而研究者未納入考慮時，將可以於空白部份加註說明，並且填入其影響值。完成第二次專家訪談後，將各專家訪談所得值以平均值的方式計算後 A~N 權重植以矩陣形式呈現，矩陣 A_1 為 $[0.7 \quad 0.78 \quad 0.43 \quad 0.58 \quad 0.75 \quad 0.55 \quad 0.8 \quad 0.7 \quad 0.55 \quad 0.58 \quad 0.6 \quad 0.53 \quad 0.8 \quad 0.73]$，而關係矩陣 B_1 如式(1)，本研究採用之門檻函數為 Logistic Signal Function，其數學函數形式如式(2)。

其中A為變數經過門檻函數對應出之值、ai為變數經過矩陣運算前之值、一般設定常數λ為5，但可依研究需要條整常數值，本研究將常數λ設定為3。

　　圖 2 說明本計畫模糊認知圖疊代計算結果，由 2 可以發現系統變數的大概趨勢，會選擇進行 20 次運算的原因在於此系統中的 14 項變數在進行第 18 次運算後將會到達穩定的狀態，因此對於系統運算採取 20 次的運算值來觀察系統的動態。

表 1 變數說明

| 變數名稱	涵蓋範圍與內容
物流績效(A)	文化性商品倉儲、包裝、分類、揀取、配送之績效
經銷商績效(B)	行銷、議價、配額業務之績效
配銷量(C)	供應商給予經銷商之文化性商品配額
文化性商品運送量(D)	文化性商品配送至各通路之運送量
競爭對手經銷商議價能力(E)	競爭對手(統一集團之經銷商：高見文化)的議價能力
退書率(F)	通路未銷完退回經銷商或供應商之文化商品
配送速度(G)	準時交貨、補貨效率、配送延遲之效率
競爭對手通路的競爭力(H)	競爭對手統一集團之實體通路、虛擬通路的競爭力
供應鏈成員的信賴(I)	供應鏈成員(供應商、經銷商、通路)彼此之間的信賴
定期會議(J)	日翊文化定期與供應鏈成員內部會議
供應商的關係(K)	台灣的供應商與經銷商之間的交易，相當重視人際關係，供應商的業務代表會利用彼此的關係，來影響經銷商的決策與行為，所以在其研究中將關係策略加入影響策略之中
通路的關係(L)	經銷商扮演中間溝通的角色，聯繫供應商與通路商，通路商的銷售情況會影響供應商的決策，所以在其研究中將關係策略加入影響策略之中
競爭對手實銷量(M)	競爭對手統一集團之通路實銷量(進貨量－退貨量)
文化性商品種類(N)	經銷商可依據本身代理的通路特性與優勢來與供應商談判，可以決定供應商所提供的文化性商品種類多寡

圖 1 建構之模糊認知圖
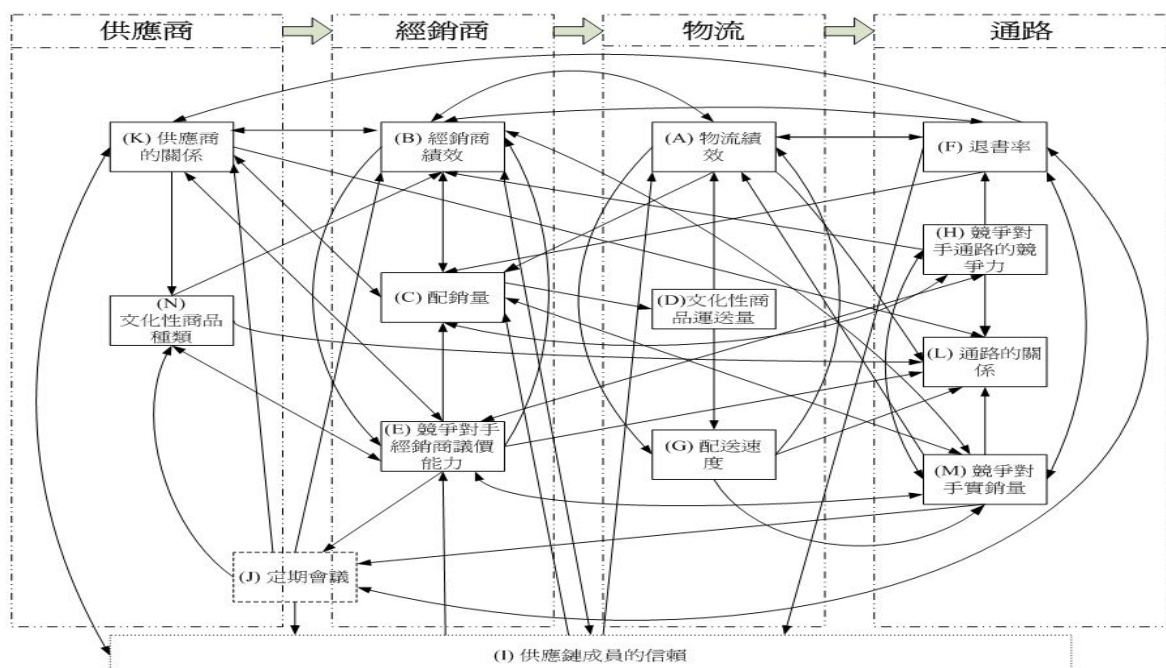
$$
\begin{bmatrix}
0 & 0.65 & 0.48 & 0 & 0 & -0.4 & 0.7 & 0 & 0 & 0 & 0 & 0.7 & 0 & 0 \\
0.7 & 0 & 0.8 & 0 & -0.2 & -0.73 & 0 & 0 & 0.7 & 0 & 0.63 & 0 & -0.3 & 0 \\
0 & 0.61 & 0 & 0.7 & 0 & 0 & 0 & -0.6 & 0 & 0 & 0.3 & 0 & -0.4 & 0 \\
0.28 & 0 & 0 & 0 & 0 & 0 & -0.38 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & -0.68 & -0.68 & 0 & 0 & 0 & 0 & 0.48 & 0 & 0.6 & -0.58 & -0.4 & 0.33 & -0.4 \\
-0.7 & -0.73 & -0.8 & 0 & 0 & 0 & 0 & 0 & -0.6 & 0.4 & -0.4 & 0 & 0.4 & 0 \\
0.68 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.43 & -0.2 \\
0 & -0.75 & -0.6 & 0 & 0.65 & 0.2 & 0 & 0 & 0 & 0 & 0 & -0.3 & 0.9 & 0 \\
0.38 & 0.6 & 0.31 & 0 & -0.3 & 0 & 0 & 0 & 0 & 0 & 0.43 & 0 & 0 & 0 \\
0 & 0.4 & 0 & 0 & 0 & -0.33 & 0 & 0 & 0.4 & 0 & 0.45 & 0 & 0 & 0.23 \\
0 & 0.41 & 0.78 & 0 & -0.23 & 0 & 0 & 0 & 0.7 & 0 & 0 & 0.33 & 0 & 0.38 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-0.35 & -0.68 & -0.5 & 0 & 0.73 & 0.73 & 0 & 0.6 & 0 & 0.3 & 0 & -0.73 & 0 & 0 \\
0 & 0.25 & 0 & 0 & -0.28 & 0 & 0 & 0 & 0 & 0 & 0 & 0.28 & 0 & 0
\end{bmatrix}
\tag{1}
$$

$$
A = \frac{1}{1 + e^{-(\lambda \, ai)}}
\tag{2}
$$

圖 2 模糊認知圖疊代計算結果
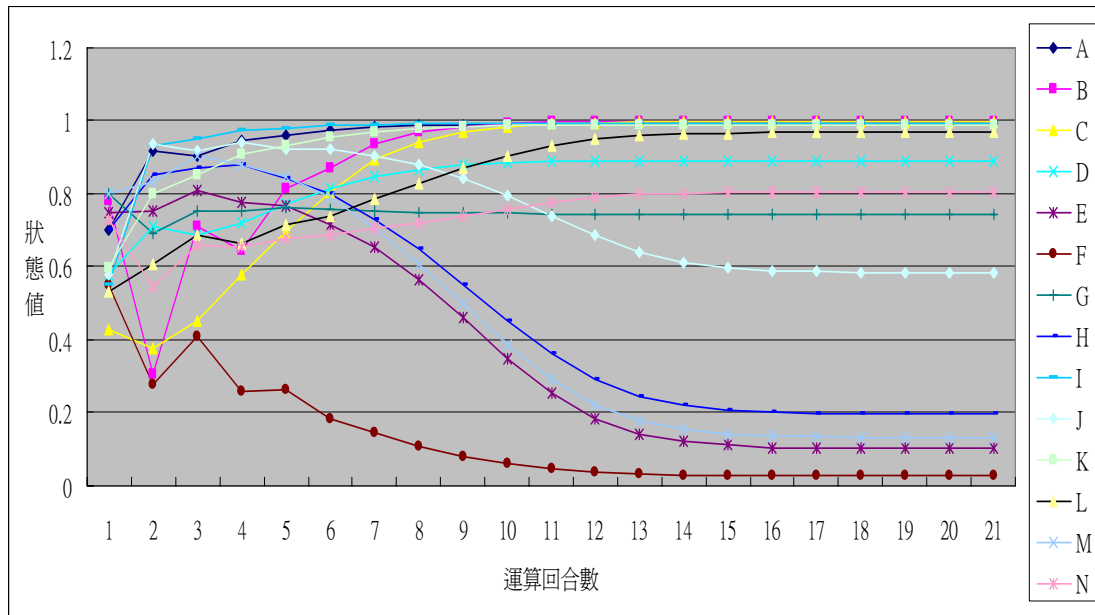
　　本研究透過專家訪談與資料文獻收集建立全家便利商店文化性商品供應鏈系統關聯圖後，探討全家便利商店文化性商品供應鏈運作上所受到的影響因素，並經由模糊認知圖法之應用，以全家便利商店文化性商品供應鏈為研究對象進行系統之操作及模擬分析。在系統關聯模式的建構過程中，本研究以模糊認知圖建立全家便利商店文化性出版品供應鏈架構與系統變數，利用專家意見，經過系統之模擬與比較之後，架構類似真實狀況之系統關聯模式，並提出三項模擬操作程序以提供未來相關應用之參考。

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3. 黃昱凱*、陳昶維 (2008)，臺灣便利商店文化性商品物流公司競爭之分析-以大智通行銷通路為例，第四屆華文出版趨勢研討會 (中國北京)，頁 217-240。

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、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）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

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1. 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

   □ 未達成目標（請說明，以 100 字為限）

   　　□ 實驗失敗

   　　□ 因故實驗中斷

   　　□ 其他原因

   說明：

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2. 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

   專利：□已獲得 □申請中 □無

   技轉：□已技轉 □洽談中 □無

   其他：（以 100 字為限）

---

3. 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）（以 500 字為限）

   本研究以我國之雜誌零售市場為分析對象，係基於：（1）該產業的產值相對於我國雜誌經營物流需求的產值，佔有重要的地位；（2）研究個案本身由多家品牌通路共同成立，通路間的成員除了必須在共同成立雜誌經銷商的架構下相互合作努力外，對於其它的商業模式卻必須彼此競爭，面對既競爭又合作的混沌環境下，進一步探討影響研究個案本身經營績效的因素以及因素間的關係，並藉此研擬經營策略的方案便成為一個重要且有趣的課題；（3）由便利商店所成立的雜誌經銷機制是我國與其他國家在相關產業發展上最主要的差異，且其市場競爭饒富變化，顯示本計畫深具研究之價值。整體而言，本研究將有助於瞭解在以便利商店為主的雜誌零售市場中，不同的供應鏈組織對於物流服務之需求及影響經銷商績效的因素，並針對雜誌經銷商研擬相對應的物流競爭策略，提供相關業者之規劃參考，期能滿足我國雜誌出版商與零售通路對於運籌需求的服務。研究的成果期能彌補過去我國在雜誌配送市場的環境中，對於雜誌零售通路所衍生出的物流需求瞭解的不足。

國科會補助專題研究計畫項下出席國際學術會議心得報告

計畫編號	NSC　　98－2410－H－343－037－SSS		
計畫名稱	應用模糊認知圖探討整合供應鏈管理對雜誌經銷商績效之影響		
出國人員姓名	黃昱凱	服務機構及職稱	南華大學出版與文化事業管理研究所助理教授
會議時間	99 年 1 月 9 日 至 99 年 1 月 10 日	會議地點	中國哈爾濱
會議名稱	國務物流與智能研討會 International Conference on Logistics Systems and Intelligent Management		
發表論文題目	應用模糊認知圖探索第三方物流業者營運動態變化 A Fuzzy Cognitive Map Modeling to Explore the Operation Dynamics of Third-party Logistics Providers		

一、參加會議經過

　　1/8 由台北飛哈爾濱，晚上參加歡迎晚宴，1/9 整天早上聽取專題演講（A.J.M. Wheatcroft, University of STIRLING 與王國文，綜合開發研究院物流與供應鏈管理管理研究所），下午參加研討會並進行論文發表。

二、與會心得

　　中國大陸的物流發展快速，但相關研究方法仍稍嫌不足。

四、建議

　　可以加強與大陸產業或學者的學術產學合作。

五、攜回資料名稱及內容

　　議程相關資料、專題演講簡報 PPT 與會議論文集光碟片

國科會補助專題研究計畫項下出席國際學術會議心得報告

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五、攜回資料名稱及內容

　　議程相關資料、專題演講簡報PPT與會議論文集光碟片

A Fuzzy Cognitive Map Modeling to Explore the Operation Dynamics of Third-party Logistics Providers

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Abstract: In Taiwan, e-tailers have formed partnerships with third-party logistics providers (3PLs) and convenience stores so that the service of shopping on-line in an electronic store and picking up goods at a convenience store could be quite common and popular these days. This study observes that the e-tailers have more bargaining power at its disposal comparing to its counterparts, 3PLs, in the sense of partnership. The study applies the methodology of "Fuzzy cognitive maps" to model and explore the operation dynamics for 3PLs. The results show that the improvement on "Relationship with e-tailers" and "Logistics performance" could significantly facilitate 3PLs in expanding the market shares, total profits and somewhat mitigating the problems 3PLs would have encountered.

Key Words: e-commerce, third-party logistics providers (3PLs), fuzzy cognitive maps (FCM)

I. INTRODUCTION

In Taiwan, the service of "Shopping on-line on the websites and picking up goods in a convenience store" has been a lot popular these days. Many e-tailers have formed close partnership with widespread convenience stores in the area of retailing delivery system originating from resolving delivery problems, so that consumers can order the goods on websites and pick up their ordered goods at the convenience store based on their scheduling preferences. Nowadays, over 1,200,000 transactions have been completed via electronic commerce through the retail delivery mechanism per month (Feng & Huang, 2005). The integration of e-commerce and logistics system of convenience stores is called "E-commerce retailing delivery (RD) model." It provides consumers with service of shopping on-line in an electronic store and picking up goods at a preferred convenience store.

In the e-commerce RD model, third-party logistics providers perform in roles of bridging the service functions of e-tailers and convenience stores. Third-party logistics (Hereafter referred as 3PLs) involves the utilization of external organizations to execute logistics activities that have traditionally been performed within an organization itself. Services such as warehousing, packaging and transportation that are not crucial to e-tailers, no longer needed to be exclusively managed by e-tailers, are outsourced to third-party logistics providers. Thus, 3PLs are important middlemen connecting the dots between e-tailers and logistics systems of convenience stores.

The details about the goods flow and information flow within the e-commerce RD model are is presented in Figure 1. E-tailers are mainly responsible for maintaining the shopping platform, promoting and selling commodities to the consumers while 3PLs are in charge of preserving, packaging and transporting the commodities for the cooperative e-tailers. The examples of renowned and sizable e-tailers in Taiwan are PayEasy and Yahoo, and their partners are both Choice Logistics and Kyyo Logistics.

Because of the necessity to cooperate, e-tailers and 3PLs have jointly built up the information system for transmitting the order data, and negotiated the transmission format and timeframe to uphold the desired efficiency. Moreover, the inter-exchanging flows of information, goods, and cash between the two parties are smooth and frequent without a hitch. Like two departments in a company, they have meetings frequently for the purposes of communications and negotiations in pricing and services, performance reviews, status and inventory check, etc. Hence, the tight cooperation and close relationship between the e-tailers and 3PLs are extremely effective as result.

In order to get to overcome and explore the vagueness of the dynamics, it may be more appropriate to apply Fuzzy Cognitive Maps (FCMs) because of its fewer limitations in application, and it may help smooth the kinks for potential research obstacles. The objectives of this study are: (1) To set up a third-party logistics provider-based fuzzy cognitive maps. (2) To acquire insights from different scenarios as to how critical concepts would have influenced the entire system. Through fuzzy cognitive maps, concepts and casual relationships among concepts will be specified and would facilitate 3PLs in implementing the strategies from a global and systematic perspective.

FIGURE Ⅰ THE E-COMMERCE RETAILING DELIVERY MODEL

modeling methodology rooted in a combination of fuzzy logic and neural networks. FCMs map the objective environment through concepts and causal relationship among concepts. Concepts and causal relationships among concepts are developed by the experts who operate, supervise, or know the environment well enough as well as how the concepts behave under different circumstances. Each concept could represent an entity, a variable, or so on due to the characteristic of the system. Causal relationships among concepts in that objective environment are developed through human experience and knowledge.

B. The applications of FCM

FCM is comparatively easier to quantify, and then foretells state transitions through a simple matrix calculation. Due to the advantage, FCM has been applied to not only social science such as investment analysis problems (Lee & Kim, 1997), political problems (Athanasios, Ilias & Konstantinos, 2003), and critical success factors modeling for an IT project process (Luis, Rossitza & Jose, 2007), but also to engineering such as behavioral analysis of electronic circuit (Styblinski & Meyer, 1991) and knowledge modeling for urban design (Xirogiannis, Stefanou, & Glykas, 2004). Besides, FCM is also applied to strategic planning such as modeling political and strategic issues and situations (Andreou, Mateou & Zombanakis, 2005), and simulating the information systems of a strategic planning process (Kardaras & Karakostas, 1999). The area of decision-making, project management, and investment analysis is also applied, for example, relationship management in airline service (Kang, Lee & Choi, 2004).

III. CONSTRUCTION OF FCM

A. Defining concepts of FCM

In order to build up the fuzzy cognitive maps to acquire the insightful characteristics on the problems, the first step is to explore the concepts within fuzzy cognitive maps. The construction of concepts this paper is primarily based on field trips to selected 3PLs and in-depth interviews with experts within the e-commerce RD model. In the process of field trips and in-depth interviews, several problems are identified as follow and incorporated into the concepts of FCM.

(1) Growing Competitor Competitiveness: No matter what sorts of industries, they are destined to struggle against competitors, so are the 3PLs. But in the e-commerce RD model, e-tailers' power is so big and unchallenged that they compels 3PLs to help hasten the pace of growth in maturity for other 3PLs.

(2) E-tailer balances the risk with order-dispensing act: In the practice of risk-aversion from overtly depending on cooperative 3PLs, the e-tailers transfer the pre-designated orders to other 3PLs to reinforce their bargaining power. Moreover, high utilization rate of 3PLs may lead to order transfer because e-tailers would like to spread the risk through order diversification. And it is natural and inevitable that they may keep in mind whether 3PLs's fixed assets could function well and as expected at all the time.

II. CONCEPT OF FCM AND ITS APPLICATIONS

A. Theoretical background

Fuzzy cognitive maps (FCMs) are viewed as an extension of cognitive maps. A cognitive map demonstrates how humans deliberate upon a particular issue to attain the want by analyzing, reorganizing the problems and graphically mapping interconnected concepts (Eden & Ackermann, 2004). For that reason, cognitive maps enable decision-makers to analyze the potential casual relationships among concepts and can unearth more significant and meaningful solutions. A cognitive map consists of nodes representing the most relevant concepts in an objective environment (Axelrod, 1976). Through adding plus (+) and minus (−) signs, it allows the identification for the type of relationship (Dikerson & Kosko, 1993), positive or negative. Positive relationship means this concept has a positive impact on the other concept while negative relationship means the one has a negative impact on the other. Guided by these representations, a cognitive map can be expressed through a calculation of an adjacency matrix showing the sign of the relationship.

However, one major limitation exists in cognitive maps, that is, the restriction of quantifying causal relationships among variables. In order to overcome the weakness, fuzzy numbers were incorporated to form a new technique that was named Fuzzy cognitive maps. FCMs are essentially a

(3) Ownership Status: Talents turnover rate, along with confidentiality disclosure of customer base is the major challenge that 3PLs must face. Moreover, the mixture of high utilization rate and low gross profit together would pose as hardship to 3PLs, too, making 3PLs think twice over whether or not to invest more in fixed assets.

All the identified problems and the corresponding reasons behind these problems are mapped into the constructed FCM. Since there are few available literatures on the subject of e-commerce RD model therefore the reviewed literatures tend to focus on the selection of 3PLs. It is because the study observes that e-tailers have more bargaining power at their disposal and the literatures could depict what customers expect 3PLs to be, which could describe more suitably the considerations 3PLs have to take into account. After the field trips to selected 3PLs, in-depth interviews with experts, and literatures are reviewed, concepts are constructed. The Table 1 below shows the constructed concepts and respective definitions.

TABLE Ⅰ The concepts in the FCM and their definitions

Concepts	Definitions
Market Share	The percentage or proportion of a 3PL's order volume (in a market) divided by the total order volumes in e-commerce retailing delivery market.
Logistics Performance	The speed and reliability of data transmission, warehousing, sorting, picking, packaging and transportation services.
Total Profit	The difference between revenue and total cost.
Relationship with E-tailers	A relatively long-term association between two or more entities. Sales representatives may involve in, for example, price, order volume, etc through their friendship with e-tailers.
Competitors Competitiveness	The competitors' power in the e-commerce RD system. It can be depicted as an overall image of competitor ability, performance and relationship with cooperated e-tailers.
E-tailers' Balancing Order	In order not to overtly depend on certain provider, e-tailers usually give balancing order to other provider.
Turnover of Talents	Talents sometimes may be head-hunted and thus enhance competitors' competitiveness.
Confidentiality Disclosure	When talents are head-hunted, they may take the techniques, and/ or customer confidentiality along with their departures.
Avg. Logistics Cost Per Unit	The average cost per unit incurred from integration of information, transportation, inventory, warehousing, and packaging.
Utilization Rate	The ratio of realistic throughput/Max. Capacity.
Unfitting Size of Fixed Assets	Property, plant, and equipment may be insufficient because of large order, breakdown, etc.

B. Measure Model

The proposed fuzzy cognitive map (see Fig.2) is constructed according to the identified operation problems which 3PLs would have encountered. In the proposed FCM, directional arc represents the causal relationship. The dotted arcs will be activated if the value of concept state is above or below the threshold. For example, if the utilization rate is high enough, the problem of unfitting size of fixed assets will then be perceived. As soon as the problem of unfitting size of fixed assets is activated, other related concepts will then be perceived(shown by the dotted arcs from or to the concept of unfitting size of fixed assets). The concepts confirmation, the initial rating of concepts, and the strength of causal relationship will be evaluated by experts in this field.
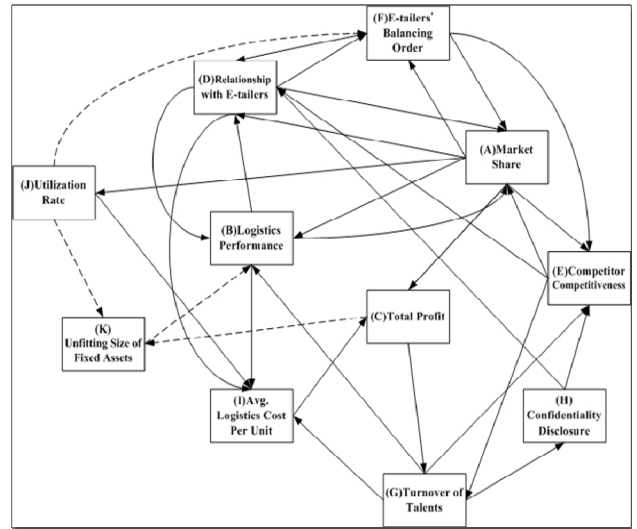

FIGURE Ⅱ THE PROPOSED FCM .

IV. CALCULATION OF CONCEPT WEIGHTS AND VALUES

A. Data consistency verification and processing

Experts inquired in this research are top echelon of the management at e-tailers- Yahoo, PayEasy (responsible for the assessment of initial state) and 3PLs- Kyyo Logistics (responsible for adjacency matrix). The two e-tailers account for about 80% market shares in the e-commerce RD market in Taiwan and Kyyo Logistics is their main partner. After the in-depth survey, four surveys are collected. The directional arcs between the concepts in the Fig.2 represent the strength of causal relationship, which is solicited and gathered through the survey process. Every expert is asked to fill the values (eij) corresponding to the cells of the Table (see Appendix I).

Besides, not only the impact of strength but also the initial rating (initial state, C_0) of the concepts state is also inquired. The rating of concept state represents the assessment of current state. Its interval falls within [0, 1]. All the experts are consulted with their experience and knowledge evaluated on a numerical scale. In order to avoid illogical deviation and error, each value in the survey cell is rigorously checked to ensure that the value difference in

each cell of every survey is within a reasonable range. The verification of whether the value conflicting with the prior experience is also implemented as result.

Once all the value is within the acceptable range, the data operation will be actuated. Let S_i be the weighting of expert i and w_i the adjacency matrix of the FCM defined by that expert. The final adjacency matrix is then given by a normalized sum according to the following formula:

$$W = \sum_{i=1}^{N} S_i W_i / \sum_{i=1}^{N} S_j \qquad (1)$$

As soon as the adjacency matrix is operated, the C_i (t_{n+1}) could be manipulated by the following equation:

$$C_i(t_{n+1}) = S\left[\sum e_{ki}(t_n)C_k(t_n)\right] \qquad (2)$$

$C_i(t_{n+1})$ is the value of concept C_i at step t_{n+1}, $C_k(t_n)$ is the value of concept C_k at step t_n, and $e_{ki}(t_n)$ is the weight of the interconnection from concept C_j to concept C_i and $S(x)$ is a bounded signal function that transformed the result of the multiplication in the interval [0, 1].

The strength of causal relationship is shown in the above cells. The values in the brackets stand for the negative impact of concept in the column to those in the corresponding row while the other values show no or positive impact. The absolute value above 0.50 is underlined. As soon as the input data is collected, the sensitivity analysis is executed. Through sensitivity analysis, it is found that: Market share, Logistics Performance, Relationship with E-tailers and Competitor Competitiveness are four significant concepts that have decisive effects on the entire objective environment.

B. Results

After the data collection and processing, the original output of proposed FCM is described as Fig. 3. We can observe that the value of each concept will vibrate, and when the vibration would be stable after several runs. It is noticed that Kyyo Logistics remains competitive because market share, relationship with e-tailers and logistics performance stay in good range if top management decides no changes in the operation.

The concepts incorporated need time to ferment in real world, each run is assumed to be 10 workdays, or 14 days instead. Kyyo Logistics, usually in the practice, needs about 5 to 10 workdays to respond to the changes. Moreover, the concepts- "Relationship with e-tailers", "Logistics performance", "Market shares", and "Competitor Competitiveness" are the critical elements mentioned before with considerable influences over the entire fuzzy cognitive map, accordingly, the following analyses will center and converge on these concepts. The major findings as the following:

(1) Value of concept A (Market share) keeps vibrating within the range [0.79, 0.82]. It shows there is no fierce change the market share as the time goes by.

(2) Value of concept B (Logistics performance) vibrates within the range [0.71, 0.83], and somewhat represents logistics performance will drop a little bit about 40 workdays later.

(3) Value of concept D (Relationship with e-tailers) vibrates at first and has almost no changes in the long run.
(4) Value of concept E (Competitor competitiveness) drops to a range [0.52, 0.54] after 80 workdays.

To conclude, the study observes that if there is no sudden accident to the case company, it will survive as time flows. Its market share will remain high, relationship with e-tailers will still be good, and the competitor competitiveness will decrease. However, the logistics performance drops a little. Thanks to the decreased competitor competitiveness, the market share will stay at the high level.
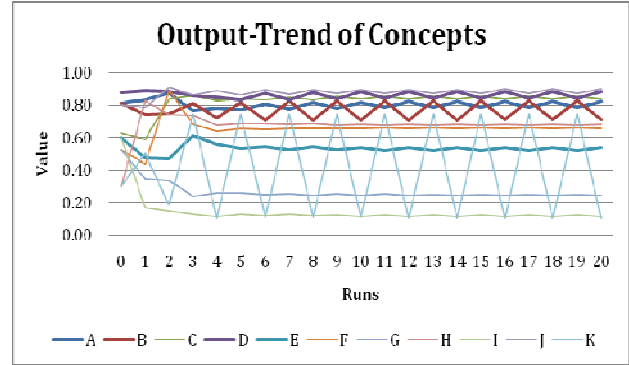

FIGURE III THE OUTPUT OF PROPOSED FCM .

V. CONCUSSIONS AND SUGGESTIONS

E-tailing has been a popular business in recent years, and it becomes more conspicuous than before especially after the global financial crisis. However, how to deliver the goods to the consumers is a big issue to the e-tailers. Thanks to the widespread convenience stores in Taiwan and the well-functioned third-party logistics providers, e-tailers can successfully find out a way to have consumers' orders delivered. That is, e-tailers successfully provide consumers with the service of shopping on-line in an electronic store and picking up goods at a convenience store. It is the third-party logistics providers that put the finishing touch on the e-commerce retailing delivery.

In this study, the FCM concerning the operation dynamics of the third-party logistics providers within the e-commerce retailing delivery model is constructed and explored. Through the many field trips to the selected companies of third-party logistics providers, in-depth interviews as well as discussions with experts, and literature reviews, this research constructs 11 concepts and explores the strength of causal relationship among them. The influential concepts such as market share, logistics performance, and relationship with e-tailers are identified and elaborated.

The output of FCM has shown reasonable trends and effects in relation to the scenarios studied. What interest us the most are the connections among and in between logistics performance, unfitting size of fixed assets and relationship with e-tailers; because they cast more impacts on the entire concepts interwoven within the objective environment.

It has been noticed that the model predicts an ascending market share and total profit if the relationship with e-tailers, unfitting size of fixed asstes and logistics

performance are significantly improved. It should also be reiterated that this is a model with much unintended vagueness, and can be more credible if more authoritative opinions from experts are incorporated. The study also admits that the constructed FCM would be more delicate if more concepts are taken into account. Besides, the procedure of data collection and processing is not conscientious enough. It is, however, a useful tool for quick and comprehensive explorations, for better understanding of the dynamics involved, and for building a basis of more complicated scenarios. Further explorations are needed to verify its credibility and to fine-tune the various concepts and operation processes involved.

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Appendix I The Input Data*

	A	B	C	D	E	F	G	H	I	J	K
A. Market Share	0.00	(0.07)	0.63	0.43	(0.46)	0.42	0.00	0.00	0.00	0.68	0.00
B. Logistics Performance	0.56	0.00	0.00	0.75	0.00	0.00	0.00	0.00	(0.30)	0.00	0.00
C. Total Profit	0.00	0.00	0.00	0.00	0.00	0.00	(0.48)	0.00	0.00	0.00	(0.63)
D. Relationship with E-tailers	0.59	0.58	0.00	0.00	0.00	(0.46)	0.00	0.00	(0.10)	0.00	0.00
E. Competitor Competitiveness	(0.60)	0.00	0.00	(0.50)	0.00	0.00	0.20	0.00	0.00	0.00	0.00
F. E-tailers' Balancing Order	(0.41)	0.00	0.00	(0.20)	0.40	0.00	0.00	0.00	0.00	0.00	0.00
G. Turnover of Talents	0.00	(0.25)	0.00	0.00	0.19	0.00	0.00	0.75	0.32	0.00	0.00
H. Confidentiality Disclosure	0.00	0.00	0.00	(0.10)	0.14	0.00	0.00	0.00	0.00	0.00	0.00
I. Avg. Logistics Cost Per Unit	0.00	0.00	(0.70)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J. Utilization Rate	0.00	0.00	0.00	0.00	0.00	(0.30)	0.00	0.00	(0.30)	0.00	0.35
K. Unfitting Size of Fixed Assets	0.00	(0.20)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(0.75)	0.00
Initial Rating	0.81	0.81	0.63	0.88	0.70	0.53	0.53	0.30	0.60	0.60	0.50

*The value of eij asked will be confined to the interval [-1, 1], and telling the strength of relationship of concepts in the column on those in the row. For example, the impact value of concept A on E is 0.75, which represents the concept A has the impact on the concept E, the strength of relationship is 0.75. ( ) showing the negative impact and 0.00 means no impact. In order to avoid illogical deviation and errors, the verification of whether the value (eij) conflicted with prior experience is executed. Moreover, each value in the cells of survey (eij) is checked to ensure that the value in each cell of every survey is within a reasonable interval. That interval is set as 0.33. If the value difference between maximum and minimum given by experts is above 0.33, the discussion and negotiation with experts about the eij will be necessary work. Until the deviation is within the anticipative interval and without confronting prior experience, the values of all cells (eij) will be applied. At the bottom of the table shows the concept raiting from the e-tailers. It shows how the e-tailers perceive the concept of Kyyo Logistics.

無研發成果推廣資料

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、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）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 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 □未達成目標（請說明，以 100 字為限） 　　　□實驗失敗 　　　□因故實驗中斷 　　　□其他原因 　說明：
2. 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 專利：□已獲得 □申請中 ■無 技轉：□已技轉 □洽談中 ■無 其他：（以 100 字為限） 相關研究已經投稿一篇國際研討會、一篇兩岸研討會以及「運輸計畫季刊（審查中）」
3. 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）（以 500 字為限） 本研究以我國之雜誌零售市場為分析對象，係基於：(1)該產業的產值相對於我國雜誌經營物流需求的產值，佔有重要的地位；(2)研究個案本身由多家品牌通路共同成立，通路間的成員除了必須在共同成立雜誌經銷商的架構下相互合作努力外，對於其它的商業模式卻必須彼此競爭，面對既競爭又合作的混沌環境下，進一步探討影響研究個案本身經營績效的因素以及因素間的關係，並藉此研擬經營策略的方案便成為一個重要且有趣的課題；（3）由便利商店所成立的雜誌經銷機制是我國與其他國家在相關產業發展上最主要的差異，且其市場競爭饒富變化，顯示本計畫深具研究之價值。整體而言，本研究將有助於瞭解在以便利商店為主的雜誌零售市場中，不同的供應鏈組織對於物流服務之需求及影響經銷商績效的因素，並針對雜誌經銷商研擬相對應的物流競爭策略，提供相關業者之規劃參考，期能滿足我國雜誌出版商與零售通路對於運籌需求的服務。研究的成果期能彌補過去我國在雜誌配送市場的環境中，對於雜誌零售通路所衍生出的物流需求瞭解的不足。