

行政院國家科學委員會專題研究計畫 期末報告

客製化商品與雲端服務資訊系統發展策略之研究

計畫類別：個別型
計畫編號：NSC 101-2410-H-041-003-
執行期間：101年08月01日至102年07月31日
執行單位：嘉南藥理科技大學資訊管理系

計畫主持人：洪健文

計畫參與人員：碩士班研究生-兼任助理人員：李冠諺
大專生-兼任助理人員：林鈺龍

報告附件：出席國際會議研究心得報告及發表論文

公開資訊：本計畫涉及專利或其他智慧財產權，1年後可公開查詢

中 華 民 國 102 年 10 月 31 日

中文摘要：隨著雲端服務以及網際網路和電子商務的發展，企業得以與顧客進行一對一接觸並提供電子化的服務。然而，雲端服務與網際網路的便利性，使得網路行銷的競爭優勢多於傳統的行銷市場，顧客也因選擇性增多而忠誠度降低。因此，如何吸引顧客是企業經營的一大挑戰。提供雲端服務客製化產品服務以符合顧客需求是一種解決問題的方式。本文提出一個雲端服務客製化產品資訊系統，以幫助企業能於網際網路中提供客製化產品行銷，以符合客製化的產品消費需求，藉此達到刺激顧客購買意願，以增加銷售量。本文提出的雲端服務資訊系統發展策略架構包含三個構成要素：(1) 電子商務服務；(2) 促銷類型模組；(3) 雲端服務客製化促銷產品。首先，制定電子商務服務，並以銷售促銷策略為理論基礎；其次，先利用類神經網路中的自適應共振理論(Adaptive Resonance Theory Network, ART)進行市場區隔後，再運用資料探勘技術中的關聯規則探勘(Association Rule Mining)及序列型樣探勘(Sequential Pattern Mining)有效率地分析顧客（包括所有顧客、族群顧客以及個別顧客）消費行為，找出候選促銷產品；最後，利用雲端服務評估指標對候選促銷產品進行評估以產生最終的促銷產品。另一方面，除了雲端服務客製化的促銷產品外，促銷產品的促銷數量將隨顧客的不同而調整。盼能藉由以主動的雲端服務客製化促銷產品與數量，提高顧客忠誠度並且增加企業利潤。

中文關鍵詞：雲端服務客製化產品促銷、資料探勘、電子商務、雲端運算、類神經網路

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loyalty due to selective increase reduces. Therefore, how to attract customers is a big business challenge.

The paper presents a cloud service customized product information system, to help businesses to be able to provide customized product marketing in the Internet in order to meet consumer demand for customized products, in order to stimulate the customers buying in order to increase sales. Cloud service of information system development strategic framework proposed in this article contains three elements: (1) e-commerce services, and (2) promotion type modules, and (3) the cloud services customized promotional products.

First of all, develop e-commerce services, and sales promotion strategy as the theoretical basis and, second, first class of neural network Adaptive resonance theory (Adaptive Resonance Theory Network, ART) following a market segment and application of association rules in data exploration techniques exploration (Association Rule Mining)-and sequence-like exploration (Sequential Pattern Mining) Efficient analysis of customers (includes all customers, community customers, individual customers), consumer behavior, identify candidates for promotional products and, finally, using the cloud service delivery and evaluation of targets to evaluate candidates for promotional products to produce the final promotional products. The other hand, in addition to cloud services customized promotional products, promotional products sales quantity will vary for different customers and adjust. We hope that through active cloud services to customized promotional products and quantity, increase customer loyalty and increased profits.

英文關鍵詞： Cloud services customized product promotions, data mining, e-commerce, cloud computing, artificial neural network

行政院國家科學委員會補助專題研究計畫

☐期中進度報告
☒期末報告

客製化商品與雲端服務資訊系統發展策略之研究

計畫類別：☒個別型計畫 ☐整合型計畫

計畫編號：NSC 101－2410－H－041－003－

執行期間：101年8月1日至102年7月31日

執行機構及系所：嘉南藥理科技大學資訊管理系

計畫主持人：洪健文

共同主持人：

計畫參與人員：李冠諺、林鈺龍

本計畫除繳交成果報告外，另含下列出國報告，共 ____ 份：

☐移地研究心得報告

☒出席國際學術會議心得報告

☐國際合作研究計畫國外研究報告

處理方式：除列管計畫及下列情形者外，得立即公開查詢

☐涉及專利或其他智慧財產權，☒一年☐二年後可公開查詢

中 華 民 國 102 年 10 月 26 日

中文摘要

隨著雲端服務以及網際網路和電子商務的發展，企業得以與顧客進行一對一接觸並提供電子化的服務。然而，雲端服務與網際網路的便利性，使得網路行銷的競爭優勢多於傳統的行銷市場，顧客也因選擇性增多而忠誠度降低。因此，如何吸引顧客是企業經營的一大挑戰。

提供雲端服務客製化產品服務以符合顧客需求是一種解決問題的方式。本文提出一個雲端服務客製化產品資訊系統，以幫助企業能於網際網路中提供客製化產品行銷，以符合客製化的產品消費需求，藉此達到刺激顧客購買意願，以增加銷售量。本文提出的雲端服務資訊系統發展策略架構包含三個構成要素：(1) 電子商務服務；(2) 促銷類型模組；(3) 雲端服務客製化促銷產品。

首先，制定電子商務服務，並以銷售促銷策略為理論基礎；其次，先利用類神經網路中的自適應共振理論(Adaptive Resonance Theory Network, ART)進行市場區隔後，再運用資料探勘技術中的關聯規則探勘(Association Rule Mining)及序列型樣探勘(Sequential Pattern Mining)有效率地分析顧客（包括所有顧客、族群顧客以及個別顧客）消費行為，找出候選促銷產品；最後，利用雲端服務評估指標對候選促銷產品進行評估以產生最終的促銷產品。另一方面，除了雲端服務客製化的促銷產品外，促銷產品的促銷數量將隨顧客的不同而調整。盼能藉由以主動的雲端服務客製化促銷產品與數量，提高顧客忠誠度並且增加企業利潤。

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Abstract

With the development of cloud services and the Internet and e-commerce, enterprise to one-to-one contact with customers and the delivery of electronic services. However, cloud services and the convenience of the Internet, makes the network marketing of competitive advantage than traditional marketing, customer loyalty due to selective increase reduces. Therefore, how to attract customers is a big business challenge.

The paper presents a cloud service customized product information system, to help businesses to be able to provide customized product marketing in the Internet in order to meet consumer demand for customized products, in order to stimulate the customers buying in order to increase sales. Cloud service of information system development strategic framework proposed in this article contains three elements: (1) e-commerce services, and (2) promotion type modules, and (3) the cloud services customized promotional products.

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一、前言

當網際網路的環境越趨成熟時，對傳統產業的商業活動產生重大的變革，眾多的行業爭相投入電子商務市場，使得顧客與企業直接接觸，形成全年無休、不受地域國界限制的網路市場，創造了可觀的市場商機，這就是「電子商務」(Electronic Commerce, EC)，透過網際網路做生意，一種全新的商業行為模式，只要上網並移動滑鼠就可輕易購物。而由於網路商業交易相關技術的發展快速，在目前所使用的商業模式及交易行為，比價、採購、付款…等，在網際網路上變得更迅速、更方便、更有效率、更省錢。根據網際網路測量公司 Net Value 的調查顯示，由於網路交易比起實體通路消費便宜，而且有許多省錢的資訊可以互通，使得提供網路交易的「電子商務」類型網站訪客不斷成長。而最受歡迎的「電子商務」類型網站包括音樂類型網站、旅遊類型網站、購物中心類型網站、電腦 3C、時尚美容類型網站等。

為使顧客及企業真正感受「網路行銷」帶來之益處，解決方式之一就是提供客製化顧客的服務，借助資訊科技有效率地蒐集、分析，以產生符合顧客的需求。因此，本計畫提出一個以客製化顧客的服務為目的，並協助企業透過雲端資訊科技技術快速地且正確地分析顧客的消費行為，並主動提供分析後的結果，亦即主動促銷產品，並給予顧客較低的促銷價，不但可節省顧客購買商品的時間，另一方面由於符合個別顧客的需求，成交機率將可因而提高，為顧客及企業創造雙贏局面。

二、研究目的

企業於雲端服務環境中提供客製化顧客服務已成為時勢所趨，然而要如何正確且快速地了解顧客的需求是企業提供客製化服務時應考量的重點，因此，本計畫針對客製化顧客服務的應用，並運用資料探勘技術從大量資料中找出符合顧客需求的促銷產品，主動告知個別顧客，節省顧客尋找產品的時間，以提升企業競爭力並提高企業利潤。

因此，本計畫的目的為建構有關於雲端服務客製化商品評選資訊系統，以提供給業界參考與應用，

本計畫的執行步驟如下所示：

- (1) 透過相關文獻，收集與整理雲端運算服務客製化商品的評選之議題，探討企業或組織應用雲端運算服務所可能產生之利益與問題。
- (2) 透過相關文獻，收集與整理評選雲端運算服務客製化商品的指標。透過專家問卷後，利用因素分析法篩選與關聯式法則與類神經網路方法，歸納出影響雲端服務客製化商品的指標，並藉此建立雲端運算服務客製化商品評選之資訊系統架構。
- (3) 進行雲端服務客製化商品評選系統之開發與實證分析，以強化本計畫所提出之雲端運算服務客製化商品評選之模式與系統的實用性，以提供雲端運算服務的模式讓企業參考。

而雲端服務客製化電子型錄優於傳統型錄有以下兩個基本利益：

- (1) 雲端服務客製化電子型錄所提供之資訊內容較為廣範且具深度：其所能提供的資訊量遠超過傳統型錄所能提供的部份，且不會像傳統型錄受版面篇幅的限制。
- (2) 雲端服務客製化電子型錄具有較佳的時效性：電子型錄可以即時或經常的更新內容，提供消費者最新的訊息，與傳統型錄一年或幾個月更新一次內容的週期成為強烈的對比。

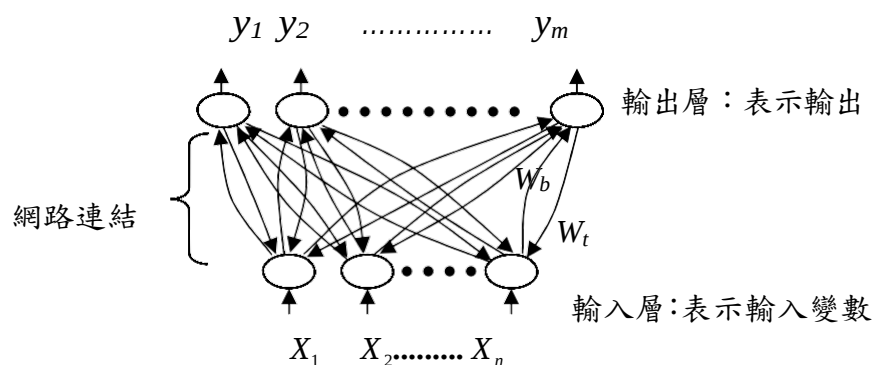
三、文獻探討

1. 自適應共振理論網路 (Adaptive Resonance Theory Network, ART)

自適應共振理論是Carpenter & Grossberg 於1976年提出的一種非監督式學習網路模式，能從問題領域中取得訓練範例，並從中學習範例的內在聚類規則，以應用於新的案例，推論出哪些訓練範例應屬於同一聚類。其基本原理可溯自認知學 (Cognitive)，人類記憶系統原來儲存一些已知的事物，當它記憶新的事物時，對於以前所記憶的事物又需保留，有時可能有矛盾，而ART即採用「Vigilance Test」來解決此一矛盾，原理如下：

- (1) 如果新的事物特性與記憶中「某一個」舊事物的特性相似，則只修改系統中該舊事物的部分記憶，使其能同時滿足新舊事物的特性，可滿足穩定性的要求。例如，一訓練範例特性與現有的某族群夠相似，ART 允許其修改該族群之特性。
- (2) 如果新的事物特性與記憶中「所有的」舊事物的特性均不夠相似，則系統為新的事物建立全新的記憶，以迅速地學習此新事物，如此可滿足可塑性的要求。例如，一訓練範例特性與所有族群不夠相似，此訓練範例形成一個新的族群。

ART 網路基本架構如下所示，包括：



圖一、自適應共振理論網路基本架構

- (1) 輸入層：用以表現網路的輸入變數，即訓練範例的輸入向量 $X=\{x_1, x_2, \dots, x_n\}$ 也可稱為特徵向量。處理單元數目依問題而定，單元內採用線性轉換函數，即 $y=f(x_i)=x_i$ 輸入變數必須是 $\{0, 1\}$ 二元值。

- (2) 輸出層：用以表現網路的輸出變數 $y=f(x_i)$ 即訓練範例的聚類，ART 處理單元數目在學習過程之初只有一個，隨著學習的進展會逐漸增加，最後會穩定在一定的數目，學習過程即結束，和其它類神經網路模式輸出層單元的數目是固定的形態很不相同。
- (3) 網路連結：ART 網路的每一個輸入層單元與輸出層單元間有二條網路連結，分別為 W^b 及 W^t ， W^b 用以計算範例的輸入向量對一輸出層處理單元的匹配值之用，匹配值高的輸出處理單元會優先被用來做警戒值測試(Vigilance Test)，且 W^b 的值為介於[0,1]的連續值。而 W^t 則是用以計算範例的輸入向量對一輸出層處理單元的相似值之用，相似值主要用來判定一輸出處理單元是否通過警戒值測試。其中 W^t 的值為{0,1}的二元值，這一特性和其它類神經網路模式不同。

由於ART 具有穩定性高與可塑性的優點，所以本研究利用ART 來做為聚類之工具，且因為ART 可以透過警戒值的調整來決定聚類數目，所以當聚類數目太多時，可以降低警戒值；反之，則提高警戒值。

ART 學習演算法步驟如下：

步驟一： 設定網路參數初值及警戒值

N_{in} ：依輸入需求設計， $N_{out}=1$ ρ ：介於 $0 < \rho \leq 1$ 之間，由使用者自訂。

步驟二：設定 W^b 及 W^t 的初始值

$$W_{i1}^b = \frac{1}{1+N_{in}}, W_{i1}^t = 1, \\ 0 < i \leq N_{in}, 0 < i \leq N_{out}$$

步驟三： 輸入一個訓練範例的輸入向量 X (X 不可設定全為 0)

步驟四： 計算每個輸出節點的匹配值(matching value)

$$net_j = \sum_i^N W_{ij}^b \cdot x_i, \quad Icount=0$$

步驟五： 找出匹配值最大的輸出單元 j^* (winning node)

$$net_{j^*} = \max_j(net_j)$$

步驟六：計算相似值 V_{j^*}

$$V_{j^*} = \frac{\sum W_{ij^*}^t \cdot x_i}{\sum x_i}$$

步驟七：警戒值測試

if $V_{j^*} < \rho$ 則跳到步驟八 else 跳到步驟九

步驟八：測試是否還有可用之輸出層處理單元

if 還有可用之輸出層處理單元 then 回到步驟五 else

(1) 產生新類別 $N_{out} = N_{out} + 1$

設定新的 W^b 與 W^t ,

$$W_{i,N_{out}}^t = X_i$$

$$W_{i,N_{out}}^b = \frac{X_i}{0.5 + \sum_i^N x_i}$$

(2) 設定輸出層之輸出值

if $j = j^*$ then $y_j = 1$ else $y_j = 0$

(3) 回到步驟三

步驟九：修正權重值

(1) 修正權重值

$$W_{ij^*}^t = W_{ij^*}^t \cdot X_i$$

$$W_{ij^*}^b = \frac{W_{ij^*}^t \cdot X_i}{0.5 + \sum_i^N W_{ij^*}^t \cdot X_i}$$

(2) 設定輸出層單元之輸出值

if $j = j^*$ then $y_j = 1$ else $y_j = 0$

(3) 如果此時正好完成一學習循環，且在此一學習循環內未產生新類別則輸出結果並終止執行，否則回到步驟三。

在ART 的學習演算法中，透過警戒值的調整來決定分群數目，因此設定不同的警戒值會得到不同的分群數。於是在本研究中利用膝點(Steepest Knee)判斷法來決定分群數目。而膝點指的是產生明顯變化的轉折點，所以當膝點出現時，表示繼續下去的分群已經無明顯的效果，所以選擇此點為最佳分群結果。

2. 關聯法則探勘

關聯法則由Agrawal & Srikant 於1994 年提出，其功能是去發掘哪些事物總是同時發生。關聯法則的表示形式為： $X \rightarrow Y$ ；其中 X 及 Y 為資料庫中的任意物項集合，且 $X \cap Y = \emptyset$ 。而關聯式規則成立的條件在於兩種參數的數值：支持度 (Support)及信賴度 (Confidence)；支持度表示某物項在資料庫中出現的比例，而信賴度則是此關聯規則可信的程度。因此，有意義的關聯規則必須分別大於使用者所訂定的支持度及信賴度的門檻值 (Threshold)。

以消費者常常同時購買電腦與記憶體為例，關聯式規則如下：

電腦 $\rightarrow$ 記憶體 [support=10% ,confidence=70%]

式子中的10%代表在整個交易資料庫中，會同時購買電腦及記憶體所佔的比例；70%則表示在購買電腦70%的顧客會一起購買記憶體。找出關聯規則有以下兩個步驟：

1. 首先，找出高頻物項集合 (Large Itemset)，此集合的支持度必須大於使用者所自訂的最小支持度 (Minimum Support)。

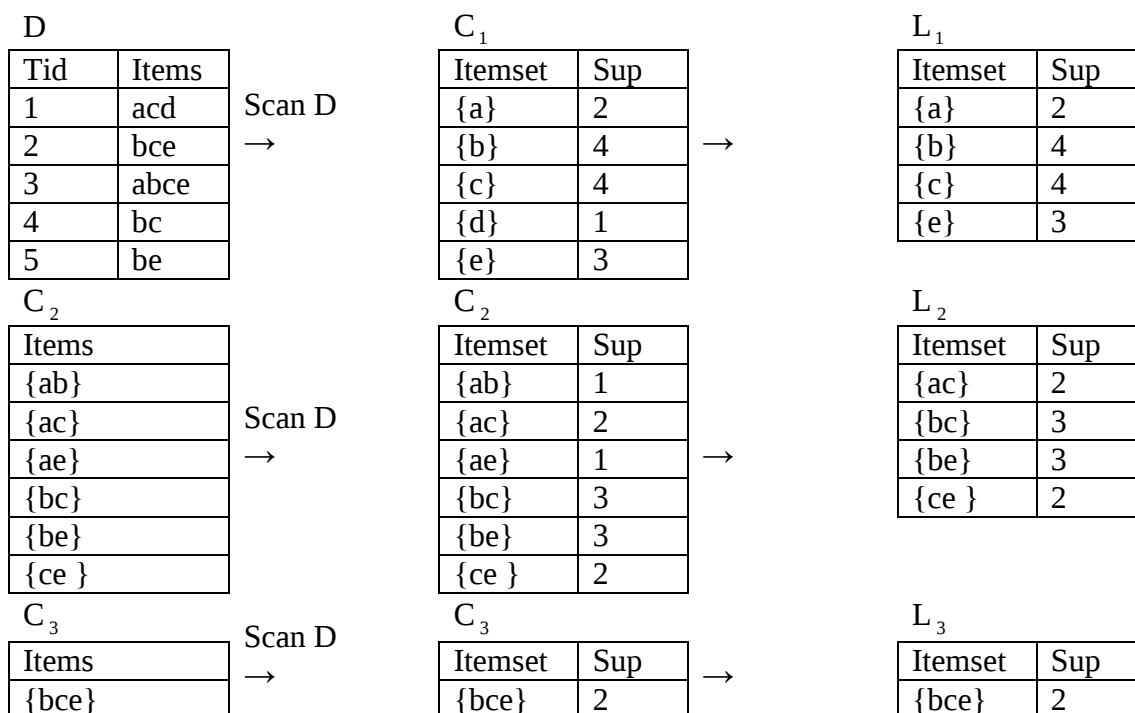
2. 其次，利用步驟1 所產生的高頻物項集合產生關聯規則。

目前，許多演算法可找出關聯規則的高頻物項集合，如Apriori(Aaker, 1996)、DHP (Park, et al., 2005)及其他演算法等。其中Apriori 最常用及最為人所知，因此本文將利用其進行資料分析，處理步驟如下：

- (1) 定義最小支持度集最小信賴度。
- (2) Apriori 演算法使用了候選項目集合(Candidate Itemset)的觀念，若候選項目集合的支持度大於或等於最小支持度，則該候選項目集合為高頻項目集合(Large Itemset)。
- (3) 首先由資料庫讀入所有的交易，得出候選1 項目集合(Candidate 1-itemset; C_1)的支持度，再找出高頻單項目集合(Large 1-itemset; L_1)，並利用這些高頻單項目的結合運算，產生候選2 項目集合(Candidate 2-itemset; C_2)。
- (4) 再掃描資料庫，得出候選2 項目集合的支持度以後，再找出高頻2 項目集合 L_2 ，並利用這些高頻2 項目集合的結合，產生候選3 項目集合。
- (5) 重覆掃描資料庫，與最小支持度比較，產生高頻項目集合 L_k ，再結合產生下一級候選項目集合，直到不再結合產生出新的候選項目集合為止。

舉例來說， D 是一交易的集合，亦可視為一特定資料庫，其中每一個交易 T 是項目的集合，每筆交易皆有一個交易序號Tid 作為識別，如圖二所示。產生高頻項目集合的步驟如下：

1. 定義最小支持度為60%。
2. 掃描資料庫 D ，計算每一個項目出現在資料庫的次數，取得 C_1 中每一個項目的支持度，小於定義的最小支持度，項目將被刪除；反之，將被保留為 L_1 。之後，藉由 L_1 中每個項目的彼此結合產生 C_2 的表格。
3. 再掃描資料庫 D ，得到 C_1 中每個項目的支持度，小於定義的最小支持度，項目將被刪除；反之，將被保留為 L_2 。接下來，藉由 L_2 中每一個項目集合的結合產生 C_3 的表格。
4. 重覆掃描資料庫，與最小支持度比較，產生高頻項目集合，再結合產生下一級候選項目集合，直到不再結合產生出新的候選項目集合為止。



圖二 Apriori 高頻項目集合之產生過程

3. 序列型樣探勘

序列型樣由Agrawal & Srikant 於1995 年提出，此演算法與關聯規則的概念類似，主要是利用資料項目間的發生順序找出隱藏在資料中的資訊，亦即同一顧客在不同時間點有許多交易紀錄，這些交易形成一個序列，每個序列為項目集所形成的有序集（Order Set）。序列型樣的表示形式為： $A \rightarrow B$ ；其中A 及B 為資料庫中的任意物項集合，且 $A \cap B = \emptyset$ 。而序列型樣成立的條件如同關聯規則，在於兩種參數的數值：支持度及信賴度；支持度表示某物項在資料庫中出現的比例，而信賴度則是此序列可信的程度。因此，有意義的序列型樣必須分別大於使用者所訂定的支持度及信賴度的門檻值。

以消費者先後購買筆記型電腦與彩色雷射印表機為例，則序列型樣可表現如下：

筆記型電腦 $\rightarrow$ 彩色雷射印表機 [support=25% ,confidence=70%]

式子中的25%代表在整個交易資料庫中有25%的顧客在購買筆記型電腦後過一段時間會購買彩色雷射印表機；70%則表示顧客在購買筆記型電腦之後有70%的顧客會再購買彩色雷射印表機。

找出序列型樣與關聯規則相同有以下兩個步驟：

1. 首先，找出高頻物項集合，此集合的支持度必須大於使用者所自訂的最小支持度。
2. 其次，利用步驟（1）所產生的高頻物項集合產生序列型樣。

目前，許多演算法可找出序列型樣的高頻物項集合，如AprioriAll(Agrawal, et al.,1995)、FreeSpan(Han, et al.,2000)、Prefix-Span(Pei, et al., 2007))及其他演算法等。其中AprioriAll 最為人知。

因此本文將利用其進行資料分析，與關聯規則概念類似，處理步驟如下：

- (1) 首先將資料庫以顧客編號(Customer_id)為主鍵、交易時間為次鍵進行排序。
- (2) 找出所有滿足最小支持度的項目集，即稱為高頻項目集合，並將這些項目集對應到一組連續整數，以便往後的比對。
- (3) 將資料庫中不是高頻物項集合之項目集去除，並將剩下的強項目集合以上述的整數來代替。
- (4) 利用Apriori 演算法藉由高頻物項集合的集合，找出滿足最小支持度的序列，即Large Sequence。
- (5) 從高頻物項集合的集合中找出最長的序列。

舉例來說，表一是一序列資料庫，資料表依照顧客的序號進行排列，而每位顧客消費的序列則根據交易的時間進行排列。以ID 為'1'之顧客為例，其消費的序列由(abc)、(a)、(b)以及(c)四個元素所構成，而第一個元素(abc)則由a、b 以及c 三個項目所組成的項目集合，第二個元素(a)乃由項目A 構成的項目集合，依此類推。序列型樣產生的步驟如下：

1. 定義最小支持度為60%。
2. 序列<(ab)c>因出現在資料表的三個序列中(顧客1、2 以及4)，成為此資料表的一個序列型樣，如表一所示。其意義表示序列資料庫中有50%以上的序列，出現項目集合(ab)後，經過一段時間會出現項目集合(c)。因此，序列<(ab)c>為一長度為2 的序列型樣。

顧客ID	Items
1	<(abc)abc>
2	<abb(ab)c>
3	<adb>
4	<ac(ab)dc>

表一 序列資料庫

4. 評估指標

為評估候選促銷產品，我們提出三種評估指標：利潤指標、顧客滿意指標及成交率指標。所有的指標值必須事先經過正規劃後降至較小範圍。

- (1) 利潤指標：獲取利潤是企業的主要目標，希望利潤高的促銷產品優先促銷給顧客，因此將產品的利潤列入評估，而其範圍為0.0至1.0。
- (2) 顧客滿意指標：除了以企業的角度考量外，由於顧客關係管理近年來日益重要，如果只以企業的利益為考量容易造成偏差，必須也站在顧客的角度，將顧客滿意指標列入考量。而顧客可擁有不滿意的權利，因此本指標範圍界於-1.0至1.0。
- (3) 顧客滿意指標主要是為了評量顧客對於系統所提供的促銷方式是否滿意，包括產品組合、產品價格等考量。顧客將於消費結束後被要求對所促銷的產品進行評量回饋至系統，以幫助企業判斷各促銷方式的成效。

成交率指標：此指標是用以評量促銷產品被接受的程度，成交率的定義表示如下。其範圍為0.0至1.0。

成交率=促銷產品被接受次數 / 促銷次數

5. 加權總合方法

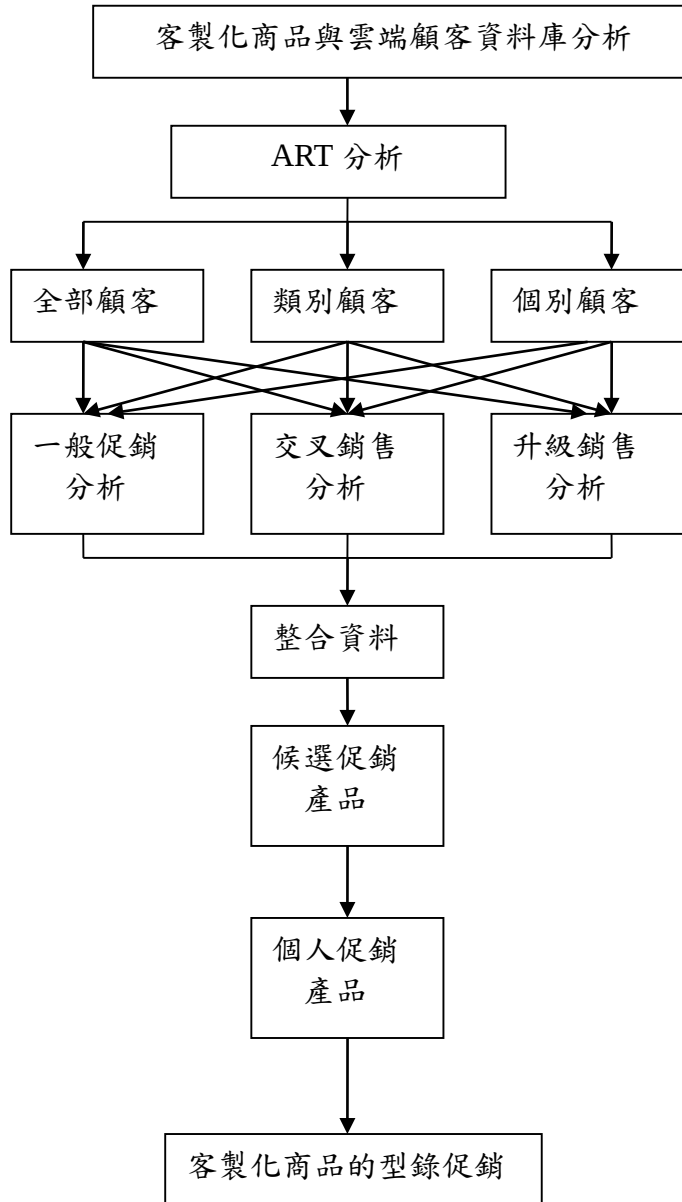
我們利用多準則決策基本分析方法中的加權總合方法計算各促銷產品最後的評估總分以進行促銷產品的排序並將評估結果不佳者排除。假設有 m 個候選促銷產品及 n 個評估指標，則每個候選促銷產品的加權總合分數可用下列式子計算取得。

$$A_{WSM-score} = \max_i \sum_{j=1}^n a_{ij} w_j, \text{ for } i = 1, 2, \dots, m, (1)$$

其中 a_{ij} 為第 i 個候選促銷產品的第 j 個指標的實際指標值，而 w_j 則為第 j 個指標值的重要程度(Triantaphyllou, 2005)。

四、研究方法

在本研究中，我們提出一個雲端服務資訊系統的雛形，利用資料探勘技術以協助企業在雲端的顧客資料庫中找出適合每位顧客的促銷產品。圖三所示即為本雲端服務資訊系統的架構圖。



圖三 雲端服務資訊系統

以下分別針對各步驟內容，逐一說明。

步驟一：建立雲端顧客資料庫的基本資料庫

此步驟主要在收集使用者的特徵屬性資料，記錄所有可能影響顧客購買行為的屬性資料。本研究將雲端顧客資料庫定義成兩部分，分別為基本資料與偏好類別。其中 C_1 到 C_{i-1} 為雲端顧客的基本屬性資料，例如像性別、教育程度、薪資等；而 C_i 則記錄使用者對產品的偏好類別，如：飲料類、乾糧類等。

步驟二：雲端顧客資料庫的預先處理以及程式編碼轉換

此步驟主要在去除無任何購買記錄的雲端顧客，並從雲端顧客資料庫中擷取所需欄位，接著將雲端顧客中的屬性資料轉換成適用於ART網路的編碼以便對使用者做屬性上的分群。

其表示法說明如下：

$$C_{i-1} = \{A_1 A_2 \dots A_K\}, A_k \in \{0,1\}, 1 \leq k \leq K$$
$$\text{If } A_h = 1 \text{ then } A_k = 1, \forall k \leq h \text{ and } A_k = 0, \forall k > h。$$

步驟三：分群模組

此步驟主要在將具有相似屬性的使用者進行分群，利用類神經網路中的ART 網路將 n 個使用者的樣本資料作分群，透過此分群流程，讓具有相似屬性的使用者分在同一群。本步驟的做法是將步驟二所產生的 n 組二元碼資料作為ART 的訓練範例輸入，每一組輸入範例均由 $\sum_{a=1}^{i-1} P_a$ 個元素所組成，輸入層變數以 UC_i 代表輸入向量

利用ART 的非監督式學習特性，重覆數個學習循環之後，加上警戒值(ρ)的選用，產生適當的分群結果。

步驟四：關聯式法則

本研究利用最常用之關聯規則方法Apriori[1]從所有雲端顧客資料庫的交易資料庫中找出被一起購買的產品。同時，我們亦將應用此方法於每個顧客族群及個別顧客的交易資料，以分別發掘各個顧客族群及個別顧客的消費行為特徵。以表二的交易資料表為例，並假設最小支持度為6。

我們得到所有顧客的關聯性產品的型樣為{A4,A10}及{A13,A15}，其代表所有顧客傾向同時購買產品A4 及產品A10 或產品A13 及產品A15 一起購買。此外，從表三中可知，顧客A102001 屬於顧客族群A。藉由對族群A 進行關聯規則探勘，我們發現此族群中的顧客經常同時購買產品A13 及產品A15。同樣地，應用關聯規則探勘於個別顧客時（以顧客A102001 為例），亦可找出此顧客喜歡一起購買產品A1 及產品A7。

因此，在此範例中針對三種不同顧客類型（所有顧客、顧客族群以及個別顧客）發現之所有關聯性產品型樣如表三所列。

項目ID	產品項目集合	顧客ID	族群
1	{A10,A13,A15}	A102001	A
2	{A1,A7,A13,A15}	A102001	A
3	{A4,A10,A11}	A102002	A
4	{B6,B7,B12}	A102002	B
5	{B2,B4,B10}	A102003	B
6	{B10}	A102005	B
7	{C4,C12}	A102005	C
8	{C1,C4,C6}	A102007	C
9	{B7,B13}	A102007	B
10	{B4,B8,B10,B14}	A102008	B
11	{C5,C13}	A102004	C
12	{C4,C13,C15}	A102004	C
13	{C15}	A102004	C
14	{C2,C4,C10}	A102006	C
15	{C3,C11,C12,C13}	A102006	C

表二 交易資料表

顧客類型	關聯性產品型樣
所有顧客	{A4,A10}{A13,A15}
顧客族群A	{A13,A15}
個別顧客(顧客A102001)	{A13,A15}

表三 三種顧客類型之關聯性產品型樣

步驟五：序列型樣探勘

透過序列型樣探勘可發現顧客購買某些產品後會再購買某些其他的產品。本研究中，將利用序列型樣探勘從所有顧客的交易資料庫中找出經常被顧客依序購買的產品。同樣地，此方法亦可應用於每個顧客族群及個別顧客以分別發掘各個顧客族群及個別顧客的購買序列型樣。以雲端顧客交易資料表為例，並假設最小支持度為5。我們得到所有顧客的序列性產品的型樣為{A4,A12}及{A10,A12}，其代表所有顧客傾向購買產品4 之後再買產品12 或購買產品A10 之後再買產品A15。如上節所述，顧客A102001 屬於顧客族群A。藉由對族群A進行序列型樣探勘，我們發現此族群中的顧客經常購買產品A7 於購買產品A10 之後。所有序列性產品型樣如表四所列。

顧客類型	序列性產品型樣
所有顧客	{A4,A12}{A10,A12}
顧客族群A	{A10,A7}
個別顧客(顧客A102001)	-

表四 三種顧客類型之序列性產品型樣

步驟六：促銷產品的評估指標

計算所有產品的加權總合分數後，即可依分數決定產品促銷順序，此外，亦可設定門檻警戒值(ρ)去除分數過低的產品，表五的候選促銷產品為例，假設門檻值為0.3，則未達標準的促銷產品將被排除。最後，價格產品的產品促銷順序為 {A14} > {A5,A10} > {A4,A11} > {A4,A10}；此外，數量產品的產品促銷順序則為{A7} > {A2} > {A4}，換言之，當購買數量達到決策者訂定的門檻值可擁有優惠。

候選促銷產品		利潤指標	顧客滿意指標	成交率指標	加權總合分數
價格產品	{A4,A10}	0.27	0.5	0.7	0.51
	{A13,A15}	0.15	0.5	0.7	0.49
	{A5}	0.35	0.5	0.3	0.41
	{A11}	0.4	0.2	0.8	0.42
	{A5,A10}	0.28	0.5	0.8	0.55
	{A4,A11}	0.37	0.5	0.7	0.53
	{A5,A11}	0.38	0.4	0.5	0.43
	{A14}	0.3	0.8	0.7	0.67
	{A14,A15}	0.2	0.5	0.4	0.41
數量產品	{A1}	0.35	0.4	0.3	0.36
	{A2}	0.25	0.7	0.6	0.58
	{A4}	0.33	0.5	0.7	0.53
	{A7}	0.1	0.8	0.8	0.66
	{A10}	0.2	0.5	0.7	0.50
	{A3}	0.15	0.5	0.3	0.37

表五 候選促銷產品的各個指標分數及加權總合分數

步驟七:客製化商品的產品促銷

若將所有候選產品促銷給顧客，可能會因其促銷資料過多造成反效果，因此，並非所有的候選促銷產品須被促銷給顧客。在本系統中，我們利用加權總合方法及三個評估指標進行促銷產品的排序，而促銷產品可分為價格產品及數量產品。如圖四所示，決策者可依照個人經驗或偏好，分別給予三種指標不同的權重，以便計算各候選產品之加權總合分數。

因此，當決策者藉由此三種指標找出最後真正能符合個別顧客需求的促銷產品時，須考量企業目前所處的情況及促銷的主要目的，以決定各指標的適當權重。倘若如此，系統不單只是協助企業有效率地提供客製化商品的產品促銷，亦能真正符合企業情況及需求，給予有效果的幫助。

Weight (between 0~1)

Profit

customer satisfaction

Success ratio

Patterns of general discount

	Customer ID	Weight	Item1	Item2	Item3	Item4
▶	A102001	0.912	55			
	A102001	0.883	48	54	55	
	A102001	0.883	48	54		
	A102001	0.862	48	55		
	A102001	0.862	48			
	A102001	0.856	54	55		
	A102001	0.856	54			
	A102001	0.826	32	38	63	
*						

記錄: 1 之 8

Patterns of purchased quantity discount

	Customer ID	Weight	Item
▶	A102001	0.936	55
	A102001	0.916	38
	A102001	0.882	32
	A102001	0.882	58
	A96001	0.882	63

記錄: 1 之 8

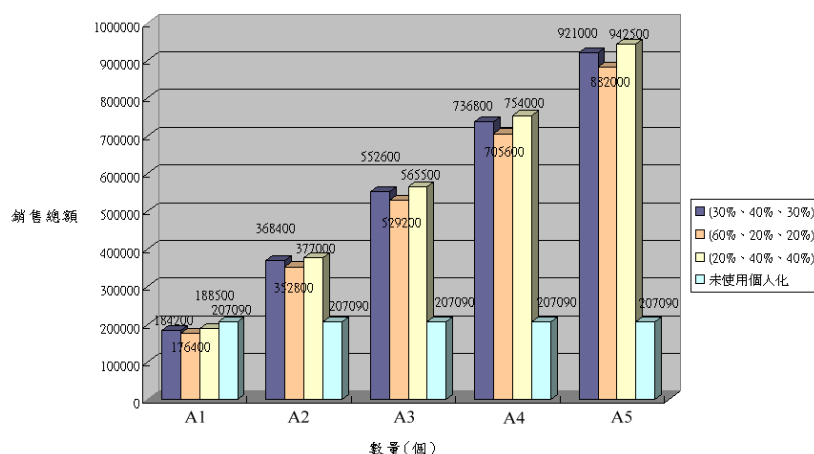
圖四、客製化商品的產品促銷

五、結果與討論

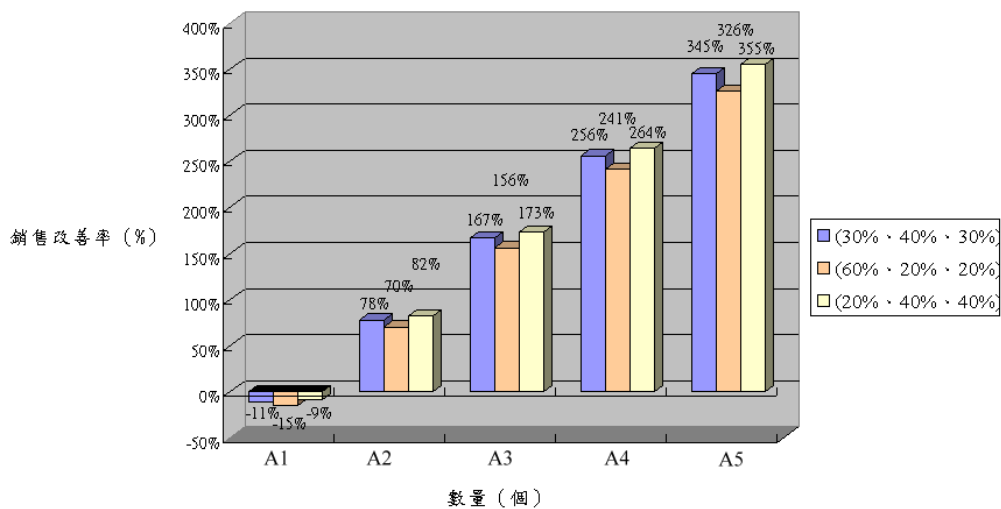
模擬本研究所開發之雲端服務資訊系統後，可以發現導入雲端服務資訊系統後之效益，可藉由下列模擬狀況分析以作為參考。導入後之效益，可發現導入後的產品數量比導入前的產品數量高，這是由於採用客製化服務的策略，且顧客必須以產品組合方式或是多量一次購買，可達薄利多銷之結果。因此，導入後所預估的銷售量大大的提高，並且也提高了產品的銷售總額，可由表六，圖五以及圖六得知結果。

	客製化商品的產品組合比率		A1 產品	A2 產品	A3 產品	A4 產品	A5 產品
雲端服務資訊系統使用前	(100%)	銷售總額	207090	207090	207090	207090	207090
		毛利總額	96840	96840	96840	96840	96840
雲端服務資訊系統使用後	(30%、40%、30%)	銷售總額	184200	368400	552600	736800	921000
		銷售改善率	-11%	78%	167%	256%	345%
		毛利總額	61700	123400	185100	246800	308500
		毛利改善率	-36%	27%	91%	155%	219%
	(60%、20%、20%)	銷售總額	176400	352800	529200	705600	882000
		銷售改善率	-15%	70%	156%	241%	326%
		毛利總額	53900	107800	161700	215600	269500
		毛利改善率	-44%	11%	67%	123%	178%
	(20%、40%、40%)	銷售總額	188500	377000	565500	754000	942500
		銷售改善率	-9%	82%	173%	264%	355%
		毛利總額	66000	132000	198000	264000	330000
		毛利改善率	-32%	36%	104%	173%	241%

表六 導入雲端服務資訊系統後之銷售總額及改善率之比較



圖五、導入雲端服務資訊系統後之銷售總額之比較



圖六、導入雲端服務資訊系統後之銷售改善率之比較

對於未來研究的方向，主要是銷售促銷策略及定價策略中的定價策略進行改善；此外，也期望用不同方式對顧客進行分群分析。考量顧客的喜好變化越來越快速，企業須能立即掌握顧客需求的改變才能保留顧客，因此動態資料挖掘是不可或缺的，也就是當雲端顧客資料庫的內容有所異動時，雲端服務資訊系統必須正確地反應出新的資料庫中所隱藏的資料，並重新進行顧客的資料分析。

未來的發展重點可從(1)定價策略(2)動態資料挖掘這兩個方向作進一步之延伸及探討，以求更符合企業之需求。於「定價策略」中，可將競爭者的定價策略列入考量。至於「動態資料挖掘」的未來研究，則是為了讓企業能更確實地掌握顧客，必須隨時地分析顧客的消費行為。

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國科會補助專題研究計畫出席國際學術會議心得報告

日期：__年__月__日

計畫編號	NSC 101— 2410 —H— 041 — 003 —		
計畫名稱	客製化商品與雲端服務資訊系統發展策略之研究		
出國人員 姓名	洪健文	服務機構 及職稱	嘉南藥理科技大學資訊管理系
會議時間	2013 年 4 月 3 日至 2013 年 4 月 5 日	會議地點	日本北九州市
會議名稱	2013 e-CASE & e-Tech International Conference April 3 - April 5, 2013, Kitakyushu International Conference Center, Japan		
發表題目	Research of the Smartphone Users' Satisfaction Factors in Taiwan		

一、參加會議經過

出國參加國際研討會，在出發前有許多的前製工作需要準備，由於研討會的地點是在日本北九州市，因此這趟旅程我們決定自由行，然而要在日本自由行，還是需做許多的功課，例如：氣候，白天溫度約攝氏 30～34 度，夜間約攝氏 23～27 度，；日幣有 1、5、10、50、100、500、1000 和 10000 元等幾種。日本與台灣有一小時的時差；飯店、餐廳等地方都可使用信用卡，如果在小販中心用餐或搭乘公車等小額消費，仍須以現金支付…等。

接著，我們開始聯絡旅行社進行訂機票與飯店等的事宜，並仔細的規劃相關行程，然後到日本參加國際研討會。

經過精心的規畫，終於四月二日我們一早帶著興奮的心情來到桃園機場，完成機場報到手續後。經過四個小時二十分鐘後，我們所搭乘的航空公司順利抵達日本。

到達日本機場時，已是中午十二點，我們立刻在機場搭乘計程車直接到飯店報到，隨即搭乘計程車到研討會會場先熟習一下附近的環境。

到了四月三日從飯店搭乘計程車到研討會會場，依據會場的指示，完成報到與領取會議議程等手續。研討會會場佈置的非常典雅，大會並提供了許多精緻的點心、飲料以及舒適的座椅，讓我們可以一邊喝著香濃的咖啡，一邊參考會議的議程，決定好哪些研究主題是我們感興趣的，大家就各自到自己感興趣的場次去聆聽其他學者的報告。主辦單位更貼心的在前兩天安排了豐盛的餐點與專家交流的時間，並在第三天安排了日本 TOYOTA 汽車製造工廠的參訪行程，這真是個很棒的研討會。

二、與會心得

雖然這不是我第一次參加國際研討會，但是這次的感受卻是特別的不一樣，由於大會在文章接受後，隨即詢問與會者是希望 Oral Presentations 或是 Poster Presentations 的方式來發表論文，經過思考後，我決定選擇以 Poster Presentations 的方式來發表論文，這是因為我從來沒有 Poster Presentations 論文的經驗，感覺很新鮮，因此想嚐試看看。

大會將 Poster Presentations 會場布置得非常典雅，感覺像在欣賞一幅幅美麗的畫作。到了 Poster Presentations 論文交流的時間，看到有些人一邊喝著咖啡，一邊欣賞 Poster Presentations 論文；有些人忙著自我介紹，並交換名片，有些人則是與其他學者討論著海報的內容，原來在悠閒的氣份中，也是可以進行學術交流的。看到來自世界各地的人，不分國籍分享大家各自最新的研究成果，並提出自己的問題與建議，這真是個很難得的經驗！

Research of the Smartphone Users' Satisfaction Factors in Taiwan

Chien-Wen Hung^{a,*}; Ken-Yi Chen^b

^a Chia-Nan University of Pharmacy & Science, Tainan, Taiwan

cwhong@mail.chna.edu.tw

^b Chia-Nan University of Pharmacy & Science, Tainan, Taiwan

tlhc912044@yahoo.com.tw

* Corresponding Author: cwhong@mail.chna.edu.tw

ABSTRACT

Since the telecom liberalization and the open market policy in 1996, mobile phone market has entered a mature stage. The role of mobile phone products changed from its functional value to become part of our daily life gradually. The number of mobile phone users increased sharply in the past decade, this made mobile phone products prominent among the market of electronic consuming goods in the information technology industry.

Under the fierce competition in the smart phone market, Enterprise trend to make their product different from other mobile phone supplier for become out standing between other brands and competitors. From this, integrates information processing function of smart phones is the most promising stars of tomorrow. Current customers are important to all brands. Apart from maintaining high customer satisfaction, satisfaction must be translated into actual loyal behavior, for the sake of strengthen their competitive ability and further consolidation of market share. Therefore, this study will be on the smart phone consumer, study of consumer buying behavior, and for consumer satisfaction and loyalty to explore the relationship between, providing enterprise with information for decision-making in marketing.

Keyword: Smartphone; Satisfaction; Loyalty

1. Introduction

More and more smart phone features, for an array of phone features and mobile phone brands, consumers are more and more selective, while the smart phone features and brands for different customers have different needs. For the mobile phone industry in the highly competitive smart phone market, a winner, you must understand the various features of the consumer smartphone degree of attention. In addition, consumer satisfaction also affect the loyalty of the mobile phone industry, and consumer loyalty will directly affect the consumer smart phone purchases.

Therefore, this study will use the consumer-centric smart phones, smart phones for the purchase of consumer purchase behavior-based, and discuss the consumer smart phone features emphasis, satisfaction and the relationship between customer loyalty and provide different options to top executives make decisions related to the decision-making. The Research flow chart shown in Figure 1

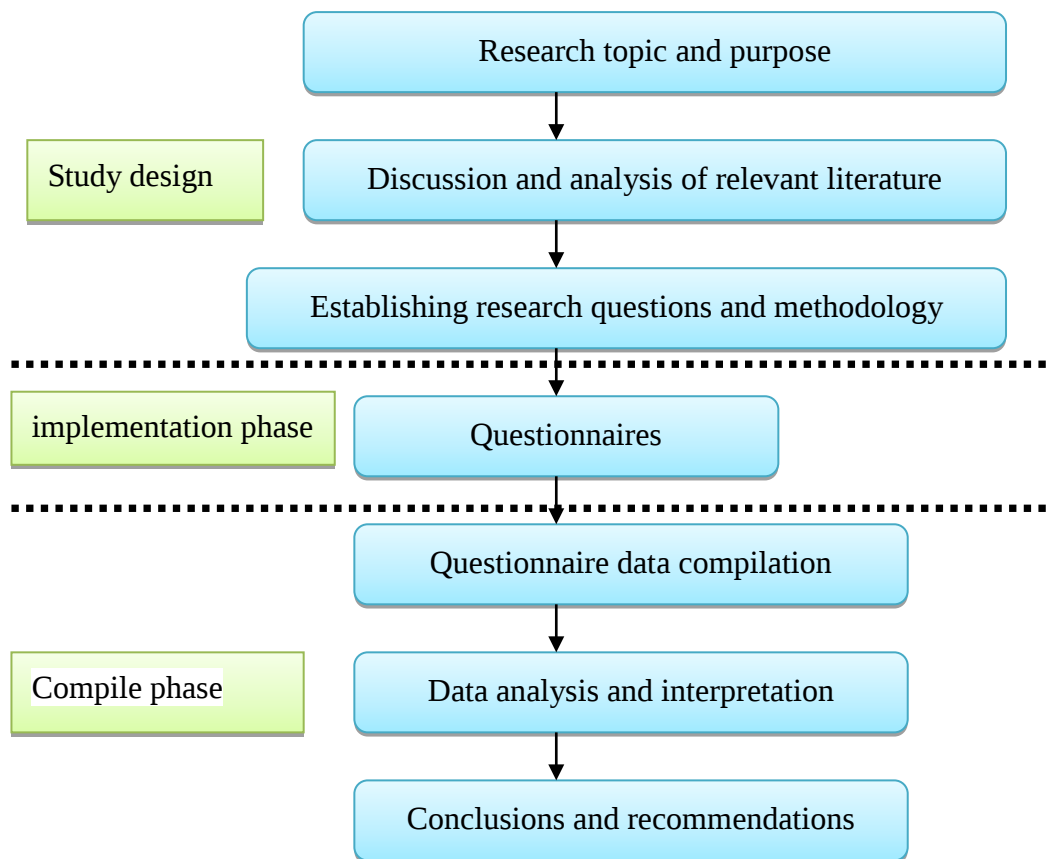


Figure 1 The Research flow chart

2. Background

2.1 Consumer Satisfaction

First proposed by Cardozo (1965) proposed consumer satisfaction (customer satisfaction) of the concept, he pointed out that consumers will buy products or services because of previous experience influence consumer evaluation of the product or service, and this assessment will affect consumers to purchase behavior. Competitive market, many of the advanced countries have established a customer satisfaction model, Kuo and Liang. (2010) mentioned the first use of consumer satisfaction model state is in Sweden, which advanced countries to establish customer satisfaction model because it has a very important role in customer satisfaction index can improve company performance, it can enable enterprises to improve the quality of products and services..

George, Barros, & Ricardo (2011) mentioned, companies must know how to satisfy their consumers, so that information can be translated into marketing strategy and organizational development, first of all, we must first understand how businesses can influence consumers services provided by way of satisfaction, so we can be able to achieve a consensus for consumer satisfaction index, we know that increased satisfaction will make the organization increase the goals and interests of its clients. Measures of consumer satisfaction are two main projects, the first one is the measure of overall satisfaction, and the second measure is a multi-surface reconstruction, while the measure of overall satisfaction is an overall satisfaction assessment and response

Chen and Ou (2011) proposed a cumulative point-based evaluation of consumer satisfaction, consumer expectations will be defined as a consumer point of view for the cumulative performance of all services firms prior experience and information services provided by a prediction, and use the perceived performance and the gap between expectations and perceived job performance and assess the gap between the ideal disconfirmation index, the length of time to resolve because of the expectations generated by positioning and

a desire for controversy.

2.2 Consumer loyalty

Consumer loyalty is a consumer product or service of a behavioral tendencies, Jones & Sasser (1995) pointed out that consumer loyalty is divided into two types, the first long-term loyalty, that loyalty is the true loyalty, consumers For a product or service will not be easily affected by external factors; the other is short-term loyalty, short-term loyal customers if they find a better product or service, will be the original will be loyal to the transfer of products or services to better products or services. Caused by short-term reasons of loyalty to restrict competition and limit government regulations patented technology alternatives, high transfer costs. And consumer loyalty is the consumer who a particular company, product or service or favor an attachment behavior.

Runyan et al., (2010) that the consumer brand loyalty is not just simply look at the behavior of the product or service to determine, consumers will buy the product or service again, not necessarily loyal to the products or services, but Because of restrictions inconvenient lack of choice or the result of the situation, this loyalty can be regarded as "false loyalty", and true loyalty is when consumers are buying products or services through the repeated performance of the behavior to a high related attitudes, there is only really faithful.

Mollen and Wilson. (2010) pointed out that the measure of consumer loyalty can use the "repurchase intentions", "key actors", "secondary behavior" to measure. "Repurchase intentions" refers directly to the consumer asks to purchase the product or service will; "main actors" refers to the information by the consumer buying behavior to do as a basis for measuring customer loyalty, for example: the purchase of frequency, purchase time, purchase quantity, purchase products or services; "secondary behavior" refers to the consumer for that product or service introduction, recommended others to buy such acts to measure customer loyalty.

2.3 Consumer satisfaction and loyalty

Customer satisfaction is the consumer expectations and the gap between the actual experience (Cheng, 2010; Anderson & Sullivan, 1993; Ramaswamy, 1996). If the actual experience to meet or exceed expectations, consumers will be satisfied, on the contrary, if the failed to meet expectations, consumers will be dissatisfied. Consumer satisfaction is a very specific measurements. This means that consumers will assess them in every occasion in contact with the performance of each service (Hill, 2011.; Bitner, 1990; Bolton & Drew, 1991; Parasuraman, Zeithaml, & Berry, 1988; Ramaswamy, 1996 .)

Consumer loyalty is the consumer's accumulated experience with the service, rather than for specific services. The consumer loyalty and customer satisfaction has a very strong relationship, the relationship between the two has been widely accepted and that this is one of the factors affecting the financial results.

Kwang-Jae Kim, In-Jun Jeong, Jeong-Cheol Park, Young-Jun Park, Chan-Gyu Kim, Tae-Ho Kim (2007) that have market saturation of the industry, retain existing customers than to develop new consumers are more important. In this highly competitive in order to survive in the market, companies should continue to be effective in improving their quality of service.

3. Framework

This study focused on factors that consumers buy the smart phone to buy degree of attention to the effect of the factors, the dimensions of satisfaction with the relationship between overall satisfaction and satisfaction

with the relationship between consumer loyalty, further explore the demographic variables and the relationship between consumer behavior. research framework shown in Figure 2.

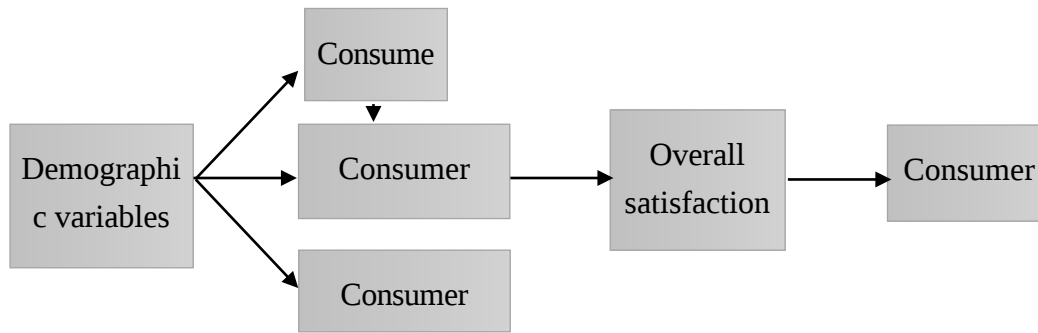


Figure 2 Research framework

3.1 Hypotheses

- H1: consumer purchase influence factors on the smart phone of emphasis, was a significant difference.
- H2: consumer satisfaction on the smart phone to use, showing significant difference.
- H3: consumers of different demographic variables on the satisfaction factor, showed a significant difference.
- H4: consumer demographic variables of each function of the different degree of emphasis on mobile factors, the differences were significant.
- H5: Consumer demographics of the different variables on consumer purchase behavior, the differences were significant.
- H6: the degree of consumer attention to the correlation between consumer satisfaction, showed significant positive correlation.
- H7: overall consumer satisfaction and consumer loyalty of the correlation was significantly positive.

3.2 The operational definition of variables

Dependent variable of this study is divided into a total of three parts, which are seriously, satisfaction and consumer loyalty. Some degree of attention of the consumers in the purchase of smart phone, smart phone may affect the purchase of factors of emphasis, in this part of the measurement method is the use of five other tables Likert scale (Likert Scale) to measure of, by the very great importance to the very neglect, to measure the consumer to buy smart phones may affect the degree of attention factors.

Part satisfaction of the consumers after buying a smartphone, the smartphone reference for each purchase of the satisfaction factors, this part of the measurement is also Likert scale with five other tables measured by a very satisfied to very dissatisfied, to measure the consumer smart phone satisfaction of the item.

Part of consumer loyalty is to understand the consumer smart phones currently in use have to purchase the brand and introduce friends and relatives to buy the will, or whether it will buy other brands of smart phones and acceptance of others buy other brands of recommendation smart phones, etc. This section is also based on five Likert scale to measure the table.

Attribute variables

The reference to Yiling Chen (2006), the product features smart phones attribute variable, the variable is a normal cell phone functions and features of different smart phones from finishing. This questionnaire is variable according to their functional properties smartphone into 28 questions and related questions, which asked the 28 items were used in smart phones and satisfaction degree of attention (show in Table 1).

Item	Question items
1	Smartphone processors (eg: brand, speed ...)
2	Types of smart phone operating system
3	Smartphone file reading functions (such as: doc, ppt, txt, pdf ...)
4	Smart phones and computer data can be updated simultaneously
5	Smart phone operating system that supports software diversity
6	Smart phone built-in camera, the size of pixel values
7	Smart phone built-in camera, the focusing ability
8	Smart phone built-in advantages and disadvantages of the camera sensor
9	Smart phone built-in cameras have built-in flash
10	Smart phone the size of internal memory
11	Smart phone has a memory slot
12	Smart phone memory card types supported
13	The screen size of the smart phone
14	Smart phone can support the amount of types of audio and video playback formats
15	Types of smart phones the size of video format
16	Smart phone has a recording function
17	Smart phone has a video editing and video conversion function
18	Smart Phone Satellite Navigation System is supported
19	The wireless smart phone functions (example: infrared, Bluetooth)
20	Smartphone Wireless Internet access (example: Wi-fi, GPRS, WAP)
21	Smart phone has a USB Interface
22	Smartphone voice features
23	The utility smart phones (such as: Notepad, Voice Memo)
24	Multimedia smartphone SMS
25	Smart phone supports the amount of game types
26	The MP3 function smart phone
27	The FM radio function smart phone
28	The size and weight smart phone

Table 1 Smart Phone importance and satisfaction variables

3.3 Questionnaire Design

Questionnaire study in accordance with the purpose of this study design and study architecture, and is divided into three parts, as follows: (1).Consumer buying behavior.(2). Smartphone emphasis, satisfaction and loyalty.(3). Demographic variables.

The questionnaires have two channels, the first pipeline to personally hunt "held smart phones" and "a willingness to complete the questionnaire" paid to the conditions of the questionnaire. The second pipeline, by the close relatives and friends to help search for colleagues and friends around the first pipe line with the conditions of the people, for the questionnaire distribution. The questionnaire and the two channels are identical.

4. Data analysis and results

4.1 Consumer Analysis

The basic information to consumers is the use of statistical analysis, the actual test in the survey, a total of 200 questionnaires issued, net of missed check and non-multiple choice questionnaires, 182 valid questionnaires were returned to 91.0 %, statistical results, in terms of gender, men accounted for 86 individual samples of 47.3%, female 96 52.7% of the total sample, the object of the present study investigated the proportion of men and women, almost the same; in age, all focused on the sample 30 years of age, the number of people 30 years of age accounted for 95.6% of all samples, of which 21 to 25 years of age up to a total of 96 people, accounting for 52.7% of all samples, followed by 20 years of age, a total of 38 20.9% of the total sample, the third number is 26 to 30 years of age, a total of 40, 22.0% of the total sample, the overall point of view, the object of this study are concentrated in the 30 years of age; in the occupation to Most students, a total of 121 people, accounting for 66.5% of all samples, and 61 office workers, accounting for 33.5%; in education, the majority of university education, a total of 151 people, accounting for 83.0% of all samples and, secondly, educational level or above, 17 people, representing 9.3% of all samples, and a third more for the specialist, a total of 10 people, representing 5.5% of the entire sample; part of the average annual income, 20 million The following is the most people, a total of 120 people, accounting for 65.9% of the entire sample, and followed by the annual income of 20 to 400,000 people, a total of 34, accounting for 18.7% of the entire sample, as the result of research data analysis, occupation is the majority of the total sample of students, so the sample is less than 20 million middle-income ratio was significantly higher.

4.2 Consumer Behavior

The dependent variable function of the Consumer emphasis on the smart phone, smart phone features consumer satisfaction, consumer loyalty on the smart phone of the three parts, and these three dependent variables of the Cronbach's α of each is 0.927,0.938,0.631, and the emphasis the reliability and satisfaction were significantly greater than 0.7, showing that the two dependent variables have very high reliability, and less than 0.7 part of loyalty, according to Nunnally (1994) of proposal, Cronbach's α greater than 0.7 for high reliability, from 0.7 to 0.35 is acceptable reliability, so loyalty to 0.631 reliability is also acceptable within the scope of this study in Table 2 the three dependent variables of Cronbach's α values.

Table 3 for the consumer emphasis on the smart phone functions of the KMO and Bartlett test factor analysis tables

Table 4 for the seven factors of emphasis percentage and cumulative percentage of variance.

Dependent variable	Cronbach's alpha
Consumer degree of emphasis on the smart phone features	.927
Consumer satisfaction on the smart phone features	.938
Consumer loyalty on the smart phone	.631

Table 2 the dependent variable is the value of Cronbach's α

Kaiser-Meyer-Olkin	.896
Bartlett test	2749.297

***p<0.001

Table 3 KMO and Bartlett test emphasis table

Factors	Features	Percentage of variance	Cumulative Percentage
Data storage and transmission factors	9.741	19.085%	19.085%
Factors built camera phone	2.558	12.718%	31.803%
Factors processor and system functions	1.961	9.570%	41.372%
Video recording and file conversion function factor	1.278	7.824%	49.196%
Entertainment factor smartphone	1.236	6.325%	55.521%
Factor in satellite navigation and voice-activated functions	1.169	6.319%	61.840%
Factors of mobile phone features additional tools	1.001	5.820%	67.660%

Table 4 Importance factor analysis table

Through factor analysis, the emphasis is divided into data storage and transmission factors, the phone built-in camera factors, factors of processor and system functions, video recording and converting capabilities of factors, smart phones entertainment factor, satellite navigation and voice control functional factors, factors of mobile phone features seven factors additional tools, and emphasis of the factor loadings were greater than 0.4, hence, have significant enough.

4.8 Regression Analysis

Through regression analysis to examine the degree of consumer attention to customer satisfaction into the analysis, the results of multiple correlation coefficient $R = 0.718$, adjusted R Square was 0.426 after the estimated standard error is 0.422, so that degree of emphasis and consumer satisfaction of consumers degree of explanatory power is 43%; Then explore consumer satisfaction and overall satisfaction of the regression analysis, the results obtained multiple correlation coefficient $R = 0.921$, adjusted R Square was 0.821 after the estimated standard error of 0.211, indicating consumer satisfaction and the explanatory power of overall satisfaction 82%; then overall satisfaction and consumer loyalty regression analysis, the results of multiple correlation coefficient $R = 0.596$, adjusted R Square was 0.293 after the estimated standard error of 0.509, indicating an overall satisfaction and consumer loyalty of the explanatory power of 29%, and overall satisfaction and consumer loyalty is a positive correlation (shown in Table 5)

	R	R squared	Standard error of estimate
Importance and satisfaction	.718	.515	.42210
Satisfaction and overall satisfaction	.921	.849	.21127
Overall satisfaction and loyalty	.596	.355	.50906

Table 5 Regression analysis of each dimension table

As can be seen from Table 6, the dimensions of the correlation between consumer satisfaction and consumer attention to the degree was positively related to degree of emphasis and overall consumer satisfaction was positively related to consumer satisfaction and overall satisfaction Was positively related to

consumer satisfaction and consumer loyalty was positively related to overall satisfaction and customer loyalty was positively correlated. The research hypothesis testing, the details summarized in Table 7.

	Degree of consumer attention	Consumer Satisfaction	Overall satisfaction	Consumer loyalty
Degree of consumer attention	1.000			
Consumer Satisfaction	.646***	1.000		
Overall satisfaction	.905***	.909***	1.000	
Consumer loyalty	-.212	.153*	.149*	1.000

*p<0.05 , **p<0.01 , ***p<0.001

Table 6 Person correlation coefficient of each dimension table

Hypothesis	Content	Hypothesis testing
1	Consumer emphasis on the smart phone features, showing significant difference.	Established
2	Consumer satisfaction on the smart phone features, showing significant difference.	Established
3	Consumers of different demographic variables on the satisfaction factor, were significant.	Part of the establishment
4	Different demographic variables of consumers on the importance scale factors, were significant.	Part of the establishment
5	Consumers of different demographic variables on the buying behavior, showing significant differences.	Part of the establishment
6	Consumers value and consumer satisfaction degree of correlation was significantly positive.	Established
7	Overall satisfaction and consumer loyalty of the correlation was significantly positive.	Established

Table 7 Master List of hypotheses

5. CONCLUSIONS

5.1 Conclusions

Data analysis by survey results, consumers smart phone, smart phone functions for the factors of importance to a significant degree level, showing that consumers in the purchase when the smart phone for smart phones Function very seriously, and as gender, age, occupation, education level and average annual income of the different features for smart phones will be different emphasis.

In the data analysis showed that the gender difference built for smart phones and smart phones factors camera processor and system function factor was significantly different, women are embedded in smart phone camera factors emphasis than men , while men of processors for smart phones and software system functionality factors emphasis than women; the different age groups of the entertainment features for smart

phones factors were significant differences in emphasis; different occupations for the smart phone Data storage and transmission factors, processor and system functions of factors, smart phones entertainment factors were significant differences in emphasis, and students of these three functions for the factors are even higher than the emphasis workers; in terms of level of education , For the smart phone functions are factors of great importance to the extent there is no significant difference; different average annual income for the entertainment factor of smart phones reached a significant level of emphasis

In the gender part, smart phone satisfaction factors, achieving significant levels of two factors, namely factor smart phone built-in camera and smart phone features additional tools factors, women for their smart phone built-in camera Factors of satisfaction than males, regardless of degree of attention in the smart phone functions or satisfaction, gender, the built-in camera functions of a significant level, and women in the importance and satisfaction level is higher than men, indicating that women Smart phone built-in camera for a greater demand; additional tools feature smart phone satisfaction factors of men than women, indicating males additional tools for the needs of smart phones than females; and age, For each smart phone feature satisfaction factors were not significantly different; in occupation, data storage and transmission factors to achieve significant levels of satisfaction, student data storage and transmission functions for the satisfaction of higher than office workers, and occupational Different functions for data storage and transmission factors of importance and satisfaction levels are reached significant levels, and students in terms of emphasis or satisfaction than workers with high student workers also often used than the camera phone, MP3, see Video and other data storage and transmission need to use the feature, so the students for the smart phone data storage and transmission functions of the large demand for more workers; education level of demographic variables and variables of the average annual income variables for the satisfaction of smart phone features Factors were not significantly different.

Consumer behavior and demographic variables for data analysis showed that information obtained from smart phones because of the different sources of demographic variables vary in gender, from television and the Internet to obtain information to achieve significant smartphone Standards, and the women on TV get smart phones from the proportion of information than men, while men on the Internet to obtain information on the proportion of smart phones than females.

And different career is in television, sales staff, store display, radio and other means of information to reach a significant level of smart phones, and students of information from the TV to obtain the proportion of smart phones significantly higher than office workers, and students "do not From the "sales staff, store display, radio and other means of information of the proportion of smart phones significantly higher than office workers.

The level of education obtained by the television for information to reach a significant level of smart phones, consumers of university education received from the television the highest proportion of smart phones; and different from the average annual income for the TV, store displays, radio and other means Information to reach a significant level of smart phones.

The results from the data analysis, a different gender in the purchase of the replacement rate and the current smart phone smart mobile phone brands held a significant difference in the frequency of replacement of smart phones, more than two years the highest proportion of women and men Highest frequency of replacement of smart phones for the year and a half to two years

Different occupations of the budget for the purchase and replacement of smart phones smart phones reached a significant level of the main reasons for the students of the budget for the purchase of smart phones

are mostly concentrated in one million or less, while the workers are mainly based on one million yuan to Two million as the purchase of smart phone of the budget; the main reason for the replacement of smart phones, students and office workers are the main reason of mobile phone failure, while the difference is due to reception and students, like other appearance of the Smart phones and mobile phone replacement of old and was significantly higher, and workers will be replaced by smart phones and mobile phone sales was significantly higher than students; educational attainment of different frequencies for the replacement of smart phones has reached a significant level , Level of education of consumers to switch mobile phone for the University more than two years the proportion of high frequency, while the educational level of consumers to switch mobile phone specialist frequency to a higher proportion of one and a half to two years.

Average annual income of the different budgets for the purchase of smart phones, smart phones the main cause of change and the current holders of smart phones reached a significant level of brand,

In the regression analysis of the results, by consumers and consumer loyalty is positively related to overall satisfaction, showing higher consumer satisfaction, the consumer brand loyalty will be higher, the smart phone industry should be Actively enhance consumer satisfaction, to maintain or enhance the brand loyalty of consumers.

5.2 Research Recommended

The smart phone built-in camera part of the women in terms of importance and satisfaction levels are higher than men, but there are many mobile phone industry will introduce a number of gender-smart phone market segment, so the mobile phone industry can Smart design for women camera phone can strengthen its function, and the camera as the features of the smart phone.

Men of processors for smart phones and systems, software feature attention than women, for the Additional utility smart phone satisfaction than women, so the mobile phone industry can strengthen the hair cut in a smart phone systems and applications Software, and improve efficiency of the processor, the smart phone market will be more obvious segments, and less able to attract male consumers.

the student budget for the smart phone features a lower, and for data transmission functions, entertainment features a high degree of importance than the office workers, so the mobile phone industry for the smart phone for the lower-order aspects of the entertainment features make innovation and upgrading, And smart phones for data storage and transmission functions to strengthen and enhance the students will purchase for the smart phone.

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四、建議

日本真的是一個非常漂亮的城市，可惜 4 月份台灣的學校還在學期中，因此，無法在日本多待幾天，所以沒有機會到日本的名勝古蹟走走，真的是太可惜了，希望如果將來研討會能改在 7、8 月份舉辦，那就更好了！

五、攜回資料名稱及內容

1. 大會為響應環保，因此僅印出發表文章之摘要，而完整的論文則是製作在光碟片中。
2. 北九州大學、國際商務學者聯合會以及台灣知識學會的簡介資料。

六、其他

在日本吃的東西都比台灣平均貴上 1.5 倍以上，因此，建議未來出國的人士，不妨自己多帶點乾糧或泡麵之類的，可節省點開支。

國科會補助計畫衍生研發成果推廣資料表

日期:2013/10/22

國科會補助計畫	計畫名稱：客製化商品與雲端服務資訊系統發展策略之研究	
	計畫主持人：洪健文	
	計畫編號：101-2410-H-041-003-	學門領域：資訊管理
無研發成果推廣資料		

101 年度專題研究計畫研究成果彙整表

計畫主持人：洪健文

計畫編號：101-2410-H-041-003-

計畫名稱：客製化商品與雲端服務資訊系統發展策略之研究

成果項目			量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）
			實際已達成數（被接受或已發表）	預期總達成數（含實際已達成數）	本計畫實際貢獻百分比		
國內	論文著作	期刊論文	0	1	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	1	100%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	0	1	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
國外	論文著作	期刊論文	0	2	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	1	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)	綜合研究的成果，此研究計畫發現參數的選擇與屬性的篩選對於資料探勘演算法的分類結果影響十分巨大，面對各種不同問題時所需最佳參數也有所不同，若沒有妥善的調整將會使分類正確率不佳或是產生過度配適問題。 另一方面在現實雲端資料庫中常存有過多屬性、雲端資料庫中存有雜訊離群值…等問題，這些不適當的數據輸入將造成結果不佳。因此必須藉由屬性篩選來幫助找雲端出最適合的最小屬性集合。 同樣的針對不同問題資料探勘演算法所需要的屬性集合也有所不同。此外針對每一種資料探勘分類器各有其優缺點及適用性的問題特性，此時可利用將其預測整合，得到更佳之結果，此種方法稱為 integrate 架構。其目的為利用多種分類組合而成，按照某種特定的方式整合各項分類方法的意見進行決策，其得到的結果會比只有單一分類方法的效果更好；此外由於每種分類方法的擅長之處不同，透過 integrate 組合的機制可以讓各種分類方法之間的準確度彼此互補，得到更好的結果。 本研究結果其啟發式的演算法會自動搜尋雲端資料庫對該資料最為適合的參數與屬性組合，無論是應用在各種商業領域中皆能對解決該領域問題有所助益。 學術價值上，此研究計畫高品質與國際標準(此文章已經投稿到 SCI 等級兩篇文章具有高水準(一篇影響力係數為 1.563；第二篇影響力係數 1.856，且兩篇排名為前 30%的國際學術期刊)。 未來可利用本計畫所提出之分類方法來解決跨領域的問題並協助提升台灣在國際學術舞台上的能見度。
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	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

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：

此研究計畫與原計畫相符程度很高，研究完全符合原本計畫書中規劃的目的，探討參數選擇與屬篩選對於資料探勘演算法(如:決策樹演算法、關聯式法則演算法、類神經網路中的自適應共振理論(ART)等的影響與參數及屬性間存在的關係，而探討資料探勘方法本身即有各自其優缺點及適用的問題之特性。若能將其預測整合，將得到更佳之結果(integrate 架構)。

研究設計與進行方面，原計畫書中採用雲端銷售資料庫中資料以及實驗評估與其他使用相同資料及進行改良分類正確類之學術文章比較，敝人有忠實地收集所需的資料集、撰寫程式與研讀相關國內外學術文章。

執行時程上剛好符合成效，原因除了研究團隊積極努力之外，亦考慮到多次反覆驗證實驗方法與程式是否有誤及修改。因此與計畫書時程相比進度時間剛好，而且在文章撰寫、實驗修正與程式驗證的時間上，也剛好符合所規劃的時間。

研究與實驗方法方面，計畫書中利用測試雲端資料集分類正確率做為評估模型好壞的基準，雖然演算法方法簡單但卻是資料探勘國際學術文章常常使用眾多資料測試與展示時常見的作法。

整體來看，與原本計畫相符程度在 90%以上，有達成原本計畫書中規劃的所有目的，也有如期順利地完成原本的研究內容。

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)

學術價值上，此研究計畫高品質與國際標準(此文章已經投稿到 SCI 等級兩篇文章具有高水準(一篇影響力係數為 1.563；第二篇影響力係數 1.856，且兩篇排名為前 30%的國際學術期刊)。

此研究計畫的成果因為無涉商業機密或專利，且可以應用在不同類型的分類問題中，且具有學術上創新與鼓勵理論發展的價值。因此，很適合在學術期刊發表此研究計畫的多項成果，除了有兩篇文章現在已經投稿到 SCI 學術期刊審查中，此外也將繼續將計畫研究成果

延伸並投稿至 SSCI 學術期刊尋求發表的機會，以協助提升台灣在國際學術舞台上的能見度。

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）

綜合研究的成果，此研究計畫發現參數的選擇與屬性的篩選對於資料探勘演算法的分類結果影響十分巨大，面對各種不同問題時所需最佳參數也有所不同，若沒有妥善的調整將會使分類正確率不佳或是產生過度配適問題。

另一方面在現實雲端資料庫中常存有過多屬性、雲端資料庫中存有雜訊離群值…等問題，這些不適當的數據輸入將造成結果不佳。因此必須藉由屬性篩選來幫助找雲端出最適合的最小屬性集合。

同樣的針對不同問題資料探勘演算法所需要的屬性集合也有所不同。此外針對每一種資料探勘分類器各有其優缺點及適用性的問題特性，此時可利用將其預測整合，得到更佳之結果，此種方法稱為 integrate 架構。其目的為利用多種分類組合而成，按照某種特定的方式整合各項分類方法的意見進行決策，其得到的結果會比只有單一分類方法的效果更好；此外由於每種分類方法的擅長之處不同，透過 integrate 組合的機制可以讓各種分類方法之間的準確度彼此互補，得到更好的結果。

本研究結果其啟發式的演算法會自動搜尋雲端資料庫對該資料最為適合的參數與屬性組合，無論是應用在各種商業領域中皆能對解決該領域問題有所助益。

學術價值上，此研究計畫高品質與國際標準(此文章已經投稿到 SCI 等級兩篇文章具有高水準(一篇影響力係數為 1.563；第二篇影響力係數 1.856，且兩篇排名為前 30%的國際學術期刊)。

未來可利用本計畫所提出之分類方法來解決跨領域的問題並協助提升台灣在國際學術舞台上的能見度。