

# We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

**4,800**

Open access books available

**122,000**

International authors and editors

**135M**

Downloads

Our authors are among the

**154**

Countries delivered to

**TOP 1%**

most cited scientists

**12.2%**

Contributors from top 500 universities



**WEB OF SCIENCE™**

Selection of our books indexed in the Book Citation Index  
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?  
Contact [book.department@intechopen.com](mailto:book.department@intechopen.com)

Numbers displayed above are based on latest data collected.

For more information visit [www.intechopen.com](http://www.intechopen.com)



# Application of Decision Support System in Improving Customer Loyalty: From the Banking Perspectives

Cho-Pu Lin and Yann-Haur Huang

*St. John's University/Department of Marketing & Logistics Management, Taipei, Taiwan*

## 1. Introduction

The focus of this research is on customer relationship management (CRM) and its adoption in Taiwan's banking industry. The concept of CRM and its benefits have been widely acknowledged. Kincaid (2003, p. 47) said, "CRM deliver value because it focuses on lengthening the duration of the relationship (loyalty)." Motley (2005) found that satisfiers keep customers with the bank while dissatisfiers eventually chase them out. Earley (2003) pointed out the necessity of holistic CRM strategies for every company because today even the most established brands no longer secure lasting customer loyalty. It seems clear that customer relationship management is critical for all service firms, including the banks.

### 1.1 Research motivations

Nowadays, for banking industry, one way to keep being profitable is to retain the existing customers, and one way to keep existing customers is to satisfy them. According to the 80/20 rule in marketing, 80% of sales comes from 20% customers. In addition, Peppers and Rogers (1993) pointed out that the cost of discovering new customers is six to nine time higher than that of keeping existing customers. Thus, it is critical to maintain customer loyalty. According to Lu (2000), through the adoption of CRM systems, companies could (1) find the best customers, (2) keep existing customers, (3) maximize customer value, and (4) develop effective risk management. In addition, successful CRM will create huge values for companies through improved customer retention rate. Therefore, it is worthwhile to conduct an empirical study on the adoption of CRM systems in Taiwan's banking industry.

### 1.2 Statement of problems

A major challenge banks are facing today is to implement new technology solutions that will provide more responsiveness and flexibility to their business clients. Many corporations are now conducting their transactions with fewer banks. Dobbins (2006, p. 1) said, "The challenge for all banks, large and small, is not only to create a centre of excellence with established international standards of communication, but also to reconstruct and automate their business processes to maximize efficiency." In addition, a number of researchers found that implementation of technology such as CRM do not guarantee that the expected results will be achieved. In fact, a number of studies indicate that firms have suffered failures

organizational problems (53%) or an inability to access the most relevant information technologies (40%) (Ernst & Young, 2001). In Taiwan's banking industry, there is also a CRM adoption issue. Most banks do not quite understand CRM. F. H. Lin and P. Y. Lin (2002, p. 528) said that according to a CRM-application survey of Taiwan's industries by ARC Consulting, 90% of the industry (most of which consists of banks) knew about CRM while only 64% understood the intension of CRM. Furthermore, only 10% of Taiwan's industries have already established the CRM systems. Hence, there is still much room for improving when it comes to CRM adoption in Taiwan's banking industry. Huang and Lu (2003, p. 115) noted that recently, the competition in local banking industry has become more acute as branches of banks are multiplying and as Taiwan has become a member of World Trade Organization (WTO). Given these environmental changes, implementing a CRM system is becoming a pressing item on local banks' agendas. At this juncture, then, addressing the importance of CRM adoption in Taiwan's banking industry is indeed a worthy cause. Huang and Lu (2003) further suggested that Taiwan's financial institutions, in this customer-oriented age, should not be limited to operational strategies that are product-oriented. Instead, according to these authors, they need to gauge customers' favorites accurately and find out the potential needs of their customers. Only by doing so, they would be able to promote their financial products with their customers. In the future, the focus of core competitive strategies in Taiwan's banking industry will shift from "products" to "customers." Thus, integrating front and back processes and understanding the intension and implementation of CRM have become an urgent task for Taiwan's banking industry. Therefore, it is imperative to explore the factors that would affect CRM adoption in Taiwan's banking industry and to solve the problems arising therein.

## 2. Literature review

A body of previous studies on this topic lends a solid basis to the present investigation. This literature covers the following sub-areas: (1) introduction of customer relationship management, (2) measurement of success with CRM, (3) CRM technologies and success with CRM.

### 2.1 Introduction of Customer Relationship Management

Customer relationship management (CRM) is now a major component of many organizations' E-commerce strategy. Trepper (2000) thought that CRM could be classified as (1) operational (e.g., for improving customer service, for online marketing, and for automating the sales force), (2) analytical (e.g., for building a CRM data warehouse, analyzing customer and sales data, and continuously improving customer relationships), or (3) collaborative (e.g., for building Web and online communities, business-to-business customer exchanges and personalized services).

### 2.2 Measurement of success with CRM

Every bank, regardless of its size, would pride itself on providing high-quality customer service. However, the challenge is that the benchmarks for high-quality customer services are changing dramatically, to the extent that yesterday's standards will not enable a bank to win today's customers. Shermach (2006) considered identifying customer expectation lines and reaching those lines the most important tasks for the banking industry. Sheshunoff (1999) likewise argued that banks will need to develop new tools and strategies in an effort to maintain their reputation and that those tools and strategies will likely involve CRM.

Once a CRM system has been implemented, an ultimate question arises. That is, whether the CRM adoption can be considered a success. Since there exist many measures to assess IT adoption success, care must be taken when selecting the appropriate approach for analyzing CRM implementations with banks. In the present study, the author chose to determine CRM implementation by process efficiency and IT product quality. These approaches make it possible to highlight the goals that need to be managed more actively during the CRM introduction process to make the adoption of CRM systems a success.

### **2.2.1 Process efficiency**

Levitt (1960) believed that customer satisfaction is the ultimate goal for every business because, for most industries, unsatisfied customers will eventually leave. To the same effect, Motley (1999, p.44) said, "In most industries, unhappy customers turn to competitors who promise more. This also happens in banking; it just takes longer." Cambell (1999, p. 40) said, "As the competition in banking and financial services industries continues to increase, achieving the highest possible levels of customer satisfaction will be critical to continued success." Along this line of thinking, Jutla and Bodorik (2001) have suggested that three customer metrics - customer retention, customer satisfaction, and customer profitability - could be used to measure CRM performance. These assertions have been corroborated by similar studies conducted in Taiwan. For instance, according to F. H. Lin and P. Y. Lin. (2002), with CRM systems, businesses could gain higher customer loyalty and higher customer value. Lu, Hsu and Hsu (2002) also argued that Taiwan's banking industry should utilize customer data analyses and multiple communication channels to increase customer satisfaction. In addition to customer satisfaction, process efficiency has been considered a norm for successful CRM adoption. Burnett (2004) stated that real-time assessment to CRM could increase efficiency, responsiveness, and customer loyalty, because it could make customer information available anytime and anywhere. As long as people continue to believe that CRM is equal to process efficiency, the real benefits of CRM will stay beyond reach. Baldock (2001) suggested that banks need to implement additional software that could do two things: (1) deciding what product or message should be offered to which customer and (2) delivering these product recommendations in real-time through all of the bank's channels allowing CRM to combine efficiency and effectiveness. The relationships that customers have with banks are becoming increasingly complex, so complex that the data that a customer's profile is based on needs to be updated continually, in real time. Luo, Ye, and Chio (2003) felt that businesses in Taiwan could involve customers in CRM by one-on-one marketing through Internet. By doing so, businesses could (1) achieve accuracy of information, (2) increase information value, (3) lower work-force demands, and (4) increase process efficiency. Chang and Chiu (2006, p. 634) also claimed that "it is also very meaningful to investigate factors influencing the efficiency of Taiwan banks." It seems clear, then, that for Taiwan's banking industry process efficiency is an important variable in determining the success of CRM.

### **2.2.2 Product quality**

Research on software engineering has identified certain IT product-quality dimensions, such as human engineering, portability, reliability, maintainability, and efficiency. A variety of metrics to assess these dimensions of CRM system quality has also been developed and validated. As this stream of research continues to evolve, its emphasis has been on the engineering characteristics of the CRM system while limited attention has been paid to

assessing and enhancing users' subjective evaluations of the system (Yahaya, Deraman, and Hamdan, 2008; Ortega, Perez, and Rojas, 2003). A key management objective when dealing with information products is to understand the value placed by users on these IT products. In contrast to the technical focus of CRM system's quality assurance research, customer satisfaction is an important objective of TQM (total quality management) initiatives. Customers have specific requirements, and products/services that effectively meet these requirements are perceived to be of higher quality (Deming, 1986; Juran, 1986). A similar perspective is evident in the IS management studies, where significant attention has been paid to understanding user requirements and satisfying them. Research has focused on identifying the dimensions of developing reliable and valid instruments for the measurement of this construct (Bailey and Pearson, 1983; Galletta and Lederer, 1989; Ives, Olson, and Baroudi, 1983). It seems clear that, for Taiwan's banking industry, product quality is an important variable in determining the success of CRM.

### **2.3 CRM technologies and success with CRM**

This section presents an exploration of the applications of certain technologies and their effects on CRM adoption in Taiwan's banking industry.

#### **2.3.1 Developing information technologies in the banking industry**

Chowdhury (2003) stated that banks are widely acknowledged to be heavily dependent on information technologies. This is so especially in the United States, where banking is considered a most IT-intensive industry. Such dependence is readily evidenced by the proportion of computer equipment and software employed by the U.S. banks in their day-to-day operation. Some researchers found that for the banks the IT spendings were as high as 8% of the industry's average revenue, with the average ratio of IT spending to revenue being approximately 2 to 3% for other industries. In addition, IT spendings represent about one third of the average operating expenses (Berensmann, 2005; Rebouillon and Muller, 2005). Furthermore, this pattern of extensive IT usage in banking is assumed to be similar across countries (Zhu, Kraemer, Xu, and Dedrick, 2004). However, this high level of IT has turned out to be a problem for many banks. Banks have traditionally relied on in-house development since the early days of electronic data processing. However, the emergent applications in the 1970s are conceived of as legacy applications today (Moormann, 1998). These legacy systems have historically been built around the banks' product lines, e.g., loans, deposits and securities, with very limited cross-functional information flow (Chowdhury, 2003). It is well known that in banking there have been substantial IT-driven business innovations which not only boost bank efficiency but also benefited the consumers. Automated teller machines and electronic fund transfer are among these innovations (Dos Santos and Peffers, 1995). Because of these cutting-edge innovations, banks have not been motivated to redesign their IT infrastructure in a modular, integrated and more flexible manner (Betsch, 2005). Consequently, most banks tend to use a number of isolated solutions to perform even standard business activities, such as loan application processing, instead of seamlessly integrating business processes and the underlying information systems. Nevertheless, prevailing legacy systems create problems not merely in data processing. They are also a major cost driver, as approximately two thirds of a bank's IT budget typically goes into the maintenance of legacy applications (Rebouillon & Muller, 2005). Therefore, existing IT infrastructures in banks are often obstacles to efficiently running a bank, in spite of a heavy investment in IT. Veitinger and Loschenkohl (2005) asserted that

modular and flexible CRM/ERP systems could mitigate some of the legacy-application problems with the banks since CRM/ERP systems may enable the banks to align their business processes more efficiently. Although the CRM systems are able to provide huge direct and indirect benefits, potential disadvantages, e.g., lack of appropriate CRM/ERP package, can be enormous and can even negatively affect a bank's Success with CRM adoption. Scott and Kaindl (2000) found that approximately 20% of functionalities/modules needed are not even included in the systems. This rate may arguably be even higher in banking, possibly creating the impression that CRM/ERP systems with appropriate functionality coverage are not available at all. In addition to the system package, the pressure from CRM/ERP vendors to upgrade is an issue. This pressure has become a problem due to recent architectural changes that systems of major CRM/ERP vendors face. That is, with the announcement of mySAP CRM as the successor of SAP R/3 and its arrival in 2004, SAP's maintenance strategy has been extensively discussed while users fear a strong pressure to upgrade (Davenport, 2000; Shang & Seddon, 2002).

### **2.3.2 Customization of CRM functions/modules**

Chang and Liu (2005) believed that customization is a key to gaining the emotional promises from the customers in Taiwan's banking industry and that such promises can increase customer loyalty (i.e., decreasing customer churn rate). Due to the fast-changing financial environment, competition and high customer churn rates, Taiwan's banking industry should focus on long-term customer relationships and strive to raise the customer retention rate. Li (2003) found that, in order to enhance customer services, the CRM systems should be adjusted when a company adopts them. In other words, companies should "customize" their CRM systems according to the demands of their own customers. If the customization of the CRM system cannot satisfy the customers, companies could further consider "personalizing" their CRM systems. Chang and Liu (2005, p. 510) stated that if a bank has effective ability to deal with a contingency or emergency and could provide professional financial plans as well as innovative services with its financial products, these customization functions could help increase the reorganization of customer values. Liao (2003) suggested that companies, when adopting CRM systems, should emphasize customer differentiation, customer loyalty, customer lifetime values, one-on-one marketing, and customization. Born (2003, p. 1) argued that "the greater the CRM functionality, the less customization of the CRM system required." Huang (2004, p. 104) also said, "When the goal of implementing CRM is to improve operational efficiency, the management should try to minimize the customization of a CRM system." Obviously, there is a difference in customization in the banking industry between the United States and Taiwan. Companies in Taiwan would more likely customize their CRM systems in order to satisfy their customers' needs. In U.S., though, customization is not as widespread. A main goal of the present study is to explore the relationship between customization of CRM functions/modules and the adoption of CRM's in Taiwan's banking industry.

### **2.3.3 Selecting the CRM vendors**

Once a company starts to implement a CRM system, it will look to the CRM vendors as a barometer of their CRM system's health. However, at any given point in time, one may choose from a host of CRM vendors (e.g., Oracle/People Soft, Siebel, Broadvision, NetSuite 10, SAP, E.pipjany, Rightnow CRM 7.0, Salesforce.com, Salesnet.com, and Microsoft).

According to Hsu and Rogero (2003), in Taiwan, the major CRM vendors are the well-known brand names, such as IBM, Oracle, Heart-CRM, and SAP. Confronted with so many vendors, organizations that wish to implement a CRM system will need to choose wisely. It has been recognized that the service ability of vendors would affect the adoption of information technologies (Thong and Yap, 1996). Lu (2000) posited that the better the training programs and technical support supplied by a CRM vendor, the lower the failure rate will be in adopting a CRM system. It is generally believed that CRM vendors should emphasize a bank's CRM adoption factors such as costs, sales, competitors, expertise of CRM vendors, managers' support, and operational efficiency (H. P. Lu, Hsu & Hsu, 2002). For banks that have not yet established a CRM system, CRM vendors should not only convince them to install CRM systems, but also supply omnifarious solutions and complete consulting services. For those banks that have already established a CRM system, in addition to enhancing after-sales services, the CRM vendors should strive to integrate the CRM systems into the legacy information systems. When companies choose their CRM vendors, they face many alternatives (Tehrani, 2005). Borck (2005) believed that the current trend among CRM vendors is moving toward producing tools that satisfy the basic needs of sales and customer support. The ultimate goal of a bank in choosing a CRM vendor is to enable the IT application intelligence to drive the revenues to the top line. Based on these views, it may be concluded that choosing a reputable CRM vendor and benefiting from its expertise are prerequisite for a successful CRM adoption in Taiwan's banking industry.

#### **2.3.4 Conducting DSS (Decision Support System)**

Since a bank offers countless daily services – offering credit cards, loans, mortgages – it is very risky for it to offer such services to customers they know nothing about. It is generally acknowledged that banks need to ensure the reliability of their customers (Hormazi & Giles, 2004). The concept here is simple: the banking industry has a need to reduce the risks from issuing credit cards or loans to customers who are likely to default. An example, given by Cocheo (2005), is of a bank that found a borrower appealing until receiving a court notice saying the customer had filed a bankruptcy. As a solution to problems such as this, the artificial neural network (ANN) has been widely adopted. According to Fadlalla and Lin (2001), an ANN is a technology using a pattern-recognition approach that has established itself in many business applications, including those in the U.S. banking industry. According to Turban, Aronson, and Liang (2004), an ANN is able to learn patterns in the data presented during training and will automatically apply what it has learned to new cases. One important application of ANN is in bank loan approvals because an ANN can learn to identify potential loan defaulters from the ascertained patterns. Turban et al. (2004) further observed that one of the most successful applications of ANN is in detecting unusual credit spending patterns, thereby exposing fraudulent charges. Therefore, conducting DSS systems, such as ANN technology, to analyze the customer data should be a critical step toward CRM adoption in Taiwan's banking industry.

#### **2.4 Summary**

In conclusion, this author, based on the previous studies, would like to test the relationship between CRM technologies and success with CRM. Table 1 sums up the factors selected from the literature review to be tested in the present study.

| <i>Factors</i>              |   |
|-----------------------------|---|
| Measurements of CRM success | A. CRM deployment.<br>B. Process efficiency.<br>C. Product quality. |
| CT1                         | Conducting the decision support system (DSS)s                       |
| CT2                         | Customizing CRM functions/modules.                                  |
| CT3                         | Choosing reputed CRM vendors.                                       |
| CT4                         | Drawing on the expertise of CRM vendors.                            |
| CT5                         | Pressure from CRM(ERP) vendor to upgrade.                           |
| CT6                         | Non-availability of appropriate CRM(ERP) packages.                  |

Table 1. A Summary of Variables Included in the Present Study

### 3. Research methodology

The objective of this study is to examine the impact of a variety of relevant factors on the CRM success in Taiwan's banking industry. This section presents the research question, hypothesis, and statistical techniques for hypothesis testing.

#### 3.1 The research question and the hypothesis

Since the challenges that the banks are facing today are to implement and support new technological solutions that will enable them to be more responsive and flexible to their business clients, the present study seeks to answer the following research question:

**Research Question:** What are the critical factors that explain the degree of success in the adoption of a CRM system in Taiwan's banking industry?

The hypothesis derived from this research question is displayed in the following:

**H<sub>1</sub>:** The CRM technology will be positively associated with successful CRM adoption in Taiwan's Banking industry.

#### 3.2 Research design

First, based on the findings from the literature review, an exploratory study (i.e., focus group interviews) was conducted to discover the nature of the problems and to generate possible solutions to the research question. Second, on the basis of the findings from the focus group interviews, a quantitative analysis was conducted using survey and statistical methods to identify possible answers to the research question.

##### 3.2.1 Research population and samples

The population for the present survey consists of the local banking industry in Taiwan, including domestic banks and local branches of foreign banks. The information about these banks came from the official website of Financial Supervisory Commission, Executive Yuan in Taiwan. There are 37 domestic banks and 31 local branches of foreign banks in Taiwan. The research samples are the CRM users in IT or Customer-Service departments in those banks.



### 3.3 Statistical methods

Two statistical methods were conducted in this present study: (1) EFA (exploratory factor analysis) and (2) SEM (structural equation modeling).

#### 3.3.1 Introduction

Figure 1 summarizes the processes of two statistical methods in the present study.

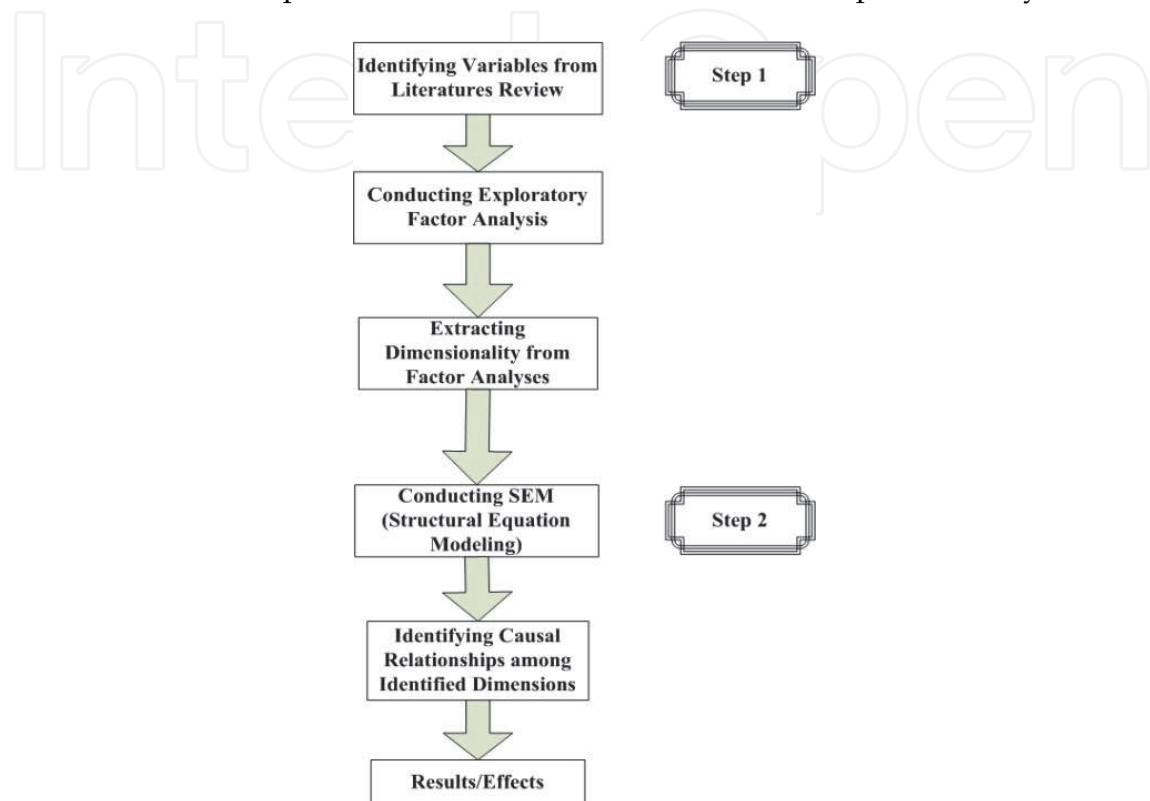


Fig. 1. A Summary of Statistical Methods

## 4. Results

In the present study, this author would like to test the causal relationship between CRM technologies and success with CRM. The hypothesis of the study, the variables involved and the statistical methods are described in the following.

Tested hypothesis:  $H_1$ : The CRM technology will be positively associated with successful CRM adoption in Taiwan's Banking industry

Observed variables: CT1 (Conducting the decision support system), CT2 (Customizing CRM functions/modules), CT3 (Choosing reputed CRM vendors), CT4 (Drawing on the expertise of CRM vendors), CT5 (Pressure from CRM/ERP package), CT6 (Non-availability of appropriate CRM/ERP packages), CRM deployment, Process efficiency, and Product quality

Latent variables: CRM technologies; success with CRM

Statistical method: Structural-equation modeling

The writing in the remaining part of this section is organized into the following subsections: (a) offending estimates, (b) construct reliability and average variance extracted and (c) goodness-of-fit.

a. Offending Estimates

As shown in Table 1, the standard error ranges from 0.001 to 0.006. There is no negative standard error in this model.

|                  | <i>Estimate</i> | <i>S.E.</i> | <i>C.R.</i> | <i>P</i> |
|------------------|-----------------|-------------|-------------|----------|
| CRM technologies | .016            | .003        | 4.481       | ***      |
| e10              | .036            | .006        | 6.453       | ***      |
| e1               | .034            | .003        | 10.318      | ***      |
| e2               | .031            | .003        | 10.202      | ***      |
| e3               | .013            | .001        | 9.132       | ***      |
| e4               | .002            | .001        | 2.015       | .044*    |
| e5               | .011            | .001        | 8.380       | ***      |
| e6               | .025            | .003        | 9.803       | ***      |
| e7               | .025            | .003        | 7.263       | ***      |
| e8               | .016            | .004        | 3.952       | ***      |
| e9               | .029            | .003        | 8.350       | ***      |

Note: Estimate = Unstandardized Coefficients; SE = Standard Error; C.R. = Critical Ration; P = Significance: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Table 1. Variances: Default model

Also, in Table 2, the standardized regression weight ranges from 0.381 to 0.983. All of the standardized regression weights are below 1.0. Thus, it is clear that the offending estimates do not occur in this model.

|                    |      | <i>Estimate</i>       |
|--------------------|------|-----------------------|
| Success with CRM   | <--- | CRM technologies .381 |
| CT1                | <--- | CRM technologies .563 |
| CT2                | <--- | CRM technologies .665 |
| CT3                | <--- | CRM technologies .863 |
| CT4                | <--- | CRM technologies .983 |
| CT5                | <--- | CRM technologies .892 |
| CT6                | <--- | CRM technologies .774 |
| CRM Deployment     | <--- | Success with CRM .791 |
| Process Efficiency | <--- | Success with CRM .895 |
| Product Quality    | <--- | Success with CRM .738 |

Note: Estimate = Standardized Coefficients

Table 2. Standardized Regression Weights: Default model

b. Construct reliability and Average variance extracted

Construct reliability of CRM Technologies was calculated (with a suggested lower limit of 0.70) by using this formula:

$$\rho_{c1} = \frac{\sum(\lambda_1)^2}{[\sum(\lambda_1)^2 + \sum(\theta_1)]} \tag{1}$$

$\rho_{c1}$  is the construct reliability of CRM technologies. Let  $\lambda_1$  be the standardized loadings (or the standardized coefficients) for CRM Technologies. Let  $\theta_1$  be the error variance for CRM Technologies. Based on the data in Table 3, the construct reliability of CRM technologies is:

$$\rho_{c1} = \frac{(0.563+0.665+0.863+0.983+0.892+0.774)^2}{(0.563+0.665+0.863+0.983+0.892+0.774)^2+(0.034+0.031+0.013+0.002+0.011+0.025)} = 0.9863 \quad (2)$$

Construct reliability of success with CRM in this model was calculated (with a suggested lower limit of 0.70) by using this formula:

$$\rho_{c2} = \frac{\Sigma(\lambda_2)^2}{[\Sigma(\lambda_2)^2+\Sigma(\theta_2)]} \quad (3)$$

$\rho_{c2}$  is the construct reliability of success with CRM. Let  $\lambda_2$  be the standardized loadings (or the standardized coefficients) for success with CRM. Let  $\theta_2$  be the error variance for success with CRM. Based on the data in Table 3, the construct reliability of success with CRM in this model is:

$$\rho_{c2} = \frac{(0.791+0.895+0.738)^2}{(0.791+0.895+0.738)^2+(0.025+0.016+0.029)} = 0.9882 \quad (4)$$

The average variance extracted of CRM Technologies was calculated (with a suggested lower limit of 0.50) by using this formula:

$$\rho_{v1} = \frac{\Sigma(\lambda_1^2)}{[\Sigma(\lambda_1^2)+\Sigma(\theta_1)]} \quad (5)$$

$\rho_{v1}$  is the average variance extracted of CRM Technologies. Based on the data in Table 3, the average variance extracted of CRM Technologies is:

$$\rho_{v1} = \frac{[(0.563)^2+(0.665)^2+(0.863)^2+(0.983)^2+(0.892)^2+(0.774)^2]}{[(0.563)^2+(0.665)^2+(0.863)^2+(0.983)^2+(0.892)^2+(0.774)^2]+(0.034+0.031+0.013+0.002+0.011+0.025)} = 0.9708 \quad (6)$$

The average variance extracted of success with CRM in this model was calculated (with a suggested lower limit of 0.50) by using this formula:

$$\rho_{v2} = \frac{\Sigma(\lambda_2^2)}{[\Sigma(\lambda_2^2)+\Sigma(\theta_2)]} \quad (7)$$

$\rho_{v2}$  is the average variance extracted of success with CRM. Based on the data in Table 3, the average variance extracted of success with CRM is:

$$\rho_{v2} = \frac{[(0.791)^2+(0.895)^2+(0.738)^2]}{[(0.791)^2+(0.895)^2+(0.738)^2]+(0.025+0.016+0.029)} = 0.9657 \quad (8)$$

To sum up, the construct reliability and average variance extracted in this model are considered acceptable as all of them are much higher than suggested values (0.70 and 0.50). This means, the inner quality of this model is acceptable and deserves further analyses.

c. Goodness-of-fit

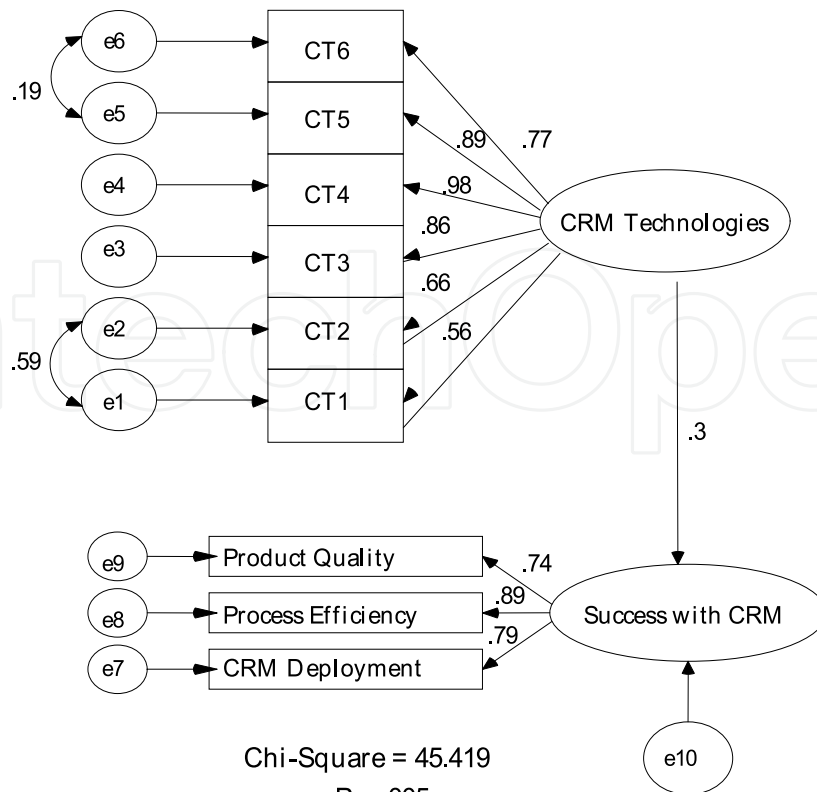
|  | <i>Factor loadings</i> | <i>Error variances</i> |
|--|------------------------|------------------------|
| <b>Latent Variable: CRM technologies</b> |                        |                        |
| Observed Variables: CT1                  | 0.563                  | 0.034                  |
| Observed Variables: CT2                  | 0.665                  | 0.031                  |
| Observed Variables: CT3                  | 0.863                  | 0.013                  |
| Observed Variables: CT4                  | 0.983                  | 0.002                  |
| Observed Variables: CT5                  | 0.892                  | 0.011                  |
| Observed Variables: CT6                  | 0.774                  | 0.025                  |
| <b>Latent Variable: Success with CRM</b> |                        |                        |
| Observed Variables: CRM deployment       | 0.791                  | 0.025                  |
| Observed Variables: Process efficiency   | 0.895                  | 0.016                  |
| Observed Variables: Product quality      | 0.738                  | 0.029                  |

Table 3. Factor Loadings and Error Variances: Default model

Figure 2 is a graphical representation of this model. With 45 distinct sample moments and 21 distinct parameters to be estimated, the total number of degrees of freedom is 24 (45 - 21). This model fits the hypothesized data structure well. The chi-square is 45.419 with 24 degrees of freedom, and  $p = .005$ . Although the p-value is below 0.05, all other critical fit index values are above the recommended critical value of .90 (GFI = .958, AGFI = .921, NFI = .969, TLI = .978) with RMSEA = .064 < 0.10.

Moreover, a few more findings came out of the testing of this model:

- i. The analyzed data in Table 4 indicate that CRM technology has a significant influence over success with CRM ( $p < 0.001$ ).
- ii. The assumption that the six observed variables (i.e., CT1 ~ CT6) would be positively influenced by CRM technologies was proved. The data in Table 4 indicate that the relationships between all of the six observed variables and CRM technologies were significant ( $p < 0.001$ ).
- iii. The assumption that three observed variables (i.e., CRM deployment, process efficiency and product quality) would be positively influenced by success with CRM was proved. The data in Table 4 indicate the relationships between all of the three observed variables on the one hand and success with CRM on the other hand were significant ( $p < 0.001$ ).
- iv. According to the standard regression weights in Table 2, the relationships among the variables in this model could be displayed with the formulas listed below:
  - a.  $\eta(\text{Success with CRM}) = 0.38\xi(\text{CRM technologies}) + e_{10}$
  - b.  $Y_1(\text{CRM development}) = 0.79\eta(\text{Success with CRM}) + e_7$
  - c.  $Y_2(\text{Process efficiency}) = 0.89\eta(\text{Success with CRM}) + e_8$
  - d.  $Y_3(\text{Product Quality}) = 0.74\eta(\text{Success with CRM}) + e_9$
  - e.  $CT6 = 0.77\xi(\text{CRM technologies}) + e_6$
  - f.  $CT5 = 0.89\xi(\text{CRM technologies}) + e_5$
  - g.  $CT4 = 0.98\xi(\text{CRM technologies}) + e_4$
  - h.  $CT3 = 0.86\xi(\text{CRM Technologies}) + e_3$
  - i.  $CT2 = 0.66\xi(\text{CRM technologies}) + e_2$
  - j.  $CT1 = 0.56\xi(\text{CRM technologies}) + e_1$
- v. The covariances in Table 5 indicate that the two-way relationships between the errors of CT5 & CT6 and CT1 & CT2 should be created. These relationships have statistical significance.



Chi-Square = 45.419

P = .005

GFI = .958

AGFI = .921

NFI = .969

TLI = .978

RMSEA = .064

Note: Chi-Square = Discrepancy; P = Probability Levels; GFI = Goodness of Fit Index; AGFI = Adjusted Goodness of Fit Index; NFI = Normed Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation

Fig. 2. Path Diagram

- vi. Based on the findings described above, it seems clear that  $H_1$  – The CRM technology will be positively associated with successful CRM adoption in Taiwan's Banking industry – is accepted, and the null hypothesis is rejected.

#### 4.1 Further discussion

As the coefficient weights in Figure 2 suggest, the variables containing special (high or negative) correlation coefficient weights need to be singled out as they are worthy of further discussion. This section will present reasons and descriptions for the phenomenon behind the correlation between these variables.

##### 4.1.1 Conducting the decision support system (DSS)

The coefficient weight between CT1 (conducting the decision support system) and CT2 (customizing CRM functions/modules) is significantly high (0.59). This result indicates that when banks in Taiwan try to a deploy a CRM project, they might need to conduct the decision support system as one of the customized CRM functions/modules. From the literature review of the present study, a difference in customization of a CRM system

|                    |      |                  | <i>Estimate</i> | <i>S.E.</i> | <i>C.R.</i> | <i>P</i> |
|--------------------|------|------------------|-----------------|-------------|-------------|----------|
| Success with CRM   | <--- | CRM technologies | .627            | .134        | 4.679       | ***      |
| CT1                | <--- | CRM technologies | 1.000           |             |             |          |
| CT2                | <--- | CRM technologies | 1.250           | .104        | 11.962      | ***      |
| CT3                | <--- | CRM technologies | 1.584           | .172        | 9.223       | ***      |
| CT4                | <--- | CRM technologies | 1.756           | .180        | 9.761       | ***      |
| CT5                | <--- | CRM technologies | 1.647           | .175        | 9.385       | ***      |
| CT6                | <--- | CRM technologies | 1.539           | .177        | 8.672       | ***      |
| CRM Deployment     | <--- | Success with CRM | 1.000           |             |             |          |
| Process Efficiency | <--- | Success with CRM | 1.216           | .099        | 12.260      | ***      |
| Product Quality    | <--- | Success with CRM | .911            | .082        | 11.113      | ***      |

Note: Estimate = Unstandardized Coefficients; SE = Standard Error; C.R. = Critical Ratio; P = Significance: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Table 4. Regression Weights: Default model

|     |      |     | <i>Estimate</i> | <i>S.E.</i> | <i>C.R.</i> | <i>P</i> |
|-----|------|-----|-----------------|-------------|-------------|----------|
| CT5 | <--> | CT6 | .003            | .001        | 2.279       | .023*    |
| CT1 | <--> | CT2 | .019            | .003        | 7.306       | ***      |

Note: Estimate = Unstandardized Coefficients; SE = Standard Error; C.R. = Critical Ratio; P = Significance: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

Table 5. Covariances: Default model

between the United States and Taiwan was discussed. In the United States, customization is not widely applied while companies in Taiwan are more likely to customize their CRM systems in order to satisfy their customers' needs. Chang (2003) believes that project managers, when adopting business intelligence systems such as CRM, should customize the systems, complete interface requirements, and conduct data conversion. Chang (p. 99) also suggests that companies establish stable and long-term relationships with their customers through customization software. Moreover, Lai (2006) argues that CRM systems should gather and analyze customer related information, develop forecasting models, provide real-time responses, and effectively customize communication channels by integrating well-established information technologies in financial service firms. Those discussions echo the statistical results from the present study. In addition, Turban, Aronson and Liang (2004, p. 457) consider CRM a fundamentally enterprise-level DSS. In the present study, this author defined CRM as a philosophy to understand and influence customers, to gain new customers, to retain existing customers, and to enhance the profits provided by customers in the banking industry. The subsequent empirical investigation makes it clear that a customer relationship management (CRM) system will provide the technology to do so. Corporations that are able to achieve high customer retention and high customer profitability are those that are able to provide the right product (or service), to the right customers, at the right price, at the right time, through the right channel (see Swift, 2001). Such is the main goal of CRM. The rise of "E-commerce" has affected the need for quality (product and service) and accurate customer analysis (Berkowitz, 2001; Kohli et al., 2001). Chou (2006)

takes artificial neural network (ANN) technology as one of the most popular methods on evaluation of credit-card loan decisions in Taiwan's banking industry. Support vector machine (SVM), an ANN technology, is singled out. Chou (2006) took artificial neural network (ANN) technology as one of the most popular methods for evaluating credit-card loan decisions in Taiwan's banking industry. Support vector machine (SVM), an ANN technology, was singled out by Chou. Both Chou (2006) and Hung (2005) held the predicting power of the support vector machine as being better than that of the other tools. Not only does it outplay the traditional statistical approach in precision, it also achieves better results than the neural network. With the incorporation of a support-vector machine (SVM) into individual credit-card loan systems, the banks will be to render a highly effective evaluation of customers credit conditions while decreasing the probability of bad debts. Equipped with complete mathematical theories, SVM can comply with the principle of risk minimization and deliver better performance. It is anticipated that properly applying the SVM theory to loaning decisions of a bank will be a great asset. Clearly, conducting decision support systems could help Taiwan's banking industry analyze its customers more accurately. CRM gathers customer data while tracking the customers. What's important here is using data to effectively manage customer relations. The foregoing discussions, in fact, resonate with the statistical results of the present study. Clearly, conducting decision support systems could help Taiwan's banking industry analyze its customers more accurately. CRM gathers customer data while tracking the customers. What's important here is use data to effectively manage customer relations. These further discussion resonate the statistical results of the present study.

## 5. Conclusion

In the present study, CRM technologies, containing six observed variables ([i.e., CT1 (conducting the decision support system), CT2 (customizing CRM functions/modules), CT3 (choosing reputed CRM vendors), CT4 (drawing on the expertise of CRM vendors), CT5 (pressure from CRM/ERP packages), and CT6 (non-availability of appropriate CRM/ERP packages)], indeed help CRM adoption in Taiwan's banking industry. Moreover, as mentioned in the research result, four variables contain special (high or negative) correlation coefficients need to be singled out. They are CT1 (conducting the decision support system) and CT2 (customizing CRM functions/modules), both with a high coefficient weight (0.59). Thus, if the banks in Taiwan wish to deploy a CRM program, they should consider the following suggestion:

**Conducting the decision support systems (DSS):** If the goal of implementing a CRM system is to improve the process efficiency and IT product quality, managers in Taiwan's banking industry should emphasize more on conducting the decision support systems (DSS) (e.g., artificial neural network (ANN) technology) as one of the customized module in the whole CRM system.

## 6. References

- Bailey, J. E. & Pearson, S. W. (1983). Development of a tool for measuring and analyzing computer user satisfaction. *Management Science*, Vol.29, pp. 519-529.
- Baldock, R. (2001). Cold comfort on the CRM front. *The Banker*, Vol.151, pp. 114.

- Berensmann, D. (2005). The role of IT in the industrialization of banking. In Z. Sokolovsky & S. Loschenkohl (Eds.), *Handbuch Industrialisierung der Finanzwirtschaft* (pp. 83-93). Wiesbaden: Gabler Verlag.
- Berkowitz, J. (2001). *Customer relationship management (CRM): The defining business initiative of the new millennium*. Available from <http://www.bi-bestpractices.com/view-articles/4662>.
- Betsch, O. (2005). The future of the banking industry. In Z. Sokolovsky, & S. Loschenkohl (Eds.), *Handbuch Industrialisierung der Finanzwirtschaft* (pp. 3-19). Wiesbaden: Gabler Verlag.
- Borck, J. B. (2005). CRM on demand. *InfoWorld*, Vol.27, pp. 30-39.
- Born, C. (2003). *What makes a good CRM package?* Available from <http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=81971>
- Burnett, A. (2004). Mobilizing CRM: Routes to success. *Customer Inter@ction Solutions*, Vol.23, pp. 40-42.
- Cambell, M. (1999). Affordable measurement at last! *Bank Marketing*, Vol. 31, pp. 40.
- Chang, B. S. (2003). *The advantages and critical successful factors of introducing customer relationship management system*. Unpublished Master's thesis, Chung Yuan Christian University, Chung Li, Taiwan, R.O.C.
- Chang, T. C. & Chiu, Y. H. (2006). Affecting factors on risk-adjusted efficiency in Taiwan's banking industry. *Contemporary Economic Policy*, Vol.24, pp. 634-648.
- Chang, K. & Liu, N. (2005). The effects of customer relationship programs on customer loyalty—An empirical study of Taiwan financial institutions. *Commerce and Management Quarterly*, Vol.6, pp. 491-514.
- Chou, C. H. (2006). *An application of support vector machines and neural networks on credit card loan decision*. Unpublished Master's thesis, National Taiwan University of Science and Technology, Taipei, Taiwan, R.O.C.
- Chowdhury, A. (2003). Information technology and productivity payoff in the banking industry: Evidence from the emerging markets. *Journal of International Development*, Vol.15, pp. 693-708.
- Cocheo, S. (2005). Back in balance. *American Bankers Association. ABA Banking Journal*, Vol.97, pp. 7-87.
- Davenport, T. H. (2000). *Mission critical: Realizing the promise of enterprise systems*. Harvard Business School Press, Boston, Massachusetts.
- Deming, E. (1986). *Out of the Crisis*. MIT Center for Advanced Engineering, Cambridge, MA.
- Dobbins, J. (2006). The future of banking technology? Available from <http://www.bcs.org/server.php?show=ConWebDoc.5851>
- Dos Santos, B. L., & Peffers, K. (1995). Rewards to investors in innovative information technology applications: First movers and early followers in ATMs. *Organization Science*, Vol.6, pp. 241-259.
- Earley, R. M. (2003). Foreshore: A vision of CRM outsourcing. *Customer Inter@ction Solutions*, Vol.22, pp. 42-46.
- Ernst & Young. (2001). *Eighth annual special report on technology in banking and financial services*.



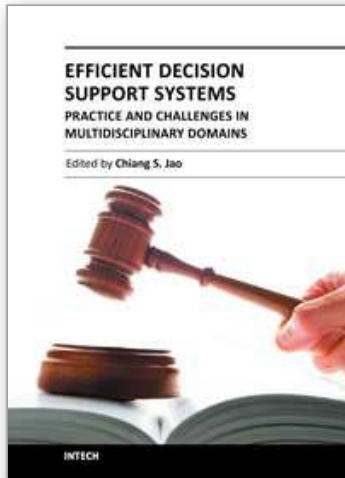
- Fadlalla, A. & Lin, C. (2001). An analysis of the applications of neural networks in finance. *Interfaces*, Vol.31, pp. 112-122.
- Galletta, F. G. & Lederer, A. L. (1989). Some cautions on the measurement of user information satisfaction. *Decision Sciences*, Vol.20, pp. 419-438.
- Hormazi, A. M. & Giles, S. (2004). Data mining: a competitive weapon for banking and retail industries. *Information Systems Management*, Vol.21, pp. 62-71.
- Huang, Y. H. (2004). E-commerce technology - CRM implementation and its integration with enterprise systems. Unpublished Doctoral dissertation, Golden Gate University, California.
- Huang, C. C. & Lu, C. L. (2003). The processing functions and implementation factors of Customer Relationship Management Systems in the local banking industry. *Journal of Information Management*, Vol.5, pp. 115-127.
- Hung, L. M. (2005). An application of support vector machines and neural networks on banks loan evaluation. Unpublished Master's thesis, National Taiwan University of Science and Technology, Taipei, Taiwan, R.O.C.
- Hsu, B. & Rogero, M. (2003). Taiwan CRM implementation survey report--2002. Available from <http://www.rogero.com/articles/taiwan-crm-report-article1.htm>
- Ives, B., Olson, M.H. & Baroudi, J. J. (1983). The measurement of user information satisfaction. *Communications of the ACM*, Vol. 26, pp. 785-793.
- Julta, D. & Bodorik, P. (2001). Enabling and measuring electronic customer relationship management readiness. In The 34th Hawaii International Conference on System Science, 3-6 January 2001. Hawaii, U.S.A.
- Juran, J. M. (1986). *Quality control handbook*. McGraw-Hill, New York.
- Kincaid, J. W. (2003). *Customer relationship management getting it right!* Prentice Hall, NJ.
- Kohli, R., Piontek, F., Ellington, T., VanOsdol, T., Shepard, M. & Brazel, G. (2001). Managing customer relationships through E-business decision support applications: A case of hospital-physician collaboration. *Decision Support System*, Vol. 32, pp. 171-187.
- Lai, K. Y. (2006). A study of CRM system from its current situation and effective factors perspectives. Unpublished Master's thesis, National Central University, Chung Li, Taiwan.
- Levitt, T. (1960). Marketing myopia. *Harvard Business Review*, July-August, pp. 3-23.
- Li, M. C. (2003). Object-oriented analysis and design for service-oriented customer relationship management information systems. Unpublished Master's thesis, Chaoyang University of Technology, Taichung, Taiwan, R.O.C.
- Liao, S. J. (2003). The study of decision factors for customer relationship management implementation and customer satisfaction in Taiwan banking industry. Unpublished Master's thesis, National Taipei University, Taipei, Taiwan, R.O.C.
- Lin, F. H. & Lin, P. Y. (2002). A Case study of CRM implementation: Cathay United Bank as an example. In The 13th International Conference on Information Management, 25 May 2002. Taipei, Taiwan, Republic of China.
- Lu, K. L. (2000). The study in CRM systems adoption effective factors in Taiwan's business. Unpublished Master's thesis, National Taiwan University, Taipei, Taiwan, R.O.C.

- Lu, H. P., Hsu, H. H. & Hsu, C. L. (2002). A study of the bank's establishment on customer relationship management. In The 13th International Conference on Information Management, 25 May 2002. Taipei, Taiwan, Republic of China.
- Luo, W. S., Ye, R. J. & Chio, J. C. (2003). The integration of CRM and Web-ERP system. In The 2003 Conference of Information Technology and Applications in Outlying Islands, 30 May 2003. Peng-Hu, Taiwan, Republic of China.
- Moormann, J. (1998). Status quo and perspectives of information processing in banking, Working Paper, Hochschule for Bankwirtschaft, Frankfurt, Germany.
- Motley, L. B. (1999). Are your customer as satisfied as you bank's shareholders? *Bank Marketing*, Vol.31, pp. 44.
- Motley, L. B. (2005). The benefits of listening to customers. *ABA Banking Marketing*, Vol. 37, pp. 43.
- Ortega, M., Perez, M. A., & Rojas, T. (2003). Construction of a systemic quality model for evaluating a software product. *Software Quality Journal*, Vol.11, pp. 219-242.
- Peppers, D. & Rogers, M. (1993). *The one to one future: Building relationships one customer at a time*. Bantam Doubleday Dell Publishing Group, New York.
- Rebouillon, J., & Muller, C. W. (2005). Cost management as a strategic challenge. In Z. Sokolovsky & S. Loschenkohl (Eds.), *Handbuch Industrialisierung der Finanzwirtschaft* (pp. 693-710). Wiesbaden: Gabler Verlag.
- Scott, J. E., & Kaindl, L. (2000). Enhancing functionality in an enterprise software package. *Information and Management*, Vol.37, pp. 111-122.
- Shang, S., & Seddon, P. B. (2002). Assessing and managing the benefits of enterprise systems: The business manager's perspective. *Information Systems Journal*, Vol.12, pp. 271-299.
- Shermach, K. (2006). Online banking: Going above and beyond security. Available from <http://www.crmbuyer.com/story/53901.html>
- Sheshunoff, A. (1999). Winning CRM strategies. *American Bankers Association ABA Banking Journal*, Vol.91, pp. 54-66.
- Swift, R. S. (2001). *Accelerating customer relationships: Using CRM and relationship technologies*. Prentice Hall PTR, NJ.
- Tehrani, R. (2005). A host of opinions on hosted CRM. *Customer Inter@ction Solutions*, Vol.23, pp. 14-18.
- Thong, J. Y. L. & Yap, C. S. (1995). CEO characteristics, organizational characteristics and information technology adoption in small business. *Omega*, Vol.23, pp. 429-442.
- Trepper, C. (2000). Customer care goes end-to-end. *Information Week*, March, pp. 55-73.
- Turban, E., Aronson, J. E. & Liang, T. P. (2004). *Decision support systems and intelligent systems (7th ed.)*. Prentice Hall PTR, NJ.
- Veitinger, M., & Lbschenkohl, S. (2005). Applicability of industrial practices to the business processes of banks. In Z. Sokolovsky & S. Loschenkohl (Eds.), *Handbuch Industrialisierung der Finanzwirtschaft*, (pp. 397-408). Wiesbaden: Gabler Verlag.
- Yahaya, J. H., Deraman, A., & Hamdan, A. R. (2008). Software quality from behavioural and human perspectives. *International Journal of Computer Science and Network Security*, Vol.8, pp. 53-63.

Zhu, K., Kraemer, K. L., Xu, S. & Dedrick, J. (2004). Information technology payoff in e-business environments: An international perspective on value creation in the financial services industry. *Journal of Management Information Systems*, Vol.21, pp. 17-54.

IntechOpen

IntechOpen



## **Efficient Decision Support Systems - Practice and Challenges in Multidisciplinary Domains**

Edited by Prof. Chiang Jao

ISBN 978-953-307-441-2

Hard cover, 478 pages

**Publisher** InTech

**Published online** 06, September, 2011

**Published in print edition** September, 2011

This series is directed to diverse managerial professionals who are leading the transformation of individual domains by using expert information and domain knowledge to drive decision support systems (DSSs). The series offers a broad range of subjects addressed in specific areas such as health care, business management, banking, agriculture, environmental improvement, natural resource and spatial management, aviation administration, and hybrid applications of information technology aimed to interdisciplinary issues. This book series is composed of three volumes: Volume 1 consists of general concepts and methodology of DSSs; Volume 2 consists of applications of DSSs in the biomedical domain; Volume 3 consists of hybrid applications of DSSs in multidisciplinary domains. The book is shaped decision support strategies in the new infrastructure that assists the readers in full use of the creative technology to manipulate input data and to transform information into useful decisions for decision makers.

### **How to reference**

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Cho-Pu Lin and Yann-Haur Huang (2011). Application of Decision Support System in Improving Customer Loyalty: From the Banking Perspectives, Efficient Decision Support Systems - Practice and Challenges in Multidisciplinary Domains, Prof. Chiang Jao (Ed.), ISBN: 978-953-307-441-2, InTech, Available from: <http://www.intechopen.com/books/efficient-decision-support-systems-practice-and-challenges-in-multidisciplinary-domains/application-of-decision-support-system-in-improving-customer-loyalty-from-the-banking-perspectives>

**INTECH**  
open science | open minds

### **InTech Europe**

University Campus STeP Ri  
Slavka Krautzeka 83/A  
51000 Rijeka, Croatia  
Phone: +385 (51) 770 447  
Fax: +385 (51) 686 166  
[www.intechopen.com](http://www.intechopen.com)

### **InTech China**

Unit 405, Office Block, Hotel Equatorial Shanghai  
No.65, Yan An Road (West), Shanghai, 200040, China  
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元  
Phone: +86-21-62489820  
Fax: +86-21-62489821

© 2011 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike-3.0 License](#), which permits use, distribution and reproduction for non-commercial purposes, provided the original is properly cited and derivative works building on this content are distributed under the same license.

IntechOpen

IntechOpen