Integrating Customer Relationship Management with Data Warehousing Technology – A Banking Industry Perspective

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A dissertation submitted to

Auckland University of Technology

in partial fulfilment of the requirements for the degree of

Master of Business

2010

School of Business

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Table of Contents

Figures

Tables

Attestation of authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Candidate signature:

Date:

Acknowledgements

This dissertation would not have been completed without the continuous support of some enthusiastic people. First, I would like to thank my supervisor Professor Bill Doolin for his support and assistance during the Masters program. Bill is always there ready to help and give constructive suggestions. His broad experience in analysing the implications of technology for organisations, and his expertise in research supervising, helped me through the most difficult parts of this research study.

I would like to thank Auckland University of Technology Business School, which gives constant support throughout the research year. The facilities and advisors are so valuable that I could not have persevered without them.

I wish to take this opportunity to thank my parents YuFu Sun and Hua Lu. Their wordless support guided me. I wish to thank my partner Melanie Han. With her understanding and patience, I finished my Masters dissertation.

A special thanks to my aunt YuHua Sun, whose encouragement and vision made me who I am today.

I acknowledge the AUT Ethics Committee (AUTEC) that approved ethic application number 09/185 for this research, at their meeting on 20 August 2009.

Abstract

This research studies the integration of customer relationship management (CRM) with modern data warehousing (DW) technology in the banking industry. The severe competition within the global financial service industry urges banks to upgrade their business intelligence systems, which ultimately increases their performance. Being the cutting-edge mass data solution, DW technology plays an increasingly important role in the customer segmentation process.

In the context of such an environment, this study seeks to analyse the optimal implementation approach for integrating CRM with DW, using case study as the main research method. Five secondary cases and one primary case are studied. Secondary cases are selected with pre-determined criteria from the existing literature. The primary case is generated through an interview with one of the leading commercial banks in China.

Based on the findings from both secondary and primary cases, the dissertation systematically reviews the critical issues of the implementation process. These critical factors are discussed in two main categories: external factors and internal factors. In addition, the customer segmentation process, which is the most important function of CRM, is analysed from both managerial and operational levels. DW infrastructures from different cases are compared and contrasted.

This research contributes to both academic research and industry practice through the empirical findings and analysis. Further research on the conceptual and technological framework developed is also needed, as they are the important factors to the success of DW technology implementation.

Chapter 1 Introduction

1.1 Background to the research

Competition within the banking industry is becoming fiercer. Effective setting up of business operational strategies is crucial to survival. Within the volatile and unpredictable financial market, banks' ability to make strategic decisions relies heavily on whether they can efficiently interpret information so as to maintain customer loyalty, reduce operational costs, maximise wealth and maintain a sustainable growth rate. In the meantime, competition is not bounded by the geographical boundaries between countries any more. Large multinational banking corporations make it even harder for the smaller ones to survive. Nevertheless, we have just witnessed a large empire in the global financial market collapse overnight. Without an effective weapon, any player in the game will suffer and eventually fail. Information will be the most important weapon in today's financial market competition.

With the development of financial institutions and commercial banks, supply and demand shifts from a seller's market to a buyer's market. The concentration of bank operations in turn shifts from product-oriented to customer-oriented. This new era requires banks to have both promotional marketing and classified service strategies. Customers are the most important resources for commercial banks. It is therefore crucial to develop customer-focused strategy and build up loyal customer relationships. Through a thorough understanding of customer needs and wants, customised products and services can be delivered. Customer relationship management (CRM) is a management concept developed according to the special needs of modern service industries.

Modern communication technologies affect the operational and business mode of commercial banks in a great deal of aspects. The wide use of the internet breaks up the limitations of different markets and requires banks to provide 24/7 financial services. The combination of electronic and traditional services provides a much wider platform. Banks are currently suffering from both economic recession and severe competition. Therefore,

a good CRM system is more important than ever before. However, to smoothly process a mass amount of data and provide accurate information goes beyond the scope of a normal database system: it must involve the implementation of data warehousing (DW) technology. Only DW technology can handle such large amounts of data and the necessary cleaning, filtering, extracting, and exporting activities. Thus, a well designed DW system is critical for building up a good customer relationship framework for commercial banks.

1.2 Research questions and objectives

The main objective of this research is to explore how to integrate CRM with DW technology effectively so that a bank could obtain a competitive advantage under a highly efficient, consistent, and mass volume data environment. Strategies of banks who adopt DW technology with the goal of CRM integration are also discussed in detail. Furthermore, this research aims to investigate infrastructures with which a win-win position for both banks and clients can be achieved. Not only could banks generate higher profit, but also customers could receive the quality service they deserve.

Four research questions form the basis of this research study:

1. How does DW technology support CRM and what is its infrastructure?

2. What factors are critical for the successful integration of CRM using DW?

3. To what extent is DW technology seen to be supporting CRM in the banking industry?

4. How is the integration of CRM realised? What is its detailed process?

1.3 Reasons for the research

Revision of previous research reveals that CRM involves IT to a significant degree, yet little research exists on the design, use or success of IT systems to support CRM from the marketing perspective (Reinartz, 2004). CRM research is considered by many researchers as limited in nature and scope, due to a lack of empirical and generally stable research. Much of the IT related research is focused on the functional aspects of implementation. The limited number of CRM-specific empirical studies and theories available today needs to be expanded and explored further.

From the author's point of view, the application of DW to the integration of CRM in the banking industry is critical and essential. From an overview of the literature, the author found that many researchers set CRM as their target for analysis without empirical support. There is little prior in-depth research focused on the technological implementation process of DW in the banking industry.

1.4 Outline of this dissertation

This research is carried out in the context of information management playing an important role within the banking industry. CRM and DW technology are analysed with real world cases and interviews.

This study will try to bridge and connect the two important concepts, namely CRM and DW technology, in a different way. The literature review will firstly reinforce the definition and significance of CRM, following which a more technical revision of DW will be carried out.

This dissertation will be organised as follows: the second chapter systematically reviews literature which is relevant to this topic. The third chapter focuses on the research methodology and research process design. After comparing several popular research

methods, case study plus interview is decided upon as the research method. Chapter 4 presents the case study findings, and Chapter 5 summarises the interview feedbacks together with supportive documents. Chapter 6 is the discussion part where the results from two sources are compared and analysed. Chapter 7 is the concluding chapter.

Chapter 2 Literature review

This chapter is a review of prior studies in the literature. The necessary background information for this research study includes CRM and DW technology. The review is organised with the following structure: First of all, descriptive introductions to CRM and DW are drawn based on previous studies in the literature. Definitions are generated and compared along the time line. Benefits of CRM in banking industries are also discussed. Several key technical terms of DW are explained with simple, descriptive English in the second part of the review. Based on the literature analysis of both CRM and DW, the author summarises a comprehensive information flow between CRM and DW. Finally, the gaps found in the literature, and the research objectives and questions are then explained.

2.1 Customer relationship management (CRM)

2.1.1 Definition of CRM

To the best knowledge of the author, the concept of CRM has been in existence for quite some years. CRM appeared around 1997 as a means of redefining the customer-company relationship through computer-based tools (Bergeron, 2002).

Author / year	Definition of CRM
Glazer (1997)	CRM attempts to provide a strategic bridge between information technology and marketing strategies aimed at building long-term relationships and profitability. This requires 'information-intensive strategies'.
Kutner and Cripps (1997)	CRM is data-driven marketing.
Hobby (1999)	CRM is a management approach that enables

	organisations to identify, attract, and increase retention of profitable customers by managing relationships with them.
Ling & Yen (2001)	CRM comprises a set of processes and enabling systems supporting a business strategy to build long-term, profitable relationships with specific customers.
Parvatiyar & Sheth (2001)	CRM is a comprehensive strategy and process of acquiring, retaining, and partnering with selective customers to create superior value for the company and the customer.
Bose (2002)	CRM is an integration of technologies and business processes used to satisfy the needs of a customer during any given interaction. CRM involves acquisition, analysis and use of knowledge about a customer in order to sell more goods or services and to do it more efficiently.
Kincaid (2003)	CRM is the strategic use of information, processes, technology, and people to manage the customer's relationship with the company (marketing, sales, services, and support) across the whole customer life cycle.
Buttle (2004)	CRM is an integration of technologies and business processes used to satisfy the needs of a customer during any given interaction. CRM involves acquisition, analysis and use of knowledge about a customer in order to sell more goods or services and to do it more efficiently.

Table 1 Historical definition of CRM

From Table 1, it can be seen that the CRM concept has not been significantly adjusted during the past decade. Instead, researchers keep the main root and develop branches of the concept. The relationship between customers and companies is discussed from time to

time in the literature, while CRM remains the connecting line. Customer information is the concentration of CRM from the very beginning. However, during recent years, the success of CRM is becoming more and more dependent on the technologies. Thus, information technology (IT) plays an important role in the application of CRM in the business environment.

In this research, the following simple definition of CRM is used: CRM is an important strategy used by businesses to select and manage their valued customers. Compared with the definitions from Table 1 above, this description of CRM is much easier to understand and follow in practical terms. CRM is a customer-focused commercial philosophy, which supports the marketing, sales and services by various means. Through continuous improvement of CRM, interaction methods, resource allocation, and operational flow, companies can achieve low operational costs, enhanced sales volume, increased productivity and satisfactory customer service quality. The purpose of the application of CRM is not only to keep up good service quality, but more importantly, to retain competitive advantage.

2.1.2 The three levels of CRM

Buttle (2004) summarises CRM into three different levels: Strategic CRM, Operational CRM and Analytical CRM. The three levels form a circle.

Figure 1 Three levels of CRM (adapted from Buttle, 2004)

There is no starting point within this loop. Each step is supported by the previous one and will in turn support the next.

2.1.2.1 Strategic CRM

Strategic CRM focuses on the formation of a business environment where customers come first. The centre of business culture is to create and retain superior customer relationships. This is also known as customer orientation or market orientation.

It has been five decades since the concept of Market Orientation came into existence as a good method for finding a target customer group (Bose, 2002). In the 1850s, businesses could sell almost anything they made. The supply of goods and services were relatively low. It was a seller's market, where companies focused on production. This is sales orientation. In the 1900s, businesses realised that competition did exist and took away their profits. In the 1950s, competition among businesses grew severe. Since then the market has shifted to a buyer's market, where companies need to convince customers and try hard to satisfy their needs. This is marketing orientation, which focuses on the needs

of different customer segments. A notable result of marketing orientation is what is now coined as customer segmentation (Bose, 2002). Segmentations can be age group, gender, career, etc. Customers are put into different groups according to a common or similar criterion.

As a firm's knowledge of marketing advanced, the needs of any one customer were lost in exchange for the more efficient trend of marketing orientation (Pride & Ferrell, 1999). Kholi and Jaworski (1990) have described market orientation as the ability of an organisation to generate, disseminate, and use superior information about both customers and competitors. As Berger and Berchwati (2000) put it, the core of relationship marketing is the development and maintenance of long-term relationships with customers, rather than simply a series of discrete transactions.

Other researchers, however, have begun to embrace a broader perspective on the market orientation construct by including exogenous factors that influence customer needs, such as competitors and even government regulation (Kholi & Jaworski, 1990; Lusch & Lazniak, 1987; Slater & Narver, 1994). Nevertheless, Kolter (2000) identifies some other business logics: product orientation and sales orientation, which compete with the customer-centric concept.

2.1.2.2 Operational CRM

Operational CRM is focused on the automation of the customer-facing parts of businesses (Buttle, 2004). In general, operational CRM is a series of software solutions to the operational process.

There are three types of automations: Marketing Automation (MA), Sales-Force Automation (SFA) and Service Automation (SA) (Buttle, 2004). Marketing automation enables the marketing process through technology implementation, helping the organisation to design, organise and monitor its marketing campaign. CRM facilitates the

target-marketing strategy. Cost-reduction marketing strategy contributes to the organisation's competitive advantage. Sales-Force Automation applies technology to daily sales activities, enabling organisations to automatically track down sales activities and customer behaviour. It facilitates the recognition of the potential sales opportunities and sales channels. Service automation enables the integration of service operations.

Different software applications enable marketing, selling and service automation. The sales information sharing network is an important role of operational CRM. Companies use their direct interaction with customers as a platform. Loyalty cards, as an example, record all transaction information and individual preferences. Through the business' operations, information is generated and collected; however, without the Analytical CRM discussed below, the information will be of no use.

2.1.2.3 Analytical CRM

Analytical CRM is concerned with exploiting customer data to enhance both customer and company value (Buttle, 2004), and is dependent on customer information, which is scattered within a corporation. There is a need to have some kind of software application to centrally store and manipulate all the relevant information.

Analytical CRM is crucial for CRM implementation. Without it, the strategic and operational functions will not be fully utilised. There are a number of reasons why analytical CRM is so important in the CRM implementation process. However, limited to the time scale and scope of this dissertation, the author has selected the following issues to discuss as particularly relevant.

The analytical CRM will benefit both companies and customers. On the one hand, customers will be receiving more customised and time-efficient products or services. On the other hand, companies will have more cross-selling and up-selling opportunities.

Apart from that, it is easier for businesses to retain customers, as the relationship with each individual is set up based on their specific needs or preferences.

Analytical CRM enables the utilisation of operational CRM. For instance, Wal-Mart adopted analytical CRM to analyse data collected from 1200 stores to identify performance of each selling segment and effectiveness of promotion (Buttle, 2004). This move can actively manage and enhance the average basket value for customers shopping at Wal-Mart.

Analytical CRM provides decision makers with an overview of their current marketing and sales situation. Since client satisfaction, relationship retention and loyalty determine the performance of the business, analytical CRM can be particularly useful in answering the following questions:

- Who are our most valuable customers?

- Which client group should we target with this product/service?

- How much of our resources should we allocate to a particular customer group?

2.1.3 Grounds for using CRM

According to Baran, Galka and Strunk (2008) there are four reasons why modern marketers should pay much more attention to their relationship with customers. First of all, technological advances in IT have made relationship marketing feasible by enabling companies to record and monitor every transaction for each of their customers. Secondly, the growth of direct marketing stimulates one-to-one relationships with customers. Thirdly, academic researchers in the marketing area realise that acquiring customers is only the first stage in the marketing process and that retaining them should be their greatest concern. Last, but not least, some industrial gurus have posted a number of

influential articles, stating that the loss of customers is one of the most important causes of company losses.

It is far more expensive for companies to acquire new customers than it is to retain existing ones. In fact, acquiring new customers can cost five times more than it costs to maintain current customers (Massey, Montoya-Weiss & Holcom, 2001). Companies have realised that instead of treating all customers equally, it is more effective to invest in those who are valuable or potentially valuable, while limiting their investments in non-valuable customers. Therefore, it is essential for businesses to analyse their clients in a variety of ways and across different levels. A long sustainable relationship between companies and customers is desired.

2.1.4 Significance of CRM in banking industries

Unlike manufacturing and some service industries, according to Zineldin (2005), bankers are selling not only products and services. First and foremost, they are selling their organisation's reputation with every customer relationship. An effective customer relationship requires the marketer to make specific efforts to create, establish and develop a good quality package mix in order to be able to maintain and enhance the relationship intact.

Within the banking industry, there are mainly two ways to establish a competitive advantage: one is to have a low cost scheme, and the other is to offer products and services in a unique and valuable way (Porter, 1980). This indicates that on top of the products and services banks could normally offer to customers, a bank needs to provide them differently, in such a way as to add value to both clients and banks. The value-added movements include analysis of customer needs and wants. The world has changed greatly during the past decade. With the increased development of information and communication technologies, the interaction between customers and banks has gradually shifted from face-to-face in branches, to various other forms, for instance, the

greater use of innovations including tele-working (Ndubisi & Kahraman, 2005): ATMs, one of the most popular means of quick cash; telephone banking or internet banking, saving time for customers and cutting costs for banks; and mobile banking, which provides an 'anytime and anywhere' service. The application of these modern communication methods not only provides more convenience for clients, but also requires a much higher standard of CRM. Meanwhile, lack of the face to face services is now challenging banking systems as it is now more difficult to assess the loss of clients' time. With all the above in mind, CRM is one of the most important strategies for banking to differentiate themselves in this industry. CRM can be viewed as a strategy used by banks to select the most profitable customers.

A bank has to create customer relationships that deliver value beyond that provided by the core product (Zineldin, 2005). It is essential for banks to build up a good customer relationship environment so that clients can receive values beyond banks' routine services or products. Competitive advantage can be achieved by differentiating products and controlling service quality. A single bank cannot possibly fulfil all the needs of a customer. Instead, it should position itself with its competitive advantage. In the meantime, service quality and CRM monitoring should be enhanced so as to sustain that competitive advantage. As a result of findings in the CRM area, banks realise the need to analyse customers' desires and their individual needs. Thus, the banking industry is being transformed into the area of CRM technical support. Data processing and manipulation is in high demand within the industry.

Wells, Fuerst and Choobineh (1999) have summarised that a one-to-one marketing paradigm has emerged that suggests organisations will be more successful if they concentrate on obtaining and maintaining a share of each customer rather than a share of the entire market, with IT being the enabling factor. There are two conclusions that the author has drawn from this statement. First of all, for a bank to achieve great success in the future, it must adopt CRM thoroughly. Second, an efficient analysis for CRM and the decision-making process will rely heavily on IT.

2.1.5 Conditions of CRM implementation in the contemporary banking industry

Wells et al. (1999) indicate that both marketing and IT need to work together with a high level of co-ordination to produce a seamless process of interaction.

During the CRM integration process, barriers may occur due to asymmetric information. IT and marketing departments will have to work closely in order to utilise the information. Data need to be sorted in such a way that customised interactions can be built up.

DW technology is the solution here. Its capability in processing mass-volume data and customer-oriented features make it visible to the top management of large organisations, especially financial service sectors.

To sum up, the above review of the literature illustrates CRM principles and impact over businesses, especially banks. Next, the focus turns to the technical support division. DW, which is the technical infrastructure used to support CRM analysis, will be reviewed in detail. The literature of DW is becoming richer than ever before.

2.2 Data warehousing (DW)

2.2.1 Definition of DW

The concept of DW was initiated by Inmon (1993): "A data warehouse is a subject-oriented, integrated, non-volatile, and time-variant collection of data in support of management's decision." This is the first formal definition of DW and from this author's point of view, the most comprehensive one. Therefore, this research will follow Mr. Inmon's understanding of the concept.

Author / Year	Definition

Inmon (1993)	A data warehouse is a subject-oriented, integrated, non-volatile, and time-variant collection of data in support of management's decision.
Kimball (1996)	A series of statistics of data are retrieved from daily transaction systems to form another data warehouse. Thus, data warehouses can be called a database of decision support.
Gray & Watson (1998)	A data warehouse (DW) is a database system designed to support organisational decision processes and is separate from traditional transaction processing systems.
Dukart (1998)	Data warehouse is a collection of all the demographic and transactional data about consumers and businesses that a company collects, stores and reviews.
Mannino, Hong & Choi (2007)	A central depository where data from operational databases and other sources are integrated, cleaned, and archived to support decision making.
March & Hevner (2007)	A data warehouse is a repository into which are placed all data relevant to the management of an organisation and from which emerge the information and knowledge needed to effectively manage the organisation.

Table 2 Definition of DW

Interpreted by Singh (1998), the four characteristics of DW are explained in simple English as follows: 'subject-oriented' means the DW focuses on the high-level entities of the businesses; 'integrated' means the data is stored in a consistent format; 'time-variant' means the data associates with a point in time; 'non-volatile' means the data does not change once it gets into the warehouse.
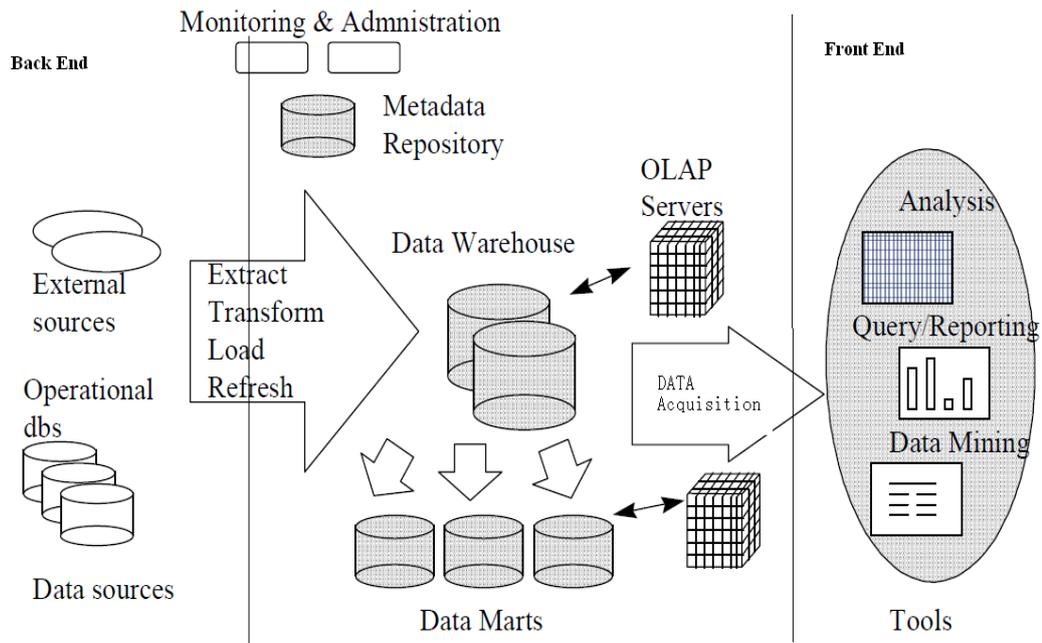
Figure 2 Composition of DW system (adapted from Singh, 1998)

2.2.2 Benefits of DW

Benefits	Constraints/ Concerns
Improves productivity of corporate decision makers through consolidation, conversion, transformation and integration of operational data and provides a consistent view of the enterprise (Singh, 1998).	The setting up cost of a new DW can be substantial; eg: hardware/software.
Data can be easily accessed and analysed without manipulation or processing, which saves a huge amount of time. It essentially saves the labour time of IT staffs and decision makers (Ku & Huang, 2003).	The implementation of the DW will cause possible technical problems. Training is essential.
The real strength of building a DW is the flexibility to combine the disparate data sources into a single combined system	

(Westerman, 2001).
The information is much better (Watson, Goodhue & Wixom, 2002).

Table 3 Benefits and drawbacks of DW

The most straightforward benefits of DW are time savings and better organised information. However, there are some implicit benefits which are called "intangible benefits" by Watson, Goodhue and Wixom (2002), who thus categorise its help in the decision-making process. DW technology helps decision makers to get real time information about opportunities or threats and leads to better decisions. Watson et al. (2002) determine that the greatest benefits occur when they are used to redesign business processes and support strategic business objectives.

The DW system is not a standalone system. In order to fully utilise the technology, a number of applications and sub-systems are introduced by the innovators. This research reviews these concepts and applications so that a more advanced DW system can then be introduced.

2.2.3 Data mart

DW supports the entire firm, but subsets can exist in the form of data marts. A data mart is a subset of the DW that contains data relating to a portion of the firm's transactions (Zikmund, Raymond & Gilbert, 2003). For instance, a DW is used by the entire corporation whereas a data mart could be used by individual departments (such as the human resource department) within the corporation. Data mart data are selected to meet the specific needs of a subset of the organisation, whereas a DW brings together data from various operational systems to provide an integrated view (Humphries, Hawkins & Dy, 1999).

2.2.4 Decision Support System (DSS)

For businesses today, strategic decision making is a rather difficult task. The reason is obvious: the requirements for an information system have increased to a higher level, where not only storage of data but also its analysis is needed. Both practitioners and academic researchers are actively seeking solutions to it.

One of the most successful solution packages is called Decision Support System (DSS). DSS is a computer technology solution that can be used to support complex decision making and problem solving (Shim et al., 2002). DSS is facilitated by the implementation of DW technology. Decisions are made upon optimal selection of multiple alternatives. DSS combines data and mathematical models to help decision makers in their work (Vercellis, 2008). The computerised modelling method and massive volume of data makes the DSS rely closely on the data processing system. DW technology, being one of the most cutting-edge data processing technologies, is deemed to be the major facilitator of the DSS process.

2.2.6 Relationship between CRM and DW technology
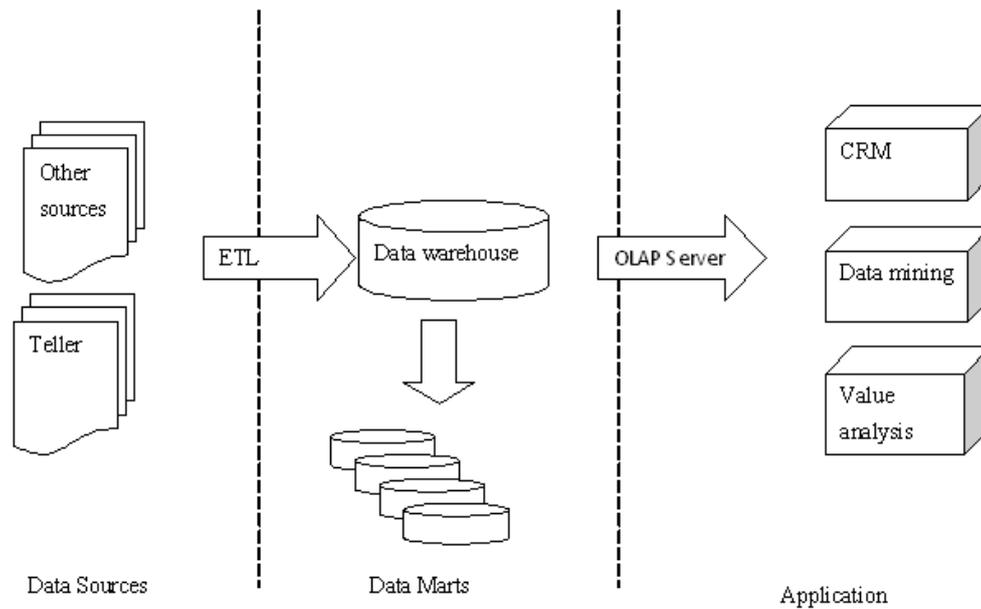
Figure 3 Relationship between CRM and DW system

Figure 3 illustrates a brief information flow between CRM and DW. Data are generated from various sources, such as bank tellers, or ATMs. A series of processes are carried out, including extracting, transforming, loading, and cleaning. The data must be cleaned up, standardised and loaded into a database, which stores cross-sectional as well as time series information. For the purpose of this research, the author assumes the DW is built up with the multi-dimensional approach. The first step is to get information into the warehouse from the data mart. The data are retrieved from DW through the use of a software application. On-Line Analytical Processing (OLAP) is used as a mainstream application in the DW process. The connection between CRM and DW is realised through OLAP as a functioning intermediate. It is a stable platform which can perform multiple commands and be scalable.

CRM is a broad concept involving a series of different decision-making tasks. Each decision-making process has a different set of data requirements. DW technology enables the integration of CRM from various perspectives. Firstly, DW capability of processing mass-volume data makes complicated data manipulation possible for the use of CRM

analysis. Secondly, CRM decision-making tasks can be simplified through the adoption of an OLAP view table. The responding time for management queries is shortened so that time-efficient decisions can be made. Thirdly, through the use of the DW system, customer segmentation is realised, which builds up the foundation of CRM.

2.2.7 Significance of DW as tool of the implementation of CRM in the banking industry

With increasing competition within the industry, information required by banks will need to be much more accurate and time efficient so that it can support the strategic decision-making process and improve CRM. Kincaid (2003) has viewed CRM as the strategic use of information, process, technology, and people to manage the customer's relationship with the company (e.g., Marketing, Sales, Services, and Support) across the whole customer life cycle. From the author's point of view, there is an emphasis on unique customer data being maintained across many departments in the banking database system. For example, the credit department would need customer information relevant to a credit check, whereas it is the sales department that has the information about the customer's preferred banking product. It would be very cost inefficient and time consuming if the two departments were to maintain their own databases separately. Thus, it is important to centralise the customer database. Banking intelligence is emerging to satisfy this requirement. Bank intelligence refers to the ability of gathering, managing, and analysing large amounts of data on customers, products, services, operations, suppliers, and partners and all the transactions in between (Lin, Zhu, Yin & Dong, 2008).

With the increasing volume of data, traditional data processing methods will no longer provide sufficient support. We are better off to open a new way to look at the CRM database – the DW. DW is a new concept as a result of technology improvement. The definition of DW technology is described as collecting data from several dispersed sources to build a central DW. Users can then use appropriate data analysing tools to store

and analyse needed data (Hwang, Ku, Yen & Cheng, 2004). Cunningham, Song and Chen (2006) have indicated that "by utilising a DW, companies can make decisions about customer-specific strategies such as customer profiling, customer segmentation, and cross-selling analysis." Zhou, Huang and Wang (2008) interpret the four features pioneered by Inmon which the author consider to be beneficial to the banking industry: Firstly, DW is subject-oriented, which means information is categorised and stored according to its theme (such as customer personal information); secondly, DW data is integrated, indicating that when needed banks could logically bundle subject-oriented information; thirdly, DW stability provides reliable historical information; fourthly, it reflects historical change, which could be used to track down the trend for analysis purpose. After all, a consistent, effective and efficient data analysis is critical to the development of a bank. It helps to improve the quality of service and increase competitiveness.

2.3 OLAP and multi-dimensional analysis

OLAP and multi-dimensional analysis are reviewed here in accordance with the purpose of this research. Being an established and effective analytical tool, OLAP is increasingly utilised in today's enterprise systems. Multi-dimensional analysis is an important aspect which will influence the outcome of this research.

Pioneered by Dr. E. F. Codd in 1993, OLAP is the abbreviation for On-Line Analytical Processing. OLAP is an approach to quickly provide answers to analytical queries that are multi-dimensional in nature (Lin et al., 2008). It describes a class of technologies that are designed for live ad hoc data access and analysis (Singh, 1998). It is an architecture used to provide users with the ability to perform dynamic data analysis (Koutsoukis, Mitra & Lucas, 1999). Traditionally, data was stored in OLTP (On-Line Transaction Processing). The occurrence of OLAP is due partially to the higher demand of decision-making information quality.

A more comprehensive definition was given by the OLAP Council (1995) "OLAP is software for manipulating multidimensional data from a variety of sources that has been stored in a DW. The software can create various views and representations of the data. OLAP software provides fast, consistent, interactive access to shared, multidimensional data. These systems are used to discover trends, analyse critical factors and perform statistical analysis."

Facts represent quantitative (or factual) data about a business entity/transaction, while dimensions contain descriptive data that reflect the dimensions of that entity (Ahmad, Azhar & Lukauskis, 2004). In other words, facts are the real contents of the DW, whereas dimensions are the names of the real contents.

Dimensions are logical groupings of attributes with a common atomic key relationship (Singh, 1998). Multi-dimensional analysis is one of the angles which we use in data observation. It contains a specific logic of data analysing. Put in a simple way: people need to know what they want before they can get it. Multi-dimensional analysis gives users a chance to combine their specific data needs and allow application software to generate pre-determined data from the DW. It is easy to understand two-dimensional data if it is put into x-y axes. Three or more dimensions are something similar to it. It is much more flexible than a fixed two-dimension observation and could satisfy various needs of data analysis.

Multi-dimensional view (MDV) is a key feature of OLAP. One dimension refers to one category. The category can be of any kind, such as name, transaction amount, time, etc. Multi-dimension is a combination of a number of different dimensions (categories). For instance, in a sales DW, time of sale, sales person and product code might be of interest and so they form a multi-dimensional perspective of sales activity.

Dimensions can be hierarchical: time of sales could be organised by day, month, quarter, and year.

One familiar example of a bi-dimensional view is represented in a Microsoft spreadsheet. Columns and rows are used to store the bi-dimensional data so it is easy to view and analyse.
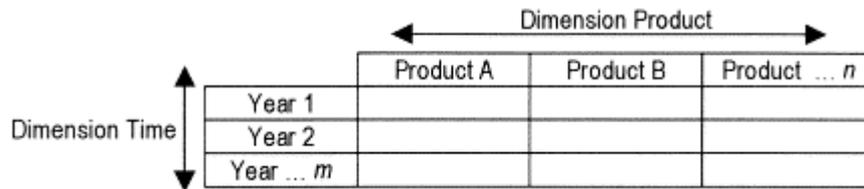
Figure 4 Two-dimensional view

Figure 4 supposes that there is a decision maker who wishes to analyse data concerning product sales volume over a period of time. It is a two-dimensional (bi-dimensional) analysis. One dimension is product codes and the other is time. In real world cases, there is very little analysis involving only two dimensions; most of the time, it includes at least three dimensions.
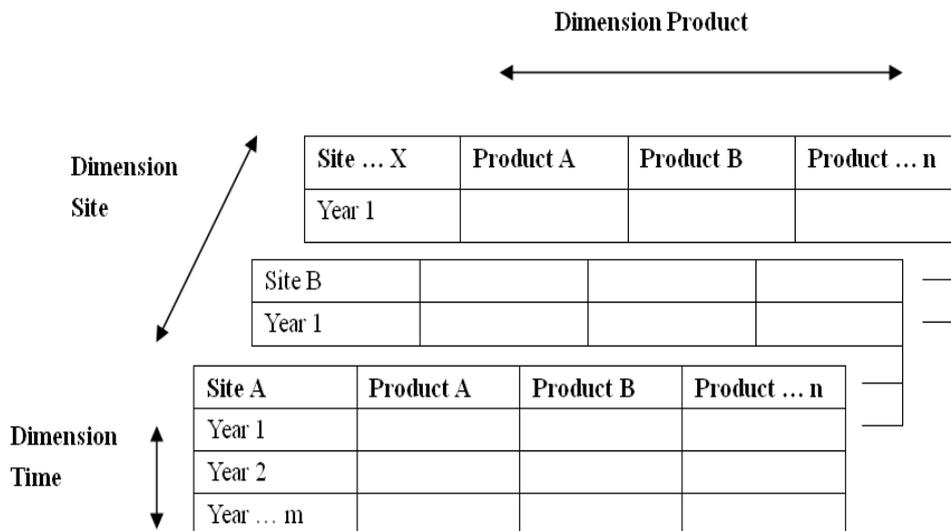
Figure 5 Three-dimensional view

Figure 5 illustrates a simple tri-dimensional case. In addition to analysing the product sales volume over time, the decision maker has to compare the sales figures across different branches in the country. Site dimension is used to represent information from different branches.

Dimension Site: All

Site: All

Dimension Product: Product A

	Product A
Year 1	

Dimension Time: Year 1
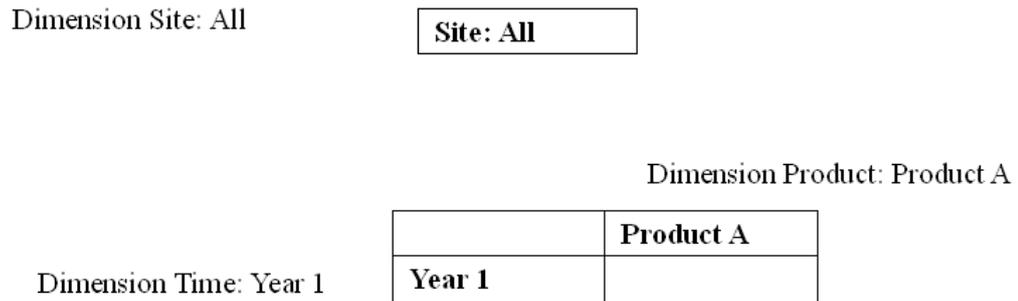
Figure 6 Slice

'Slice' refers to chopping of the dimension being selected. Figure 6 reveals the site dimension and control of the time and product dimensions. For instance, regardless of which branch the product is sold from, management would like to seek the sales volume of product A in year 1. This is the sliced multi-dimensional information set.

Dimension Site: Year

Year: All

Dimension Product: Product A

	Product A
Site A	

Dimension Time: Site A
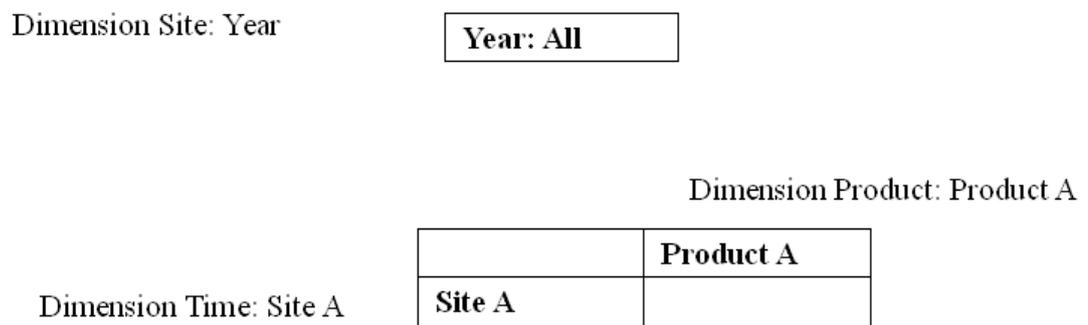
Figure 7 Dice

'Dice' is a move to rotate the sliced dimension. Figure 7 is an example of rotation. Management wants to view the branch A sales volume of product A regardless of the year of sale.

Dimension Product: Product A

Dimension Salesman: All

Dimension Time: Year 1 - m

Salesman	Product A		
ALL	Year 1	Year 2	Year ... m
Site I			
Site II			

Dimension
Site: Site I, II

Figure 8 Pivoting and nesting

'Pivoting' is also known as 'rotating', and refers to the rotation of the dimensional orientation or page display. 'Nesting' is the ability to nest different dimensions. In other words, nesting displays values from one dimension within another dimension.

Dimension Product: Products A - n

Dimension Site: Site I

Site I		Product A	Product B	Product ...n
Year 1	Quarter 1			
	Quarter 2			
	Quarter 3			
	Quarter 4			

Dimension Time:
Year 1 Quarter

Figure 9 Drill-down

'Drill-down' is the exploration of data to subsequent levels of more detail along a dimension (Koutsoukis et al., 1999). Figure 9 illustrates the drill-down process, which tracks down from annual sales to quarterly sales. It details the dimension into finer intervals.

Dimension Site: Site I

Dimension Product: Product A - n

Dimension Time:
Quarter – Year 1

Site I	Product A	Product B	Product... n
Year 1			

Figure 10 Roll-up

'Roll up' is the reverse process of drill-down. It takes the aggregation of all lower level dimensions and achieves a higher level data. Figure 10 represents the process by which the quarterly sales amount is added up and annual volume is retrieved.

2.4 Research questions

From the systematic literature review above, together with the researcher's curiosity, the following research questions are detailed.

1. How can DW support CRM integration in banks?

DW is purely a technical concept, whereas CRM is a management framework in the service industry. This question is a summation of three different integration levels: Firstly,

27

a DW system should be built up for banks. Secondly, the DW system should be able to help with the decision-making process of banks. Thirdly, one decision-making process should be supported by analysis from various dimensions. Multi-dimensional analysis will enhance the effectiveness and efficiency of the decision-making process.

2. What factors are critical for successful integration of CRM using DW technology?

The implementation process is very expensive and of high risk. This challenging task needs not only technical but also financial support. One study reported an average cost of 2.2 million dollars for a typical DW (Gagnon, 1999). It is expected that many problems will arise when actual implementation takes place. Therefore, how to solve these problems becomes essential. Large amounts of funds are invested in building up the DW system with the purpose of gaining more profits, but the reality is that successful implementation becomes exceptional. According to recent reports, the failure of information system implementation is about 41% (Conner, 2003). Thus, it is critical to understand the factors which will affect the successfulness of implementing DW. This research question stresses the importance of these factors. From a thorough view, CRM is integrated with the help of the successfully implemented DW system. Therefore, this study is to generate the factors as a guideline for implementation of DW with the hope of integrating CRM in the banking industry.

3. To what extent are these factors observed in the banking industry?

A study conducted by IDC, a leading research firm, found the average return on investments in DW projects to be about 400% (Desai, 1999). This return appears to be quite substantial. However, this measures only those who successfully implemented the DW system. Factors influencing the integration process will be observed from both primary and secondary data in this research. In the meantime, factors with their influences will be analysed with the empirical findings.

4. How is the integration of CRM realised? What is its detailed process?

A key development in today's consumer markets is the diversity of customers with which vendors are confronted (Kumar & Reinartz, 2006).

In order to be sustainable and successful, CRM must be treated as a business methodology that the whole organisation and value chain adopts (Baran et al., 2008). Therefore, its integration process should be of special care to the whole organisation. According to Baran et al. (2008), failure to meet the real-time requirement, and lack of 'backbone' to deliver consumer information to all points of interaction in real time, are the main reasons for modern CRM failures. The integration process of CRM using DW technology involves a highly complex combination. Modern CRM within the financial industry has a higher standard for customer data. To enable CRM effectively, disparate customer data must be integrated into a cohesive information flow so that all data can be available during any customer interaction (Baran et al., 2008).

This study will discuss the formation of DW technology-enabled CRM process in detail. The detailed process is investigated from both strategic and technical terms.

2.5 Chapter summary

This chapter reviews the literature of both CRM and DW technologies. Based on revision on the banking industry and literature, the author concludes that while CRM is a very popular concept within the business context, DW is a necessity for its implementation.

Defelice (2005) has indicated that the problem of many financial service companies was their focus on pushing products to the masses, instead of giving individual customers the service they needed when they needed it. Therefore, banks need to know how to utilise customer information through modern technology as well as managing large amounts of data efficiently. Indifferent marketing strategy is out of date in the current highly competitive market; rather, differentiating becomes an important marketing strategy for commercial banks. This is an emerging trend. Therefore, banks should place emphasis on

customer analysis and promote differentiated products or services to customers in different categories. It is essential for commercial banks to move from a traditional to a customer-centric environment.

Lastly, based on the comprehensive literature review, the author details the four research questions. The following chapter discusses the research methodology adopted in this study. The selection criteria and collection approach of both secondary and primary data is to be described in the next chapter.

Chapter 3 Research methodology

This chapter will firstly discuss the methodology and research design for this study. The research process is divided into a number of steps. First of all, research questions are proposed; the main purpose of this study is to find answers for those questions. Following this, an appropriate research methodology will be drawn, indicating its strengths and weaknesses. A general comparison between qualitative and quantitative research methodologies will also be presented to decide the appropriate method for this study, and the specific research strategy adopted will be discussed. This is followed by presentation of the data generation methods and data analysis approach used. Lastly, reliability and validity of this research will be presented.

3.1 Research questions

As stated earlier, the aim of this research is to explore how to integrate CRM with DW technology effectively so that a bank may gain competitive advantage over others. The four research questions underlying this research are:

- How can DW support CRM in banks?

- What factors are critical for successful integration of CRM using DW?

- To what extent are these factors observed in the banking industry?

- How is the integration of CRM realised? What is its detailed process?

3.2 Methodology for this research

Generally speaking, there are two types of research methodologies: quantitative and qualitative.

Quantitative approaches are concerned with 'what' is contained in the research, while qualitative approaches are focused on an insight into the deeper question of 'why' (Williams & Gunter, 2005). Instead of getting the answer for 'what', this study probes for the answer of 'why' and 'how'. Silverman (1999) argues that there is a common belief that qualitative research can provide a 'deeper' understanding of social and environmental phenomena, rather than quantitative data alone.

CRM integration goes beyond figures. It emphasises the experiences of human beings. DW technology is a complex data flow system built upon customised needs. The needs of DW cannot be illustrated numerically.

Based on the nature of this research, the qualitative method will be an appropriate method to use. Research into information system management nowadays has opened a new era. The literature has moved gradually from pure technological analysis to conceptual innovation. Qualitative research methodology analyses data which is not expressed numerically only. Instead, it emphasises the use of human experiences. There are a variety of different techniques that can be involved when doing qualitative research, such as action research, ethnography and case study.

3.2.1 Strategies of research

A research strategy is the overall approach of the research to generate answers to the proposed research questions. A number of strategies were reviewed and analysed, from which the most appropriate ones were chosen.

Ethnography is the study of peoples or cultures (Oates, 2006). It requires the researcher to spend time in the targeted environment and participate in observations. Unwritten rules will be generalised. However, it is a very subjective research strategy, the findings of which are largely dependent on the feelings of individual researchers. This research study does not require specifically the informal rules of organisation. Therefore, it does not require the researcher to spend time in the banking environment. Aside from the above reason, the author does not want to introduce subjective results.

Action research is an effective approach for knowledge building, especially for those highly unstructured problems in exploratory research. Researchers are required to put themselves into real world situations where they wanted to study for a predetermined time period. The studies are generated by the researcher's own experience. However, the relevant difficulties also restrain the adoption of this method, such as its time consumption, its lack of measures of achievement, and its complex process (Creswell, 2003; Kotzab & Westhaus, 2005). Based on the time frame given, it is not practical to adopt the action research method. Furthermore, "this participative approach and democratization of research is not always apparent in many examples of IS [information systems] and computing" (Oates, 2006). For the proposed research, the case study method will be the most appropriate method to employ.

Case study research is the most common qualitative method used in information systems (Alavi & Carlson, 1992; Orlikowski & Baroudi, 1991). "A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Oates, 2006). According to the nature of this author's research questions, case study is chosen as the research strategy.

Case study fits this research in various ways: First of all, the investigation of CRM and DW is not a single factor event. The complexity of required information is best suited to a case study strategy. Secondly, the expected outcome of this research is a conceptual framework. Case study allows the author to build up the theoretical and conceptual

framework through the analysis of cases. Thirdly, using independent cases to illustrate DW technology-enabled CRM integration makes the findings more representative and persuasive.

Multiple cases are used in this research. It comprises five secondary cases and one primary case. The objective of analysing secondary cases is to generate a framework which is used to compare and refine against that of the primary case. The original target of the number of primary cases is three to five. Unfortunately, regardless of the effort dedicated by the author, due to the confidentiality feature of the industry and cutting-edge technology discussed in this research, most banks refused to give any information. In accordance with the scope of this research and time constraints, only one empirical case is carried out. Bank MS, where the author had an internship for the past two summers, agreed to carried out the interview. Personal reliability gains the author a chance to explore more in-depth information.

3.2.2 Data generation methods

How the data is generated will be discussed in this section. There are a number of ways to generate qualitative data: interviews, questionnaires, documentation, etc. Among the available methods, the author chooses to combine the use of document review (to generate secondary data) with interview (to generate primary data).

Documents (secondary case data)

The secondary data collection in this research uses documentation as a mean of data generation. Document-based data involves a wide range of sources, such as published journal articles, books, conference notes, corporate notes, etc. According to the nature of this research topic, it is very difficult to generate a single discipline. Instead, a combination of corporate strategic management theories and technological support analysis construct the best description of search descriptor.

Using the data from published journals or books is far more convenient and time-saving than conducting interviews or questionnaires. The information collected by other people will be re-analysed with the specific research targets.

The relevant journal articles are scattered among various article databases, which can be accessed through search engines provided on campus. The usability of secondary data is the greatest concern from the author's point of view. The main target data type for this research is qualitative. The evaluation of usability should take relevancy, research purpose and many other aspects into consideration. Thus, the selection of secondary data will be carried out with caution. The selection criteria are as follows:

− Only those articles with full text available are selected

− Only those articles closely related to the research target – CRM integration with DW support – are chosen

− Keywords: CRM, data warehousing technology, DSS, banking industry

All the articles selected are reviewed and categorised with caution. The usability of secondary cases is discussed with academic people knowledgeable in these fields.

The mass amounts of articles on CRM and DW literature developed over time is filtered through the above selection criteria. Articles with a case study nature will be selected first, eight being generated after the first round of selection and five in the second round. The reasons for eliminating the other three are various, such as the low relevancy to the research objective or inadequate information. The five cases chosen are reflective on their empirical findings and can provide comprehensive background information. Each of the five cases is analysed and discussed in this research.

Interview (primary case data)

In an interview, information is gathered from participants and transferred to the researcher through a communication process; thus, interviews can be characterised by

concepts of information, communication, and control (Zouwen & Smith, 2005). Led by the interviewer, the questions should lead the interviewee to discuss what the interviewer wants to know. This control is crucial in a successful interview.

Interview is one of the most important data generation methods for research, and is appropriate for use in case study. The interview template is used to consult with the staff in charge of the bank's information system. With a comprehensive understanding of related researches, the author has an in-depth understanding of the targeted research area aiding in the construction of effective interview questions.

One of the purposes of this research is to investigate the factors affecting the adoption of DW in the banking industry. A majority of the interview questions are based on the findings from prior academic studies, which give necessary information and clues to build up question flow.

The interview is constructed in two parts. Phase one is to collect basic data from the interviewee. It includes the respondent's basic information and fundamental information about the bank interviewed. Phase two collects data from the interviewee and asks questions about DW from the proposed aspects. Supported by the information provided, the interviewee responds actively to the questions. A list of interview questions is stated in the Appendix.

Only one interviewee is used, chosen because she is the manager responsible for information analysis office, within which CRM is one important analysis target. Therefore, she could provide both a high level strategic view and a perspective informed by her knowledge of the bank's CRM/DW practice. Relying on a single interviewee is a major limitation; however, this was necessary because of the short-term scope of this research and the geographic distance involved between the researcher and the researched.

The research is carried out using telephone and note taking. Several phone calls are made in order to get in touch with the appropriate personnel and to explain the research objectives. The interview questions are carried out through two independent phone calls,

each lasting around 35–40 minutes. Following the questions, the interviewee provides some supplementary data which cannot be discussed clearly through the telephone.

3.2.3 Data analysis

Qualitative data refers to words, documents, interview records, etc. There are two sources of qualitative data in this research: documentation and interview.

Documentation (secondary cases) is generated from the literature with specific selection criteria as stated above. Therefore, the analysis of this type of data should be both vertical and horizontal. The different findings from different empirical evidences of different authors are worth comparing and contrasting. Categorising each case is the first step of data analysis. For instance, one particular case reflects a majority of critical factors and hence it is categorised as the critical factor case. In addition, from the different perspectives of authors, viewpoints and attitudes towards the researched subject are analysed. Upon viewing the secondary cases, the author takes notes of the important concepts or frameworks, which can be used to generate interview questions and compare with the primary findings.

Interview is another source of the data. The analysis of interview data (primary case) is not the same with documentation data (secondary data). As suggested earlier, effectively leading the interviewee to answer the questions desired is crucial for a successful interview. The feedback from the interviewee are reorganised according to the different analytical needs. In addition to plain facts, the author demands a certain degree of personal experience within this field. Upon analysing the two sources of data independently, the author takes the next step of comparing the two so that coherent arguments can be drawn.

3.3 Research reliability and validity

Reliability and validity are critical to all research work. Therefore, the author of this research pays close attention to them.

Reliability of research refers to the level of stability. It means if the work is done by one other independent individual, they should get a similar result. Similar questions are considered for both documentary data and primary data. This ensures that the findings from the two sources are comparable and reliable.

There are two approaches to improving validity: using multiple information sources for data collection and allowing participants to review the final report (Creswell, 2003). This research adopts two sources of data, documentary and interview, with the objective of improving the validity. Due to the high workload of the interviewee, time constraints and physical distance, the interviewee is not able to review the interview findings.

3.4 Chapter summary

Chapter 3 discusses the research methodology adopted in this research study. It firstly reinforces the research questions, after which a discussion of qualitative methods is drawn. The research design is based on the analysis of multiple cases. The author adopts two different data sources: primary and secondary. Published data from journals or books are the secondary data. The findings from analysing this secondary case data will inform and be contrasted with primary empirical data collected through interviews in a Chinese bank.

Following the research design, the next two chapters will present the findings from both secondary and primary case data sources.

Chapter 4 Secondary cases

4.1 Introduction

This chapter describes the findings from detailed analysis of five case studies. These cases are selected adopting the procedure described in Chapter 3.

Using these findings from different perspectives, the implementation of DW technology into CRM of banking industry is observed and analysed. Critical factors are generated from the cases. Findings will be used as the foundation for generating interview questions.

The five secondary cases are analysed with a uniform format: case background, findings, and summary of findings. Even though each case represents a different category of findings, the five do have areas in common, which will be addressed later in the chapter.

4.2 Case 1 – Fortune 500 financial services organisation

4.2.1 Case background

This case is selected as the first documentary study because of its high relevancy with the research target: How does DW support the decision-making process in financial services? Detailed process and problems raised are discussed within the study. In addition, effective solutions are introduced.

One Fortune 500 financial services organisation is analysed by Wells and Hess (2002). The case study research methodology was selected based on the nature of targeted research questions. As suggested by the author, research questions of this study are explanatory in nature and a focused viewpoint made it difficult to manipulate the respondents' behaviour. Therefore, according to its descriptive nature, this author chooses to use the case study method. The organisation participating in the study (FS) is

within the financial service sector. FS utilises CRM functionality to generate sales leads, enhance customer service, and improve profitability through customer segmentation. To achieve this initial goal, FS built up its own DW and CRM application. Originally, DW was built within database 2 with the sole purpose of supporting CRM. The DW system of FS enables the DW-DSS infrastructure of the organisation.

Around 40 different data sources are involved in the DW, for instance, account master files, customer service files, etc. Data mining is carried out and professional analysis leads to potentially profitable customers.

Over 1500 personal financial advisors utilised the applications component of the system and about 75 analysts utilised enabling technologies in the DW-DSS infrastructure.

The interviewees are four users of the enabling technologies component (analysts) and four users of the applications solution component (advisors/end-users).

The findings of this case study reveal in detail how the decision–making process is supported by the DW system. In addition, issues from DW end-users are also presented.

4.2.2 DW system-enabled decision-support process

The first finding from this case is to discuss in detail how the DW-DSS system supports the decision-making process of FS. Wells and Hess (2002) present this result from three infrastructure components.

4.2.2.1 The core technologies of DW in FS

Based on the interview with DW administrators, two issues are raised with regard to the data transformation process. First, a consistent format requirement is essential for the DW to function properly. A proper data format rule will make the dynamic data usable. For

instance, the voice recognition unit should be transformed so that it could be placed in DW in a usable format for the decision-making process. The second issue is closely relating to the first one: descriptive information of the data from DW, such as transformation rule, should be up to date.

The main concern of formatting and transforming rules is for qualitative type data and DW administrators give examples of this. For financial services organisations, 'customer disposition' is an important concept, referring to the analysis of customer's individual needs and investigating for potential sales opportunity. However, in most cases, the disposition is in words rather than measured quantitatively, creating transforming problems for the DW.

In addition, FS requires more qualitative data. Accurate customer details are needed, such as their marital status, dependent children, etc. Customer segmentation is regarded as an important decision-making strategy by FS. Therefore, how to effectively collect and record this type of data is a cause of concern.

4.2.2.2 Decision-making support from enabling technologies

Due to the novel nature of qualitative data, a high degree of offline processing is needed. Analysts interviewed expressed dissatisfaction with the quality of metadata. The metadata application provides analysts with user-invoked text-based information in Graphic User Interface (GUI) interface. However, lack of accuracy and consistency makes the task more complicated. One analyst estimated that on average, 20-50% of their time is spent on tracking down accurate metadata.

4.2.2.3 Decision-making support in the CRM application

The DW of FS provides a list of 60 customer leads together with a single product or service recommendation. Finance advisors of FS use the information to sell targeted customers the appropriate product/service. However, advisors interviewed found the DW-DSS does not provide a comprehensive solution for the decision-making process. A single product or service per customer may not be sufficient in practice. It is observed that the more experienced an advisor is, the less the reliance on the information provided by DW-DSS. Instead, experienced financial advisors pay little attention to the recommended list and analyse each individual need multi-dimensionally.

From the interviews, it is summarised that DW-DSS of FS is providing descriptive information but not sufficient for the decision-making process. External data and personal experiences still play an important role in the decision-making process.

4.2.3 Usability of DW-DSS outcomes

The second finding from this case study is to answer the following question: Do the constructs and relationships in the DSS decision performance model adequately explain the decision-making processes within a DW-DSS?

Findings of the above question are summarised in Table 4.

Constructs	Analysts	Advisors (end users)
Task	Highly unstructured More novel Heavy offline processing	Structured to Semi-structured More routine Moderate offline processing
DSS capabilities	Very lacking, required heavy offline processing	Somewhat lacking, required moderate offline processing
Perceived accuracy	Spend a considerable amount of time tracking down missing information (e.g., metadata) to increase decision accuracy	Novices were unable to effectively judge decision accuracy Experts altered strategy to increase decision accuracy
Perceived effort	High effort attributed to missing metadata and unstructured tasks	Novices reported low effort Experts reported high effort
Perceived incentives	Nothing outside job description and task visibility	Nothing outside job description and task visibility
Decision strategy	Unguided	Guided
Decision performance	Number of new accounts, lifetime value of customer	Account balances, number of new accounts, success per contract

Table 4 Summary of Todd & Benbasat Model DSS-Decision Performance Assessment (adapted from Wells & Hess, 2002)

Table 4 separates the feedback of analysts and advisors from interviews. The two different working tasks result in very different responses to DW-DSS systems. Analysts generate and analyse part of the data through the use of DW and data mining methods, while advisors are the ones who use the information prepared by the DW-DSS to provide product or service to clients of FS. Opinions on the seven aspects about DW-DSS of FS

are collected. It is observed that the capability of the existing DW-DSS system of FS does not adequately support the novel type of decision-making process. Apart from that, accuracy, effort, and incentives vary across different strategy selection activities. For instance, FS does not give any incentives to advisors to adopt the DW-DSS suggested product or service, nor does it track whether a transaction is made according to the recommendation of DW-DSS. It is very difficult to work out the efficiency and effectiveness of the system, and hence the improvement is subject to limitation.

It is observed that advisors with more experience tend to rely less on the recommendation from the DW-DSS system as they tend to have less confidence on the accuracy of the recommendation. In contrast, novices, who have less experience, often promote the only product recommended by the DW-DSS system.

4.2.4 Decision-making environment

The third finding of this case study is to describe the DW-DSS decision-making environment. How the features of DW-DSS affects strategic selection and decision making are investigated. A summary of the characteristics of DW-DSS is presented in Table 5.

Characteristics	Analysts	Advisors (End Users)
Metadata	Standalone, GUI application Low confidence in metadata accuracy When poor, users sought supplemental information	Limited use of metadata (primarily field descriptions) When poor, users sought supplemental information Primarily viewed as explanations
Explanations	Primarily thought of in terms of metadata	Considered to be lacking in current DSS environment
Qualitative Data	Not used Need transformation to complete, discrete categories	No incentives for accurate data capture/storage Desire to use rich, unstructured data

Table 5 Summary of DW-DSS characteristics (adapted from Wells & Hess, 2002)

The three characteristics of DW-DSS of FS are investigated in detail. Through the interview, the author found that first of all, the quality of metadata, a term not familiar among the advisors, is lower than expected from the analysts' point of view. The quality of metadata directly affects the decision making of analysts but does not have strong influence over advisors. In contrast, advisors react to the term 'explanations' more than analysts. Experienced advisors query the source and deviation of the information generated by the DW-DSS, while novices' actions are mainly in accordance with its recommendations. Basically, metadata and explanation are of one purpose: to explain and describe the data. Explanation type (content, format, and provision mechanism) is believed to influence explanation use (frequency, extent of use), which subsequently influence DSS performance (Gregor & Benbasat, 1999). From the feedback of both analysts and advisors, it can be seen that both groups need more information on this unstructured data. The use of qualitative data is deemed to be important by end users. However, the storage and sorting difficulty makes the qualitative data less productive in

terms of the decision-making process. The interpretation process of qualitative data is time-consuming and costly.

4.2.5 Summary of findings

Within this first case study, three findings are presented. Firstly, treatment of qualitative data is raised. This is a problem to most of the financial institutions. Because of the DW system, FS can generate customer-oriented sale opportunities, but in the meantime, it needs to find a proper solution using the system to process qualitative data. Secondly, the usability of outcome from the DW system is questioned by the more experienced marketing staff within the organisation. Single output does not provide enough information of clients' needs and sale opportunities. Therefore, comprehensive results are expected from the end user's point of view. Lastly, the decision-making environment is analysed with different end user perspectives. In summary, shortcomings of DW-DSS are recognised within FS.

4.3 Case 2 – First American Corporation

4.3.1 Case background

The second case is selected because it is one of the first few corporations who realised the importance of client segmentation, which contributes to the research in terms of strategic and technical solutions.

First American Corporation (FAC) had successfully transformed from a business losing 60 million dollars per year in 1990 to a profitable and innovative leader in the financial services industry ten years later. FAC's success is achieved through an ambitious strategic vision, and investment in DW enabled that strategy.

During 1990s, severe competition from rivals in the banking industry nearly pushed FAC into oblivion. With the new Chief Executive Officer's lodgement, FAC with its top management gradually walked out of the shadows. Recognised by top management, a long-term strategy is the secret of surviving in the industry. After a round of strategy selection, FAC decide to adopt a so-called 'customer intimacy' strategy. The CEO realised that they would need to "create a basic change in the fundamental way that bankers approach the business".

One of the authors of this study is involved in the management of FAC. The classification and descriptive goals made the authors choose case study as the research methodology. In contrast to the first case, the FAC case is written from an internal perspective.

4.3.2 Strategic innovation

Tailored Client Solutions (TCS) appeared in September, 1995. The diagram below is a brief illustration of the strategy. Four inter-locking components surround the client: supreme client information, flexible product line to meet customised needs, consistent service to help clients with their goals, and distribution solution with client preference. The jigsaw shape emphasises the inter-connection of the four projects.
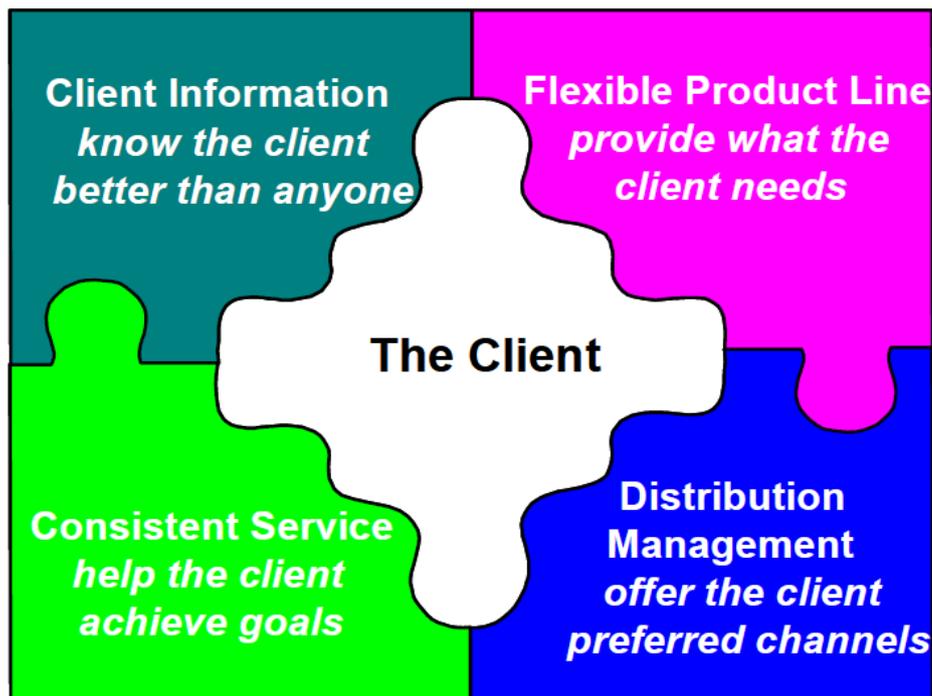
Figure 11 Tailored Client Solutions (adapted from Cooper, Watson, Wixom & Goodhue, 2000)

It is very clear that achieving detailed information of clients is the first and foremost step of this whole strategy, after which, every step demands more and better information about the client. However, FAC did not make significant investment in IT in the 1980s or early 1990s. Its IT department did not have relevant experience in providing information solution strategies. This led to the failure of the initial attempt, which used an in-house IT department.

Table 6 is a summary of FAC's timeline and goal of the VISION project. FAC clearly identify the inter-relationship between business goal and technical goal. The ultimate goal of integration of customer information management is to realise the business goal. This clear picture contributes to the success of the VISION project.

	First and second quarters 1996	Second and third quarters 1996	Third quarter 1996 – First quarter 1997	Second quarter 1997 – First quarter 1998	Second quarter – Fourth quarter 1998
Business goal	Identify the top revenue producers	Identify the least profitable customers	Include actual transaction and product data in profitability formulas	Understand all aspects of client and product profitability	Incorporate profitability understandings in business processes
Technical goal	Enhance the existing customer information system with retail revenue	Enhance the existing customer information system with direct contribution view for consumers	Enhance existing customer information system with net income after capital charges (NIACC) for consumers	Deploy the warehouse – proof of concept (consumer) Commercial profitability integration	Complete production testing of the warehouse

Table 6 FAC Goals of VISION (adapted from Cooper, Watson, Wixom & Goodhue, 2000)

The planned goal of VISION helps managers from either the technical or business department to have a big picture of the whole strategy. The implementation process is clearly illustrated in the goals. It solves the incompatible moves between commercial and technical people.

The goal is set up with the benchmark data provided by The First Manhattan Consulting Group, an industrial leader in the financial services sector.

4.3.3 Implementation of VISION

The actual implementation process started in the first quarter of 1996. Lessons were learnt by FAC so that they chose the 'technology monopoly' – NCR – to build the VISION with. After working closely together for a few months, both parties understood the other's needs, an essential for any DW project to be successful. Figure 12 briefs the DW system of VISION.
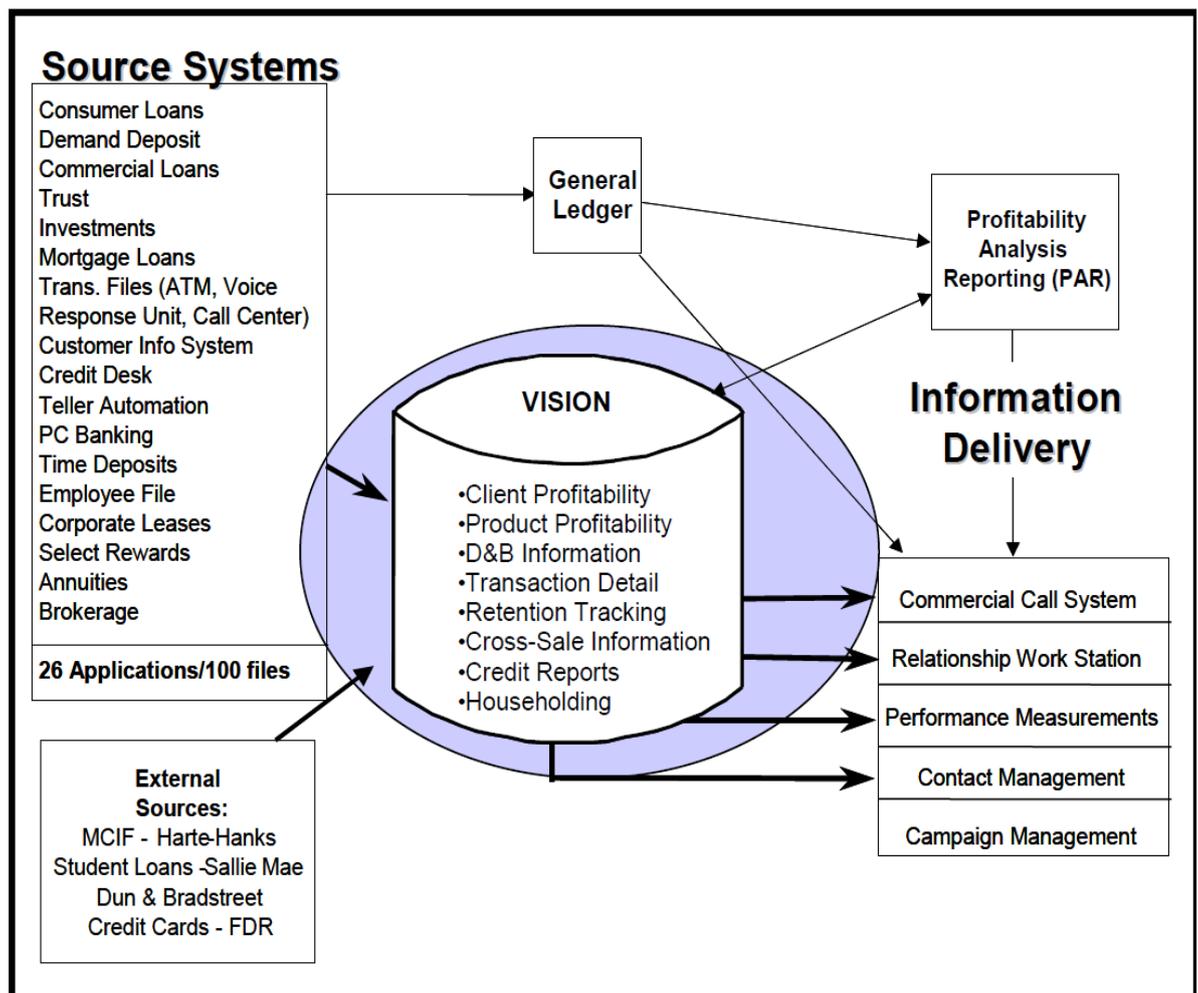
Figure 12 The VISION DW architecture (adapted from Cooper, Watson, Wixom & Goodhue, 2000)

The new warehouse utilises over 100 source files that were extracted from 26 legacy applications. The data storage volume is increased dramatically. Various data recorded in the warehouse are listed in the chart above. According to Cooper, Watson, Wixom and Goodhue (2000) the database held 2 million accounts and information about 1.2 million households; all data could be analysed at any level of aggregation, from bank-wide or line of business down to individual account or client relationship. There are 100 files from 26 applications extracted into the VISION DW.

The VISION data can be divided into three different levels according to the client activities.

Data	Description	External Sources
Client behaviours	Products Delivery channels Transactions	IBM mainframe Sallie Mae
Client buying patterns	Segments Attitudes Expressed needs	IBM mainframe Dun & Bradstreet geographic and demographic data Harte-Hanks household data
Client value positions	Profitability	IBM mainframe Profitability algorithms

Table 7 Client activity level (adapted from Cooper, Watson, Wixom & Goodhue, 2000)

In conclusion, VISION DW contains four types of data: transaction data, demographic data, behavioural data, and revenue and cost data (Watson et al., 2002).

VISION is used by different staff across FAC. In general, there are five types of people who can benefit from FAC: top management, marketing analysts, frontline tellers, financial analysts, and personal financial consultants (Watson et al., 2002).

VISION serves marketing analysts with more accurate and time-efficient information so that effective marketing strategy can be carried out. For instance, data from VISION can help marketing analysts to find out potential cross-selling products. Similarly, VISION helps financial analysts to assess the profitability of FAC, and profitable activities and customers can be recognised. This in turn affects the selling behaviour of personal bankers or tellers. Take fee-waiving for example: Fees are one of the most important incomes of banks, but there are times when clients request a waiving of fees. Through the application of VISION, financial analysts of FAC investigate the overall customer account and work out the maximum amount of fees that can be waived. The information is then passed on to the frontline staff.

In terms of the application of VISION using customer information, there are four aspects: customer preferences and profiles, profitable accounts, contact management system and distribution management system.

4.3.4 Personnel management of VISION

The DW team of FAC consists of 18 full time employees. The team structure and duties are summarised in the following flow chart. Maintenance duty is mainly carried out by the NCR, who has a contract with FAC.

FAC discovers three phases in the DW cycles: design it, build it, and exploit it. Each of the three phases needs people with different talents and strong experience within the DW technological field. Terra Data of NCR is the leading global business providing such products and services. For the DW system to run smoothly, skilled talents are in high demand. However, there is concern that no such talents are found within the organisation.

The current structure of personnel arrangement built upon support from external sources is not stable from the author's point of view. Therefore, FAC has to explore new talents and restructure its DW department personnel arrangement for the long term.
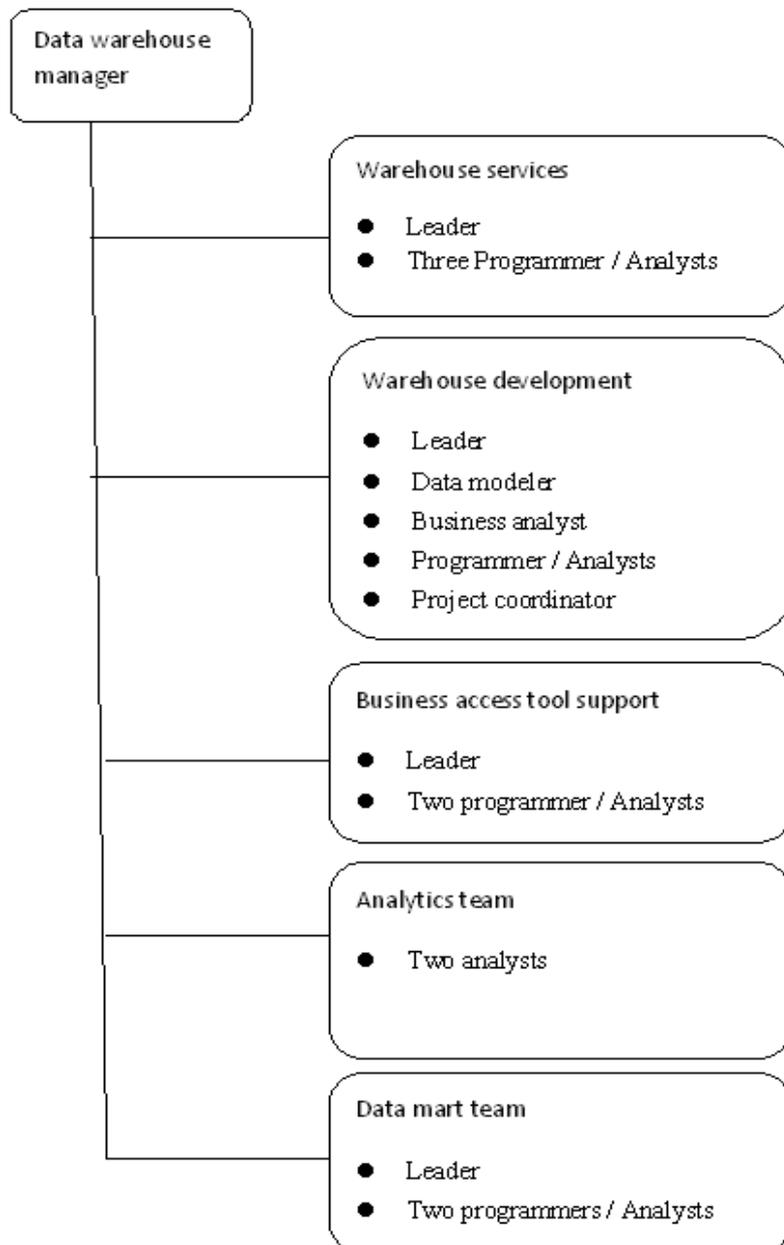
Figure 13 FAC personnel arrangement (adapted from Cooper, Watson, Wixom & Goodhue, 2000)

4.3.5 Summary of findings

As summarised earlier, FAC changes its strategies towards client relationship management, through the adoption of VISION, the DW system. The innovation is carried out with support from top management. The whole organisation is determined to save the situation through information integration and client segmentation. Its Tailored Clients Solutions illustrates the four interlocking components surrounding 'Clients'. FAC's client-centred strategy forms its foundation of CRM integration.

4.4 Case 3 – Taiwan banking industry

4.4.1 Case background

Obtaining the industrial view, case 3 has contributed to the study in terms of the critical issues arising when banks in Taiwan implement the advanced DW technology.

The banking industry in Taiwan is experiencing keener and stronger competition than ever before in its history. The high demand for information in this industry requires advanced IT tools. However, according to Wen, Chou and Yen (1997), the adoption of DW technology, which requires huge capital spending and also consumes a good deal of developing time, carries a high possibility of failure. The failure rate is approximately 20%. Therefore, Hwang et al. (2004) conclude that it will be essential to have a comprehensive understanding of critical success factors. In addition, the increasing interest in Asia's economy makes it valuable to generate a list of factors which can be adopted by banking industries across different countries in Asia. The purpose of their research is to identify critical factors influencing the adoption of DW technology in the banking industry in Taiwan and also the current status of the adoption of DW technology (Hwang et al., 2004).

Their study is a combination of qualitative and quantitative research methods. Through a survey as a means to generate data in need, the authors work out the statistical significance of each research question. Hypotheses are tested through the review of relevancy and validity of each variable.

In total, 50 banks in Taiwan are reached with questionnaires and 30 valid responses are used. The target group of this research is the Chief Information Officer (CIO). The average work experience of the respondent CIO is 15.27 years. It is a combination of qualitative method and quantitative method. There are six hypotheses, all of which are investigated using statistical analysis over the valid responses.

4.4.2 Current status of Taiwan banking industry

Adopting condition	Classification of adopting condition	Number of banks (%)	Total (%)
Adopted DW technology	Have adopted in the process of adoption / implementation	5 (31.25%) 11 (68.75%)	16 (53.33%)
Not adopting DW technology	Evaluating and studying for possible adoption	12 (85.71%)	14 (46.67%)
	Abandoned the idea of using DW technology	2 (14.29%)	

Table 8 Current DW adoption status in Taiwan (adapted from Hwang, Ku, Yen & Cheng, 2004)

Table 8 shows the findings of current DW adoption status. Among the 30 correspondents, 16 have adopted or are in the process of adopting a DW system. The majority of the remaining 14 correspondents are studying or evaluating the possibility of adopting a DW system.

There are three types of DW system to be found.

Types	Number of banks	Percentage (%)
Enterprise DW	2	12.50
Data mart	7	43.75
Implementing DW and data mart simultaneously	7	43.75
Total	16	

Table 9 The different orientations of implementation for banks having adopted DW technology (adapted from Hwang, Ku, Yen & Cheng, 2004)

Table 9 is a summary of the findings from interviews with general managers. The construction of DW and data mart is only for the part of banks having higher competitive advantage or for the real needs of each department, instead of an integrated consideration for the information system of the bank (Hwang et al., 2004). However, the shortcoming of this is the lack of integrated information management. It will not fully utilise the function of DW technology.

4.4.3 Critical factors observed from the organisational dimension

Critical factors are observed according to the six hypotheses stated. Firstly, it is found that the size of the bank adopting DW technology is larger than that of those who do not adopt it. Therefore, the size of the bank has great influence on the adoption of DW technology in the Taiwanese banking industry.

Secondly, this study found the existence of champions plays an important role in the adoption of DW. Champions, in this research, refers to those who can be helpful in the enterprise to bring up innovative ideas for new adoption and/or implementation and have the ability to persuade the chief executive officers, department managers, and other associated employees to support their ideas (Hwang et al., 2004).

Thirdly, top management support is one other important factor which influences DW adoption, since this partially guarantees the capital and human resource input of the organisation. In the absence of this support, DW will not get the necessary resources and its adoption will be affected.

Apart from the above factors, the internal needs of the banking industry are also a key factor. The adoption and implementation of DW depends on how badly the bank needs it. The needs include the better capacities to integrate the bank's internal data, the ease of acquiring real-time and correct data, and the importance of analysing future trends from historical data (Hwang et al., 2004).

4.4.4 Critical factors observed in the environmental dimension

From the empirical research of Hwang et al. (2004), exogenous factors such as the degree of business competition and selection of vendors do not significantly affect the decision whether or not to adopt DW.

The banking industry in Taiwan is experiencing severe competition from domestic and international rivals. Governmental policy releases entrance requirements and introduces foreign competitors so that a large number of rivals are competing for a steadily growing market. But in contrast to expectation, the degree of rivalry will not affect a bank's decision on whether DW technology should be adopted.

4.4.5 Critical factors observed in the project planning dimension

DW technology is a cutting-edge technology, and highly informed staffs are needed. Prior studies suggest that the project team plays an important role in adopting DW technology. Personnel factors are the main concern at this dimension. Personnel skills are

assessed by evaluating the following three factors: the technical capability of a project team, the communication skills and the degree of understanding user needs (Hwang et al., 2004). The empirical result of this study suggests that even though having a skilful project team is a plus to the implementation process, it does not directly affect the decision on whether or not to adopt a DW system.

Co-ordination of organisational resources is another factor investigated in this study. It found that the co-ordination of organisational resources may not be a dominant factor. In addition, the participation of end users in the adoption process does not significantly affect the decision. According to the empirical result, employing internal consultants is a factor which directly affects the adoption decision.

4.4.6 Summary of findings

Among the banks investigated in the case, over 50% have already implemented the DW system. Among those who have not yet adopted the technology, the majority are currently evaluating and studying possible adoption.

Critical factors are summarised in the case from different perspectives: organisational, environmental and project planning. Internally, there are three major factors, namely, top management support, champion and organisational size. Externally, economic conditions and competitor strategy largely influence the bank's behaviour in terms of decision making over the adoption of DW technology. From the project planning perspective, an experienced DW engineer is the most valuable factor in the process. In addition, organisational co-operation is one other critical factor observed from the case of the Taiwan banking industry.

4.5 Case 4 – The Royal Bank of Canada

4.5.1 Case background

Case 4 is a typical successful example of a bank which adopted DW technology to the integration of CRM.

The Royal Bank of Canada (RBC), a leading Canadian commercial and personal bank, successfully implements their customer relationship strategy by using modern DW technology. RBC has a client base of more than 11 million, around 1300 retail branches and more than 4800 ATMs, telephone banking, internet banking and point-of-sale terminals.

RBC realised the importance of data processing technology and the marginal value which brought by the client information. RBC is actually one of the first banks to implement first-generation DW solutions in the early 1990s.

It is another classic case, illustrating how the implementation of DW can affect the CRM and hence the performance of banks. Similar to the FAC study, this study is carried out by the managing director of the bank. It is more of a professional analysis than a plain case study. However, it adopts the case study as a general methodology. The data are retrieved from internal sources.

4.5.2 Outcomes of using DW technology to integrate CRM

According to a report from Teradata[1] there are five outcomes upon adopting a DW system to support the CRM strategy.

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[1] A division of NCR, vendor of the Royal Bank of Canada DW system

First, by differentiating between current and potential value of clients, the bank uses CRM to better manage customer relationships by ensuring the right products are available at the right times in each customer's life.

Second, revenue per marketing dollar has shown double-digit growth for three continuous years.

Third, direct marketing campaign response rates are up dramatically, as high as 40% in some cases, compared to an average industrial rate of 2–4%.

Fourth, a targeted marketing program led to a 51% increase in deposits for Registered Retirements Saving Plans (superannuation plan in Canada).

And lastly, sales personnel proactively pursue opportunities with clients, enabling true account management that generates greater consumer loyalty through relevant product offers.

The five achievements are realised through the implementation of the DW system. It enables the CRM strategies to be achieved.

4.5.3 Reasons for success

Analysis has been carried out on why RBC can successfully implement a DW system into their CRM strategies. Below is a summary of possible explanations (Tully, 2001).

● Cross-business unit support

  Different business units are operated independently with internal-active support.

● Committed sponsor

  A highly committed and confident internal sponsor was empowered to make decisions at the project level, working closely with the project team.

- Clear project definition

  The project is defined clearly including important information such as deadlines and budgets. The project team is well informed about their task and when to stop.

- Teamwork

  The close relationship between the RBC and vendor NCR enables the co-operation of highly skilled individuals from different backgrounds to work together as a single team.

- Current and future needs assessment

  This assessment leaves room for further improvement and potential customisation. One-off co-operation will not give a result as satisfactory as this one, because both parties know they will be required to solve a problem again someday in the future, and this continuous co-operation forces them to work well together this time.

4.5.4 Summary of findings

RBC is the leading commercial and retail bank in Canada. It is one of the first few financial services organisations who invested in DW technology implementation.

Through the adoption of DW-enabled CRM integration, RBC effectively increased the response rate of marketing campaigns. Target marketing strategy is enabled by customer segmentation and the return per market dollar is increased dramatically. This case summarises a number of successful reasons, such as cross-unit support and clear project definition. These reasons are important but not necessarily critical for other banks. It provides a valuable ground for analysis.

4.6 Case 5 – ABSA

4.6.1 Case background

ABSA is one of the four leading banks in South Africa. Its outstanding business intelligence and DW practice is taking place globally. Founded in 1992, with branches all around the world, ABSA has more than 52 billion dollars in assets, around 7 million customers, 11 million accounts, 31,000 employees, 675 branches and over 5000 ATMs. ABSA provides a variety of products and services, such as insurance, retail banking, and commercial banking.

What sets it apart from others is its vision to position itself in targeted market segments and the segmented client base (Watson & Donkin, 2005). Similar to previously discussed studies, ABSA is also analysed using case study as a research methodology. This agrees with the research target, which concentrates on the analytical explanation of ABSA's success in business intelligence application.

4.6.2 ABSA DW technology implementation

There are two types of business units in ABSA, customer-based and product-based. Customer-based units include retail banking service, personal banking service, corporate and business banking services. Product-based units are home loans, credit cards, trust and fund management. Both of these types demand a high level of specification of customer segmentation. ABSA's enterprise DW is the ultimate source of consolidated group information for analytics, performance reporting, and other applications (Watson & Donkin, 2005).

The DW has a high degree of data integration across products, customers, and business units, and provides a single view of the customer (Watson & Donkin, 2005).

The success of ABSA is closely related to its information management sector, whose major role is to make ABSA highly customer-focused.

Value of what is being done	How it is being accomplished
Increasing sales / revenues	Through the application of customer analytics. An emphasis is placed on cross-selling and lead generation by identifying customers with specific needs or a high propensity to acquire a specific product or service.
Increasing customer retention	Through customer behaviour analysis. Attention is paid to any behaviour that is out of the ordinary for a specific customer.
Improving customer acquisition	Through data mining of internal and external data.
Understanding profitability	Through financial and statistical analyses, the profitability by customer, product, and geographical area are known.
Improving distribution channels	Through statistical modelling, decisions are made on the optimal kind, number, and placement of distribution channel, such as branches and ATMs.
Supporting compliance with government regulations	Through data sourcing and reporting in order to comply with a variety of government regulations, including Basel II and FIC (Financial Intelligence Centre) ACT.
Providing access to information and facilitating the sharing of knowledge	Through access to information and knowledge using the Internet, knowledge portals, and an employee portal.
Supporting improved strategic decision making	Through balanced scorecards and reporting.
Leveraging the use of information	Through the information architecture and analytics.

Table 10 Information management's value proposition to ABSA (adapted from Watson & Donkin, 2005)

From Table 10 above, it can be seen that through a series of customer segmentation and information analysis, the CRM of ABSA has been of huge advantage. The DW system of ABSA enables segmentation and analytical activities, and hence supports the decision-making process. Upon analysing the information provided by the DW system, using specific modelling methods, ABSA improves its performance from various aspects, such as profitability, customer satisfaction level, etc.

To ABSA, the increasing recognition of the consolidated information need speeds up the development of information management, who encourage the use of the DW system. The CRM is enhanced from every aspect, such as cross-selling opportunities, and retention of clients.

Analytical levels

ABSA defines three types of analytics. The first is the reporting of applications, used to describe what has happened. The second is analysis, which interprets the meaning of what has happened. The last one is predictive modelling; this involves many sophisticated statistical tools and focuses on the prediction of future events or client behaviour propensity. This three-level analytical process reviews previous performance and explores potential sales opportunity.

Personnel arrangement

There are 27 permanent members working on the DW system, a team consisting of 11 data acquisition developers, 8 information builders, 5 analysis and design system analysts, and 2 application database administrators who manage the physical database. There are two technical supporters from the vendor – Oracle – to make sure the system is fully

utilised. This personnel arrangement is customised according to the unique needs of ABSA.

4.6.3 Summary of findings

ABSA provides world-class products and services with its cutting-edge banking intelligence technology. In order to compete with the three other large banks in Africa and a large number of competitors internationally, ABSA must be highly customer-focused. This urges ABSA to integrate customer data using modern technology.

ABSA defines three analytical levels that simplify the complex analysing process. Tasks are clearly stated at each level. Through achieving each task, DW technology is successfully implemented in helping a customer-focused managing strategy. In addition, effective allocation of human resources is a factor leading to the success of ABSA. ABSA realises that a fully utilised DW system is a critical and cost-saving strategy. Technical professionals from the DW vendor ensure the system is effectively used and fully utilised.

4.7 Discussion and summary

The five cases analysed provide the ground for the primary research. In general, there are three issues analysed in the cases: CRM perspective, DW technology and the integration of CRM using DW technology.

From the CRM perspective, there are several critical issues needing to be taken special care of. Client-oriented strategic planning is essential at the beginning stage. Customer segmentation and customer behaviour analysis form the foundation of successful CRM.

In addition, a high customer-information recording standard is critical as it is the original source of the later data processing phase.

- **CRM perspective**

    ◇ Enterprise-wide strategic planning

    ◇ Client-oriented strategy

    ◇ Customer behaviour analysis

    ◇ Descriptive information is objective and unreliable

    ◇ Customer segmentation

    ◇ Marketing strategies using CRM

From the DW technology perspective, some factors observed from the cases are deemed to be vital. Firstly, DW infrastructure design is a very critical point. Sufficient communication between end users and system designers is a must. In addition, the fitness and validity of the DW infrastructure is to be constantly examined and monitored by management. Secondly, comprehensive transferring and formatting rules should be set. Treatment of non-quantitative data is important for the analytical process as well. As well as the above, personnel arrangement is one other concern for banks adopting DW technology. Training systems should be improved to keep pace with the technology implemented. Education of the importance and significance of the new technology adopted should be made throughout the organisation.

- **DW technologies**

    ◇ Structure design process as a communication process

    ◇ DW infrastructure fitness and validity

    ◇ Data formatting and transformation rules

    ◇ Treatment of qualitative data

✧ Customised DW to serve different needs of different groups of users

✧ Exogenous factors, such as selection of vendor and rivalry

✧ Understanding of terminologies

The implementation and integration process is the marriage of CRM and DW technology. The first and foremost issue at this stage must be a clearly defined goal from both the business and technology perspective. A bank must know what the expected outcomes are after adopting the DW technology to integrate CRM. End users of the system should be properly trained and educated with routine technical knowledge. Integrated customer information should be of high reliability and accuracy. The CRM integration process should be clearly defined, carried out and monitored.

− **The marriage of the two**

✧ Organisational goals of adopting the DW for CRM integration need to be made clear to all staff involved.

✧ The personnel requirement is a cause of concern. According to the findings, two types of people are needed. On the one hand, champion staff who introduce the innovative idea and have the personal ability, in terms of technical and managerial, to promote the implementation are needed. On the other hand, maintenance staff familiar with the technical and operational processes are needed to provide necessary maintenance to the system. In addition, organisation of the staff is one other important issue in the implementation process.

✧ Internal communication from the initial set-up stage.

✧ Interpretation and reliability of information.

✧ End users of DW-enabled customer information are, in many cases, the frontline sales staff. Whether the information is usable depends on the competence of the frontline staff.

✧ Actual internal needs and top management support.

♦ Internal co-operation.

♦ Independent information management team and clear-set tasks.

The above secondary findings from cases studied provide a foundation and direction for the primary research. These findings are used to generate interview questions from different perspectives. Critical issues are considered in the primary research. The relevance of each critical factor to the primary research will be analysed. The next chapter carries out primary case analysis, which is built upon the interview with a major commercial bank in China.

Chapter 5 Primary case

5.1 Introduction

This chapter presents the primary analysis based on the interview carried out with the Information Department Manager from Bank MS. The analysis is a combination of both direct feedback from the interviewee and supportive documents provided by her.

The primary findings summarise the responses from the Manager, and form the basis of an empirical case that can be compared with the findings of the secondary cases presented in the previous chapter. The interview questions focus on the implementation of DW technology in CRM practices in the researched bank from a management point of view. The researcher explores the Manager's perspective of integrating CRM using DW technology. In addition, detailed operational and strategic processes of implementing DW technology in supporting CRM are presented and summarised.

5.2 Case background

Bank MS is a joint-stock commercial bank held primarily by non-public-hold enterprise. Like most banks in China, there are three organisational levels in the MS Bank: national head office, regional supervising branch banks, and local elemental branch banks. By the time Bank MS started the DW project, it had 16 regional supervising branches over the country with a network of 145 customer contact points.

It has been nearly two decades since the reformation of Chinese commercial banks in terms of technologies and orientations. Relatively homogeneous products and services in the banking industry in China now speed up the differentiation process of each individual

bank, especially commercial banks. The increasing pace of market-exploring activities in the national banking sector and the increasing number of overseas banks urges Bank MS to find a globalised strategy.

On 1 Dec 2003, MS Corp. announced that it would partner with Teradata, a division of NCR, to build three corporate systems: CIM (customer information management), CRM and EDW (enterprise data warehouse). The key objective of this large spending project was to increase the bank's competitive advantage by integrating client information so that its stakeholders' benefits can be maximised. Relationship technology has been proved by a substantial number of international financial organisations to be one of the most effective differentiation tools.

Teradata of NCR is the world's leading vendor of relationship technology. The FS-LDM (Financial Services – Logical Data Model) has been implemented in more than 230 organisations within the financial service sector around the world.

The global leading position in EDW and enterprise analytic technologies of Teradata attracts the attention of Bank MS. It creates value for organisations through the manipulation of client information and interaction.

5.3 Interview questions and findings

What is the personnel arrangement for Bank MS's Information Management Department?
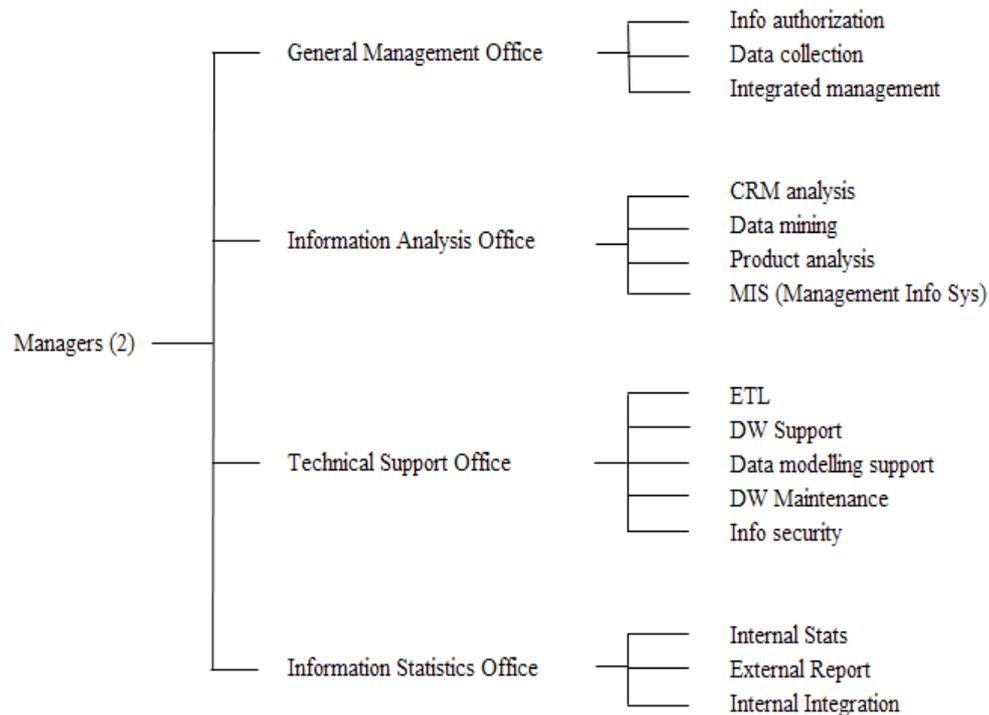
Figure 14 Personnel arrangement diagram

Figure 14 illustrates the personnel structure within the Information Management Department. There are four sub-offices under the direction of two managers of the department. It can be seen that the CRM analysis is a function separate from the other three information analysis functions. This relationship analysis is enabled by the technical support function within the department as well as a series of jobs done externally.

Which department is the interviewee working for and what is its main function within the bank?

The interviewee is in charge of the Information Analysis Office which carries out information analysis and data mining tasks. Decision makers can rely on the figures provided by the Office so that strategic decisions will reflect the reality. In addition, the Office provides training and monitoring functions to employees of Bank MS.

The Information Analysis Office has a position called CRM analysis. This role conducts five tasks: customer analysis, relationship maintenance, relationship management, marketing evaluation, and customer information/feedback management. The CRM analysts cannot work on themselves; rather, there are a number of other functions carried out within the office which provide support to them.

Why is CRM needed within Bank MS?

There are two reasons for Bank MS to build and integrate CRM:

1. Increase profitability

   ✧ Enhance profitability

   Targeted marketing strategy is, in other words, a cost-saving strategy.

   ✧ Explore new market and sales channels

   Expanding the market share can be realised though the integration of CRM. Based upon the in-depth analysis of client information, potential sales channels can be developed.

2. Form a loyal and profitable customer relationship

   ✧ Cross sale

   Client consumption behaviour is analysed which develops cross-sale opportunity for the bank.

   ✧ Enhance client loyalty

   A better understanding of the clients helps the bank to provide customised products and services. This makes the clients feel unique to the bank and thus loyalty is built up. It increases earnings per capita through a deep understanding of differentiated client needs.

By analysing customer performance through customer segmentation, Bank MS is able to recognise high and low performance clients. Through various operational and marketing strategies, the earnings per capita are increased.

In addition, there are many other factors which influence Bank MS's decision on CRM.

✧ Differentiated needs of clients

No two persons are identical. This differentiated nature urges banks to have strategies dealing with different clients' needs. Large data volume, the manipulation of client information and product customisation became a technological barrier for a majority of banks, including Bank MS.

✧ Resource scarcity and increasing rivals

Organisations usually have limited resources. Profit maximisation using scarce resources is an undeletable item from board-meeting agenda. Client information management consumes a large amount of labour and capital. An integrated system, which can enhance the efficiency of the client information management process, would surely be applauded.

Domestic and international rivals are speeding up their expansion in China's financial market. To survive, Bank MS needs to work hard on competitive advantage. CRM is one of the most important concepts in the contemporary financial market.

What achievements are expected from the integrated CRM and what is the significance of these achievements?

Bank MS sets up short-term and long-term goals for customer segmentation.

Short-term goals

In the short term, Bank MS summarises three goals: first, customer segmentation supports the bank in terms of asset valuation and resource allocation; second, it helps to integrate the client structure; and lastly, it forms the foundation of a comprehensive CRM system.

For instance, taking the client contribution to Bank MS as a segmentation criterion, there are four groups of customers needing to be clarified: strategic clients, key clients, important clients and common clients.
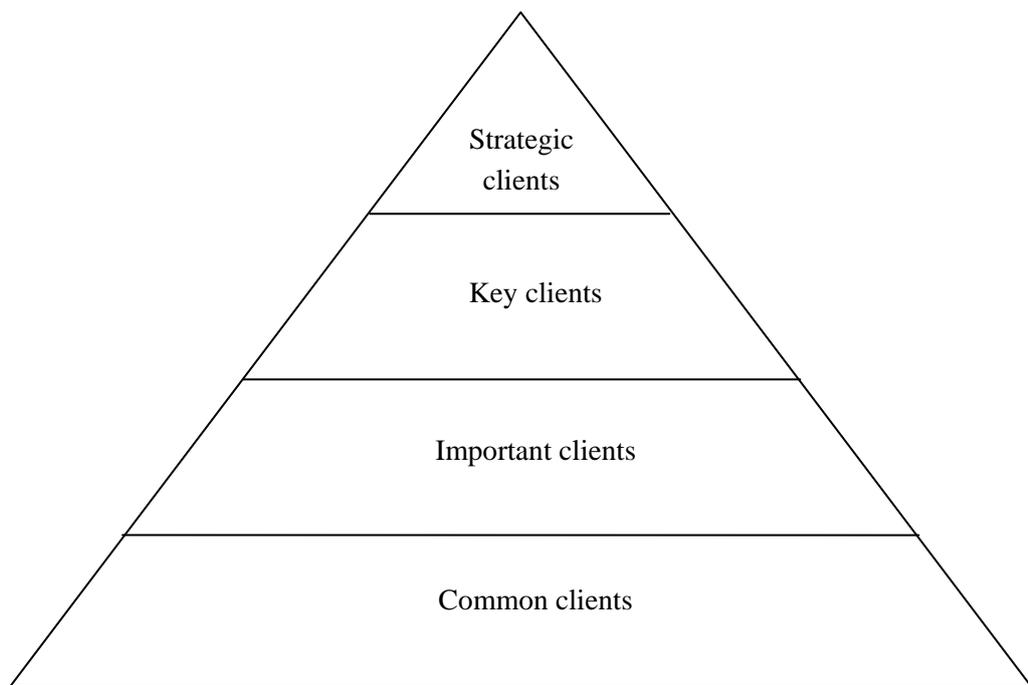
Figure 15 Client pyramid (adapted from Bank MS document)

This is a client structure pyramid. With client segmentation, the pyramid is formed and analysed. 'Strategic clients' are those industrial leaders who have lowest credit risk and highest profit potential. This client group can bring side benefits for Bank MS other than purely monetary profits. However, limited by the current size of Bank MS, the 'strategic client' group is not the centre of concern. The 'key clients' group is the most concentrated client group of Bank MS. With moderate risk, the overall profitability of this group is substantially higher than the other groups. The marketing department can utilise the client

pyramid through target-oriented activities, reducing marketing costs, and simultaneously increasing marketing efficiency.

Long-term goals

	Project team management	
Risk management	**Clients**	Organizational decision making
	Products and services	
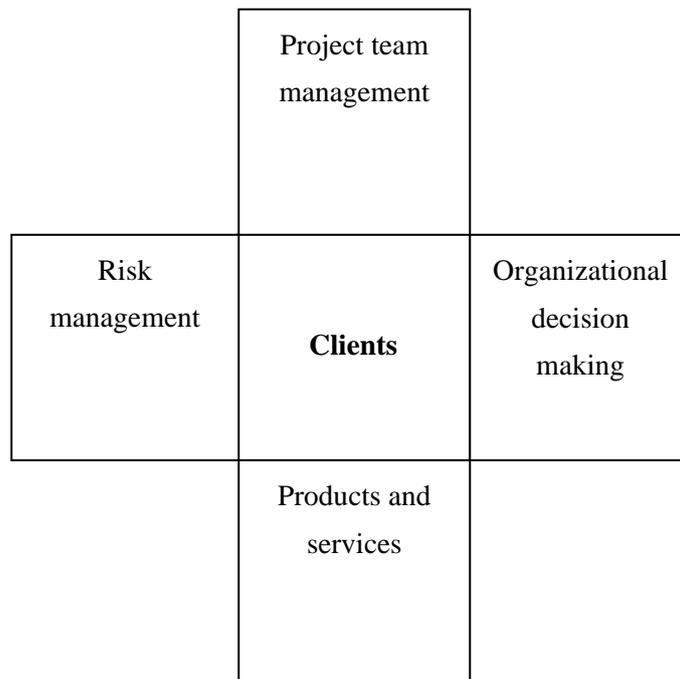
Figure 16 Long-term coherent goals (adapted from Bank MS document)

In the long term, Bank MS plan to achieve an integrated CRM system so that the above coherence can be realised. The client-centred long-term structure illustrated in the chart above clearly sets out the importance of CRM in Bank MS in the longer time frame. Through the introduction of integrated CRM, four achievements can be made in the long term. Firstly, differentiated and customised products and services are delivered to clients. Secondly, risk and return analysis for each individual client is carried out according to the CRM analysis. Thirdly, project teams, both marketing and technical support, should be customer-oriented. Lastly, organisational decision makers should take integrated client information into consideration.

What is the customer segmentation process from the managerial level?

Based on the interview and supplementary document provided, the customer segmentation process of Bank MS can be split into five phases from the managerial level.

Phase 1 – Market positioning

Understanding the bank's market position and target clients is a good point to start with. In order to survive from the severe competition, efficiently managing and promoting products and services is crucial.

Phase 2 – Choose customer segmentation methods and define the dimensional variables

The effects of manipulation methods and variable selection are significant. Therefore, the selection process should be undertaken with special care. Upon understanding the differentiated needs of clients and nature of businesses, appropriate methods and optimal variables are selected. The number of variables should be one of the most important decisions made during the process. Examples of dimensional variables are age groups, income brackets, etc. Neither too many nor too few variables will fully satisfy the needs of CRM analysis. Trade-off decisions between cost and accuracy need to be made by experienced professionals.

Phase 3 – Data collection and initial manipulation

The initial data collection and manipulation is the foundation of the whole customer segmentation process. The preciseness of raw data is the central concern. As mentioned earlier in this paper, to successfully transfer raw data into the DW system, a series of actions need to take place – the Extracting Transforming Loading (ETL) process.

Phase 4 – Choose the segmentation software

Currently, a majority of organisations choose to outsource their OLAP task to experienced vendors. This not only reduces the training cost of staff, but also utilises the vendor's economy of scale. Bank MS, similarly, chooses one of the most experienced OLAP vendors around the world – BRIO Platform Software – to do the task.

Phase 5 – Performance monitoring and evaluation

Not all segments are relevant to the CRM analysis. Therefore, further monitoring and evaluation should be carried out. There are several selection criteria for segments:

✧ The degree of relevancy with the targeted business goal

✧ Understandability of segmentation

✧ Materiality of the segmentation

✧ Potential benefits each segment may provide

Segmentation variable selection

There are various ways to retrieve the client database with dimensions so that analysis can be carried out efficiently. Bank MS defines the following selection rules of dimensional variables:

✧ According to client nature, commercial or household

✧ According to geographic differences

✧ According to human nature, such as gender, age group

✧ According to transaction information

✧ According to product preferences

✧ According to profit contribution

✧ According to industrial feature of each commercial client

Measurement index

Similarly, Bank MS predefines the measurement index of each variable. The following is a table containing a sample measurement index and definition of the index:

Name of index	Definition of index
Number of clients	subject to a particular selection criterion
Client percentage	$$\frac{\text{Number of clients satisfies selection criterion}}{\text{Total Number of clients}}$$
Account balance same day last period (monthly, seasonal, or annually)	The comparison among this period figure with the one from last period. It can be positive or negative.
Deposit balance same day last period	subject to certain selection criteria
Loan balance same day last period	subject to certain selection criteria

Table 11 Measurement index (adapted from Bank MS document)

What are the possible outcomes of customer segmentation?

● High-performance client group

This specific client group is the most valuable asset to the bank. Therefore, providing outstanding services and customised products will increase the overall performance of the bank. Building up a long-term loyal relationship with this client group is of particular importance. The majority of these high-end clients are involved in bank A's investment products and services. A survey carried out in the four major cities of China shows that amongst this group, 74% are interested in the personal financial consultant, 41% of whom are urging a customised investment plan.

- Moderate-performance client group

  Compared with the high-end clients, customers at this range are generally well-educated young people. They have relatively stable income and the majority of their needs spread along the following areas: home loans, small- to medium-scale investments, car finance, education funding, etc.

- Low-performance client group

  Clients of this group are those who generate lower profit compared with the other two groups. However, it is not likely that a bank could actually eliminate their services or products to these customers. Instead, banks can reduce their spending on them through a series of cost-saving activities, for instance, ATM, telephone banking, internet banking, etc.

The 20/80 rule applies in the customer segmentation of banks. Those who consume 80% of the resources are not the most profitable clients.

What is the structure of Bank MS's DW system?

Three levels of jobs are involved in the formation of the Bank MS DW system, namely generation of data, data source analysis, data transfer and data loading.
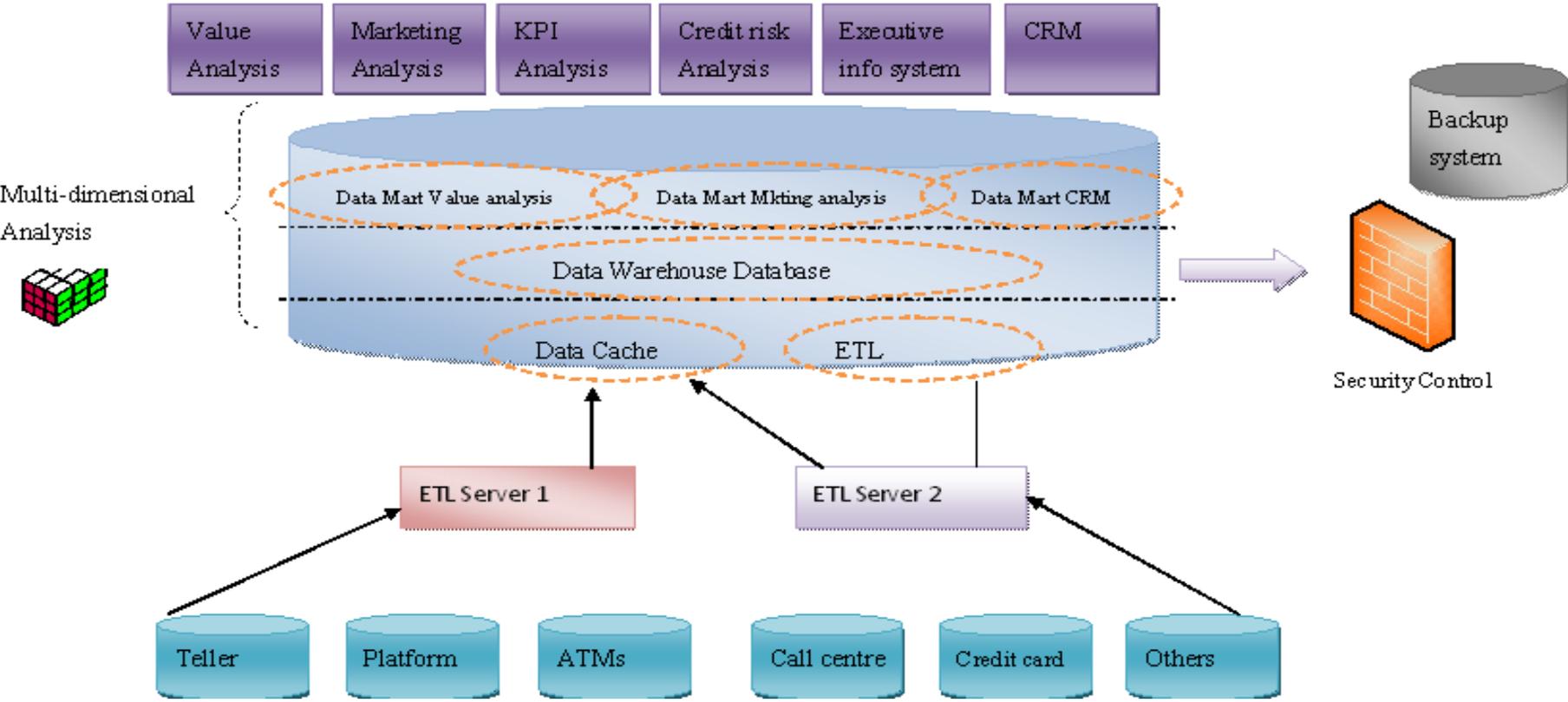
Figure 17 Bank MS's DW architecture

Figure 17 briefly illustrates the infrastructure of the DW system of Bank MS. At the bottom level, there are a number of direct interaction points with clients. These interactions generate raw data directly from clients. For instance, tellers of the Bank will record the amount of deposit onto one client's account. This process is what we called OLTP.

The raw data collected from the direct interaction will then be transferred into the ETL server. As discussed earlier in this dissertation, ETL will process raw data with cleaning and reformatting functions. The data is then stored in the DW. Data marts are then formed, each mart constructed with a target. For example, the CRM data mart is separated from the value analysis mart. This provides convenience for the end users of the DW.

At the top level, there are a series of outcomes from the DW system, presented through the adoption of the OLAP tool which provides a platform to view the outcomes. CRM is one of the results. This system is protected by professional security control and a comprehensive backup system. The system adopted by Bank MS integrates information with multi-dimensional analysis. Multi-dimensional database can be interpreted as an array of different dimensions, in contrast to the traditional database system. Thus, a large number of matrices are stored within the system. Compared with the traditional relational database, the multi-dimensional database adds the time dimension, which enhances the data processing speed and responding efficiency.

What is the customer segmentation process from an operational point of view?
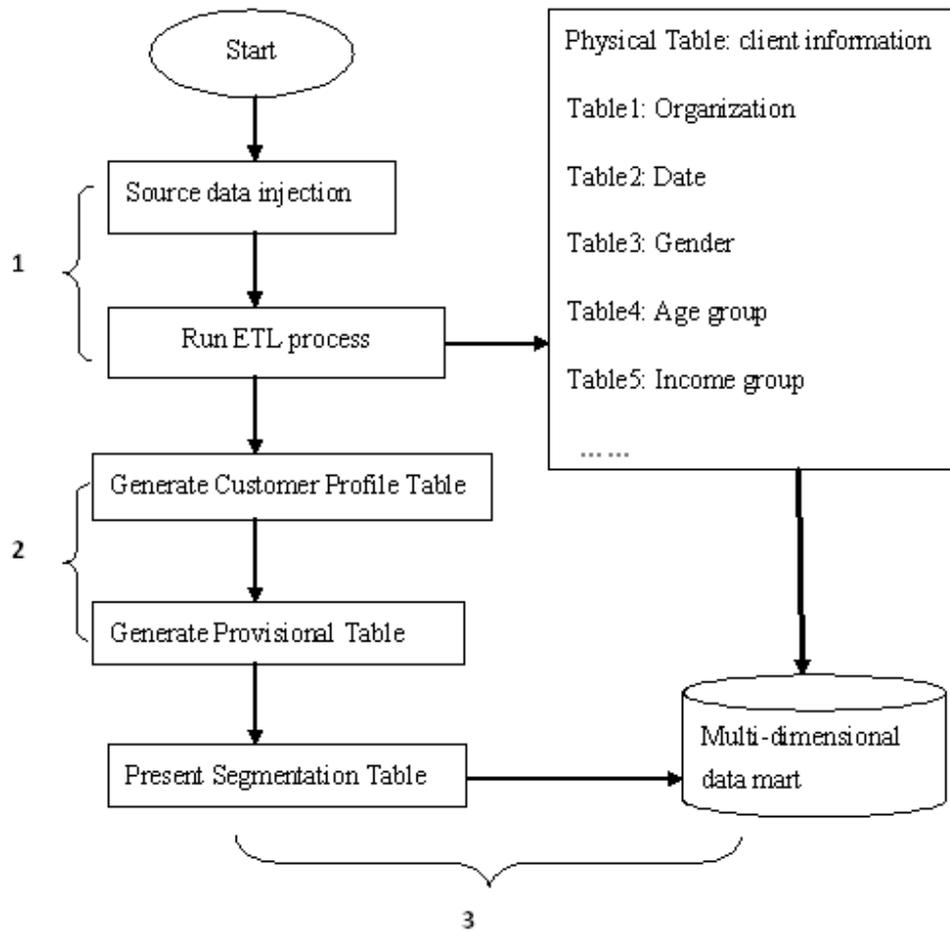
Figure 18 Segmentation process

As shown in Figure 18, there are three operational steps in the customer segmentation process.

Step 1 – Loading data from data source

Firstly, data is loaded from the data source, and is stored in theme format in the DW. Theme is generated and stored according to customer attribute information. Since OLTP stores a massive amount of working transactional data, we must avoid interrupting it when trying to retrieve. Therefore, the OLAP tool is adopted to retrieve data for direct use. Data loaded from the warehouse has already been manipulated by the ETL process.

Step 2 – Usage of data loaded

OLAP tools directly use data themes when preparing a table view. It displays the connected dimensional table views (star schema) so that multi-dimensional segmentation data mart (CUBE) is finalised. The finalisation of CUBE signals that most of the work of customer segmentation has been done; the latter task of OLAP tools is to carry out client segmentation management application.

Step 3 – Multi-dimensional data analysis

Information of concern is summarised and calculated before the referencing phase. Through the adoption of the multi-dimensional view, professionals are able to analyse data in a much more target-oriented way.

Star Schema
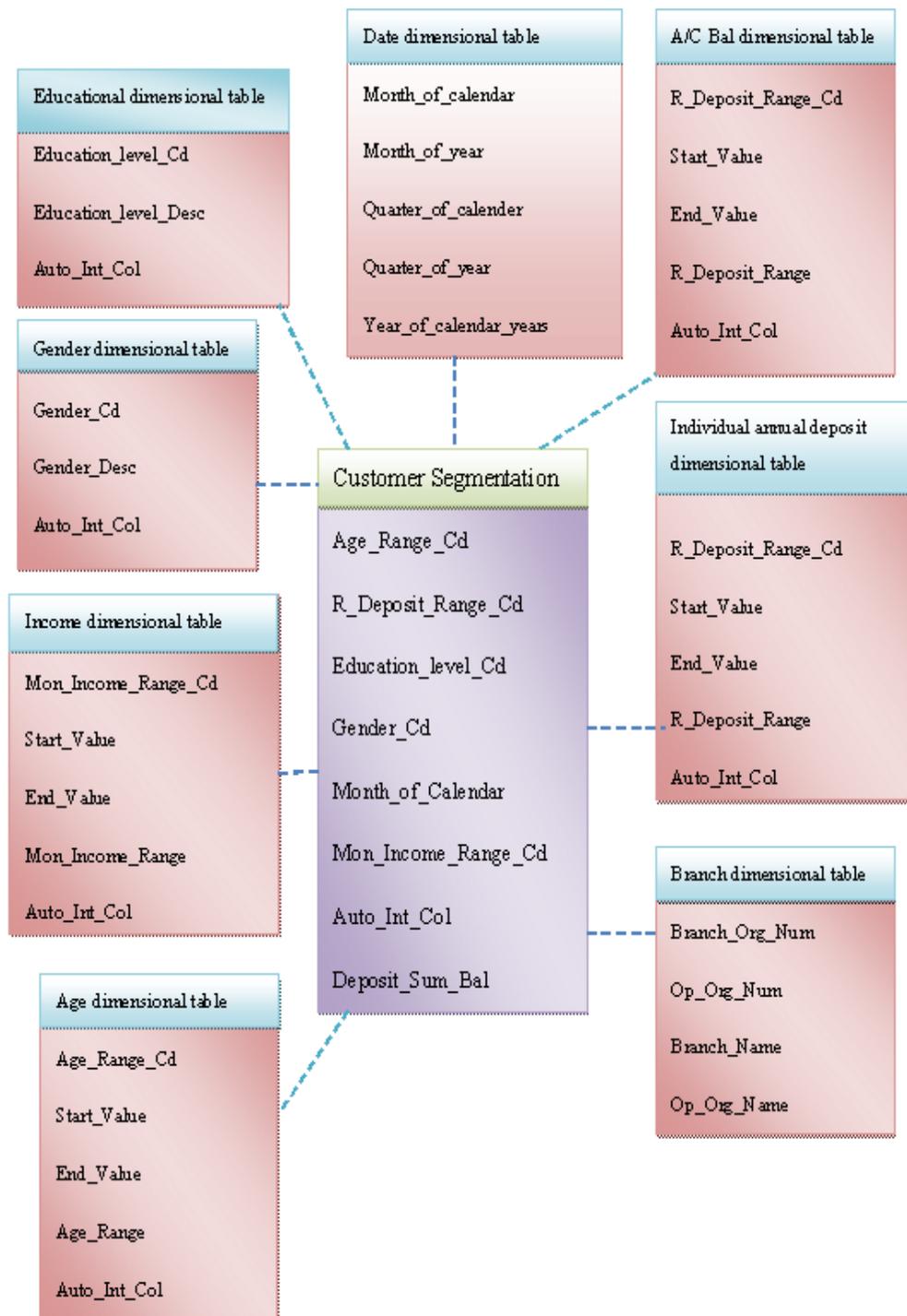
Figure 19 Star schema

Figure 19 shows the relationship between the dimensional table and the fact table. The centre one is the fact table and the surrounding ones are the dimensional tables. This table view is constructed by one fact table and seven dimensional tables.

Fact table reflects the quantitative information which the bank needs to capture for a particular object or event. Dimensional tables contain descriptive information; each represents one dimension of the event. In event of selecting valuable clients of the bank, facts are client number, deposit balance and their elemental branches. The corresponding dimensions are client age group, date range and deposit balance range. Once facts and dimensions are determined, primary key is used as the connection method among tables. This kind of relationship is called star schema.

Multi-dimensional analysis

Multi-dimensional database is an improved method which retrieves data from different dimensional tables. Information is collected according to different analytical needs. Customer segmentation and multi-dimensional analysis improve the bank's performance from various aspects. Client information is presented using the standardised measurement index. Through the use of three dimensions, analysts are able to grasp the targeted analytical group.
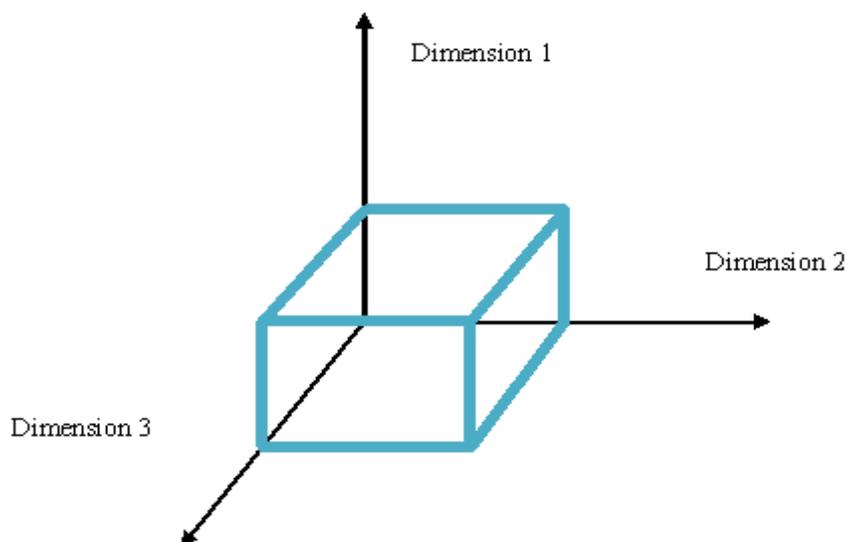
Figure 20 Tri-dimensional analysis (summarised from interview)

Figure 20 illustrates the client-based multi-dimensional analysis method. Within this particular case, three dimensions are selected. The tri-dimensional approach provides decision makers of Bank MS with analysis of a particular customer segment and/or product type subject to the three selected dimensions.

OLAP analysis

OLAP is an approach to quickly provide answers to analytical queries that are multi-dimensional in nature (Lin et al., 2008). Currently, there are two main types of Multi-dimensional database (MDD), namely MOLAP and ROLAP. Bank MS's project is built upon the use of MOLAP, which applies the star schema model. The following is a sample of the star schema applied by the bank. It stores data in a dimensional format.

OLAP is the ultimate task among all tasks, providing a direct view to decision makers.

Date	Age Group	Individual annual deposit range	Gender	Education	Monthly income range	
Mar	41-55	1 million to 5 million	All	All	All	

Supervising Branch	Elemental Branch	Client number	Client %	Compare with year beginning	Compare with last period	Deposit Bal ('000)
		1200	26.35	528	3	201,849.81
SH branch		659	14.47	332	-13	109,391.95
GZ branch	201	105	2.31	41	-3	18,455.28
	202	26	0.57	11		4,045.48
	203	15	0.33	8	-2	292.21
	204	22	0.48	14	1	4,241.42
	207	29	0.64	25	1	4,529.83
	208	31	0.68	13	1	4,616.99
	209	12	0.26	5	-1	2,250.93
	212	16	0.35	7	1	3,010.84
	213	15	0.33	10	3	2,131.32
	214	26	0.57	8	-2	4,198.28
	215	19	0.42	10	-1	2,997.42
	217	20	0.44	3	1	4,017.60
	218	18	0.40	11		2,237.43
	219	8	0.18	1	-1	1,407.38
	220	9	0.20		-2	2,019.29
	221	8	0.18	2	-2	1,057.51
	222	4	0.09	3		546.49
	223	11	0.24			2,321.04
	Total	394	8.65	183	-6	67,006.75
WH branch		330	7.25	165	-8	50,347.29
DL branch		176	3.86	86	-5	31,087.31
HZ branch		188	4.13	66	-5	37,292.34

Figure 21 Analysis of valuable clients (demonstration data, not real ones)

Figure 21 is an illustration of multi-dimensional analysis selection using the OLAP tool. For instance, management is questioning the percentage of top-end clients in the middle-age group. The Information Department generates the result with three selection

criteria. At the top of the screen, criteria are defined as time period, age group and deposit range.

It can be seen that within the supervising branch of concern – GZ branch – there are in total 394 clients satisfying the selection criteria. The circled number 15 represents the number of clients satisfying the criteria within elemental branch 203. Thanks to the adoption of the star schema model, end users – decision makers – are able to view detailed information by clicking on the number of clients. Figure 22 is the result of clicking on the circled number 15. So far, customer segmentation from different dimensions has been achieved.

Date	Age Group	Individual annual deposit range	Gender	Education	Monthly income range
Mar	41-55	1 million to 5 million	All	All	All

Client ID	Client Name	Date open	Sub-branch		
1005655218	Lan	10/12/2003	203 More >>		
1005951849	Zhong	07/10/2001	203 More >>		
1005999290	Xu	07/10/2001	203 More >>		
1007846482	Huan	22/10/2001	203 More >>		
1043848924	Bi	22/07/2002	203 More >>		
1057641732	Li	11/03/2003	203 More >>		
1081018954	Zhang	26/11/2003	203 More >>		
1097811248	Li	11/10/2004	203 More >>		
1098725853	Xu	24/10/2004	203 More >>		
1106656970	Chen	14/04/2005	203 More >>		
1110242275	Chen	30/06/2005	203 More >>		
1114005566	Deng	11/09/2005	203 More >>		
1114450032	Zhang	17/09/2005	203 More >>		
1114990712	Pan	25/09/2005	203 More >>		
1117147487	Mei	08/11/2005	203 More >>		

Figure 22 Elemental branch client information (demonstration data, not real ones)

From the above demonstration example, it can be seen that Bank MS realises customer segmentation through the adoption of DW technology. It shows the final outcome of the implementation and integration process. Through the use of the OLAP tool and demonstrated data, the author tries to explain how the DW framework of Bank MS influences their decision-making process. In addition, differentiated information demands can be realised using the variable selection criteria within the system.

5.4 Summary

This chapter summarises the interview questions and responses. The objective of this primary research is to explore solutions to a series of research questions. It demonstrates CRM strategy and application of DW technology from the banking intelligence perspective. It can be split into two sessions: business, and technical, as shown in Figure 23. The flow chart represents the logical order of the interview questions.
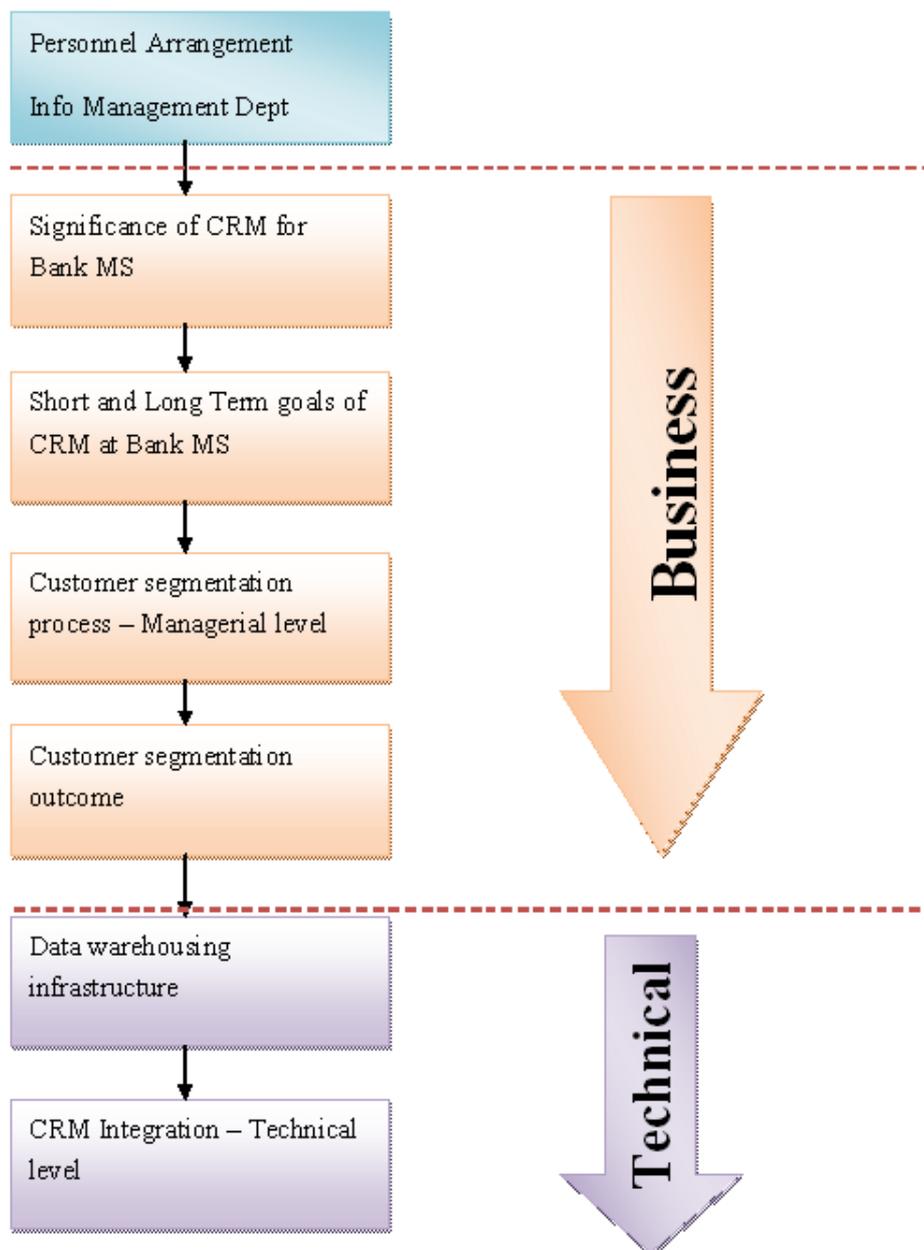

Figure 23 Summary of primary findings

Firstly, personnel arrangement and the interviewee's position are stated. The construction of the Information Management Department is analysed with their detailed tasks. The department is in charge of all DW-related tasks. In addition, CRM analysis is carried out independently by this department.

The reasons why Bank MS needs to build up an integrated CRM with comprehensive DW technology are then discussed. Top management of Bank MS has realised the importance of IT in supporting its businesses. Enhanced profitability and loyal customer relationship are the main outcomes expected.

This is followed by the short-term and long-term goals set by Bank MS. From strategic and operational views, the customer segmentation process is discussed in detail. In addition, segmentation rules and variables are mentioned before an actual example using the OLAP tool is carried out.

Lastly, from a technical level, this research demonstrates real world application of DW infrastructure used to implement banking intelligence solutions. DW architecture of Bank MS is presented in a simplified graph. The primary findings also provide deep insight into the operational process.

Star schema is introduced with a simple example. OLAP is at the heart of bank intelligence, providing a platform from which to view information and enabling quick responses to analytical queries that are multi-dimensional in nature.

With all the above primary findings, discussion will be carried out next. Within the discussion chapter, comparison of secondary findings and primary findings will be drawn by the author.

Chapter 6 Discussion

Based on the secondary and primary findings, the information collected enables discussion on the integration of CRM implementation in the banking industry. Focusing on comparisons between the primary and secondary findings, this is constructed in six sections, each of which discusses an issue generated from different perspectives of the research.

6.1 DW technology supports corporate strategy in the banking industry

DW is used by banks hoping to conquer the limitations of DSS and go beyond the boundary. The decision-making process relies on the use of DSS and thus whether DSS provides high quality information for management is a critical point for many organisations. The use of DW can impact organisational design, intelligence, and decision making (Huber, 1990). DW improves the performance of DSS and thus information quality.

According to Guimaraes and Igbaria (1997), and Lucas (1981), information quality will affect individual performance and improved information systems will enhance decision quality. For an IT to impact on individual performance, it must be utilised and there must be a good fit between the user's tasks and the system (Goodhue & Thompson, 1995). Whether information can be retrieved effectively and efficiently is a critical factor for a good decision-making process. The decision quality will be highly affected by information accessibility. The outstanding accessibility of information makes DW a unique component of DSS.

Due to the potential benefits of a DW as well as internal and /or external pressure for creating a competitive advantage, many organisations have launched DW projects with

the expectation of acquiring a consistent and reliable source of data for their DSS (Park, 2006). Because of its business nature, the banking industry will sometimes come across uncertain or risky information. The level of uncertainty needs to be reduced so that consistent and reliable information can be generated and analysed. The effectiveness of an information system can be achieved when system capabilities reduce ambiguity and uncertainty (Daft & Lengel, 1986).

It is said DW is mushrooming in the banking industry, but on closer examination, two patterns are emerging: one for the big banks and another for mortgage and community banks. Spending estimates suggest that bigger banks have DW under construction while smaller institutions are only getting in on the act (Sullivan, 1996). Thus, there is room to grow within this industry. The trend is irreversible. From the secondary cases, it can be seen that the adoption of DW technologies help a number of organisations stand out against others.

6.2 Importance of integrated CRM in the banking industry

The significant impacts of integrated CRM in the banking industry will be discussed in this session.

From the above case studies and interview, CRM is found to be of special importance from a practical perspective. Different banks present different levels of concern over CRM integration. There is a common goal for these banks: enhance their competitive advantage so that higher shareholder wealth can be created.

From case analysis, the Fortune 500 financial organisation put more effort in technically supporting decision makers with relevant information. Even though it is found that a number of experienced financial advisors do not behave according to the results from the DSS system due to limited outcomes, the system provides convenience to end users.

In comparison, FAC focuses more on the improvement of the information structure from a strategic level. FAC turned from a business losing 60 million dollars annually to a profitable leader in the industry through a series of strategic innovation in information management. It clearly sets off the periodic goals from the business and technical perspectives. FAC connects the technical and business parties closely through adequate communication, so that the technical people clearly understand what is needed within the system. Compared to the Fortune 500 FS, FAC enables CRM integration with a more comprehensive analysis of business.

The two banks above pay different attention to the DW-enabled CRM integration; however, regardless of which specific level it is in, each of them pays a substantial amount of attention to it. The different viewpoints and unique needs of each bank largely influence their attitudes towards the process.

The implementation and integration process is very time-consuming and expensive. Nevertheless, the success of such investment is not guaranteed. However, there are still a large number of banks or other financial institutions trying to adopt such integration. For the earlier pioneers, their target is to develop a 'blue ocean' where no one else can be comparable. This competitive advantage does not last long in global economic terms. Bank MS, one of the first few banks in China to adopt DW-enabled CRM integration, is trying to catch up internationally and develop a competitive advantage domestically. There will be more banks following this track, because the trend is irreversible, like the use of the internet. Those who refuse the trend will find it very difficult to survive later on.

6.3 Critical factors influencing DW-enabled CRM integration

As summarised in the secondary findings section, there are a number of critical factors influencing the application of DW technology in CRM integration. Whether these factors are equally relevant to the interviewed bank will be compared and contrasted.

The critical factors can be subjective and biased; therefore, the author does not directly get feedback from the single interviewee. Instead, based upon the information fed from the interview, internal and external critical factors are discussed independently.

The integration of CRM through the adoption of DW technology has a direct impact over the bank itself. Although the industrial trend has the power to influence an individual bank, it cannot directly affect its decision. Internal factors are those that arise within the bank itself. For instance, the competence of bank staff is a typical internal factor. External factors are those beyond the control of a bank; market trend and economic conditions are classic examples of external factors.

The implementation of DW technology is a huge project, involving much more than one person's effort. Therefore, the coalition of a project team, top management and internal system users is a vital factor for success.

The implementation and integration process of DW technology in Bank MS is analysed in detail in the previous chapter. It can be seen that within its Information Management Department, the four offices work independently as well as corporately. Technical support is closely related to business analysis and customer relationship analysis to people. Internal needs are met through various communication channels, such as meetings or training sessions.

Apart from the above internal factors, there are some external factors which will directly or indirectly affect banks' decisions.

Technology development is one of the most important factors which will directly affect the innovation process. With high-paced evolution, DW technology is widely used in the financial services field. Due to the nature of the business, DW is designed to suit the mass-volume data processing need.

Economic conditions, such as competition within the industry, are another important external factor. Domestic and international rivals are pushing Bank MS to immediately improve its information management so as to improve its overall performance.

During the CRM integration process, banks focus more on the technical perspective of the system instead of encouraging implicit implementation. Client loyalty and strategic management are critical in utilisation of the CRM.

From case study 1, it can be seen that consistency of data format is one of the critical factors, which will directly influence the reliability of the CRM integration process using DW technology. Apart from the formatting issue, case study 1 also mentioned the technical solution to the decision-making process and the importance of staff training. The education of new terminologies and techniques is equally critical as the technology itself. The end users are the ones who will realise the integration. In addition, the output of DW-enabled CRM integration should be of practical use. Analytical results should not be replaced by individual experience otherwise the improvement using the system would be very limited.

Case study 2 points out the importance of strategic innovation within a corporation during the integration process. Goals are clearly set up from the very beginning of the implementation project. This is one of the most critical factors which will influence the overall outcome of the integration process.

From a management perspective, apart from the client-centred solution, how to use the solution efficiently is equally important. Therefore, personnel management of the project is another critical factor.

Case 3 summarises the critical factors from three perspectives: Organisational dimension, environmental dimension and project planning dimension. First of all, from organisational dimension, three critical factors are observed. The size of the bank is an important factor for whether or not to adopt DW technology. Larger banks usually have more resources in terms of money resources and human resources. According to the statistics from the third case, it is found that the bigger the size of the bank, the more likely the bank will adopt the DW technology as a client relationship solution. Championship as well as top management support within the integration process are two other critical factors. Capable individual and supportive management would ensure the integration process runs smoothly and efficiently. In addition, coalition of organisation resources is a must during the integration, especially for those smaller banks.

Even though it is observed from the third case study that exogenous factors do not have significant influence over the integration of CRM with DW technology, it worth analysing rivals' technological movements.

From a project planning dimension, case study 3 found whether or not the existence of a competent team would affect the decision to adopt the solution. However, a completive project management team will lead to integration success.

Case study 4 analyses the successful experience of RBC. Several factors are found to be critical in the process: committed sponsor, clear project definition, teamwork and needs assessment.

Case study 5 emphasises the importance of management realisation about the business intelligence. ABSA positioned itself with a long-term vision. It is critical to be determined and consistent about one's goal.

6.4 Organisational goals from both business and technical perspectives

It can be seen from the case studies and interviews that clearly set goals are vital to the success of the implementation process.

FAC defines its business and technical goals along a timeline. This step-by-step instruction guides FAC through the implementation and innovation process. In addition, the time frame ensures that the project is completed on time and within budget. Technical goals are set in accordance with the needs of business goals. These clear goals help staff from both the technical department and the business sector to have the big picture of the innovation process, i.e. everyone knows what everyone else is doing.

ABSA put its goals into a series of value-added activities. These targets are enabled by the information department adopting DW technology. Its detailed goals in CRM integration and market segmentation set ABSA Bank apart from other banks. It became one of the top four banks in Africa within a decade.

Bank MS, in particular, developed short-term and long-term goals with a comprehensive evaluation system. In the short term, high performance and low performance clients are identified through the adoption of segmentation tools. This helps Bank MS with an improved resource allocation strategy. In the longer term, Bank MS places its attention on the coherence of client-centred activities, namely, risk management, differentiated products and services delivery, project team management, and organisational decision making.

6.5 The significance of DW technology over CRM integration process within banks

DW technology has been deemed as one of the most important tools of CRM integration. Therefore technical issues will largely influence implementation of the CRM integration process.

DW technology provides consolidated and integrated information for decision makers. Detailed and discrete data is of no use in terms of CRM integration. DW systems analysed in the primary research is modelled multi-dimensionally. The simplified DW system infrastructure of Bank MS illustrates how the system facilitates plain data into analysable information. The sophisticated system can process mass volumes of data and complex analysis. Through data generation, data transfer or loading, and data analysis, raw data is turned into material information. Client segmentation is realised through the adoption of DW technology. Data is manipulated within the warehouse and viewed using the OLAP tool. The sample view table in the previous chapter demonstrates that the use of DW technology shortens the query response time and facilitates customer segmentation.

Compared to Bank MS, the VISION system of FAC utilises over 100 source files to enable information analysis and customer segmentation. The VISION system serves the marketing department with accurate and time-efficient information.

6.6 Problems and barriers in the application of customer segmentation

Qualitative data manipulation is one of the problems arising from the implementation process. Users of the DW-DSS system within the investigated Fortune 500 FS point out the difficulties when qualitative data are involved. This is an issue which will be faced by many other banks. Qualitative data are complementary to the numbers, helping end users

to have a better understanding of one particular aspect of clients. However, the nature of qualitative data makes storing and transferring complicated. How to effectively manage the qualitative data is one major concern of a large number of DW users.

An effective staff training system should be developed to prevent barriers internally. DW technology is enabling the banking industry to provide differentiated products or services with an in-depth understanding of clients' needs. However, the new technology requires a comprehensive training system. Problems arise when an 'absolute' marketing person meets computerised technology. Apart from receiving systematic training, it is essential for them to understand the benefits that technology-enabled CRM could bring. RBC reports a direct outcome of targeted marketing campaign response rates as high as 40%, compared to an average industry rate of 2–4%. In addition, cross-selling opportunity can be identified.

6.7 Summary

This chapter discusses the issues arising from the primary and secondary case research. It firstly recognises the significance of DW technology from banks' strategic level. This is followed by the importance of CRM integration in the banking industry: it not only provides a loyal customer relationship, but also improves overall performance in economic terms. Critical factors, which influence the DW-enabled CRM integration, are discussed from internal and external aspects independently. Internally, coalition among the project team, top management and the rest of the bank plays an important role. The implementation process is beyond one-man control; rather, much teamwork is involved. Externally, overall economic and technological conditions have substantial impacts over the CRM integration process. In addition, clear business and technical targets should be set to guide the process. Lastly, the problems and barriers in the implementation process are raised and discussed.

Chapter 7 Conclusion

7.1 Summary and contribution

This research takes a systematic view towards CRM integration using DW technology. Four research questions are proposed at the beginning of the study. Upon analysing the primary and secondary cases, this research successfully answers each of the four with empirical data. Banks should complete both strategic and operational processes in order to realise DW-technological support function to CRM. Critical factors are explored and summarised into two general levels: external and internal, which largely influence the success of the CRM integration process. Customer segmentation is a major approach to achieve the aim of CRM. Through the adoption of various dimensional variables, customer segmentation can be simplified according to differentiated needs. Decision support can be provided in the front-end application. End users can easily retrieve the information necessary for decision making.

Based upon the five secondary case studies and primary data from one of the leading commercial banks in China, this research analyses the optimal DW technology implementation process. It is observed that even though the DW infrastructures are not exactly the same from bank to bank, common points exist. In addition, the research summarises the critical factors which influence the success of CRM integration with DW technology.

Critical factors observed are categorised into internal and external. Internally, organisation coalition is deemed to be one of the most important factors that will determine the success of CRM integration. In addition, a clearly defined goal is another condition for success. From both case studies and primary research, the author found that a well-defined goal is crucial. The majority of the researched banks (both secondary and primary) state the significance of a clear goal. Externally, technology and economic environment largely influences banks' decision-making and implementation process.

The economic environment includes industrial competition, global economic conditions, etc. Severe competition within the financial sector increasingly affects banks' decision-making processes. Personnel arrangement for information departments is analysed. From the human resource standpoint, experienced DW technical professionals with some business background are in high demand.

The customer segmentation process from both managerial and operational levels is analysed within the primary findings. From the management perspective, customer segmentation is summarised into five phases:

1. Market position

2. Segmentation method and dimensional variable selection

3. Data collection and initial manipulation

4. Segmentation software selection

5. Performance monitoring and evaluation

From an operational perspective, it can be generalised into three major steps:

1. Data loading

2. Data manipulation

3. Multi-dimensional data analysis

In addition, problems and barriers are recognised: treatment of qualitative data and staff training are observed to be the two important barriers during the implementation and integration process.

Technically, the DW structure is demonstrated with the star schema model in an example of the customer segmentation being realised using the system.

This research tends to draw attention from banks that have not yet adopted DW technology in their CRM integration. The economic value of adoption and implementation is not mentioned in dollar terms. However, the strategic value of customer segmentation is presented. Through customer segmentation and analysis, loyal customer relationship can be built and retained. Targeted marketing strategy increases the return per market dollar and resource allocation can be optimised.

This research contributes to literature with an empirical framework which helps both future researchers and banks to have a better understanding of potential issues involved in the CRM integration process. The gap found in the literature is partially filled with these empirical findings. This study links technologies with business needs. In addition, the DW framework summarised in this research provides a ground for practitioners who have responsibilities in comprehensive decision making. Banking organisations benefit from the findings of this research in various ways. The summarised framework helps banks to understand better about the importance of DW-enabled CRM and how it can be utilised in their own situation.

7.2 Limitations of research

This study has several limitations. Firstly, the number of cases is limited to six and the findings may not be representative. Bias may be introduced. Secondly, despite the author's invitational effort, only one bank carries out the interview with the researcher. The limited number of primary interviews makes this research less persuasive. Thirdly, due to the confidential requirements of the financial industry, this research demonstrates only a brief outline of the infrastructure. In addition, the exclusion of unpublished researches and conference notes may lead to the omission of information.

7.3 Future study

This research has reviewed a number of aspects with room for future study. Suggestions for the future research opportunities are made over the integration of CRM using DW technology.

For further study, the author suggests that more effort be made into exhaustively exploring the conceptual and technological framework. More critical factors can be analysed and a systematic view of those factors will be helpful in practical terms. A generalised guide of critical factors using a balanced score card is a good point to start.

Another possible research direction is to utilise the multi-dimensional analysis of the DW system and other relevant data mining techniques so that deeper understanding of customer information can be realised. This may require a more comprehensive understanding of business nature and technology implementation. A longer investigation time frame is also needed.

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Appendix

Interview questions

- What is the organisation's background?

- What is the interviewee's position within Bank MS?

- What is the personnel arrangement for Bank MS's Information Management Department?

- Which department is the interviewee working for and what is its main function within the bank?

- Why is CRM needed within Bank MS?

- What achievements are expected from the integrated CRM and what are the significances of these achievements?

- What is the customer segmentation process from a managerial level?

- What are the possible outcomes of customer segmentation?

- What is the structure of Bank MS's DW system?

- What is the customer segmentation process from an operational point of view?

Abbreviations

CIM – Customer Information Management

CRM – Customer Relationship Management

DSS – Decision Support System

DW – Data Warehouse

EDW – Enterprise Data Warehouse

ETL – Extracting Transforming Loading

FAC – First American Corporation

FS – Fortune 500 Financial Services Organisation

FS-LDM – Financial Services Logical Data Model

GUI – Graphic User Interface

MA – Marketing Automation

MDD – Multi-Dimensional Database

MDV – Multi-Dimensional View

OLAP – On-Line Analytical Processing

OLTP – On-Line Transaction Processing

RBC – Royal Bank of Canada

SA – Service Automation

SFA – Sales Force Automation

TCS – Tailored Client Solutions