

Data mining practice in SMEs: a customer relationship management perspective

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Abstract

Data mining is a relatively new practice for small and medium sized enterprises (SMEs). This study investigates the level of data mining practice being employed by small firms and their motives and interest by implementing data mining. Qualitative questionnaire was designed and distributed to 192 SMEs of which 75 usable responses were received representing 39 per cent of response rate. The findings show that the implementation of data mining is very shallow and varies with firm's size and the nature of the business. Participants express interest in gaining the knowledge and practical techniques of data mining. This study shows that the motives of SMEs in implementing data mining are very much customer-oriented.

Keywords: SMEs, Small Firms, CRM, Data Mining

1. Introduction

In the last decades, customer relationship management (CRM) was emerged to reflect the crucial role of customers as the focal point of company's profitability and operations. The aim of CRM is to understand the needs of customers and to leverage that knowledge to increase the company's profitability in long term (Stringfellow et al., 2004). Considering the fast changing business culture, the economics of customer relationships are changing in a fundamental way. Businesses are facing the need to implement new solutions to address these changes (Rygielski et al., 2002). In this context, the advent of information technology (IT) has transformed the way CRM is being done and how companies manage information about their customers (Shaw et al., 2001).

Customer data and information technology tools are the foundation upon which successful strategies are built (Ngai et al., 2009). With this trend, technologies such as data mining and data warehousing have opened a new era to CRM through which business enterprises can gain competitive advantages. Data mining offers a sophisticated set of tools to extract customer data in an analytical CRM framework. Data

mining techniques are considered to be a leading CRM tool which has been deeply influenced by advancements in IT.

Undoubtedly, the advancements in IT call for businesses to re-construct the way CRM functions in their business culture. Many authors have researched the potential advantages of data mining systems in managing customers (Ahmed, 2004; Chu et al., 2007; Ngai et al., 2009; Wu et al., 2005), of which few have applied the principles of such strategic tools to SMEs. Interestingly, although SMEs have a strong focus on customers, suppliers, employees and other stakeholders, they have not well implemented the principles of e-business in their marketing strategies. Compared with large firms, data mining has received much less attention in SMEs.

This paper is intended to, a) investigate the level of the use of data mining in SMEs; and b) examine the interests and motives of SMEs in implementing the data mining practice in their operations. The structure of the paper is as follows. First, a brief background of relevant areas covered for this study is presented. Research method and objectives are explained and identified in Section 3. Section 4 presents the research findings and managerial implications. Conclusions are drawn in Section 5.

2. Literature review

Much research has been carried out in the context of data mining in larger firms (e.g. Hsu, 2009; Kusiak and Smith, 2007; Shaw et al., 2001). However, similar literature in SMEs is very limited. The reason is well justified. In many cases smaller firms cannot afford the initial capital investment for the installation of a systematic data mining system. In addition, information about the adoption of such techniques in SMEs is very limited.

2.1 CRM in SMEs

Due to ever intensifying competition, businesses are moving away from product-oriented business strategies to customer-oriented ones. Globalization, increased competition and advancements in information and communication technology have forced businesses to focus more on managing customer

relationships in order to efficiently maximize revenues and profit (Özgenera and Iraz, 2006). As a strategy to optimize the lifetime-value of customers, CRM can help businesses to succeed in the world of e-business (Tie, 2003). Day and Van Den Bulte (2002) define CRM as a cross-functional procedure to attain a continuous exchange of ideas with customers, across all their contacts and access points, with personalized dealing of the most valuable customers to increase customer retention and the effectiveness of marketing networks. Not only large and multinational enterprises, but also SMEs are actively seeking to deploy CRM in order to gain long-term profitability. Particularly, customer retention is important to SMEs because of their limited resources (Baumeister, 2002). Skaates and Seppanen (2002) believe there is a major role where CRM contributes to the competence development of SMEs. Furthermore, SMEs are embracing CRM as a major element of business strategy because technological applications permit a precise segmentation, profiling and targeting of customers (Gurau et al., 2003).

2.2 Data mining in CRM

There are a variety of definitions available to describe the concept of data mining. Data mining is an analysis of automation and semi-automation for the discovery of meaningful relationships and rules from a large amount of data in a database (Hui and Jha, 2000). The techniques used are the result of a long research and product development process (Rygielski et al., 2002). There has been growing use of data mining motivated by the need for companies to find knowledge that is hidden in their data (Marbá'n et al., 2008). Due to the need for sophisticated methods to discover knowledge from the extracted data, data mining tools and algorithms have been developed (IBM, 1999; ISL, 1995; Witten, 2000).

The CRM framework consists of operational and analytical points of view (Berson et al., 2000; He et al., 2004; Teo et al., 2006), where operational CRM lies with the automation of business procedures and the analytical CRM refers to the analysis of customer characteristics so as to support the organization's customer management strategies (Ngai et al., 2009). Analyzing and understanding customer behaviour and characteristics are the foundation to develop a competitive CRM strategy to acquire and retain

potential customers and maximize customer value (Ngai, 2005). Analytical CRM is a collection of powerful tools aimed to prioritise targeted areas and allocate organizational resources more effectively to the most valuable customers.

Despite the importance of data mining techniques to customer relationship management (CRM), there is a dearth of literature in this area (Ngai et al., 2009). The implementation of data mining applications in CRM follows an emerging trend among business organizations. Appropriate data mining tools, which are good at extracting and identifying useful information and knowledge from enormous customer databases, are one of the best supporting tools for making CRM decisions (Berson et al., 2000). As such, the application of data mining techniques in CRM is worth pursuing in a customer-centric economy (Ngai et al., 2009). Based on the literature (Parvatiyar and Sheth, 2001; Swift, 2001), CRM consists of four dimensions:

1. Customer Identification;
2. Customer Attraction;
3. Customer Retention;
4. Customer Development

These dimensions are considered as a close loop of a customer management system (Au and Chen, 2003; Kracklauer et al., 2004). Additionally, the essential aspect of data mining pursues the development of a model from the organization's data set (Carrier and Povel, 2003). Data mining techniques can perform one or more of the following modelling tasks:

1. Association;
2. Classification;
3. Clustering;
4. Forecasting;
5. Regression;

- 6. Sequence discovery
- 7. Visualization

Based on the review of the relevant literature, Ngai et al. (2009) have developed a framework of data mining techniques in CRM (Figure 1.)

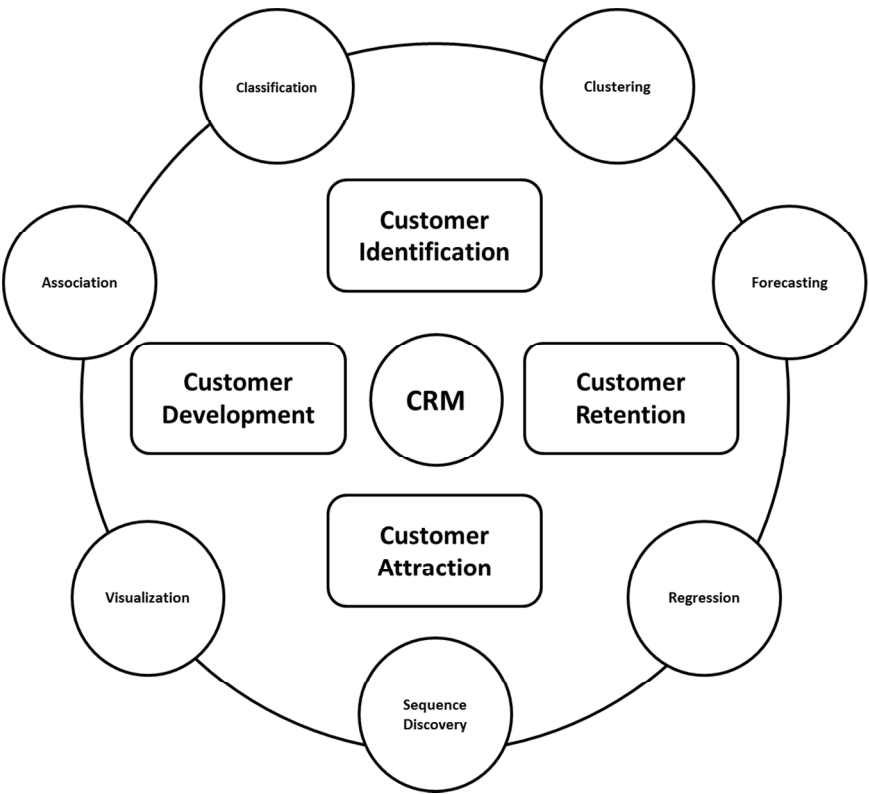


Figure 1. Classification framework for data mining techniques in CRM (Ngai et al., 2009)

It is clear that from the literature review that there is no lack of research that has been conducted in the context of large enterprises. However, there is a clear dearth of research on data mining in SMEs despite the interests shown by these firms. In addition, there has been increasing pressure on SMEs to improve their CRM through innovative approaches in competitive markets. It therefore makes sense to investigate the potential applications of data mining in SMEs.

3. Methodology, objectives and data collection

The research method for this study consists of three main stages: questionnaire development, data collection and data analysis. The initial questionnaire design was based on literature review. To refine the questionnaire, five interviews were conducted to ensure the questions included in are clear and relevant to the research questions. Data were collected through a self-completion questionnaire. The questionnaires were distributed through fax and direct contact to sale managers or relevant position in SMEs. The SMEs sample had to meet the European Union (2003) criteria of SME definition:

- less than 250 people employees; and
- Annual turnover less than 50 million US dollar.

Data collection was based on the availability of firms to participate in the study. The questionnaire was designed to answer the following two main research streams:

RS1. What is the level of the use and awareness of data mining in SMEs?

RS2. What are the interests and motives of SMEs in implementing the data mining practice?

The questionnaire has two parts. The first part consists of 7 dichotomous questions to answer RS1. The designed questions cover a range of topics from simply assessing SMEs' knowledge on data mining to their interest in investment in such systems. To answer the RS2, respondents were asked to indicate, using 1-5 Likert scale, the importance of nine factors related to the use of data mining. The nine factors were extracted from the data mining applications in CRM from the literature.

The questionnaires were sent out on February 17th, 2010 to 192 randomly selected SMEs in southern Iran. A reminder was sent out on March 12th, 2010. 75 usable responses were received representing 39 per cent of response rate. Table 1 shows the percentage and number of companies involved in the survey by industry sector where n = 192. Table 2 gives the percentage breakdown of companies that returned usable responses. Minitab 15 was used to analyse and test the collected data from questionnaires.

Table 1. Survey sectors

Sector	Percentage	Number of firms
Manufacturing	33.3	64
Service-Utility	19.8	38
Engineering	15.1	29
High tech	12.5	24
Packaging	9.9	19
construction	9.9	18
Total	100	192

Table 2. Sector's respond rate

Sector	Percentage	Number of firms
Manufacturing	37.5	24
Service-Utility	42.1	16
Engineering	38	11
High tech	33.3	8
Packaging	42.1	8
construction	44.4	8
Total	100	75

In order to check whether there were any significant characteristics differences between respondents and non-respondents in the survey, a paired sample T-test was carried out. In many cases, a systematic difference would norm the generalizability of the results (Flynn et al., 1990). The test was deployed based on the number of full time employees of the companies. The T-test result did not show any significant difference among the participating companies, which indicates that the non-response bias does not affect the further analysis of the results.

4. Research Findings and Managerial Implications

As expected, 56 per cent of the responded firms did not have a basic understating of data mining techniques and principles (RQ1). However from the survey results, manufacturing firms were more aware of the techniques and principles than others by showing the highest positive response rate. Results from RQ2 showed that 70 per cent of small firms gather and categorize customers' data in both conventional

and systematic methods. Interestingly only 4 per cent of those firms using data gathering programs apply professional data mining software.

The result of RQ3 indicates that 78 per cent of respondents believe that their customers are interested in participating in their data gathering analysis program. This can be interpreted as customers' awareness of the critical role of information exchange between customers and suppliers. 90 per cent of SMEs answering the RQ4 indicate their awareness of the need of a systemic data collection approach for analysis of customers' data. About 70 per cent of the respondents showed an interest to join training workshops and seminars to gain knowledge in data mining and associated applications (RQ5). This finding indicates that SMEs recognise the importance of such advancements in managing their customer relations. In contrast to earlier findings, only 37 per cent of respondents are willing to invest in data mining implementation (RQ6). This might be due to of high initial costs of purchasing data mining software.

The results obtained from the analysis of the second part of the questionnaire indicate that those factors which have a direct and strong relation with meeting the customers' needs were rated as important factors in the implementation of data mining systems (Figure.2). In other words, those applications are beneficial to deal with customers' satisfaction and improving the quality of goods or services. By descending order, customer retention, analysis of buying behaviour, sale forecasting and pricing are closely standing at the next level of importance. It is interesting to note that all the four factors are linked to marketing-related strategies. Taken together, this finding indicates that strengthening marketing data analysis is being considered as the second major aim of data mining implementation for SMEs.

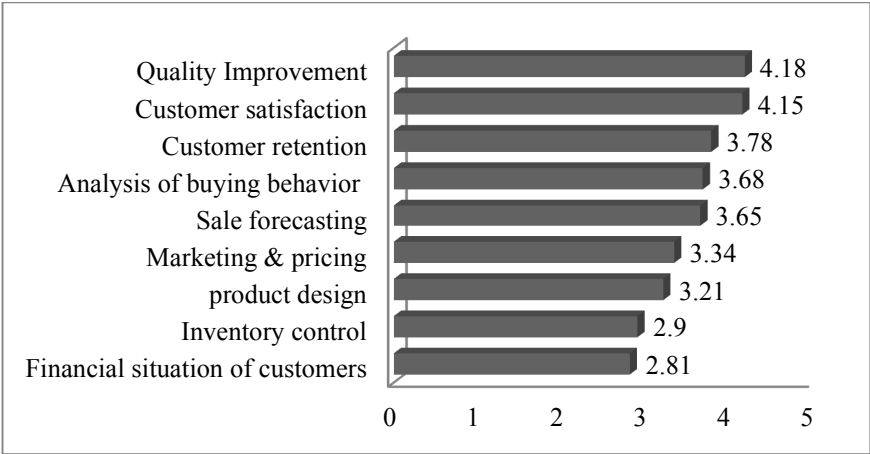


Figure 2. Areas of importance in implementing data mining from SMEs’ perspective

Product design and inventory management as the elements of production management receive a lower level of attention from SMEs as data mining applications in CRM. While, the analysis of customer’s financial situation is highlighted as the least important factor among all.

5. Conclusion

Data mining is considered as a relatively new experience among small firms and has been increasingly used for competitive advantage. The current research sheds light on the assessment of the current use of data mining practice among SMEs and their possible motives in implementing the practice. Most studies in this area have only focused on data mining in large firms with very limited research in SMEs. The significant findings of this study can be highlighted by showing that the majority of SMEs are unfamiliar with the basics of data mining and relevant applications. However, most of the participants do apply traditional and self-designed methods of collection, classification and analysis of data.

Additionally, the exchange of information between SMEs and their customers is not considered as a barrier in the data collection process. Enthusiasm of SMEs in learning data mining application is reflected by the positive responses to attend training workshops and seminars. This finding is contrary to the number of firms which are agree to invest in data mining systems. Fair enough, large firms were the developers of data mining systems and consequently current data mining frameworks are not well fitted to

smaller firms. We make the conclusion that SMEs perceive data mining differently than larger firms as an analytical tool for both internal and external data assessment. From the results of this research, it can be concluded that small firms perceive the data mining as a tool to meet the customers' satisfaction. This study opens a new area for data mining developers for design, development, and commoditize data mining systems in SMEs scale.

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