

Original Article

Proposing a customer knowledge management model for customer value augmentation: A home appliances case study

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ABSTRACT Customer Relationship Management (CRM) plays a prominent role in enabling businesses to meet their customers' needs, and therefore it acts as a catalyst in the process of creating and delivering value to them. As CRM concerns managing customer knowledge, it can be considered as a subset of Knowledge Management (KM). Therefore, in this study, the effort has been made to propose a Customer Knowledge Management (CKM) process model to compensate the existing lack of a study integrating CRM and KM with the aim of customer value augmentation. In this CKM model, all forms of CRM are employed to support all the phases of CKM. Finally, a home appliances case is studied to illustrate the proposed CKM model.

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INTRODUCTION

Currently, businesses are subject to challenge by a turbulent environment.¹ In fact, fierce competition along with globalization and Information Technology (IT) advancements are the emerging predominant forces, making circumstances extremely difficult for businesses to survive. Therefore, to tackle these conditions and even prosper, businesses commenced to shift their focus onto customer value.

In spite of its recent emergence, a lot of scholars and practitioners have investigated the concept of value.^{2–6} Customer value as defined by Xu and Cai⁶ is 'the net benefits a customer obtains from a product or a store'. Customer value facilitates predicting customer choice, and businesses can gain competitive advantage by means of serving customers with customer value.⁶ Customer needs refer to what customers ultimately want, whereas customer value indicates

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what customers want with certain limitations.⁴

Logically, all businesses have the ultimate goal of creating and delivering value to their customers and then capturing value from them in return.⁷ In order to augment these processes of value creation and capturing, adoption of an effective customer-oriented marketing strategy seems crucial.⁷

In order to capture customers entering the market, businesses in the 1950s and 1960s utilized marketing techniques, because satisfying growing demand was their main goal. However, today transaction marketing (product, price, place and promotion, the 4 Ps) is not sufficient anymore.⁸ Consequently, relationship marketing is proposed to fulfil the new needs of businesses in today's totally different business environment. In comparison to transaction marketing, relationship marketing develops more unique relationships with customers and adds more value to goods and services.⁸

One of the prominent constituents of relationship marketing is value. In addition, providing superior value to customers is considered as one of the most successful competitive strategies.⁹ This provision makes businesses capable of gaining sustainable competitive advantage.⁹

As Gro'nroos¹⁰ stated, 'The role of relationship marketing is to identify, establish, maintain and enhance relationships with customers and other stakeholders, at a profit, so that the objectives of all other parties involved are met; and that this is done by a mutual exchange and fulfilment of promises'. In general, relationship management comprises management of both long-term relationships and short-term transactions. With regard to the fact that long-term relationships are more profitable than transactions, relationship marketing concentrates mainly on long-term relationships with customers.

As Lindgreen *et al*⁸ stated, Customer Relationship Management (CRM) is 'the

management of relationship marketing'. In fact, as Chan *et al*⁷ defined, CRM can be considered as 'a philosophy that anticipates customer needs with the purpose of providing the target customers with the right product, at the right time, in the right place'. Therefore, CRM plays a significant role in enabling businesses to satisfy their customers' needs and consequently develop customer retention and customer loyalty, and augment market share.^{7,9} As CRM provides businesses with great financial returns, it can be regarded as the best catalyst for the process of creating and delivering value to customers and capturing value from them. In other words, CRM strengthens the primary value creation activity in today's business environment, that is, it develops customer relationships, and as a direct result it helps businesses to remain competitive.⁵⁻⁹

CRM concerns managing customer knowledge in order to realize and serve them in an effective manner.¹¹ Customer-related knowledge plays a significant role in retaining competitive advantage of businesses.¹² It should be noted that CRM objectives can be attained through obtaining customer-related knowledge; in fact, CRM embodies a huge Knowledge Management (KM) element.¹²

Owing to the fact that KM comprises not only customer knowledge but also product and service knowledge, industry knowledge, competitor knowledge, knowledge of methods and processes and so on, it can be considered as a vast concept that encompasses CRM.¹³ As Plessis and Boon¹³ argued, 'Customer Relationship Management systems can, therefore, be seen as a subset of Knowledge Management systems'. As CRM processes are knowledge-intensive processes,¹⁴ it is crucial for an effective CRM system to have access to abundant and continuously updated customer knowledge.^{11,12,15}

As Liew¹⁶ summarized, three levels of progress can be considered for CRM,

which are (i) Transaction-based data processing customer services, (ii) Informed decision-based customized services and (iii) Knowledge-based customer and value-driven relationship management. In order to reach the last level of CRM sophistication, the organization should consider KM as a strategic change.¹⁶ In addition, implementation of CRM naturally tends to be technological, whereas implementation of KM is more likely to be organizational. Therefore, successfully implementing KM can set the stage for a successful CRM implementation in the organization.^{17,18}

Therefore, the remainder of this study proceeds as follows. The following section describes the previous authors' contributions. Then the discovered gaps are discussed. In the section 'Theoretical background', CRM and KM are explained as the theoretical background. This section also contains a classification selection for CRM forms. The section 'Deriving the CKM process model' embodies the proposed Customer Knowledge Management (CKM) process model; despite the fact that this process model is mainly designed for intensifying customer value, it can be regarded as a comprehensive CRM–KM integration model. In the section 'Home appliances case study', the proposed CKM model is applied to a home appliances case study as an illustration. Finally, the section 'Conclusions' concludes the article.

RESEARCH GAP

The literature survey has been carried out from the perspective of intensifying customer value through integration of CRM and KM. Indicating that only few researchers have concentrated on the CRM–KM integration, Table 1 summarizes the results of the literature survey. The contributions of each paper, as well as the point that whether they are proposing a CKM model to enhance customer value, are briefly discussed in this table.

The review of the CKM literature helped discover some fascinating facts about the researches on intensifying customer value through CRM–KM integration.

In the first place, there is no study striving to integrate CRM and KM with the aim of customer value augmentation. Another missing link that has been observed in the researches is that the literature lacks a study trying to integrate all KM phases with all forms of CRM to propose a comprehensive CKM model as it is offered in this study; a few studies have endeavoured to integrate KM with Operational and Analytical CRM, some with Operational and Strategic CRM and majority of them focused on the integration of KM and just Analytical CRM. In addition, a few papers took advantage of CRM form classifications in a way that it sounds necessary to consider a unified classification of CRM forms for proposing a rigorous CKM model.

In order to fill these gaps, this study first provides a unified classification of CRM forms and then proposes a thorough process model for CKM. Although this model is primarily designed for customer value enhancement, it can also be utilized as a comprehensive model for the integration of CRM and KM.

THEORETICAL BACKGROUND

CRM

Currently, businesses are encountering basic changes in the economics of customer relationships and consequently they have to adopt new strategies that address these changes. Customer relationships regarded as the focal business issues are replacing mass marketing, which emerged during the first stages of industrial revolution.^{12,19,20} Only those businesses that can precisely identify what, when and how much their customers demand are capable of satisfying their customers through delivering the appropriate product at the appropriate time and to the right customer.^{17,19}

Table 1: The summary of the CKM literature

Reference	Year of publication	Contribution of the paper	The study's approach to KM-CRM interaction	KM phases considered in the study	CRM phases considered in the study	Proposing a model or framework	Introducing a unified classification of CRM forms	Integrating KM and CRM to intensify customer value
15	2012	A decision model premised on consumer behaviour and purchase characteristics is proposed. The model would enable retailers to focus their KM efforts to leverage the potential of customer knowledge for both productivity benefits and product innovation	The retail industry needs customization on a large scale to attract and retain its customers. This would only be possible by adopting a systematic and process-oriented approach towards acquisition, storage, analysis and application of customer knowledge of an organization practice that can be broadly described as 'CKM'	Three components of KM in knowledge-intensive service industries are: (i) Document repository, (ii) Expert's directory and (iii) Collaborative platforms	—	No	No	No
21	2012	As IT managers lack a clear vision of how to improve organizational performance, the study addresses the link between CKM and firm performance	KM enables a firm to position its tacit knowledge to be able to respond quickly to customers, create new markets, develop new products and dominate emerging technologies	—	—	No	No	No
11	2011	The study examines the relationships between KM and CRM success using a structural equation model. The main contribution is that having KM capabilities is not sufficient for the success of CRM, but there are other factors to consider	The long-term relationships are based largely on customer knowledge and KM and CRM systems improving not only the organization's ability to interact, attract and build personalized relationships with customers, but also the ability to increase their knowledge about them	—	—	Yes	No	No

22	2011	In this study, an integrated framework for CRM through the application of KM technology is presented. The framework can be the basis for enhancing CRM development	—	Operational, analytical, collaborative	Yes	No	No
23	2011	The paper considers how to develop a strategy and operational framework that would build Analytical CRM on the foundation of existing DM techniques and KM approach to meet the business challenges. On the basis of this research, a customized, integrated framework to match the needs of business is also designed	—	Operational CRM, Yes Analytical CRM, and Mobile CRM and Electronic CRM, and Operational CRM)	Yes	No	No
24	2011	This study devises a novel model to predict customers' prospect value. In the proposed model, we utilize the concept of finance that stands in the current status and predicts future value based on historical data	—	—	No	No	No
25	2011	Investigating the four dimensions of CKM in polymeric pipe and fitting manufacturers, this study reveals that the organizations dealing with this type of industry are demonstrating a feeble connection among the four dimensions of Content, Competence, Collaboration and Composition of CKM	—	—	No	No	No

Table 1: Continued

Reference	Year of publication	Contribution of the paper	The study's approach to KM-CRM interaction	KM phases considered in the study	CRM phases considered in the study	Proposing a model or framework	Introducing a unified classification of CRM forms	Integrating KM and CRM to intensify customer value
26	2010	This study determines how knowledge sharing among members of firms' collaboration affects CRM profitability. A CRM profitability model is also formulated and used and a questionnaire survey is mailed to investigate travel agent managers and employees in Taiwan	—	—	—	Yes	No	No
27	2010	This article mainly probes into the research of CKM from acquiring, sharing and even creating the customer knowledge	KM is the main tool for interactions in CRM	—	—	No	Yes	No
17	2010	This article investigates the factors that can positively leverage the implementation and use of CRM and creates differentiation among these factors and KM factors. What is more, the article aims at determining technical feature between CRM and KM and manages to compare KM with CRM successfully	—	Identify, verify, capture, disseminate and use knowledge	—	No	Yes	No
28	2010	This article uses the <i>a priori</i> algorithm as a methodology for association rules and clustering analysis for data mining, which is implemented for mining customer knowledge from the case firm, Phoenix Tours International, in Taiwan	—	—	—	No	No	No

29	2009	The findings of this study reveal the nature and practical complexities associated with knowledge sharing in travel industry alliances, and suggest how a travel agent can create an appropriate knowledge-sharing strategy and increase CRM profitability by IT	Knowledge sharing has contributed to successful CRM in this study	—	Yes	No	No
30	2008	In this article, a conceptual model of CKM is presented by identifying and analysing the existing tools in the market	—	—	Yes	No	No
31	2006	To address the importance of the need of customer knowledge in innovative product development, this study proposes an E-CKM model with a methodology for precisely delineating the process of CKM for innovative product development	—	—	Yes	No	No
32	2006	This study presents a proposed model of Knowledge-enabled CRM and demonstrates the way in which the presented model can facilitate the identification of important factors that have key impacts on business performance in particular settings	Both CRM and KM approaches can have a positive impact on reducing costs and increasing revenue	Identify, capture, select, storage, sharing, application, creation and sell	Yes	No	No
33	2005	A conceptual model of an analytical CRM system for customer knowledge acquisition is developed based on the findings and literature review	—	—	Yes	Yes	No

Table 1: Continued

References	Year of publication	Contribution of the paper	The study's approach to KM-CRM interaction	KM phases considered in the study	CRM phases considered in the study	Proposing a model or framework	Introducing a unified classification of CRM forms	Integrating KM and CRM to intensify customer value
14	2004	In this article, the use of modern IT to provide knowledge support to CRM processes is illustrated. The reasoning is based on an integrated CKM process model, which identifies six CRM sub-processes and four aspects of KM. This integrated model aims at achieving knowledge transparency, knowledge dissemination, knowledge development and knowledge efficiency	Customer-focused companies have to provide knowledge that customers demand process the knowledge that customers pass to the company and possess knowledge about customers. The cultivation of knowledge to support business processes is the task of KM. Thus, the application of KM concepts and technologies in the context of CRM is a relevant field of research	Content, competence, collaboration and composition	Campaign management, lead management, offer management, contract management, complaint management and service management	Yes	No	No
13	2004	To enable organizations to become more efficient and effective in delivering products and/or services to customers; thus, creating customer delight, knowledge on customers will have to be managed to ensure that the services organizations provide are those that will address customer needs. KM is, therefore, an integral part of CRM and e-Business	A KM system can provide real-time knowledge and information on the customer spanning the customer relationship lifecycle	—	—	No	No	No

12	2003	<p>This article is intended to: (i) propose a conceptual model of CRM development stages; (ii) investigate the extent of the usage of KM customer-related instruments and CRM information systems by Greek organizations and their relationship with organizational and demographic variables; (iii) investigate whether companies systematically conduct customer satisfaction and complaining behaviour research; and (iv) examine the impact of the type of the information system used on CRM-related practices</p>	<p>CRM is definitely related to the discipline of KM. Thus, the existence of sufficient and continually updated customer knowledge is critical for an effective CRM system</p>	—	—	No	No	No
34	2002	<p>A three-step model by which companies can obtain this knowledge is proposed in this article</p>	—	—	—	Yes	No	No
18	2001	<p>A systematic methodology that uses data mining, and KM techniques are proposed to manage the marketing knowledge and support marketing decisions. This methodology can be the basis for enhancing CRM</p>	—	—	—	Yes	No	No
35	—	<p>On the basis of the CRM and customer knowledge theory, this article suggests that total CKM and the integration of the internal knowledge and customer knowledge should be emphasized</p>	—	—	—	No	No	No

At present, organizations strive to enhance customer value by means of customer lifecycle analysis.^{20,36} Benefiting from technologies such as data warehousing, data mining and other CRM tools, businesses can seize opportunities of working on relationship marketing concepts. According to Bueren *et al*,¹⁴ relationship marketing is ‘an integrated effort to identify, built up and maintain a network with individual customers for the mutual benefit of both sides’.

A ‘sell–build–redesign’ model has replaced the traditional ‘design–build–sell’ model. In other words, businesses are moving towards a customer-oriented approach, a radical departure from their traditional product-centric view.^{20,32,37} The traditional marketing was aimed at increasing the number of customers; instead, in the current business environment, it is more logical to foster through not only winning new customers but also retaining current customers.^{20,38} In essence, as Lin *et al*³² stated, ‘the marketing focus shifts away from the breadth of customer base to the depth of each customer’s needs’. Businesses recognized the significance of close customer relationships, and thus CRM became so desired.^{17,20}

On the other hand, although companies have supported their back-office functions by means of utilization of Enterprise Resource Planning (ERP) systems, it is the time to concentrate on enhancement of front-office functions to augment the value they offer to their customers.⁴⁰

CRM is the core competency and in fact the competitive advantage of an enterprise that has placed a high value on management of its customers as its central business.¹⁶

Generally, CRM can be considered as a concept consisting of two major stages. The first stage is moving from a product-centric view to a customer-centric view; and the second stage is to develop the customer-centric approach by means of improving

the process of value proposition to customers.³⁹

Despite the fact that CRM has become widely recognized and a lot of authors have defined it from different points of view,^{12,13,33,41–46} there is no universally accepted definition of CRM.^{42,45} For reference, some definitions of CRM that highlight its prominent role in intensifying customer value are as follows:

Tiwary⁴⁴ defines CRM as ‘a tool that is becoming increasingly popular as it provides a method of maximizing exiting customer resource as well as adding value from the customers’ perception’.

Reinartz *et al*⁴⁷ treated CRM as ‘A systematic process to manage customer relationship initiation, maintenance, and termination across all customer contact points in order to maximize the value of the relationship portfolio’.

Finally, according to Tsai,⁴⁵ CRM can be defined as ‘a universal process of gaining and remaining customers, with the support of business intelligence, to maximize the customer value to the organization’.

Overall, CRM is a multi-disciplinary concept with certain objectives that deal with marketing concepts such as relationship marketing and consumer behaviour, concepts related to information systems such as e-commerce and human–computer interaction, management and so on.^{40,48} Businesses adopt CRM strategies to increase customer satisfaction, improve customer loyalty and to tackle problems concerning fierce competition in the market, the trend towards globalization and the rising customer acquisition costs. However, the primary aim of CRM is to maximize the lifetime values of the whole customer base.^{17,36,44}

CRM forms

Owing to the lack of a unified classification of CRM forms, this section concentrates on choosing a classification of CRM forms with respect to researches in the literature.

Table 2: CRM forms

Reference	CRM forms			
48	Operational	Analytical	Strategic	
42	Operational	Analytical		
43	Operational	Strategic		
33	Operational	Analytical	Collaborative	Electronic

Although the CRM frameworks in different studies vary and the number of CRM forms range from two^{41,43} to four³³ (Table 2), some consensus is evident with three major forms of CRM, that is, Operational CRM, Analytical CRM and Strategic CRM. Therefore, this study is grounded in these three common forms of CRM.

Operational CRM Operational CRM concerns the automation of business processes that are capable of enhancing the efficiency and accuracy of day-to-day front-office functions.^{42,48} In other words, Operational CRM embodies automation of sales, marketing and service. Operational CRM facilitates cost-to-serve reduction and transactional accuracy improvement.⁴⁸ In addition, it helps businesses to personalize relationships with their customers and respond to their needs in a more immediate manner.³³

Analytical CRM Analytical CRM refers to the analysis of customer characteristics and behavioural patterns with the aim of improving business decisions.^{42,48} Through utilization of tools capable of processing the customer data, Analytical CRM supports the process of providing customer information and customer knowledge acquisition.³³

A wide variety of databases, operational customer data warehouses, analytical tools and techniques of data mining are just some of the constituents of Analytical CRM for extracting hidden patterns residing in customer data. Analytical CRM plays an important role in the processes of cross-selling, up-selling, target marketing, market basket analysis, fraud detection and

customer segmentation, to name but a few.²³

All in all, Analytical CRM helps businesses to identify the products that can be sold together, the most profitable customers, the customers who are likely to churn, the upcoming trends in the market and the way of increasing cross-selling and up-selling.²³

Strategic CRM In accordance with the definition offered by Sales Educators,⁴⁹ Strategic CRM is 'the process that identifies customers, creates customer knowledge, builds customer relationships and shapes customers' perceptions of the firm and its products/solutions'. Parvatiyar and Sheth⁵⁰ also defined Strategic CRM as 'A comprehensive strategy and process of acquiring, retaining and partnering with selective customers to create superior value for the company and the customer'. Overall, Strategic CRM can be considered as the process of determining how a firm should be linked with its customers through channels, messages, products and services.⁴³ Implementing Strategic CRM helps businesses to transform into a customer-centric business aimed at augmenting customer value.⁴⁸

KM

The concept of KM has become the focal point of a lot of research during the past two decades.^{51,52} Nonetheless, the concept of knowledge has attracted a lot of interest from scholars for a long time.⁵² Knowledge exploitation, leading to innovation, can provide organizations with competitive advantage in an unstable business environment. As it is so hard for others to

duplicate this knowledge, the consequent superiority is sustainable. Organizations can solve confronting problems and take opportunities by means of managing knowledge.³⁹ In fact, as Francis Bacon has mentioned, 'knowledge is power'.⁵³ KM is associated with cultural change in a broad context, with the aim of switching people's attitude from 'my knowledge is power' to 'sharing knowledge is power'.³⁹ Many definitions, concerning KM, exist in the literature. As Hibbard⁵⁴ stated, KM is 'the process of capturing the collective expertise of the organization from different sources (i.e., databases, paper and people) and utilizing that knowledgebase to leverage the organization'. According to Davenport and Prusak,⁵⁵ 'Knowledge management is concerned with the exploitation and development of the knowledge assets of an organization with a view to furthering the organisation's objectives'. Kamara *et al*⁵⁶ also offered that KM is 'the organizational optimization of knowledge to achieve enhanced performance through the use of various methods and techniques'. All in all, KM is a systematic process consisting of a number of phases to manage a combination of knowledge, information and data with the aim of linking people who need to know to the knowledge of the right ones in a timely manner.^{52,57-59} As Sedera and Gable⁵⁹ showed, four salient phases that can be considered for KM in accordance with the literature on KM processes are as follows: (i) Creation, (ii) Retention, (iii) Transfer and (iv) Application.

DERIVING THE CKM PROCESS MODEL

Embedding KM in CRM

As knowledge plays a significant role in the current turbulent competitive global marketplace, plenty of companies are trying to perform their KM effectively to gain competitive advantage over their competitors.^{1,60} In fact, KM is a systematic

method for managing knowledge through processes of acquiring, organizing and communicating knowledge. KM is aimed at knowledge optimization in order to achieve improved performance by means of diverse processes, methods, tools and techniques. In essence, KM helps businesses to survive.⁶⁰

Although the continuously changing environment has made businesses to compete fiercely to win customers, companies that focus mainly on their customers' needs and wants are emerging more victorious in achieving long-term success. Therefore, in order to win the battle, numerous businesses rushed to implement a CRM system.³⁸ CRM systems help businesses with enhancement of business intelligence, customer relationships, offering of high-quality services and products, and facilitation of decision-making process.³⁸

Overall, CRM is supposed to enhance customer acquisition and customer retention by winning new customers and developing long-term relationships with current customers, whereas traditional marketing was concentrating on just acquiring new customers.^{38,11} According to Guozheng and Yun,³⁷ CRM means 'not only [...] managing all customer interactions, but an indispensable resource for competitive advantage through knowledge management and value creating'.

It should be noted that customer knowledge is the base of these long-term relationships.¹¹ As Wang Hualin and Yu Zhongdong²⁷ stated, customer knowledge is 'the experience, value, situational information which are needed, produced or possessed, dynamically combine with the experts' clairvoyance'. Rowley⁶¹ also defined customer knowledge as 'knowledge about customers, which includes knowledge about potential customers, customer segments and individual customers and knowledge possessed by customers'. Customer knowledge differs from customer data and customer information; it can be either explicit and structured or tacit in

mind of employees and customers. However, effective utilization of all customer data, information and knowledge deserves further research.³³ Many scholars have perceived the strategic significance of gaining customer knowledge in preserving the competitive advantage of businesses.^{12,27,33,62}

Hence, businesses that seek to survive in the marketplace should invest in CKM. CKM is a kind of activity concerning acquisition, developing, sharing and maintaining of customer knowledge in order to maximize customer value.^{27,32,36} To implement CKM effectively and reap the maximum returns from the customer relationships, customer knowledge should be managed in a recycling system (Figure 1).²⁷ It means that customer knowledge can be obtained by either generation or acquisition or refining; then, the gained knowledge should be organized in accordance with its content and elements. Afterwards, the new organized knowledge should be integrated with the existing knowledge of a knowledge base

and distributed throughout the enterprise. That way, strategic decision makers can be fed with useful knowledge to make appropriate marketing decisions. Finally, in order to refine the existing knowledge, the insight gained through knowledge application should be used to feedback into knowledge organization.¹⁸

Just a quick glance at the CKM recycling system could demonstrate that CKM is just a form of KM. Similar to every other KM system, stages of CKM recycling system can be categorized in four major phases, that is, knowledge creation, knowledge retention, knowledge transfer and knowledge application.

As three primary forms of CRM systems can be employed to support all the four phases of creating, retaining, transferring and applying customer knowledge, a CKM model encompassing CRM–KM integration is proposed in this study (Figure 2).

Analytical CRM, supporting customer knowledge creation

As Buttle⁶³ defined, Analytical CRM is ‘a bottom-up perspective, which focuses on the intelligent mining of customer data for strategic or tactical purposes’. In fact, Analytical CRM is an information management process that enhances the strategy development through provision of market information. Analytical CRM plays a prominent role in the value creation process and customer strategy development. It helps businesses to realize their customers’ behaviours and to be able to segment their market in an effective manner.⁴⁸ In order to operate Analytical CRM, businesses derive benefit from various ITs and techniques such as data mining and Online Analytical Process techniques.^{18,19,33}

However, data mining techniques play an important role in Analytical CRM in a way that they can be considered as the core of customer knowledge creation.^{18,23,42,44,45,64}

Data mining is just one stage of a process that is so called Knowledge Discovery from

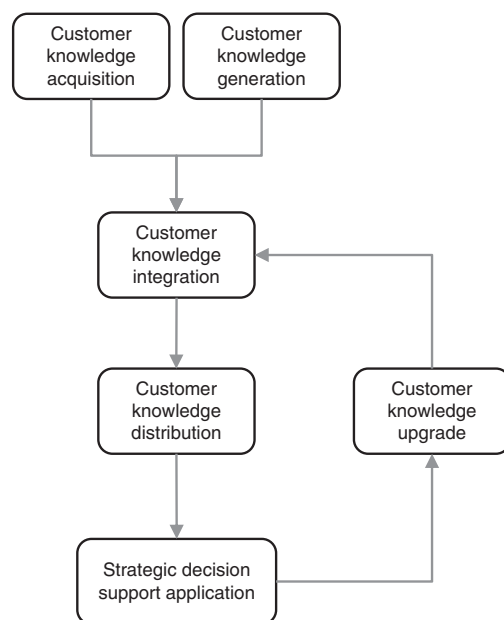


Figure 1: CKM recycling system (adapted from reference¹⁸).

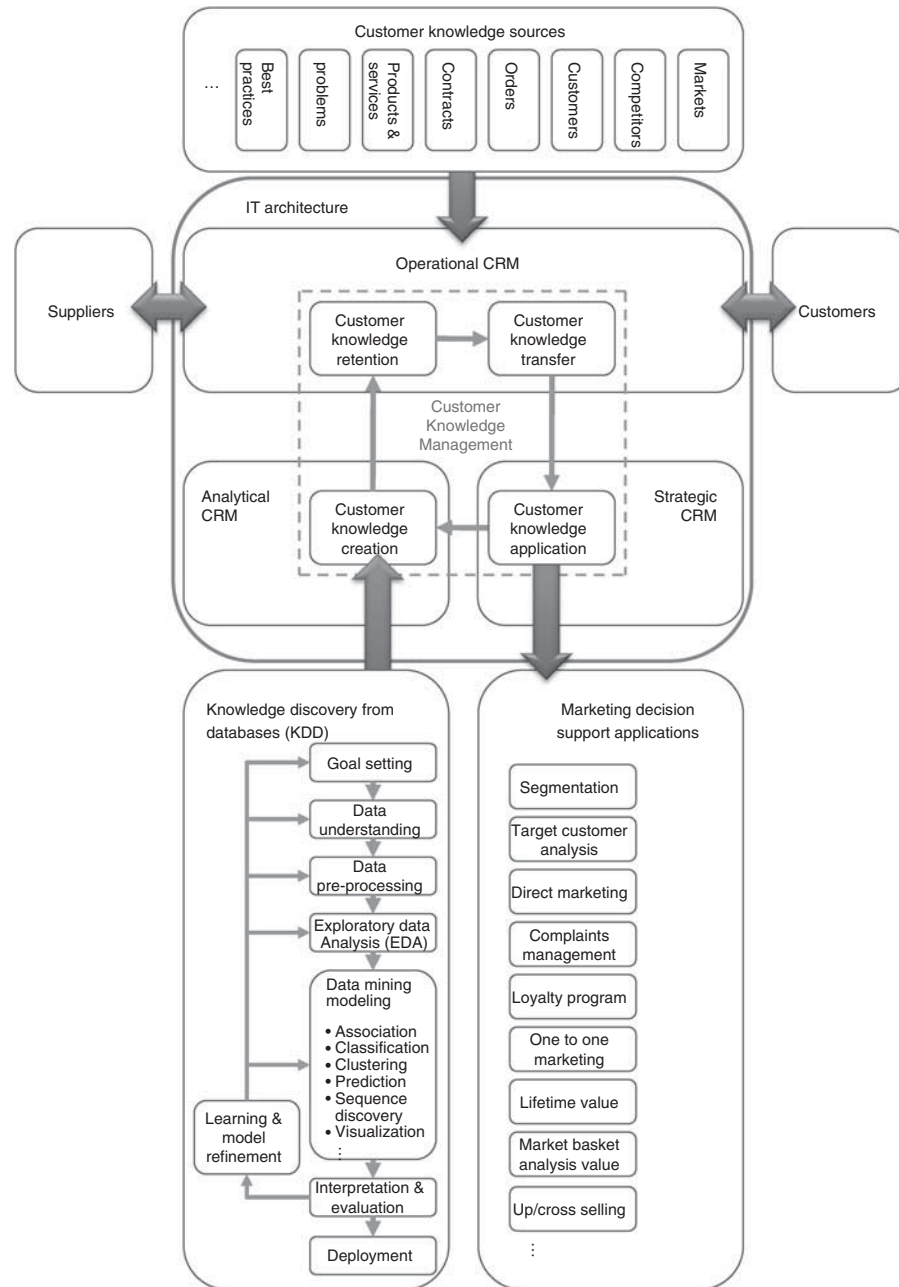


Figure 2: CKM process model.

Databases (KDD). Therefore, in this study, KDD is employed as the kernel of the proposed CKM model for customer knowledge creation.

KDD KDD is a process of extracting knowledge from raw data. The KDD process is

interactive and iterative, involving a number of steps in which sometimes some of them are merged by some authors.⁶⁵ The overall steps of KDD process are as follow:^{65,66}

The first step is the understanding of application domain and KDD process goals. The second step is data and variable selection

and understanding. The third step concerns data pre-processing, which incorporates data preparation techniques such as data cleaning, integration, transformation and data reduction. In the fourth step, which is named Exploratory Data Analysis (EDA), usually statistical techniques are used to explore data. In this step, analysts gain some prior notions of the expected relationships among the variables.⁶⁷ Data mining is the fifth step. Data mining is an essential process where intelligent methods are needed to be applied to extract data patterns.⁶⁶ The sixth step is interpreting the mined patterns, possibly returning to any of the previous steps for further iteration.⁶⁵ This step may contain evaluation of data mining modelling results and visualization of extracted models and patterns.⁶⁵ Finally, the last step is utilizing the discovered knowledge and deploying KDD results in the considered system.

Data mining

In parallel with software and hardware development and increasing abilities of data storing, data mining has become the most powerful tool for discovering hidden patterns in databases and data warehouses. In fact, data mining is the process of discovering interesting knowledge from large amounts of data stored in databases, data warehouses or other information repositories.⁶⁶ As mentioned before, Data Mining is the main inner phase of KDD. In general, data mining tasks can be classified into two groups, namely, descriptive and predictive. Descriptive tasks can find hidden patterns and correlations, for example, and on the other hand Predictive tasks use existing data to predict. In addition, data mining methods can be categorized as supervised, unsupervised or even a blend of both. In supervised methods, there are target variables, whereas in unsupervised methods there is no specific target variable; these methods mine the data to find interesting and useful patterns or structures. The major data mining modelling are

Association, Classification, Clustering, Prediction, Sequence discovery and Visualization.^{42,44,64,67-69}

In order to accomplish each task, a wide variety of techniques can be employed.⁴² In some of the cases, it is possible to take advantage of one particular technique to perform some different modelling; for example, it is possible to use association rules mining techniques for classification. Many data mining and machine learning techniques are pointed out by a plenty of authors.^{42,64,66-68} However, the most common techniques in CRM area are Neural networks, decision trees, association rules and regression, to name but a few.⁴² In this section, it is strived to categorize the main usages of data mining modelling in CRM studies.

Association: Association rules mining task is to find which attributes or characteristics go together.^{39,67} Market basket analysis, cross-selling programmes and one-to-one marketing are typical examples of CRM areas where association rules mining is used.⁴²

Classification: Classification is the most studied data mining task.^{42,44} In classification task, each record has a discrete and predefined class label, and classification models are aimed at predicting these classes for each record as accurately as possible.^{42,67,68} The most common classification techniques in CRM areas are neural networks, decision trees and regression.⁴² Classification techniques are mostly utilized in loyalty programmes, one-to-one marketing and direct marketing.⁴²

Clustering: Clustering is the task of grouping records according to their similarity in a way that in each group records has the most similarity while there are fewer similarities between all the groups.^{44,64,67,69} Customer segmentation, one-to-one marketing and Customer lifetime value are some of the CRM areas that Clustering techniques play a prominent role in.⁴²

Prediction: Prediction is similar to classification, but still there is a difference; in prediction, the target variable is numerical and the results lie in the future.^{44,67,69} Neural networks and logistic model prediction are the most commonly used prediction techniques.⁶⁹ Prediction can be used in direct marketing, loyalty programme and lifetime value.⁴²

Sequence discovery: Sequence discovery is the identification of associations or patterns over time like time series analysis.^{42,68} As stated by Mitra *et al*,⁶⁸ 'The primary goal in sequence discovery is to model the states of the process generating the sequences or to extract and report deviation and trends over time'. Common usages of time series analysis are in stock price forecasting.

Visualization: Visualization refers to graphical and Schematic presentation of data in an understandable manner so that users can view complex patterns or relationships in data mining process.^{42,69} Data visualization tools help business decision makers to view complex and hidden patterns lying among their customers' data as multi-dimensional and multi-colour diagrams with simple interpretation figures.¹⁸ Some data visualization techniques include 2D and 3D graphs, Hygraphs and SeeNet.^{18,42}

Operational CRM, supporting customer knowledge retention and transfer

According to the definition offered by Buttle,⁶³ Operational CRM is 'a perspective on CRM which focuses on major automation projects within the front-office functions of selling, marketing and service'. Operational CRM is aimed at automating the business processes that underlie regular functions of sales, marketing and sales. In order to optimize sales productivity, sales automation takes advantage of ITs for management of selling activities. In this regard, sales automation intensifies not only

the speed but also the quality of information flow with the aim of enhancing internal communications among the sales force and management. Similarly, in order to help organizations with management of their marketing programmes, marketing automation benefits from ITs for marketing processes. Service automation utilizes ITs as well. In this way, it can augment customer satisfaction.⁴⁸ All in all, Operational CRM, based on an IT architecture, takes advantage of technological advancements such as groupware systems, data warehouses, information retrieval engines, workflow systems and web-based technologies;¹² Thus, it can strongly support customer knowledge retention and customer knowledge transfer. It also can be used as an appropriate tool for absorbing internal and external knowledge residing throughout the supply chain. Other customer knowledge is mostly gained from a wide variety of sources. Competitions, markets, customers, products and services, orders, contracts, problems, best practices and account plans are just some of the customer knowledge sources.^{27,32,70}

Strategic CRM, supporting customer knowledge application

Buttle⁶³ has treated Strategic CRM as 'a top down perspective on CRM, which views CRM as a core customer centric business strategy that aims at winning and keeping profitable customers'. Strategic CRM should be regarded as a basic business strategy rather than a solution. Therefore, it should be considered as a long-term vision motivating businesses to create and deliver high value to customers. In fact, businesses can employ Strategic CRM to fulfil their current and potential customers' needs, and as a direct result optimize the process of customer value generation.⁴⁸ Strategic CRM is supplied with the extracted knowledge by Analytical CRM and absorbed knowledge by Operational CRM. It will finally lead the business to strategic decision support applications such as

segmentation, target customer analysis, direct marketing, complaints management, loyalty program, one-to-one marketing, lifetime value, market basket analysis and up/cross-selling.⁴² Therefore, it can be concluded that Strategic CRM facilitates the process of applying all the extracted customer knowledge to make businesses more customer centric.

CKM along supply chain

Considering customer knowledge as just one of the portions of the whole knowledge of an organization, the SECI knowledge spiral proposed by Nonaka and Konno⁷¹ can be adapted to demonstrate how customer tacit knowledge and explicit knowledge convert to each other. Accordingly, four conversion paths can be considered among these two types of

customer knowledge (Figure 3), that is, Socialization (S), Externalization (E), Combination (C) and Internalization (I). Generally, three levels retain knowledge, namely, individual (i), group (g) and organization (o). Each of the SECI conversion paths depicts how customer knowledge changes from one form to the other one. The SECI process begins in the socialization stage where customer knowledge is tacit and resides in individuals. In this stage, exchange of thoughts leads individuals to enhanced understanding and customer knowledge creation. During externalization, the created customer knowledge can be standardized and codified and consequently become communicable. In the externalization stage, tacit customer knowledge converts to explicit customer knowledge. Now it is the time to combine

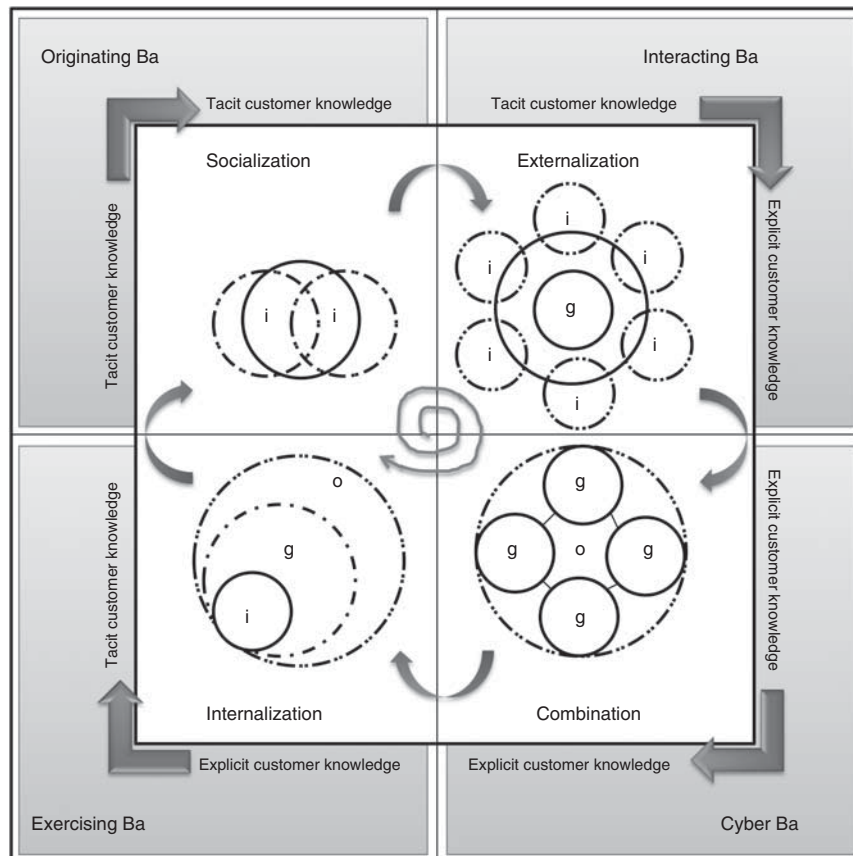


Figure 3: SECI knowledge spiral (adapted from reference⁷¹).

the created explicit customer knowledge with other explicit customer knowledge. Therefore, in the combination stage of the SECI spiral, all types of the explicit customer knowledge are combined and expressed in a specific format; as a direct result, it can be retained at the organizational level. Finally, in the internalization stage, the explicit customer knowledge is assimilated and applied by all groups and individuals.⁷²

In order to support and accelerate all four stages of the SECI process of customer knowledge, organizations can benefit from different types of 'Ba' (Figure 4). 'Ba' is a Japanese concept that can be considered as a shared space acting like a strong foundation for knowledge creation.⁷¹ Each type of 'Ba' facilitates one particular conversion process. By means of providing face-to-face experiences, 'Originating Ba' supports socialization. In comparison with originating Ba, 'Interacting Ba' is more consciously constructed, and therefore it

facilitates the conversion of tacit customer knowledge to explicit customer knowledge. On the other hand, 'cyber Ba', which is a virtual world for interaction, properly supports transferring and combination of customer knowledge. Finally, 'exercising Ba' supports the conversion of explicit customer knowledge to tacit customer knowledge; in other words, it supports the internalization stage.

Taking advantage of different types of 'Ba', especially interacting and cyber Ba, customer knowledge can flow along the supply chain to help all strategic decision makers establish and adopt appropriate marketing strategies (Figure 5). An Operational CRM that is supported by IT infrastructure can derive benefit from technological advancements such as groupware systems, web-based systems and Virtual Communities of Practice (VCoPs) to allow all parties in the supply chain to have access to the generated customer knowledge. That way, the fresh and updated customer knowledge can be spread throughout the supply chain in an efficient and effective manner.

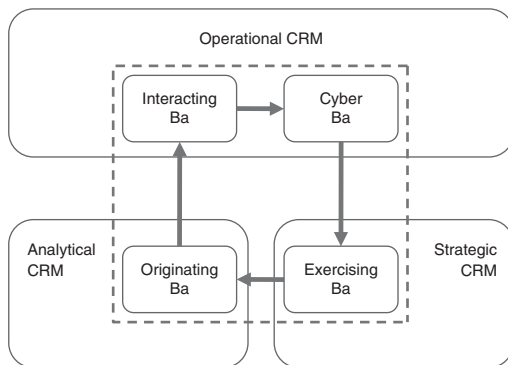


Figure 4: Embedding different types of 'Ba' in CRM forms.

HOME APPLIANCES CASE STUDY

As it is stated above, this section contains the empirical illustration of the proposed CKM process model.

Company background

Located in Tehran, Iran, Company A (for anonymity purposes, the company identity is not disclosed), which is an industrial

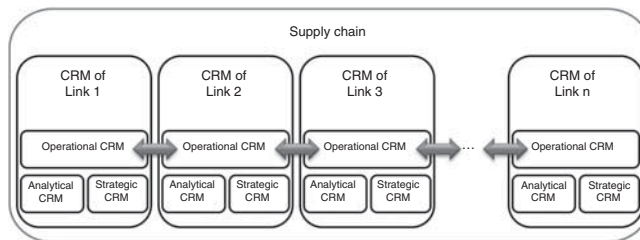


Figure 5: CKM along supply chain.

company, was established in 1969 with cooperation and technical assistance of a Japanese enterprise as a joint venture. It has emerged as one of the largest manufacturers of household appliances in the region with over 1400 employees and a wide variety of high-quality products. At present, owning six factories in the field of home appliances industry, it is known as the biggest manufacturer of electrical appliances in Iran. Although last year its sales figure was over US\$60 million, this company imports raw materials, industrial components and parts from foreign sources for manufacturing costing over \$15 million per year. It produces several equipment in 14 production groups such as food processor, toaster, iron, chopper, juicer, fan, tea maker, rice maker, meat grinder, vacuum cleaner and so on.

In order to gain competitive advantage over its competitors, this company has started investing in relationship marketing strategies. For instance, in order to augment customer satisfaction and customer loyalty, it has provided 25 months of free after-sales services along with the opportunity of free production replacement for 2 months. However, appreciating the importance of customer knowledge and its management, this company has intended to implement the proposed CKM model to intensify its customer value augmentation.

Model illustration

To implement the CKM model in this company, in the first place it was strived to follow the KDD steps to benefit from the core of Analytical CRM for customer knowledge creation. As it has a valuable storage of untapped customer data, some data mining tools were added to extract some hidden and precious patterns for guidance of strategic managers.

In this case study, no serious problems were faced from Operational CRM point of view. This company has also employed most of the desired KM sub-systems. It

absorbs customer knowledge through sources such as its Website, questionnaires, which are filled by customers, and interviews with customers in distribution centres. It also possesses a call centre to record customer opinions about quality, price, after-sale services and so on, as well as their complaints. Taking advantage of some databases, it stores all kinds of data, information and knowledge concerning customers gathered from a wide variety of external and internal sources. By means of a few information-retrieval engines, some simple reports can be produced in this company. Recently, this company has provided the appropriate infrastructure and training courses for utilization of VCoPs with the aim of proper customer knowledge absorption and dissemination throughout the supply chain. That way, strategic managers can be guided for better marketing decision making. Therefore, Company A is not only capable of combining the extracted knowledge with the prior stored knowledge and retaining it in a knowledge base, but also capable of conveying all the gained customer knowledge to wherever that it is needed through some appropriate channels.

All the process of KDD and its following strategy developing are depicted as follows:

- (i) *Goal setting:* The major objective of this study is finding primary customer value indices and strategies that are suitable for customer value augmentation. We can use data mining tools to discover which customers care about which value indices and which products are valuable for each segment of customers. An expert team consisting of 10 CRM experts has participated in this data mining project. This team reviews and accredits the data mining results.
- (ii) *Data understanding:* In this study, the data is collected from 29 500 questionnaires. Each customer has

filled a questionnaires form from either the Website or the product packaging. These forms have constituted the basic database of this study. The main questions asked in the questionnaires are: (1) *Which value indices do you care about when it comes to buying a piece of home appliances?* and (2) *Do you have any products of Company A in your home? Which ones? How many?* It was necessary to convey all the data to spreadsheet for data mining in this database. All the data can be categorized in two groups with 33 attributes. Whereas the first group of attributes comprises all the offered products of the company along with the customers' provinces, the second group consists of customer value indices that all customers were able to select (Table 3).

- (iii) *Data pre-processing:* Raw data should be prepared for data mining modelling. Usually, raw data is noisy, missing and incomplete in a way that pre-processing is needed for data mining modelling. Data pre-processing approximately accounts for 60 per cent of all the time and effort spent in the entire data mining process alone.⁶⁷

Table 3: Initial attributes

Attributes	Type
<i>Category 1</i>	
Provincial code	Set
Vacuum cleaner	Flag
Telescopic fan	Flag
Rice cooker	Flag
Iron	Flag
Meat grinder	Flag
Juicer	Flag
Other	
<i>Category 2</i>	
Quality	Flag
Credit	Flag
Guarantee	Flag
Price	Flag
Experience	Flag
Isochromatic	Flag
Colour	Set
Other	

(a). *Data cleaning:* Mistakes and faults in data entry are so common in the process of database building. In this case, most of variable types are flags. About 7.52 per cent of data fields are noisy and some data fields are missing. Data imputation and data correction methods are applied on the data.

(b). *New attributes construction:* In this case, new attributes were constructed with regard to the available attributes. In the first place, all the products are grouped in three categories in accordance with the experts' ideas, that is, strategic products, gifts and others. Then the quantity of each category purchased by each customer was calculated and three new attributes are constructed in this way. Afterwards, with respect to the point that the products are mainly used in kitchen or out of kitchen, two other attributes are constructed (Table 4).

- (iv) *EDA:* In this section, some statistical analyses are performed in the database. Table 5 illustrates the results of these analyses on the customer value indices in whole database. According to Table 5 quality, Isochromatic and credit are the most selected value indices by customers. It can be concluded that Company A should pay a lot of attention to these value indices. With respect to the statistical analyses results, the average volume of product purchased by every single customer is 4.12 with standard deviation of 2.51. Customization is one of the most effective techniques for increasing customer satisfaction and consequently increasing sale rate. Considering the difference between various provincial cultures, effective strategies can be developed for every province by means of analysing each category of provincial data individually.

Table 4: New generated attributes

<i>New attribute label</i>	<i>Definition</i>	<i>Type</i>
Q of SP	Quantity of strategic products purchased by each customer	Numerical
Q of GP	Quantity of gift products purchased by each customer	Numerical
Q of OP	Quantity of other products purchased by each customer	Numerical
TP	Total products purchased by each customer	Numerical
IK	Quantity of in-kitchen products purchased by each customer	Numerical
OK	Quantity of out-of-kitchen products purchased by each customer	Numerical

Table 5: Statistical analysis on customer value attributes

<i>Value indices</i>	<i>Percentage</i>
Quality	79.68
Isochromatic	74.31
Credit	51.83
Price	50.56
Guarantee	47.63
Experience	47.08
Design	34.64
Recommend	19.96

As it is shown in Table 6, the priority of customer value indices differs in different provinces. Thus, in order to motivate customers to purchase, it seems crucial to increase each of these important factors with regard to their priority in each province. Quality is the factor with highest priority in all the Provinces, and hence from customers' point of view quality of products is the first important value index. In some provinces, the order of customer value indices is different from Table 5. According to Table 6, some customer value indices in some of the provinces have fallen under the average of value indices in Table 5. Among all the provinces, customers of Khorasan have placed more value on guarantee as an important factor convincing them to buy. It seems that the company has gained a high share mind in this province after providing great after-sale services in a way that it has attracted more interest from customers; therefore, it can be inferred that the company

should increase the quantity of after-sale service branches in Khorasan. Khorasan is the biggest province in the database, and people who live there pay more attention to fashion than others; as a direct result, customers who live in Khorasan place a high value on design as a value index in comparison to the other provinces in a way that in Khorasan it is above the average. Therefore, it seems necessary for the company to produce in a wide variety of sizes, colours and designs of products in such a province. Developing distribution channel in order to demo product variation is also an effective technique. Establishing the company's brand shops can help it to present its products on the shelf to increase sales. All of these activities can help the company in facilitating one-to-one marketing.

- (v) *Data mining modelling:* In this study, association rules mining methods are employed for modelling. *A priori* and GRI algorithms of Clementine 12⁷³ are applied to the prepared data. Supervised association rules mining is considered and various combinations of customer value indices and new generated attributes are set as outputs in modelling while various combinations of variables are set as inputs in each modelling. In this study, minimum antecedent support, minimum confidence and lift are set to 20 per cent, 60 per cent and 1.00 per cent, respectively. Rules that met the thresholds during the modelling

phases are accepted. Some of the accepted rules are shown in Table 7. In order to interpret the extracted rules in a right manner, each rule should be read correctly. For example, rule number two in Table 7 should be read like the following form: 'If the quantity of out-of-kitchen products purchased by each customer is above 1.5 then they have chosen quality as a high value index' with the confidence of 84.77 per cent. Furthermore, by using analytical tools such as Data mining techniques, firms can obtain an integrated and holistic view of the customers of a particular province (Table 8). DM provides detailed information for managers to make decisions and apply different

strategies to different situations. (vi) *Interpretation and evaluation:* In this phase, some of the accepted rules and extracted patterns should be interpreted to give the strategic managers some hints for developing effective strategies. According to the data mining modelling phase, the interpretation of the discovered rules are as follows:

- According to Table 5, isochromatic is one of the most important value indices that costumers have chosen. Rule Number 1 indicates that people who have purchased one or more out-of-kitchen products have chosen isochromatic as an important value index. This means everybody who has purchased one

Table 6: Provincial distribution of costumer values

	Tehran (%)	Rank	Azerbaijan (%)	Rank	Esfahan (%)	Rank	Gilan (%)	Rank	Khorasan (%)	Rank
Quality	74.87	1	83.24	1	78.56	1	77.39	1	82.16	1
Isochromatic	74.63	2	73.44	2	74.45	2	71.94	2	77.20	2
Credit	52.44	3	47.77	4	53.79	3	52.28	3	54.50	5
Price	54.03	6	46.61	3	50.77	4	47.72	4	55.69	4
Guarantee	49.31	5	43.40	5	49.23	6	49.02	5	50.94	6
Experience	47.65	4	46.08	6	48.07	5	50.18	6	55.80	3
Design	29.95	7	36.01	7	38.70	7	32.75	7	39.73	7
Recommend	19.80	8	17.91	8	23.23	8	16.85	8	24.37	8

Table 7: The major portion of the extracted rules

Number	Consequent	Antecedent	Antecedent support (%)	Confidence (%)	Rule support (%)	Lift
<i>GRI modelling</i>						
1	Isochromatic	OK > 0.5	83.38	75.13	62.65	1.01
2	Quality	OK > 1.5	47.65	84.77	40.40	1.06
3	Quality	Q of GP > 0.5	43.31	83.09	35.99	1.04
4	Credit	TP > 4.5 and Q of SP > 3.5	27.97	60.61	16.95	1.17
5	Price	TP > 5.5	24.85	60.13	14.94	1.19
<i>Apriori modelling</i>						
6	Quality	Telescopic fan	66.67	82.59	55.06	1.04
7	Quality	Meat grinder	61.20	84.05	51.44	1.05
8	Quality	Rice cooker	56.33	83.59	47.09	1.05
9	Quality	Juicer	49.37	84.75	41.84	1.06
10	Quality	Vacuum cleaner	46.97	83.68	39.31	1.05
11	Telescopic fan	Iron	28.61	79.47	22.73	1.19
12	Meat grinder	Iron	28.61	74.62	21.35	1.22
13	Juicer	Food processor	26.16	80.30	21.01	1.63
14	Meat grinder	Food processor	26.16	76.44	20.00	1.25

Table 8: The extracted rules concerning customization

Name	Consequent	Antecedent	Antecedent support (%)	Confidence (%)	Rule support (%)	Lift
Ardebil	Quality	Q of SP > 2.5	49.21	100	49.21	1.05
Azarbayjan-e Gharbi	Quality	Q of SP > 2.5	48.57	89.22	43.33	1.06
Booshehr	Quality	Q of SP > 3.5	42.56	93.08	39.62	1.07
Golestan	Experience	Q of SP > 2.5	61.73	61.5	37.96	1.27
Ghom	Price	Q of SP > 2.5	56.41	60.84	34.32	1.07
Hamedan	Credit	Q of SP > 2.5	58.53	58.31	34.13	1.13
Hormozgan	Isochromatic	Q of SP > 2.5	45.92	71.78	32.96	1.03
Lorestan	Price	Q of SP > 3.5	35.64	58.66	20.91	1.25

or more out-of-kitchen products considers isochromatic as a very important factor to match their other home appliance products in their home. Among all the derived rules, this rule has a greater support and thus it deserves more attention. Owing to the fact that Company A produces a limited number of coloured products, the best policy that can be adopted according to this rule is that future out-of-kitchen products should be produced in diverse colours.

- Regarding rule Number 3, it can be concluded that quality is a valuable index for buying a product as a gift for customers. According to Iranian culture, it is important for a product bought as a gift to have high quality. Hence, it guides managers of the company to concentrate on quality of gift products instead of focusing on design and model or other indices.
- Regarding rule Number 4, it can be concluded that customers after purchasing more than three strategic products and totally more than four products discover that Company A has a good creditably; this means that our company has a good concentration on the strategic products in comparison with others; in addition, due to the fact that a huge portion of

our customers who deliver a huge amount of value to the company (purchasing more than five products) have chosen creditability as a value index with a high value, it seems that the company should invest more in branding and advertising activities.

- According to rule Number 5, approximately 15 per cent of the customers buying more than five products in total have chosen price as an index with a high value. Considering customers purchasing more than five products as loyal customers, the group of experts believes that pricing in the Company A is fair enough. Therefore, in order to increase the percentage of this group of valuable customers, it seems crucial for the company to preserve its fair pricing strategies through decreasing total cost of products.
- All of the antecedents in rules Number 6–10 are strategic products. These rules illustrate that quality is the most important index in buying strategic products. Market studies show that these products are leaders in the market due to their high quality. Accordingly, it is evident that instead of investing in innovation, keeping concentration on production of high-quality

products is the best policy for increasing the sale of these products.

- Rules Number 11–14 concern product basket analysis; it is one of the common examples of association rules mining. For instance, according to the results, about 22 per cent of customers who have purchased iron have purchased telescopic fan; hence, it can be inferred that such associated products should be presented together in fairs, advertisements and on the shelf in brand shops. Furthermore, taking advantage of direct marketing techniques like sending catalogues, making phone contacts, emailing and texting, the company can make contact with its customers to encourage them to purchase the products that can come together in a basket.
- In order to develop customized strategies, association rules can be applied to each province. Table 8 reflects the importance of significant customer value indices that have interested the customers with regard to their specific local culture and quantity of purchased strategic products. In this table, the quantity of strategic products bought by each customer is set as the antecedent and customer value indices are set as the consequents. Each province has different results with different support. In diverse provinces, people purchased the strategic products of the company because of a wide variety of reasons.
- All antecedents of these rules became accidentally the same (Q of $SP > 2.5$); nevertheless, the customer value indices that are set as consequents differ from each other. For example, in Ardebil,

quality is regarded as a value index with a high value among customers purchasing more than 2.5 strategic products, whereas in Golestan customers purchasing more than 2.5 strategic products experience the most important value index. Therefore, the company should adopt appropriate strategies to enhance the value indices selected as the important one in each province.

CONCLUSIONS

Owing to the fact that currently businesses cannot be successful unless they provide their customers with high customer value, the importance of customer value indices selected by customers is realized.

Accordingly, those businesses that are offering products or services in accordance with the prominent customer value indices are more likely to prosper. CRM, playing an important role in enabling businesses to fulfil their customers' needs and making them more loyal, acts as a catalyst in the process of creating and delivering value to customers. As CRM concerns managing customer knowledge in order to realize and serve them in an effective manner, it can be considered as a subset of KM systems. Therefore, this study has tried to propose a CKM process model to compensate the existing lack of a study integrating CRM and KM with the aim of customer value augmentation. In this regard, a unified classification of CRM forms is selected and then KM is integrated in all CRM forms, that is, Operational CRM, Analytical CRM and Strategic CRM. In this CKM model, Analytical CRM is employed to support customer knowledge creation; KDD regarded as an overall process encompassing data mining acts as the core of Analytical CRM in this study. Taking advantage of various types of information repositories and communication channels, Operational CRM strengthens the process of customer knowledge retention and transfer. Finally,

the Strategic form of CRM helps businesses to practice all the gained customer knowledge to become a pure customer-centric business. As it is evident, the cycle of CKM is followed in this CKM process model. In order to make the gained customer knowledge flow throughout the supply chain, taking advantage of Interacting Ba and Cyber Ba is suggested in this study. A simple example of these kinds of Ba is VCoPs where the personnel of an organization can interact in an informal atmosphere and exchange their ideas and knowledge.

At the end, a home appliances case is studied to illustrate the proposed CKM model. In this case study, new knowledge is created through association rules mining methods. Then the new gained customer knowledge and the prior stored customer knowledge are combined in the central data/knowledge base of the company. All the retained customer knowledge is flowed throughout the supply chain by means of a VCoP as a proper Cyber Ba. Finally, all the gained customer knowledge is interpreted to make some strategic marketing decisions, which lead the company to better customer value offering.

Despite the fact that this study incorporates a case study, due to vastness of the proposed CKM model the authors have mainly concentrated on the customer knowledge creation and application phases. To implement the proposed model thoroughly in a company, in the future all phases should be paid attention to equally. It means that customer knowledge retention and transfer are important as well.

In addition, in the future, the KM phases can be customized for the knowledge of all stakeholders who are playing roles in creating and delivering value to customers.

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