Knowledge – Driven CRM: Issues and Challenges

Goon Tuck Choy[a] and Ian Chai[b]

[a]*Faculty of Information Science and Technology*
Multimedia University, 75450 Ayer Keroh, Melaka
Tel: 03-89965168, E-mail: tcgoon@yahoo.com

[b]*Faculty of Engineering*
Multimedia University, 63100 Cyberjaya, Selangor
Tel: 03-83125379, E-mail: ianchai@mmu.edu.my

ABSTRACT

In this paper, we will examine the issues surrounding the convergence of KDD (Knowledge Discovery in Databases) and CRM (Customer Relationship Management) in building knowledge – driven CRM. By understanding the issues and challenges, we hope to achieve better customer understanding and thus, create a better CRM solution.

Keywords

CRM (Customer Relationship Management), KDD (Knowledge Discovery in Databases), Knowledge – Driven CRM, Data Mining, Challenges, issues

1.0 INTRODUCTION

The explosion of e-commerce, driven by today's communication technologies, has changed virtually every aspects of business. But one thing remains, the customer is still king. Now customers expect even more personalised service than ever before.

Knowledge – driven CRM is an idea that exposes a CRM's true potential. Companies today are especially eager to harness their "wild" CRM data, trying to minimise their marketing cost during this current gloomy economic climate. There are plenty of obstacles, and several aspects to consider first before deciding to develop and eventually constructing knowledge – driven CRM systems. These issues must be viewed independently for each entity to ensure that results meet expectations.

This paper provides a high-level overview of the implementation challenges of knowledge – driven CRM.

1.1 Knowledge – Driven CRM Background

Knowledge - driven CRM involves the integration of an existing CRM system with knowledge discovered, being able to create a dynamic customer model that can evolve to accommodate customer behaviour while at the same time providing the basis for predictive management of customers' future needs (Goon and Chai, 2003).

The goal is to provide the predictive analytics that can be used to target profitable customers with a high likelihood of response and to optimise the marketing mix in getting to the right customer at the right time through the right channel, and sharing that information throughout the organisation. This is something the customer greatly appreciates. This is what will differentiate one organisation from another.

Knowledge - driven CRM makes more intelligent use of your existing CRM database. It is an automated data mining model that assigns scores to customers and prospects. Based on the knowledge acquired in the previous tasks of KDD, the models, typologies and scoring can be applied to the End-User Companies' databases and a general "Methodology Framework" can then be extracted. This "Methodology" is then intended to operate on new or updated databases belonging to the same or different End-User Companies. These can be used to cross-sell, retain and project figure-of-merit scores for each individual. The easy-to-understand scores from such a system in a product-oriented business will show the likelihood of an individual or an

organisation purchasing and retaining products. The best customers or prospects will have the highest numbers. In this task, all refined models, typologies, and scoring will be integrated into a coherent system, recognizing that while any of them can be used in isolation, greater value is derived when used in conjunction with one another (Goon and Chai, 2003).

2.0 COMPLEXITIES

There are several complexities surrounding the entities that make up knowledge – driven CRM. In this section, we shall explore the main stumbling blocks of those entities.

2.1 CRM

The first of these issues surrounding CRM, and in many ways the least important, is that organisations must be content with their new information technology. This implies that companies must make a series of smart decisions about infrastructure and applications over a period of time. Most organisations actually have a pretty good track record in this regard, or they wouldn't exist any more (McKenzie, 2001).

The more important issues have to do with how CRM changes the way organisations work. New or revised business policies, procedures, and processes have to be developed. Roles and responsibilities have to change, affecting the very structure of the organisation. There are situations where the enterprises have to change its culture to adapt to this new change. Amplifying this problem is the fact that organisations themselves have become increasingly complex. This directly reflects the ever-increasing intricacy of the business environment in which they operate.

All of this complexity is at the heart of the failure rates forecasted by industry analysts for CRM programs. So what can an organisation do? How does it position itself so that it can make the needed changes? How does it steer a steady path through all of the issues? Some suggestions of how to implementing CRM in order to overcome the challenges are listed below, (Holland, 2002):

Strategy Development – Without a strategy, a CRM initiative must support the business strategy and make economic sense to an organisation's members. E.g.: Assess CRM readiness, develop CRM goals, etc.

Program and Project Management – Putting a sophisticated application in place while preparing employees to use it, it calls for disciplined and rigorous program management.

Data Integration – Event the best of systems will be of little value if the data environment lacks definition, integrity and consistency. Data issues are particularly critical in a sales environment where control of information is so closely held by people in sales positions. Without a systematic process for the collection and integration of high quality data implemented in parallel with the system itself, all will be lost.

Operations Integration – No CRM initiative will be successful unless CRM processes and tools are aligned and highly utilized by all members of the organisation who have a customer relationship responsibility. Operations integration includes the redefining of customer processes to align with the CRM strategy and to fit with the CRM application. In addition, individual and team roles must be redefined to align with processes and tools, and employees must be trained and put under a commitment to use CRM as needed for company success.

2.2 Data Mining

Data holds the record of the organisation's performance in all of its business areas. Provided the relevant data has been collected, is available and reasonably accurate, the answers to these questions, as well as a host of others, may be hidden in the organisation's data. Yet it is the volume of data collected that makes it impossible for humans to understand (SPSS, 1999).

Different business problems in data mining can be expressed in the following:

Classification – We are always dealing with a finite set of classes and we assume that new objects belong to one of the pre-defined classes. Misclassification may often occur.

Estimation – deals with problems where the values to be estimated are defined over a continuous range (e.g.: income, probability of fraud, etc.). It is a classification problem in which a score is established.

Association – determine things that happen together. Results are very useful but, may be hard to find association.

Clustering – cluster a heterogeneous population in a set of homogeneous clusters. The challenge here is that, there are no pre-defined classes and this task is often performed other discovery tasks.

3.2.1 Technology Limitations

It is not algorithms that discover knowledge. What the algorithm does is, to find a pattern, perhaps a coincidence, in the data. But it is the human expertise, in the form of knowledge of the meaning and context of the data that can decide both how the data might reasonably be analysed, and how to interpret and evaluate any results produced. It uniquely remains the responsibility of the knowledge engineer to rigorously test any model or prediction, and, crucially, to decide whether to act on its "recommendations." This is especially true in the health care and pharmaceutical area where decisions are literally a matter of life or death.

The disadvantage here is that, the people with the business or medical expertise — often the "data owners" — are seldom skilled in analysis technologies and even less in machine learning. Until recently, they require an additional "technology" expert, usually an external consultant, to operate the analysis technology on their behalf. As the sophistication and complexity, of analysis techniques increases and more different techniques are used together, the gap between the business professional and the technical analyst widens.

This situation is not ideal in a business sense because:

The cost of such expertise is high.

When modelling is complete, the data owner is left dependent on what may be an external, and still expensive, resource.

Many banks and credit card companies are in a dilemma because they rely on models built at some considerable expense by external modelling companies for credit scoring and direct marketing. As the pace of business increases and competitors repeatedly introduce new products to address gaps and niches in the market, customer behaviour changes. Unless models are constantly updated, they become obsolete. But as the cost and timescales of external modelling consultants (and also the costs of deployment) are too high, this discourage the banks from updating their models frequently enough.

The gap between business knowledge and analytical knowledge is even more important during modelling. Often the data owner is removed from direct participation in the analyses, limiting the use of his business knowledge to a time-consuming feedback process.

We believe that data mining is really more of an art rather than a science. It is very hard work to follow train-of-thought hunches, if the business professional has to keep telling the technology expert what to do, and then wait minutes or often hours or days for the result.

3.0 INTEGRATION

According to a report entitled "Integration: Critical Issues for Implementation of CRM Solutions," which investigates why integration can be instrumental to the success of a CRM system by Meta Group (www.metagroup.com), failure to integrate CRM business processes and technologies will have "significant ramifications that will directly affect the effectiveness of a business." Companies that undertake integrated CRM initiatives, along with careful architecture and business planning, may experience increased operational efficiencies and improved customer satisfaction and retention, according to Meta's research. Not following an integrated approach to an enterprise CRM system can directly impact the effectiveness of the business, resulting in problems such as longer time-to-market and slower implementations, increased management workload and investment costs, and lack of synchronization between demand and supply chains and across customer touch points (Meta Group, 2001).

Integration is one of the most difficult tasks in implementing knowledge – driven CRM. To address this issue (and the business opportunity

that it represents), the industry has spawned an integration market. There are many integration technologies and products available. There are emerging standards in messaging protocols and business process specifications.

Integration is becoming easier as more companies recognise the business benefits of responsive customer service and supply chain management. Do not, however, underestimate its complexity and the time and effort needed to do it effectively.

In order to achieve this, we need to look for integration capabilities in CRM products that implement operational applications that simplify integration tasks. Some examples are:

- A range of integration approaches - synchronous, real-time program-to-program integration, asynchronous, message-based integration.
- Integration of both internal business systems and external customer and supplier systems.
- Support of integration standards such as XML (eXtensible Mark-up Language) and, perhaps, expose some sort of Web services and its functionalities (We're still early in the implementation and adoption of Web services).
- Packaging of integration technologies and products that minimise development.

Successful CRM initiatives must be based on a holistic view of the customer life cycle, from initial engagement, to transaction, fulfilment, and service. The challenge for most companies will be to integrate not only technology across the life cycle, but also a company's own business practices. In order for any of the CRM components to be successful, both the business processes and associated technologies must be designed to work together.

3.1 Predictive Applications

For predictive applications, integration is not as important as the evaluation criterion. This is because predictive applications are often not linked into automated business processes. Most of them execute separately, in data mining environments. However, we want to use predictive analytics in line with operational applications to implement real-time analysis in areas such as cross-sell, up–sell, and retention of customers. Real-time predictive analytics – KDD – are only effective if they can be integrated with operational applications – CRM.

Combining KDD and CRM will require synergy at each stage of the research process. While the customer deserves to be seen as a thinking and acting entity, combining these disciplines provides the unique ability to analyse the gaps that are known to exist between plans and practice. Thus, data capture must expand to include all information, subjective and objective, intentions and actions. The storage of data must come together so that the analysis stage can leverage both. In addition, the analysis stage must leverage new processes that take advantage of the best of both disciplines, including empirical behavioural modelling and qualitative research methods. Finally, the deployment of insight, whether to human or machine, should take advantage of the knowledge gained from both KDD and CRM. Only then, a full perspective of the customer is available to the user, to draw conclusions from it and the most accurate insight can be deployed accordingly (Elliott, Scionti and Page, 2003).

4.0 PRAGMATIC CONSTRAINTS

We cannot avoid the fact that, most companies are dealing with customer data that spreads across the organisation, and always will remain that way. This does not mean that we can ignore this problem but, rather, we should get realistic about how to address it.

The nature of business intelligence systems is such that, it often requires formalisation of an open – ended domain of human knowledge. Unless the domain is precisely specifiable and understood, for example in the design of integrated circuit chips, even though the direction of achievement may be clear but the goal is somewhat at "infinity". Consequently, it is to be understood and accepted by all parties involve in the decision to deploy this technology, that knowledge – driven CRM systems software development is necessarily exploratory and that no predictions can be made about the needed resources for any level of accomplishment. As such, no attempts should be made towards product development unless a pre-project phase has been completed. The pre-project phase is not just a matter of building a series of prototypes, but rather requires a very precise sequence of

objectives to be achieved. Some of these pre-project tasks are as follows:

Formalising the problem domain
Verifying the relevance of domain concepts
Reproducing and formalising the task profiles for key decisions.
Identifying the end-user application requirements, and
Building a pilot system for testing in the real world.

The purpose of carrying out the first two tasks is to arrive at a proof-of-concept as early as possible, in order to determine the feasibility of automating the decision-making process. It also helps in establishing the demands on people resources that are likely to be made during the knowledge acquisition process, an open-ended task that must be given some bounds before a project plan can be formulated. One must start with an educated guess of a part of the whole domain that can be formulised as an initial step but which still be representative and result in measurable performance. Once this is done, the concepts (facts, business rules, process flows, etc.) can be put into a functional prototype, which should be subjected to repeated revisions until an acceptable level of qualitative output is achieved, indicating basic viability of the underlying knowledge base.

The remaining two tasks are aimed at helping the end-user formulate a prioritised list of expectations from the knowledge – driven CRM system, so as to ensure its ultimate utility for the end-user. In the process, is also able to make a first estimate of the resources that are likely to be required during the entire development lifespan in the context of end-users' priorities. The scope of each distinct knowledge based module or component in the prototype versions is extended until one overcomes the known gaps in decision-making knowledge, and until the behaviour and functionality are adequate for the system to be used as a pilot version. The pilot system must then be used to fine-tune the knowledge content, its task emulation and the user-interface. It is only after the acceptance of the pilot system (by the end-user) that the product development phase starts.

Although deployment of knowledge – driven CRM systems within a company requires that management be prepared to commit time, money and interest to the project, the steps described above ensure that the investment at every stage of the process is justifiable, optimal, and consistent with the final goals. Such preliminary efforts are well worth it, considering the risk of the alternative where one could potentially end-up investing huge amounts of resources with an eye expectantly trained at the final product only that may or may not meet expectations. The key message here is that the development of knowledge – driven CRM system is unlike classical software development in that it requires several incremental exploratory phases as described above to help "discover" what should be represented in the knowledge base to result in an effective knowledge – driven CRM system.

5.0 KNOWLEDGE ACQUISITION

As described under Pragmatic Constraints, a major portion of development costs for knowledge – driven CRM systems are incurred during the knowledge acquisition process. A major bottleneck in the construction of knowledge – driven CRM systems, this task bears the sole responsibility for uncontrollable time delays during knowledge – driven CRM systems development. It is common to find domain experts and knowledge engineers using totally different vocabularies to express themselves during interview sessions. So, the results from mutual discussions do not always fall within the painfully pre-convinced templates formulated by a knowledge engineer and which supposedly model the "best" approach experts use for problem solving. Knowledge exists in several different forms within an expert's mind and it is primarily the responsibility of a knowledge engineer to understand the domain and its intrinsic characteristics. Re-casting the knowledge in a manner that meets specific technical design or development objectives is also an important step, albeit a secondary one.

A knowledge engineer, therefore, has to necessarily absorb a significant portion of the domain know-how to have a meaningful discourse with an expert. Only then can he/she help the experts in structuring their knowledge and encapsulating it in software, by identifying and formalising the key concepts within the chosen domain. It is only by establishing mutual rapport, based on a sound understanding of the concepts, that the confidence of an expert can be

gained. The experts must be encouraged to take on the roles of informant, problem solver, and teacher at different times of the knowledge acquisition process. Recognising the significance of mutual roles, an expert then strives to help the knowledge engineer in creating, extending and refining the knowledge content. This interaction is imperative for building an effective knowledge – driven CRM system. The key notion to be understood here is that, by definition there can be no better "expert" than the chosen expert – so the knowledge engineer should avoid attempting to second-guess him or her.

6.0 DEVELOPMENT RESOURCES

Although common sense and forethought play an important role in knowledge – driven CRM systems development, one cannot under-estimate the absolute necessity of a qualified team of technical people with a formal background in the fundamentals of computer science and system development. After all, a wonderfully conceived knowledge base is of little use if its high-level concepts cannot be mapped onto an equally effective and efficient software implementation. Not only there must exist an understanding of the existing structured design techniques within the development team, but also a firm grasp on the established knowledge representation and knowledge engineering principles. Although one tends to easily get seduced by the simple and intuitive structure of object-oriented design at the data level, one should not overlook the importance and difficulty of designing the scope and granularity of the of the domain concepts to be represented at the knowledge level.

7.0 DESIGN METHODOLOGY

Traditionally, most business intelligence systems have been built using classical techniques, with the usual functionality decomposition of the application into its software components followed by the program specifications. No accommodation is made for encapsulating and no explicit representation made during the underlying business decision processes. Neither is any differentiation made during the design between data, information, and knowledge or meta-knowledge, or of the specific operations that can be performed on each of these categories (business rules). In such a system, domain concepts exists only at the implementation level, where procedural programs contain data structures with information implicit only in the name used to reference them, and knowledge implicit in the branching logic or flow of control within each procedure.

Such an approach defeats the fundamental goals of reusable knowledge – driven CRM systems – the separation of knowledge from how it gets used, interpreted or generated. The problems associated with the obscurity of underlying knowledge become painfully apparent at the time of verification, enhancement, or general maintenance of the system. Besides, as we mentioned earlier, implicit representation of knowledge makes it impossible to benefit from the uses that this knowledge. In order to maximise the utility of gathered knowledge, the designer must explicitly formulate detailed models of the experts' world and reasoning process, represent them in a computer encoded format for subsequent manipulation constructs using appropriate tools, and only then transcribe them into the implementation constructs using classical programming techniques. Using this approach, a clear distinction is made between the implementation, logical, epistemological and conceptual levels of knowledge within a system, as identified in some of the earliest publications on the use of knowledge representation techniques.

The key piece of advice for knowledge engineers here is to adhere to the basic business intelligence systems design techniques which called for an explicit specification of knowledge and its structure, and the operations that can be performed on these knowledge structures, independent of the options of implementation schemes and development tools that are used to realise the final system.

8.0 CONCLUSION

In this paper we have presented the major challenges that underlie a decision of a service-oriented company to develop and deploy knowledge – driven CRM solution. Considering knowledge as a corporate resource, one must address the basic issues of tapping, moulding and utilising it like any of the other resources that an organisation possesses.

Although usually perceived as a risky proposition, a careful and timely evaluation of the pros and cons of a business intelligence system

significantly reduces the possibility of an unexpected outcome. The burden is on favouring of this technology to bridge the gap between its developers and its potential end-users within companies and the market in general. The success of knowledge – driven CRM systems as a mass-market proposition can only be realised through a responsible dissemination of its strengths and limitations, while at the same time creating a supply of powerful and extremely useful solutions that are representative of its true potential.

However, it is also clear that a wide array of competencies is required to successfully develop and deploy knowledge – driven CRM solution – these are unlikely to be all found in any one company among its in-house IT resources. To achieve this, one should consider external resources to fill the gaps in required competencies is prudent for such initiatives.

New knowledge is not discovered by the algorithms, but by the user. The end-user's business or clinical knowledge is essential to determine what factors to consider for particular applications, and how the various input factors may need to be combined. Clinical, business or scientific expertise is always required to determine whether models can safely or usefully be deployed.

9.0 REFERENCES

Elliott K., Scionti R., Page M., (2003). The Confluence of Data Mining and Market Research for Smarter CRM, Two Rivers.

Goon T.C., Chai I. (2003). Knowledge – Driven CRM. In proceedings of MMU International Symposium on Information and Communications Technologies (M^2USIC) 2003, [M019]. Petaling Jaya, Malaysia.

Holland D., (2002). CRM failures… these too will pass, SearchCRM, http://searchcrm.techtarget.com/tip/1,289483,sid11_gci843656,00.html .

McKenzie R., (2001). Overcoming the complexities of customer relationship management, SearchCRM, http://searchcrm.techtarget.com/tip/1,289483,sid11_gci550783,00.html.

Meta Group (2001). Integration: Critical Issues for Implementation of CRM Solutions, Commissioned by Oracle Corp., Meta Group Inc.

SPSS, (1999). Data Mining: an introduction, SPSS White Paper, SPSS Inc.