

Full Length Research Paper

The role of intelligent agents in customer knowledge management

Sai Hong Tang¹, Seyed Mahdi Homayouni^{1,2*} and Hamed Alaei³

¹Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, University Putra Malaysia, UPM Serdang, 43400, Selangor, Malaysia.

²Industrial Engineering Department, Lenjan Branch, Islamic Azad University, 84741, Isfahan, Iran.

³Graduate School of Management, Universiti Putra Malaysia, UPM Serdang, 43400, Malaysia.

Accepted 16 May, 2011

Customers are known as a brilliant source of knowledge for the companies, because they gain knowledge and expertise while selecting and using products or services. Customer knowledge management is a new stage of relationship management between organizations and the customers. Most of the models in the literature are focused on human resources to set up a framework to exchange knowledge with the customers. In this paper, the applicability of agent-based systems to the customer knowledge management was investigated. As a feasibility study, characteristics of the agents and their role in knowledge management systems were reviewed in advance. Then, the requirements of customer knowledge management systems were described. Finally, using an introductory model, the applicability of the intelligent agents in customer knowledge management systems were shown and discussed.

Key words: Customer knowledge management, agent based knowledge management, customer relationship management, agent mediated customer knowledge management.

INTRODUCTION

Customer behaviors and requirements have changed during the last decades which have influenced an immediate effect on organizational operations and performance. According to Xu and Walton (2005), customers can be regarded as the partners of the organizations in their business processes. Nowadays, companies compete on how to be more compatible with ever-changing demand of the customers. Therefore, a relationship management is required for the companies to assure they provide enough information for their customers. Ahn et al. (2003) defined customer relationship management (CRM) as a process designed to collect data related to the customers, to grasp features of the customers, and to apply those qualities in specific marketing activities.

Customization, retaining, and attracting more customers, and increasing market share, are the immediate advantages of the CRM projects. However, according

to Zhang (2011), many of the consulting companies reported that CRM projects during 2001 to 2009 have a high failure rate. Richards and Jones (2008) reported that many CRM managers believe that CRM practices not only failed to deliver profitable growth, but also had damaged long-standing customer relationships. This would be a result of one-way relationship between the companies and the customers in CRM, which does not provide enough enthusiasm for the customers to participate in the CRM activities.

In a new era of marketing practices, many pioneer organizations focused on knowledge as the most important asset (Ma and Qi, 2009; Nissen and Levitt, 2004). Among all the resources of knowledge for the organizations, customers have been introduced as a vital source of knowledge. They gain their knowledge about the products and services, during their selection period, and while they use it.

Knowledge management (KM) has been introduced as an effective way to manage intellectual capital of the organizations (Grundspenkis, 2007). Therefore, KM is defined as a systematic, holistic approach to the

*Corresponding author. E-mail: homayouni@iauln.ac.ir. Tel: +60 389466332; Fax: +60 386567122

sustainable improvement of the knowledge handling at all levels of an organization (Dignum, 2006).

Deficiencies of CRM processes led many researchers to consider linkage of knowledge management and CRM as a new development for the companies (Rowley, 2002). Garcia-Murillo and Annabi (2002) stated that gathering, managing, and sharing customer knowledge is a valuable competitive tool for the companies. Among all possible attempts to improve the performance of companies, effective management of customer relationships by taking advantage of customer knowledge is a major source for keeping competitive differentiation (Lin, 2007). While both KM and CRM focused on gaining knowledge about the customer, managing customer knowledge is geared towards gaining knowledge directly from the customer (Gibbert et al., 2002). Gebert et al. (2003) demonstrated that CRM and KM have a high synergy potential and should be used in conjunction with each other, addressed as customer knowledge management (CKM).

Despite the fact that researches in the area of customer knowledge management has been considered increasingly by the researchers, especially in last five years (Zhang, 2011; Liao et al., 2011; Zhang and Liu, 2010; Afrazeh, 2010; Ma and Qi, 2009), the body of knowledge is still fragmented. This research proposes to use intelligent agents in developing CKM systems. An intelligent agent is a computer system capable of flexible autonomous action in a dynamic, unpredictable and open environment (Chira et al., 2006). While intelligent agents have shown their abilities in KM systems, they can be used in practical applications of CKM. To pursue the objective of the research, the abilities of intelligent agents in knowledge-based systems are analyzed in first step. Next, the requirements of a CKM system based on its current theoretical models are investigated. This leads to a new framework for the customer knowledge management systems, introduced as agent-mediated customer knowledge management (AMCKM).

A REVIEW ON CUSTOMER KNOWLEDGE MANAGEMENT

As an external source of knowledge, customer knowledge attracted researches in the last few years. Customer knowledge is a dynamic combination of values, expertise, and insight of experts that are generated while customers and companies communicate (Gao and Li, 2006). It is so important for the companies to know customers' preferences, and use it while developing their new products and services. CKM is the strategic process by which pioneer companies liberate their customers from passive recipients of products and services, to their as knowledge partners. Zhang (2011) defined CKM as a process to capture, share, transfer, and apply the data, information, and knowledge related with customers for organizational benefits.

Salomann et al. (2005) surveyed about the knowledge-enabled customer relationship management. More than 60% of their respondents replied that they have no processes to manage customer knowledge. They investigated three major European companies who successfully managed to make use of knowledge for, from and about their customers.

In another survey study, Xu and Walton (2005) stated that 71% of the managers believe gaining and using knowledge and experience of the customers is a new competitive arena of the companies. The customer knowledge has been categorized by the researchers as followings:

- a. Knowledge for customers includes knowledge on products, suppliers or market.
- b. Knowledge about customers includes customer histories, desires, requirements, etc.
- c. Knowledge from customers can help companies in new product developments, services improvements, etc.

According to Garcia-Murillo and Annabi (2002), "knowledge for customers" includes knowledge of market, product needs, and product characteristics, required for the customers to make their purchase decisions. Moreover, "Knowledge from customers" empowers the companies to make more intelligent decisions about products, services, and communication gateways with customers. Enunciated by Xu and Walton (2005), "knowledge about customers" includes customer insight, profiles, habits, and contact preferences which help to improve an organization's contact with the customer.

Two major obstacles are arisen out of CKM implementations, first, the cultural challenges, in terms of re-thinking about the role of the customer; and second, the competency challenges, in terms of the skills and processes needed to take full advantages of participative techniques (Gibbert et al., 2002). Bueren et al. (2005) implemented a process model for CKM in some European companies and investigated about the challenges of CKM practices. Ma and Qi (2009) stated that top management commitment, organizational culture, technology support, and reward systems are the success factors of the CKM systems. At first look, CRM and CKM seem to be the same in their processes. However, CKM concentrates on revealing the cryptic knowledge resides in customers' minds. On the other hand, the CRM focuses on knowledge about the customer (Gibbert et al., 2002). Garcia-Murillo and Annabi (2002) stated that CRM and CKM follow different objectives. While CRM tries to identify profitable customers, CKM tries to gather customers' ideas. Furthermore, CRM uses customized marketing but CKM tries to identify the service improvement areas and new product developments.

Accordingly, the final goals of CKM practices are transparency, dissemination, development, and efficiency of knowledge in communication with customers (Gebert

Table 1. Differences between CRM and CKM.

Variable	CRM	CKM
Goal	Customized marketing, identification of high profit customers	Improvement in services and products, new product development
Employees' role	Offering information to customers based on their requests	Knowledge acquisition through communication with customers and interpretation of this knowledge
Information	Information are based on statistical data	Information are based on customers' experiences

et al., 2003). Table 1 shows main differences of CRM and CKM based on Garcia-Murillo and Annabi (2002).

Gibbert et al. (2002) found that pioneer organizations applied CKM systems practically. They categorized CKM approaches in five main styles including, prosumerism, team-based co-learning, mutual innovation, communities of creation, and joint IP/ownership. Garcia-Murillo and Annabi (2002) proposed a model for CKM which considered the potential of simple personal interactions between sales persons and the customers. Preferences of the customers, information about competitors, and data on future market, are gathered in this interaction. Furthermore, the knowledge about various products/ services helps the customer to make his purchase decision.

Gebert et al. (2003) proposed a theoretical model for CKM to acquire and share knowledge with customers. Each of the departments in organizations has a pre-defined role in the proposed CKM. Knowledge for customers is gathered through campaign management, and is disoriented to offer management and contact management. Knowledge about and from customers is captured by offer, service, and complaint management and is disoriented to campaign, and service management (Gebert et al., 2003). Bueren et al. (2005) researched about the use of modern IT to help the CKM systems. They applied the proposed model in European companies in financial and insurances service sector. Another theoretical model for CKM processes was proposed by Lin et al. (2006). They implemented this model in two test cases. The results showed that hard measures such as market share, repetitive purchases, cost savings, and customer retention and soft measures such as customer satisfaction, market leadership, and customer loyalty are improved through CKM. Lin (2007) proposed an object-oriented method to develop a CKM information system. Recognition of the customers and their desired knowledge-accessed behaviors are the first step in his method. The last step of the method is to analyze and design the architectural classes/objects of the realized behaviors.

Lopez-Nicolas and Molina-Castillo (2008) presented the application of CKM in e-commerce. Through a survey of more than 250 customers with a previous online

experience, they evaluated the impacts of risk, and Internet preference in addition to Internet knowledge on customers' online perceived risk and purchase intentions. Ma and Qi (2009) developed a process-based model for CKM, through which organizations acquire the knowledge from their customers, integrate and internalize this knowledge, and then apply the knowledge to better serve their customers. Zhang and Liu (2010) emphasized on the improvement tactics for the application of the CKM to provide theoretical instructions for the enterprise practice. These tactics include but not limited to effective organizational culture, intra-department collaboration, application of IT, cultivating knowledge-oriented employee, and supportive organization system. In a recent practical research, Karami et al. (2010) reported the practical implementation of CKM systems in Iranian banks. They found that the role of human resources is the most important factor in CKM systems.

Afrazeh (2010) developed a problem solving method for customer knowledge management maturity. He applied the principals of just in time theory in knowledge management process, to deliver right knowledge in right time and place to right person. In a recent Ogunde et al. (2010) explained the modified CKM systems by using the intelligent agents. They developed a model for e-commerce organizations. Salojärvi et al. (2010) focused on the relationships with the most important customers. In other words, they combined a key account management context and the theoretical models of CKM. Liao et al. (2011) proposed to combine online shopping systems and home delivery. The method clusters the customers and proposes to provide information on various catalogues based on the clusters' consumption preferences. They predicted that this combined system of CKM, would increase the market share of the companies.

AGENT BASED KNOWLEDGE MANGEMENT

Oxford English Dictionary (2011) defined knowledge as "facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject". As stated by Nissen and Levitt

(2004), knowledge is the most important property of an organization.

In agreement with Alavi and Leidner (2001), knowledge is embedded in multiple entities including organization culture, routines, policies, systems, and documents, and of course the knowledgeable employees. KM is a managerial process to facilitate creating vital information, to structure, share and distribute it. To be effective, such environments must provide users with relevant knowledge that enables users to better perform their tasks, at the right time and in the right form (Dignum, 2006). These issues of KM are the same as the principals of total quality management (TQM). Ooi (2009) explained that TQM practices can improve and support the KM activities.

In agreement with Dignum (2006), knowledge management must be “reactive” and “proactive”. The former is essential for the KM practices to respond changes in the environment and user preferences, and the latter is vital to take initiatives to attend to user needs. The knowledge is distributed among many individuals, departments, and data stores. This is why accessing, sharing, and distribution of knowledge are too difficult. On the other hand, a heterogeneous issue of knowledge sources is a main concern in developing KM systems. Huang and Lai (2004) described the application of intelligent agents in KM systems. The outcome system is introduced as agent-based knowledge management (ABKM).

An intelligent agent is a computer software package which is a member of a larger community (usually called environment). The intelligent agents are able to perceive from the environment and autonomously act on behalf of their user. The intelligent agents have a set of objectives and take actions in order to accomplish these objectives (Luck et al., 2003). The actions that the intelligent agents have to perform are directly related to their objectives, relations with other intelligent agents, or to control other objects in the environment (Froelich et al., 2006). The intelligent agents are capable to navigate in diverse computing environments. They are working alone, or in communication with other intelligent agents. The community of multiple interacting intelligent agents operates as a whole, and seeking for an overall set of objectives. Multi-agent systems (MAS) are defined as a loosely coupled network of intelligent agents that work together to solve problems that are beyond the individual capabilities or knowledge of each intelligent agent (Chira et al., 2006).

The intelligent agents are autonomous, reactive, proactive, and have social ability. Therefore, the intelligent agents make decisions individually based on their objectives and comprehension of the environment. The intelligent agents are able to take actions without direct intervention of humans. They do not simply act in response to their environment; they are able to exhibit goal-directed behavior by taking the initiative (Wooldridge and Ciancarini, 2001). The intelligent agents have made it possible to support the representation, co-ordination, and

co-operation between heterogeneous processes and their users (Dignum, 2006). To define an intelligent agent systematically, the literature defined some basic characteristics for their behavior. Table 2 reported the most important set of characteristics, defined by Chira et al. (2006) and Wooldridge and Ciancarini (2001). Autonomy is known as the most essential characteristic of any kind of intelligent agents. By the way, Chira et al. (2006) stated that at least one of the other characteristics is required for the intelligent agents.

van Elst et al. (2003) believed that the intelligent agents are suitable for modular, decentralized, changeable, ill-structured, and complex application. They stated that KM systems have wicked nature, and the intelligent agents are best suited for application of KM systems. Reactivity and proactivity of the intelligent agents provide enough flexibility required for KM tasks. According to Dignum (2006), agents based systems may provide the following services in KM systems:

- i. Search to acquire, analyze, integrate, and archive information from multiple heterogeneous sources;
- ii. Inform users when new information of special interest becomes available;
- iii. Negotiate to purchase and receive information corresponding to goods or services;
- iv. Explain the relevance quality and reliability of that information;
- v. Learn to adapt and evolve to change conditions.

Three main types of intelligent agents have been categorized by Huang and Lai (2004). “Acquiring agents” are responsible to collect, integrate and analyze data from knowledge sources. “Organizing agents” are liable to comment about acquired data, explain it, and to store data or knowledge. “Distributing agents” have to deliver the knowledge to the right user at right time, to represent appropriately knowledge resulting from analysis techniques and be a friendly interface to final users of knowledge.

INTELLIGENT AGENTS IN CKM

The inspiration for intelligent agents’ application in CKM stems from the reality that due to growing complexity and diversity of knowledge resources for the companies, intelligent and automated tools are essential requirements for an efficient CKM model. The proposed model facilitates dispersing knowledge that clumps in various areas of the organization and customers’ mind. Gibbert et al. (2002) declared that the CKM system should embrace a suite of technologies, including intelligent agent software that, if properly integrated, provides a single user interface for access to knowledge resources and business processes.

Garcia-Murillo and Annabi (2002) proposed a practical model for CKM, in which the most important method for

Table 2. Essential characteristics of intelligent agents

No.	Agents' characteristic	Description
1	Autonomy	Agents make decisions based on their perceptions of the environment, without the direct intervention of humans or others.
2	Reactivity	Agents can respond to environmental changes.
3	Pro-activeness	The initiative is required for the agents to pursue their individual goals.
4	Social ability	Agents interact with other agents (and possibly humans) via some kind of agent-communication language.
5	Learning	An agent should have the ability to learn while acting and reacting in its environment.
6	Mobility	A mobile agent has the ability to move around a network in a self-directed way.
7	Veracity	An agent should be reliable and precise in its process of gaining, interpreting, transferring, and delivering data and information.
8	Compatibility	The agents should be compatible with the changing environment, either other agents, or the objects.
9	Rationalism	A rational agent is expected to do whatever action is required to maximize its performance measure, on the basis of the perceptions of the environment and its built-in knowledge.

knowledge exchange with customers is a direct dialogue between them and the sales person. The current research considers their model as a basis for AMCKM. However, instead of sales person, intelligent agents are responsible for communication.

Performance of human staffs in communication with customers depends on psychological conditions of both parties, that is, customers and sales person, and the atmosphere of the dialogue. The sales person (or in general human staffs), often shows unstable behavior. Nevertheless, the intelligent agents can deal with clients almost alike and similar in various times and conditions. Various human staffs might have different levels of knowledge; whereas, a knowledge base is used for the interface intelligent agents. Therefore, the same level of knowledge is provided for every customer contacted with the AMCKM system. This is an immediate benefit of applying the intelligent agents in CKM systems. On the contrary, the customers as the other side of this interaction play an important role. If they do not know how to use the software (for example, internet-based AMCKM); they may be in trouble with the system.

The customers can be clustered by the agents based on their preferences. Therefore, the behavior of the intelligent agents against various clusters of customers can be customized. The intelligent agents memorize the preferences of the customers and provide most appropriate knowledge for them. Providing routine knowledge packages for defined customers is not the basic intended

application of the intelligent agents in CKM.

An intelligent agent or MAS is able to deal with customers, analyze and reveal the cryptic data in customers' words, and to extract knowledge lies in it. Autonomy of the intelligent agents among other features has an essential role. Therefore, the AMCKM is able to respond changes in customers' requests more quickly than a conventional CKM system relies on human resources. Table 3 shows the abilities of the intelligent agents in KM and the requirements of the CKM which can be covered by the intelligent agents. The intelligent agents need to be rational in providing services for the customers. In many cases customers may enter wrong data into the CKM system (for example, many clients of AMCKM would like to know how the system works). The intelligent agents need to be wise enough to identify such cases and avoid providing wrong knowledge for the wrong data.

In CKM, most of the customer knowledge may gain in an interaction between the company and the customer (Garcia-Murillo and Annabi, 2002). In the proposed AMCKM model, both parties of such interactions are known as knowledge resources. Both customers and company acquire their preferred knowledge, while offer their own knowledge and experiences. In a company most of the organizational departments uses the customer knowledge, especially marketing, new product development, R and D, and CRM sections. Moreover, the top management level of the organization may use the captured customer knowledge to make their strategic

Table 3. The abilities of the intelligent agents in CKM

No.	Ability of agents	Requirement of CKM
1	Autonomy	Provide quick response to the customers' requests.
2	Reactivity	Agents need to interact with customers and respond to their actions.
3	Pro-activeness	Predict the requirements of the customers prior to explaining them.
4	Social ability	Usually MAS are needed in CKM systems, communication with other agents and human supervisor is required.
5	Learning	The agents can learn the preferences of a special customer during their long-term communication with the CKM system.
6	Veracity	All the knowledge provided for the customers should be reliable and precise.
7	Compatibility	The agents should be customizable according to the ever changing preferences of the customers
8	Rationalism	The agents should follow the final goal of CKM which is to provide knowledge for customers and collect knowledge from and about customers.

decisions. An introductory model representing the sources and destination of knowledge stream inside the company has been introduced by Homayouni et al. (2008).

A schematic view of the proposed AMCKM model is depicted in Figure 1. This model illustrates the basic application of the intelligent agents in CKM systems. In this figure, the intelligent agents and the knowledge bases are shown by circles and cylinders, respectively. Moreover, the stream of knowledge is shown by arrows. The intelligent agents include but not limited to interface agents and the knowledge-based agents. As shown in Figure 1, the customers and the company are both sources of knowledge and its destination. Interface agents are responsible to directly interact with the customers and the company. The interface agents should be supported by the knowledge-based agents. The knowledge-based agent provides the required knowledge for the interface agents, and gathers, classifies, and deposits the knowledge from, for and about the customers in knowledge bases (KB). Interface agents used the KBs to provide the knowledge for customers, based on their requests (KB about customers, KB from customers, and KB for customers in Figure 1).

The main stream of knowledge for customers is gathered through interface agents, the source of this knowledge are various departments of the company. "Knowledge for customers" needs to be classified and stored in KB for customers by a knowledge-based agent, based on the clusters of the customers (if any). An interface agent is responsible to interact with the customers and to offer their desired knowledge. Knowledge from customers is analyzed by a knowledge-based agent.

Knowledge about the competitors, their products, ideas on potential customers, and concept of potential services/products can be discovered through this process. Moreover, if some part of relevant knowledge required by customer does not exist in KBs of CKM, company should disclose it, and try to provide it for the customers.

Interface agent can refer an unidentified customer to a customer registrar agent (not shown in Figure 1). This is to create a knowledge base for information about the existing and potential customers, and to speed up the customization process for the customers. The registration process should be as easy as possible to encourage the customers for registering at the AMCKM system. However, the basic information should be available for all the customers, even if they do not prefer to register at the system. The registrar agent can obtain the main parts of knowledge about customers.

Knowledge about customers is used by the company to know the preferences, geographically distribution, most beneficial products/services, and so on. Repeated purchases, special purchases, and potential customers for specific purchases, can be identified and analyzed by knowledge-based agents and be stored in KB about customers. After acquiring the knowledge from and about customers, a mechanism is required to provide proper channels between knowledge bases and the organizational processes to use this knowledge. In fact, these processes are known as the main users of knowledge from and about customers.

Development of AMCKM system may result in a significant reduction in the amount of human resources required for the conventional CKM systems. By means of AMCKM, the agents are responsible to interact with the

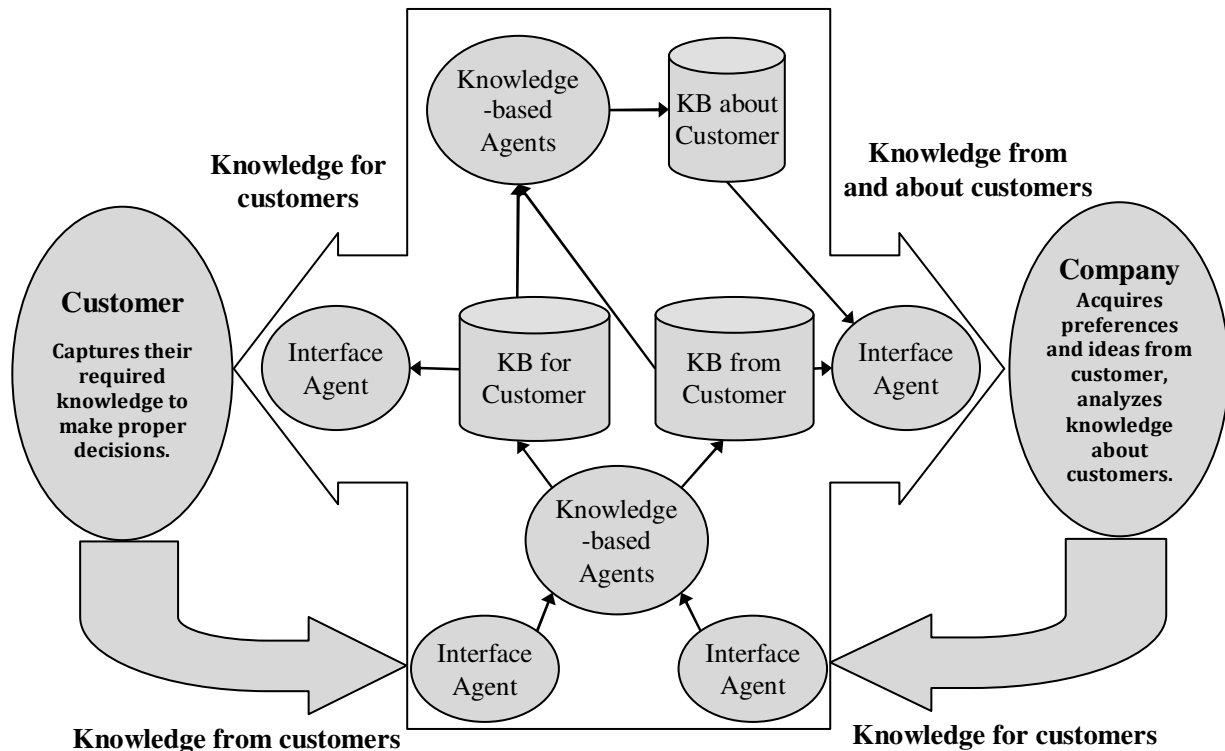


Figure 1. Proposed model for AMCKM.

customers and the expert human staffs are responsible to provide more reliable and precise knowledge for the customers, and to analyze the knowledge from and about customers. On the other hand, developing AMCKM system needs high skilled experts which may increase the costs of such systems' development.

CONCLUSION

Three main stream of knowledge should be managed in CKM practices, which are knowledge "about", "for", and "from" customers. Customers are regarded as the main external source of knowledge for pioneer enterprises. They may obtain their own knowledge and expertise while selecting, purchasing, and using various products and services. The CKM theoretical models presented in literature, focused on human resources to communicate with the customers. On the other hand, intelligent agents have been considered as a strategic tool for knowledge management systems to gain, share, and distribute knowledge among various clients of the KM system. Independent and autonomous intelligent agents facilitate the search, acquisition, analysis, and integrating the knowledge from the heterogeneous knowledge resources and the customization of knowledge for various users.

This paper investigated various abilities of the intelligent agents and compared them to the requirements of

the CKM systems. The key aim is to propose a semantic knowledge exchanging model for CKM which facilitates the active access and reuse of this knowledge. The introductory model for intelligent agent mediated customer knowledge management is also proposed in this paper. The applicability of intelligent agents in CKM is illustrated; and the benefits of using intelligent agents in practical CKM models are shown by this model. Agents' reactivity gives aid to AMCKM to respond the behavior of customers and to show the proper reaction. Generally, intelligent agents provide an effective, reactive and autonomous interaction between the customers and the company.

Intelligent agents are so young in the literature. Despite the fact that CKM gained more research in the last few years, the knowledge structure for the CKM is still disjointed and only primitive application of real CKM systems have been introduced by the researchers. Most of the existing CKM models did not describe the process of knowledge acquisition as the most important and difficult process in CKM.

Although this paper introduced intelligent agents as a toolset for CKM systems, it seems more researches and theoretical models require for practical implementation of the AMCKM. For future studies, the researchers are invited to do more researches on the application of evolutionary intelligent agents in CKM and the communication languages needed in MAS environment in CKM models.

ACKNOWLEDGEMENT

This research is an extended version of a paper entitled “knowledge exchange with customers using intelligent agents”, published in proceedings of the 38th international conference on computers and industrial engineering (CIE38) in Beijing, China, from 31 October to 2 November, 2008, that was edited by Guoping Xia and Xiuquan Dengpp (pp. 479 – 486).

REFERENCES

- Afrazeh A (2010). A problem solving method for customer knowledge management maturity (CKMM): Case study in some Iranian oil companies. *Afr. J. Bus. Manag.*, 4(11): 2205-2215.
- Ahn JY, Kim SK, Han KS (2003). On the design concepts for CRM system. *Ind. Manage. Data Syst.*, 103(5): 324-331.
- Alavi M, Leidner DE (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Q.*, 25(1): 107-136.
- Bueren A, Schierholz R, Kolbe LM, Brenner W (2005). Improving performance of customer-processes with knowledge management. *Bus. Process Manage. J.*, 11(5): 573-588.
- Chira O, Chira C, Roche T, Tormey D, Brennan A (2006). An agent-based approach to knowledge management in distributed design. *J. Intell. Manuf.*, 17(6): 737-750.
- Dictionary OE (2011). Definition of knowledge. Retrieved 17 Feb. http://oxforddictionaries.com/view/entry/m_en_gb0447820#m_en_gb0447820
- Dignum V (2006). An Overview of Agents in Knowledge Management. In M Umeda, A Wolf, O Bartenstein, U Geske, D Seipel and O Takata (Eds.), *Declarative Programming for Knowledge Management Springer Berlin / Heidelberg*, 4369: 175-189.
- Froelich W, Kisiel-Dorohinicki M, Nawarecki E (2006). Agent-Based Evolutionary Model for Knowledge Acquisition in Dynamical Environments. In V Alexandrov, G van Albada, P Sloot and J Dongarra (Eds.), *Computational Science – ICCS, Springer Berlin / Heidelberg*, 3993: 839-846.
- Gao Y, Li L (2006). Discussion on customer knowledge management of modern manufacturing enterprises. Paper presented at the 7th International Conference on Computer-Aided Industrial Design and Conceptual Design (CAIDCD 06), Hangzhou, China.
- Garcia-Murillo M, Annabi H (2002). Customer knowledge management. *J. Oper. Res. Soc.*, 53(8): 875-884.
- Gebert H, Geib M, Kolbe L, Brenner W (2003). Knowledge-enabled customer relationship management: integrating customer relationship management and knowledge management concepts. *J. Knowl. Manag.*, 7(5): 107-123.
- Gibbert M, Leibold M, Probst G (2002). Five styles of customer knowledge management, and how smart companies use them to create value. *Eur. Manag. J.*, 20(5): 459-469.
- Grundspenkis J (2007). Agent based approach for organization and personal knowledge modelling: knowledge management perspective. *J. Intell. Manuf.*, 18(4): 451-457.
- Homayouni SM, Tang SH (2008). Applicability of Agent Based Systems in Customer Knowledge Management. Paper presented at the Knowledge Management International Conference, Kmice'08. Langkawi, Malaysia, pp. 359-363.
- Huang CC, Lai GH (2004). Knowledge management system: an agent-based approach. *Knowl. Manag. Res. Pract.*, 2(2): 80-94.
- Karami A, Gharleghi E, Nikbakht F, Mirasadi S (2010). Customer Knowledge Management in the Iranian Banks. *Int. Bull. Bus. Adm.*, 9: 74-91.
- Liao S-H, Chen Y-J, Lin Y-T (2011). Mining customer knowledge to implement online shopping and home delivery for hypermarkets. *Expert Syst. Appl.*, 38(4): 3982-3991.
- Lin J (2007). An object-oriented development method for customer knowledge management information systems. *Knowl-Based Syst.*, 20(1): 17-36.
- Lin Y, Su HY, Chien S (2006). A knowledge-enabled procedure for customer relationship management. *Ind. Mark. Manag.*, 35(4): 446-456.
- Lopez-Nicolas C, Molina-Castillo FJ (2008). Customer knowledge management and E-commerce: The role of customer perceived risk. *Int. J. Inform. Manag.*, 28(2): 102-113.
- Luck M, McBurney P, Preist C (2003). Agent technology: Enabling next generation computing: Citeseer.
- Ma Z, Qi L (2009). Toward an Integrated Customer Knowledge Management Model: A Process-Based Approach. Paper presented at the International conference on Management and Service Science (MASS 09), Wuhan, China.
- Nissen ME, Levitt RE (2004). Agent-based modeling of knowledge dynamics. *Knowl. Manag. Res. Pract.*, 2: 169-183.
- Ogunde AO, Folorunso O, Adewale OS, Ogunleye GO, Ajayi AO (2010). Towards an agent-based customer knowledge management system (ABCKMS) in e-commerce organizations. *Int. J. Comput. Sci. Eng.*, 2(6): 2181-2186.
- Ooi KB (2009). TQM and knowledge management: Literature review and proposed framework. *Afr. J. Bus. Manag.*, 3(11): 633-643.
- Richards KA, Jones E (2008). Customer relationship management: Finding value drivers. *Ind. Mark. Manag.*, 37(2): 120-130.
- Rowley J (2002). Eight questions for customer knowledge management in e-business. *J. Knowl. Manag.*, 6(5): 500-511.
- Salojärvi H, Sainio L-M, Tarkiainen A (2010). Organizational factors enhancing customer knowledge utilization in the management of key account relationships. *Ind. Mark. Manag.*, 39(8): 1395-1402.
- Salomann H, Dous M, Kolbe L, Brenner W (2005). Rejuvenating Customer Management: How to Make Knowledge For, From and About Customers Work. *Eur. Manag. J.*, 23(4): 392-403.
- van Elst L, Dignum V, Abecker A (2003). Towards Agent-Mediated Knowledge Management. In L van Elst, V Dignum and A Abecker (Eds.), *Agent-Mediat. Knowl. Manage.*, 2926: 433: Springer Berlin / Heidelberg.
- Wooldridge M, Ciancarini P (2001). Agent-Oriented Software Engineering: The State of the Art. In P Ciancarini and M Wooldridge (Eds.), *Agent-Oriented Software Engineer.*, Springer Berlin / Heidelberg. 1957: 55-82.
- Xu M, Walton J (2005). Gaining customer knowledge through analytical CRM. *Ind. Manage. Data Syst.*, 105(7): 955-971.
- Zhang Z (2011). Customer Knowledge Management and the Strategies of Social Software. *Bus. Process Mng. J.*, 17(1): 82-106.
- Zhang Z, Liu L (2010). The Application Tactics of Customer Knowledge Management. Paper presented at the International Conference on Management and Service Science (MASS), Wuhan, China.