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Integrating Knowledge Management and Relationship Management in an Enterprise Environment

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ABSTRACT

Knowledge management and relationship management are essential ingredients for value creation to gain competitive advantages in the knowledge-based economy of the 21st century. The merging of the two disciplines has received increasing attention both in academia and in business. Past research focuses on the integration of knowledge management and customer relationship management at the business process level. This paper extends the concepts to enterprise relationship management to include customer relationship management, supplier relationship management and partner relationship management. The merging of knowledge management (KM) and enterprise relationship management (ERM) yields two perspectives: the ERM-oriented KM (EKM) and the KM-oriented ERM (KERM). In this paper, an integrated KM-ERM process model that consists of EKM and KERM is developed. An enterprise framework for KM-ERM integration is proposed through the construct of an enterprise model that spans the external, conceptual and internal levels of an enterprise across the dimensions of operations, analytics and knowledge.

INTRODUCTION

Value creation strategies in the 21st century have shifted from product differentiation and operational efficiency to knowledge creation and relationship building across the value network. Knowledge management (KM) and relationship management (RM) are two sides of the same coin in gaining competitive advantages in the knowledge-based economy. The focus of relationship management has been on customer relationship management (CRM), which has helped companies to acquire and retain customers and increase market share and profitability. For businesses that have a high percentage of sales through indirect channels, such as the high-tech industry (Tanoury & O'Leary, 2000), partner relationship management (PRM) has become an important business strategy in the sell-side relationship management. As procurement cost and suppliers' commitment to meet production requirements can drastically impact a firm's performance (Aberdeen, 2001; Lang, Paravicini, Pigneur, & Revaz, 2002; Carey, 2005), the upstream supplier relationship management (SRM) is equally important as the downstream CRM and PRM. Enterprise relationship management (ERM) is a business strategy that optimizes the relationships between a firm and its customers, channel partners, suppliers and alliance partners in order to maximize opportunities. Knowledge management is a value creation strategy that exploits the knowledge assets of an enterprise to achieve business goals. It is concerned with the creation, sharing and utilization of knowledge in an organization. The internal focus of knowledge management to improve product innovation and operational efficiency has shifted to an external focus of enhancing business processes across the extended enterprise. In particular, the application of KM to CRM business processes and the management of customer knowledge have received increasing attention both in academia and in business.

The merging of KM and ERM yields two perspectives: the ERM-oriented KM (EKM) and the KM-oriented ERM (KERM). The focus of prior research in this area has been on the integration of KM and CRM. While different models have been proposed for customer knowledge management (CKM) and knowledge-enabled CRM (KCRM), there are no standardized definitions of these terms. A commonly accepted concept is that CKM deals with the processes of managing customer knowledge, whereas KCRM deals with the utilization of knowledge to improve CRM processes.

Gibbert, Leibold and Probst (2002) described CKM as the management of knowledge from customers and emphasized CKM as the strategic process by which customers are empowered as knowledge partners. It proposed five styles of CKM that can be used by companies depending on the nature of their customers. Paquette (2006) described CKM as the processes that a firm employs to manage the identification, acquisition and internal utilization of customer knowledge. Su, Chen and She (2006) proposed a conceptual framework for an E-CKM model by incorporating IT into the CKM model. Eppler, Siefried and Popnack (1999) classified business processes by knowledge intensity and process complexity. High CRM process complexity implies a high degree of knowledge to pursue the process goals. KCRM is the enablement of CRM processes by knowledge across the operations of marketing, sales and service. Gebert, Geib, Rolbe, and Piernpp (2002) and Gebert, Geil, Kobe, and Brenner (2003) described a CKM model based on a research approach in business engineering developed at the University of St. Gallen. The term CKM used by the St. Gallen authors refers to both the CKM and the KCRM aspects in the context of this paper. The St. Gallen approach derives from the reflections about CRM (Derliyski & Frohlich, 2004; Zanjani, Rouzbehani, & Dabbagh, 2008), in which customer knowledge is applied to support CRM processes (Gebert et al., 2002; Bueren, Schierholtz, Kolbe, & Brenner, 2004). The St. Gallen concept of the CKM model describes the basic elements for successful knowledge management in customer-oriented processes (Gebert et al., 2003). The model focuses on the integration of KM and CRM at the business process level.

The objectives of this paper are: (1) to develop an integrated KM-ERM process model, and (2) to develop an enterprise framework for KM and ERM integration that includes the integration at the process, conceptual and technical levels of the enterprise across the dimensions of operations, analytics and knowledge. The contribution of this paper is in three areas. First, the KM-CRM integration concepts are extended to the KM-ERM integration concepts. Second, it provides an enterprise integration strategy that goes beyond process integration to include the external, conceptual and internal levels of the enterprise across the dimensions of operations, analytics and knowledge. This aspect is particularly important for successful implementations of KM and ERM, since the lack of an enterprise-wide integration strategy was among the leading causes for failure for prior enterprise systems implementations. Third, this research brings together the disciplines of knowledge management, enterprise relationship management and enterprise modeling, which provides a framework for future works in the enterprise integration of relationship management and knowledge management.

The structure of this paper is arranged as follows. Following the introduction, Section 2 presents the ERM process model. Section 3 describes the KM process model. Section 4 describes the knowledge requirements for ERM. Section 5 presents an integrated KM-ERM process (IKEP)

model. Section 6 presents an enterprise model framework for KM-ERM integration. The paper concludes in Section 7 with suggestions for future research.

THE ERM PROCESS MODEL

The integration of KM and CRM concepts at the process level has shown to be beneficial to both KM and CRM approaches (Gebert et al., 2002). This concept is extended in this paper for the integration of KM and ERM. The ERM process model allows the identification of knowledge requirements for KM activities and provides the basis for how knowledge can be applied to improve the ERM processes. The ERM process model consists of three sub-models: the CRM process model, the SRM process model and the PRM process model. In the following, an adaptation of the CRM process model based on the St. Gallen CKM model (Gebert et al., 2002, Bueren et al., 2004) will be described, and the SRM and PRM process models will be developed. Figure 1 summarizes the proposed ERM process model.

Figure 1: The ERM Process Model.

ERM PROCESSES	CRM	SRM	PRM
Marketing	Campaign Management	Campaign Management	Campaign Management
			Recruitment Management
Sales / Purchase	Lead Management	Lead Management	Lead Management
			Referral Management
	Offer Management	Source Management	Contract Management
	Contract Management	Contract Management	
	Customer Order Management	Purchase Order Management	Partner / customer Order Management
	Service	Service Management	Service Management
Inquiry and Complaint Management		Inquiry and Complaint Management	Inquiry and Complaint Management

The CRM process model consists of the business processes of campaign management, lead management, offer management, contract management, customer order management, service management, and inquiry and complaint management. Here, we have added the business processes of customer order management and inquiry management to the St. Gallen model. *Campaign management* is the process of planning, development, execution, control, monitoring and analysis of marketing campaigns towards target individuals or segments. *Lead management* is the process to generate, qualify and prioritize leads for sales. *Offer management* is the process that includes activities leading to and including the delivery of a binding offer to a customer. *Contract management* is the process of creation and maintenance of contracts between a firm and its customers. A contract may cover many customer orders. *Customer order management* is the process of managing product catalogs and configurations, order entry, order processing, order fulfillment, invoicing and accounts receivable of customer orders. *Service management* is the

process of planning, execution, control, tracking and analysis of service activities for customers. After-sales service may include maintenance, repair, warranty and customer support. *Inquiry and complaint management* is the process of identifying and processing customer inquiries and complaints, and providing responses and resolutions.

From the buy-side perspective, major business functions for SRM consist of marketing, purchase and service. While marketing in CRM is downstream to customers, marketing in SRM is upstream to suppliers. The sales function in CRM is replaced by the purchase function in SRM. Service provided to customers in CRM is replaced by supplier service received by the firm. Business processes for SRM in the primary functions of marketing, purchase and service consist of campaign management, lead management, source management, contract management, purchase order management, service management, and inquiry and complaint management. Marketing campaigns for suppliers aim at promoting a firm's needs to attract suppliers and ensure competition. *Campaign management* in SRM is the process of planning, development, execution, control, monitoring and analysis of marketing campaigns towards suppliers. *Lead management* in SRM is the process to generate, qualify and prioritize supplier leads for sourcing. *Source management* is the process of identifying, qualifying and selecting suppliers based on specific categories of purchasing requirements. *Contract management* in SRM is the process of creation and maintenance of contracts between a firm and its suppliers. A contract between a firm and a supplier may cover many purchase orders. *Purchase order management* is the process of managing the requisition, purchase order generation, receiving, quality assessment and payment of invoices for purchase orders. *Service management* is the process of planning, execution, control, tracking and analysis of service activities in receiving services from suppliers. After-sales service from suppliers may include maintenance, repair, warranty and support. Service management includes the management of calls made to suppliers, the scheduling and tracking of service activities in maintenance, repair and warranty by suppliers, and the assessment of quality of service received. *Inquiry and complaint management* is the process of issuing inquiries and complaints, and tracking responses and resolutions.

Similar to CRM, PRM deals with downstream sell-side relationship management. Sales channel partners may include distributors, retailers, dealers, independent agents and value-added resellers (VARs). Depending on the type of channel partners, different models in marketing, sales and service may be deployed. Major business processes in PRM consist of campaign management, recruitment management, lead management, referral management, contract management, partner/customer order management, service management, and inquiry and complaint management. While similar to CRM in many aspects, PRM processes have a business-to-business focus (Tanoury & O'Leary, 2000). The PRM cycle begins with successfully recruiting channel partners. *Recruitment management* is the process of identifying, contacting and qualifying potential partners. *Contract management* in PRM is the process of creation and maintenance of contracts between a firm and its partners. *Campaign management* in PRM is the process of planning, development, execution, control, monitoring and analysis of marketing campaigns to end customers in conjunction with channel partners. *Lead management* in PRM is the process of generating, qualifying, dispatching and monitoring leads. Effective lead management requires the timely dispatching of leads to the right channel partners. Leads can flow in the opposite direction, from a channel partner to the firm due to a partner's unsuitability of handling the opportunity. *Referral management* is the process in PRM to manage referrals

from channel partners. These referrals become leads for the firm or are redistributed to other channel partners in the network. Similar to order management in CRM, *partner/customer order management* in PRM is the process of managing product catalogs and configurations, order entry, order processing, order fulfillment, invoicing and accounts receivable of partner orders for the partners or on behalf of end customers. *Service management* in PRM is the process of planning, execution, control, tracking and analysis of service activities for channel partners or end customers, directly by the firm or through channel partners. After-sales service may include maintenance, repair, warranty and support. *Inquiry and complaint management* is the process of identifying and processing inquiries and complaints from channel partners or from end customers, and providing responses and resolutions.

THE KM PROCESS MODEL

The key processes in knowledge management consist of knowledge creation, acquisition, dissemination and sharing, representation, storage and utilization. Nonaka and Takeuchi (1995) described the knowledge creation of explicit and tacit knowledge in the SECI model of socialization, externalization, combination and internalization. Created knowledge is then acquired or captured in various processes by different entities within an enterprise. Acquired knowledge can go through the SECI process for new knowledge creation. Knowledge is then disseminated and shared within the enterprise. Disseminated knowledge may be further processed for new knowledge creation in the SECI model. The acquired knowledge is then structured and represented in knowledge models such as meta-knowledge models and ontology-based knowledge models. Physical storage of knowledge can be designed and built based on the conceptual knowledge models. Knowledge can be stored in machine-readable formats in knowledge bases or in human-readable formats in knowledge repositories and warehouses. Knowledge is utilized in decision making or in the performance of tasks either by machine or human processes. The KM process model is illustrated in Figure 2.

THE KNOWLEDGE REQUIREMENTS FOR ERM

Gebert et al. (2002) classified knowledge in CRM processes into three categories: knowledge for customers, knowledge about customers and knowledge from customers. Knowledge for customers is required to satisfy specific needs of customers such as knowledge about products and suppliers. Knowledge about customers is accumulated to understand the motivations of customers to allow a firm to personalize its offerings to specific customers. Knowledge about customers may include customer characteristics such as demographics, purchasing history and buying patterns. Knowledge from customers is knowledge residing in customers, created through their experience with a firm such as using its products and services. Gebert et al. (2002) emphasized that gaining knowledge from customers is based on customers gaining their own expertise while using a product or service, through which, customers are empowered as equal partners when discussing changes or improvements.

Similar classifications of knowledge for suppliers, knowledge about suppliers and knowledge from suppliers in SRM processes can be defined from the buy-side perspective. Knowledge for suppliers is required to satisfy needs of suppliers such as knowledge about production needs and forecasts, inventory, products, customers and markets. Knowledge about suppliers is accumulated to understand the capability, cost, performance and liability of suppliers. Supplier

capability refers to the ability of suppliers to fulfill the requirements of the firm. Supplier performance includes quality and on-time delivery. Supplier liability includes previous recalls, known product defects and financial risks. Knowledge from suppliers is knowledge residing in suppliers through their experience with the firm.

Knowledge for partners is required to satisfy specific needs of partners such as knowledge about products, markets and suppliers. Knowledge about partners is accumulated to understand the capability of partners in promoting the firm's distribution of products and services. It includes the knowledge of partners' distribution networks, products, services, market space and value-added offerings. Knowledge from partners is knowledge residing in partners through their experience with the firm while interacting or collaborating with the firm in selling its product and service.

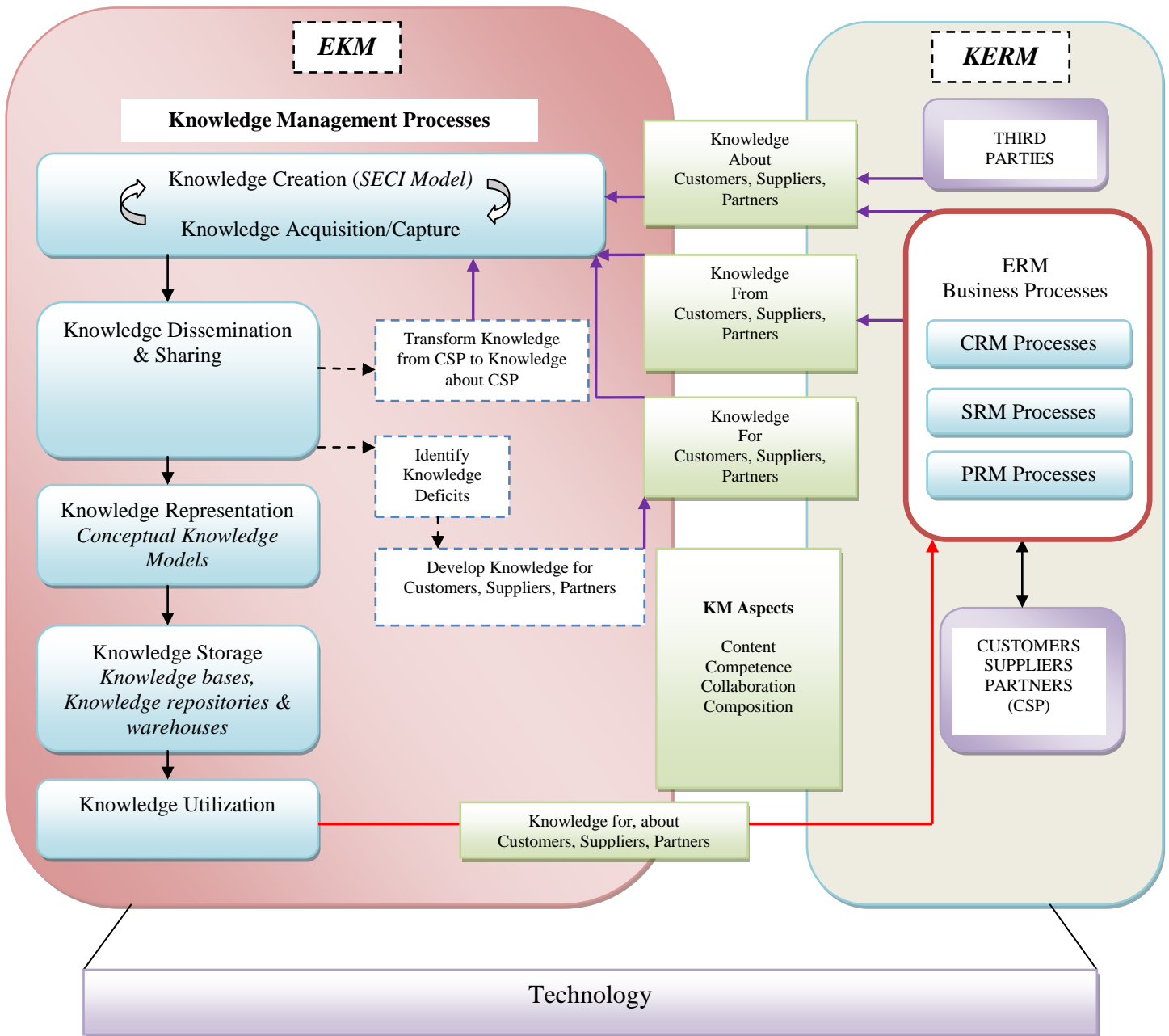
AN INTEGRATED KM-ERM PROCESS (IKEP) MODEL

The integration of KM and ERM results in two perspectives: the ERM-oriented KM (EKM) and the KM-oriented ERM (KERM). In the following, an integrated KM-ERM process (IKEP) model that consists of EKM and KERM supported by knowledge aspects and enabling technologies is developed (Figure 2).

EKM concerns the management of customer, supplier and partner knowledge, whereas KERM concerns the utilization of knowledge to enhance ERM processes. In the EKM model, the KM processes described in Section 3 that consist of knowledge creation, acquisition, dissemination and sharing, representation, storage and utilization are focused on knowledge requirements for ERM processes as specified in Section 4, i.e. knowledge for, about and from customers, suppliers and partners.

Hereafter in the discussion, "CSP entities" will denote the business entities of customers, suppliers and partners. *Knowledge from CSP entities* is captured from ERM business processes through the firm's interactions with CSP entities. It is then processed through the knowledge creation, dissemination and sharing cycle and becomes knowledge about CSP entities. *Knowledge about CSP entities* can be captured through ERM business processes, third parties or other knowledge sources. It goes through the knowledge creation, dissemination and sharing cycle where knowledge deficits are identified and *knowledge for CSP entities* is created. Knowledge about and for CSP entities is structured and represented in conceptual knowledge models and physically implemented in knowledge bases and knowledge repositories, respectively in machine-readable and human-readable formats. Knowledge about and for CSP entities is utilized by machine and human processes that implement the ERM business processes. The flow of the three types of knowledge between KM processes and ERM processes is illustrated in Figure 2.

Figure 2: An Integrated KM-ERM Process (IKEP) Model.



Knowledge for CSP entities is created within the enterprise by entities such as R&D, production, marketing, sales (for CRM and PRM), purchasing (for SRM) and service. Knowledge for CSP entities is captured and refined by campaign management (for CRM), source management (for SRM) and recruitment management (for PRM), and distributed for utilization by other ERM processes. *Knowledge about CSP entities* is created by CSP entities and third parties, and through the internal processing of knowledge from CSP entities. Third party data mining firms that collect and analyze consumer data can provide knowledge about customers regarding buying patterns for particular segments of customers. The Food and Drug Administration and the Better Business Bureau can provide valuable knowledge about suppliers such as product recalls and complaints against suppliers. Partner or value-added reseller directories published by private

companies can be knowledge sources for knowledge about partners. Knowledge about CSP entities can be captured through various interactions and touch points in ERM processes. It can also be captured through the discovery in knowledge sources such as databases, data warehouses, knowledge bases, agency reports and news reports. Knowledge about CSP entities can be utilized by all ERM processes. Similar to knowledge about CSP entities, *knowledge from CSP entities* can be captured through various interactions and touch points in ERM processes. It is processed and becomes knowledge about CSP entities to be utilized by ERM processes.

Gebert et al. (2002) described four knowledge management aspects in the CKM model: content, competence, collaboration and composition. These knowledge management aspects deliver services that support the CRM processes and can directly impact process performance. As described in Bueren et al. (2004), the content aspect refers to the management of explicit knowledge, and is supported by technologies such as content management and document management. The competence aspect refers to the management of both implicit and explicit knowledge in an individual in the performance of a task. It is supported by technologies such as expertise directories, skill management systems and e-learning systems (Bueren et al., 2004). The collaboration aspect refers to the management of creation and dissemination of knowledge among few individuals, whereas the composition aspect refers to the management of dissemination and usage of knowledge among a large number of individuals in an organization. Bueren et al. (2004) further described the technologies for collaboration to include email, group information tools and instant message systems; and the technologies for composition, which focus on searching and navigation for explicit knowledge, to include knowledge mining, personalization, taxonomy management and knowledge maps systems. These four knowledge management aspects in the CKM model are applicable to the extension of CKM to EKM to include supplier knowledge management and partner knowledge management where content, competence, collaboration and composition deliver services that support processes in CRM, SRM and PRM.

Various types of technologies can be applied to the KM processes. Marwick (2001) described the technologies supporting the SECI knowledge creation model (Nonaka & Takeuchi, 1995) to include technologies in groupware (e.g. Lotus Notes, on-line meetings, synchronous chat), collaboration (e.g. brainstorming applications), expertise location (e.g. search engine for individuals), knowledge capture (e.g. email, electronic documents, Web pages, speech recognition), document classification, text search, portals and meta-data. Marwick (2001) further described the use of e-meetings and synchronous chat in socialization, the use of answering questions and annotation in externalization, the use of text search and document categorization in combination, and the use of visualization and browsable video/audio presentations in internalization. Knowledge sharing is the process of dissemination of knowledge to other individuals or groups in the organization. It is facilitated by social communication channels and technical communication channels such as information networks, technical communities, the Internet, intranets and extranets (Sagan, 2006). Technologies utilizing formal logic, procedural representation, semantic networks, rules, frames and metadata models can be used in knowledge representation. Knowledge storage can utilize technologies in knowledge bases for machine processes and knowledge repositories for human processes. Knowledge utilization by machine processes can be supported by artificial intelligence (AI) systems such as expert systems, case-based reasoning systems, artificial neural network systems and intelligent agents. Retrieval systems can be used to extract knowledge from knowledge repositories for human processes.

The adoption of enterprise systems in CRM in the last decade and recently in SRM and PRM has provided the automation of many ERM processes, increasing operational efficiency in downstream and upstream management in the supply chain. Knowledge-based systems leveraging artificial intelligence technologies are widely used in CRM. Technologies in artificial neural networks and case-based reasoning have been used in areas of marketing and sales such as market segmentation and sales forecasts (Chang & Lai 2005; Chiu, Chen, Kuo, & Ku, 2009; Lu & Wu, 2009). El Sawy and Bowles (1997) and Davenport and Klahr (1998) described the importance of the role of knowledge management leveraging artificial intelligence technologies in customer service and support. Case-based reasoning has been used as an effective means of help desk automation (Turban, King, Aronson, & Liang, 2005; Bolloju, 1996). Other applications of AI technologies in knowledge-oriented CRM processes include the use of artificial neural networks in customer surveys (Lee & Park, 2005) and the use of e-service intelligent technologies in customer service and call centers (Tillett 2000; Turban, King, McKay, Marshall, Lee, & Viehland, 2008). Analogous to CRM in many aspects in sell-side relationship management, similar CRM technologies can be deployed in PRM.

In SRM, case-based reasoning and artificial neural networks can be used to select and benchmark potential suppliers (Choy, Lee, & Lo, 2003). Choy, Lee, Lau, & Choy (2005) described a knowledge-based supplier selection and evaluation system using case-based reasoning for outsourcing operations. With the emergence of e-procurement systems in the 1990s, a unified open platform for buyers and suppliers was created through public and private e-marketplaces and exchanges. It brings together all supplier information and automates the process of requisitioning supplies, obtaining PO approvals and dispatching orders to the appropriate suppliers (Pallatto, 2002). AI technologies have been deployed in various areas in procurement systems such as agent-based services and performance based procurement (Giovannucci, Rodriguez-Aquilar, Reyes, Noria, & Cerquider, 2008; Kashiwagi 2004).

Examples of SRM-oriented KM (SKM) and KM-oriented SRM (KSRM) are described in the following to illustrate the IKEP model. In the SKM model, *knowledge for suppliers* such as production requirements is created by purchasing in the RFP process. *Knowledge from suppliers* such as a supplier's capability to satisfy a firm's requirements including knowledge about products, pricing, availability and delivery commitment is created by the supplier and can be captured by purchasing in the supplier's response to RFP. Knowledge from suppliers is processed and becomes *knowledge about suppliers*. Other knowledge about a supplier can be created by third-party entities such as the Better Business Bureau, or by internal parties such as marketing or production through interactions with the supplier or its products in marketing events and manufacturing processes. Knowledge about suppliers goes through the knowledge creation, dissemination and sharing cycle where knowledge deficits such as the lack of knowledge of a supplier about product quality and safety requirements are identified, and *knowledge for suppliers* is created. Knowledge about and for suppliers is structured and represented in conceptual knowledge models and physically implemented in knowledge bases and knowledge repositories to be utilized by machine and human processes. In the KSRM model, SRM processes are enabled by knowledge about and for suppliers generated in the SKM model. For example, the campaign management process utilizes knowledge about suppliers' markets and channels to promote the firm's needs. The purchasing process utilizes knowledge for suppliers to generated RFP requirements. It also utilizes knowledge about suppliers' product offerings, pricing, delivery capability and risk for supplier selection. Knowledge about suppliers'

inventory and shipment schedules can be disseminated to and utilized by other entities such as production to ensure the just-in-time manufacturing process. Knowledge can be utilized through human or machine processes to support decision making or performance of a task. For example, a purchasing officer can utilize knowledge about suppliers from a report stored in a knowledge repository. A supplier selection program using artificial intelligence can utilize knowledge about suppliers stored in a machine-readable knowledge base. Business processes that utilize knowledge about suppliers can further capture new knowledge about suppliers that feeds back to the SKM model.

AN ENTERPRISE MODEL FRAMEWORK FOR KM-ERM INTEGRATION

The integrated KM-ERM process model described in the previous section addresses the integration of KM and ERM at the process level. In this section, an enterprise model framework (Figure 3) is developed for the integration of KM and ERM at all the levels of an enterprise that includes the integration at the process level, conceptual level and technical level across the dimensions of operations, analytics and knowledge.

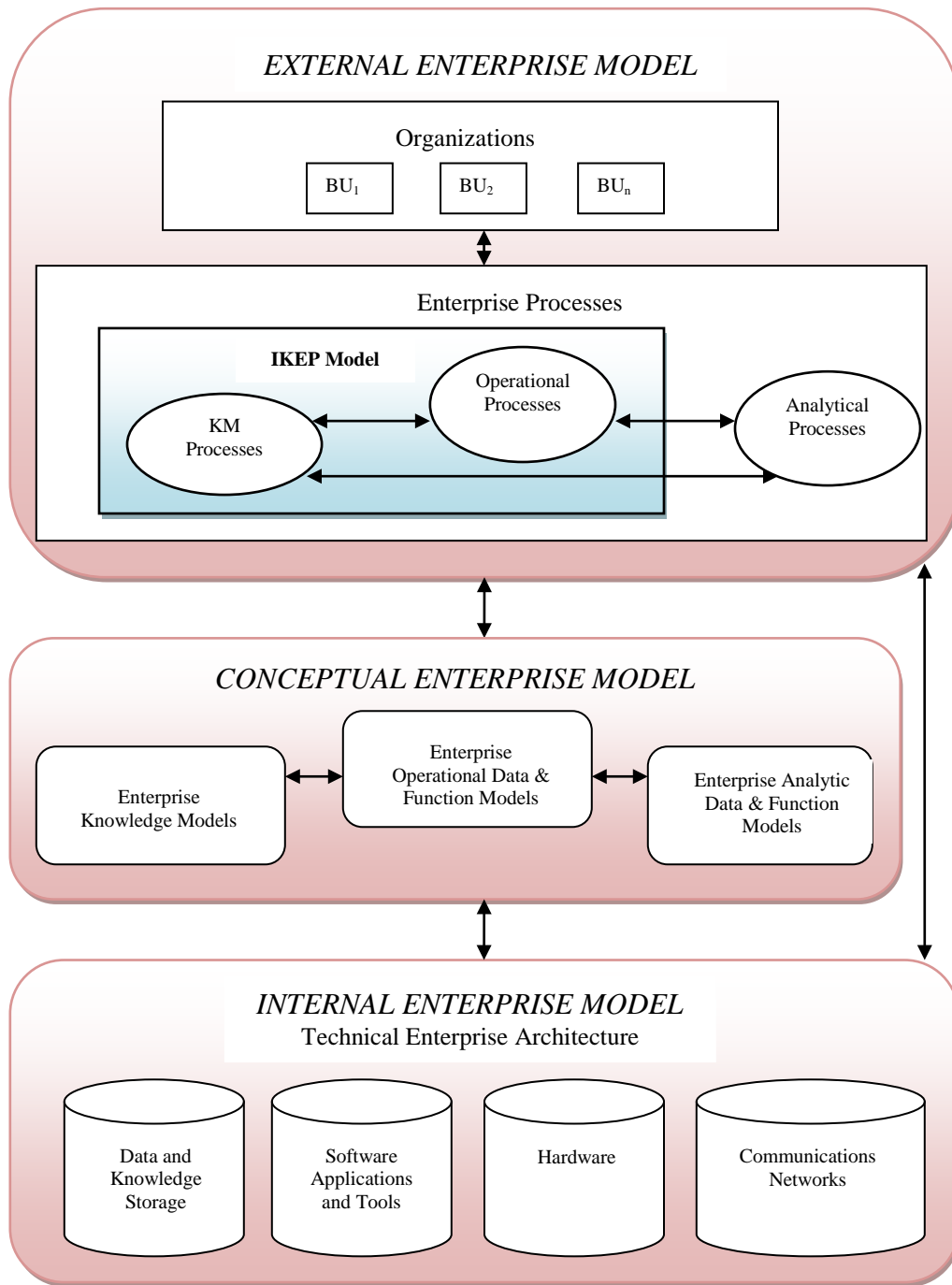
An enterprise model is a structured representation of requirement specifications of interrelated sub-models that include objectives, concepts, activities, processes, information, resources, people and systems (Bubenko & Kirikova, 1995; Fox & Gruninger, 1998). Chan (2008) described the enterprise model as the representation of interrelated components within and across the external, conceptual and internal levels of the enterprise.

Figure 3 depicts the three levels of the enterprise model. The many-to-many relationships between entities are denoted by bidirectional arrows in the diagram. For example, a data element in the conceptual enterprise model may support multiple enterprise processes in the external enterprise model, and conversely, an enterprise process may utilize multiple data elements in the conceptual enterprise model. The *external enterprise model* consists of organization structures and processes. *Organizations* consist of business units (BUs) and *enterprise processes* consist of processes for KM, operations and analytics. *Operational processes* can be enabled by knowledge and business intelligence resulting from *KM processes* and *analytical processes*. Knowledge and information captured in operations can in turn feed into the KM and analytical processes to generate new knowledge and business intelligence. The *conceptual enterprise model* consists of the conceptual representations of enterprise data, knowledge and functions, denoted by *enterprise operational data and function models*, *enterprise knowledge models* and *enterprise analytic data and function models*. The *internal enterprise model* consists of technical components in *data and knowledge storage*, *software applications and tools*, *hardware* and *communications networks*. The enterprise model spans the dimensions of operations, analytics and knowledge across the different levels of the enterprise. In the following, each level of the enterprise model will be discussed pertaining to KM-ERM integration.

The External Enterprise

At the external enterprise level, process integration occurs across the dimensions of operations, analytics and knowledge. The process integration between operations and knowledge has been discussed in the IKEP model in Section 5. Analytical processes are used to create business intelligence to enhance business operations. They include the utilization of methods in statistical processing, online analytic analytical processing (OLAP), data mining and visualization.

Figure 3: An Enterprise Model Framework for KM-ERM Integration.



ERM business processes can be enabled by business intelligence created by analytical processes, and conversely, data and knowledge collected in ERM processes provide inputs for analytical processing to create new business intelligence. There is also synergy between knowledge management and analytics. Business intelligence can be created by combining knowledge management processes and analytical processes. For example, the knowledge about a customer’s credit risk created through the use of an artificial neural network combined with the customer profitability information created in an OLAP application can provide additional input to analytic

processes that create the business intelligence to enable real-time loan application decisions. Conversely, customer analytics can provide knowledge about a customer for customer knowledge management processes.

The Conceptual Enterprise

The conceptual enterprise model provides a representation of enterprise requirements in operations, analytics and knowledge, independent of process and technology implementations. It consists of the enterprise operational data and function models, enterprise analytic data and function models and enterprise knowledge models. Various representation methods can be used in the modeling of enterprise operational data and functions, which may include entity-relationship modeling, function modeling and object modeling. Enterprise analytic data models can be constructed using dimensional modeling techniques such as the Star Schema. Operational and analytic models can be linked via the mappings between the objects in the respective models. Meta-knowledge models and ontology-based models can be used to represent enterprise knowledge at the conceptual enterprise level. Knowledge models and enterprise data models can be linked through the use of pointers in the representations. The conceptual enterprise models provide a central definition of data, function and knowledge for the enterprise that can be shared and reused by different systems and processes across the enterprise.

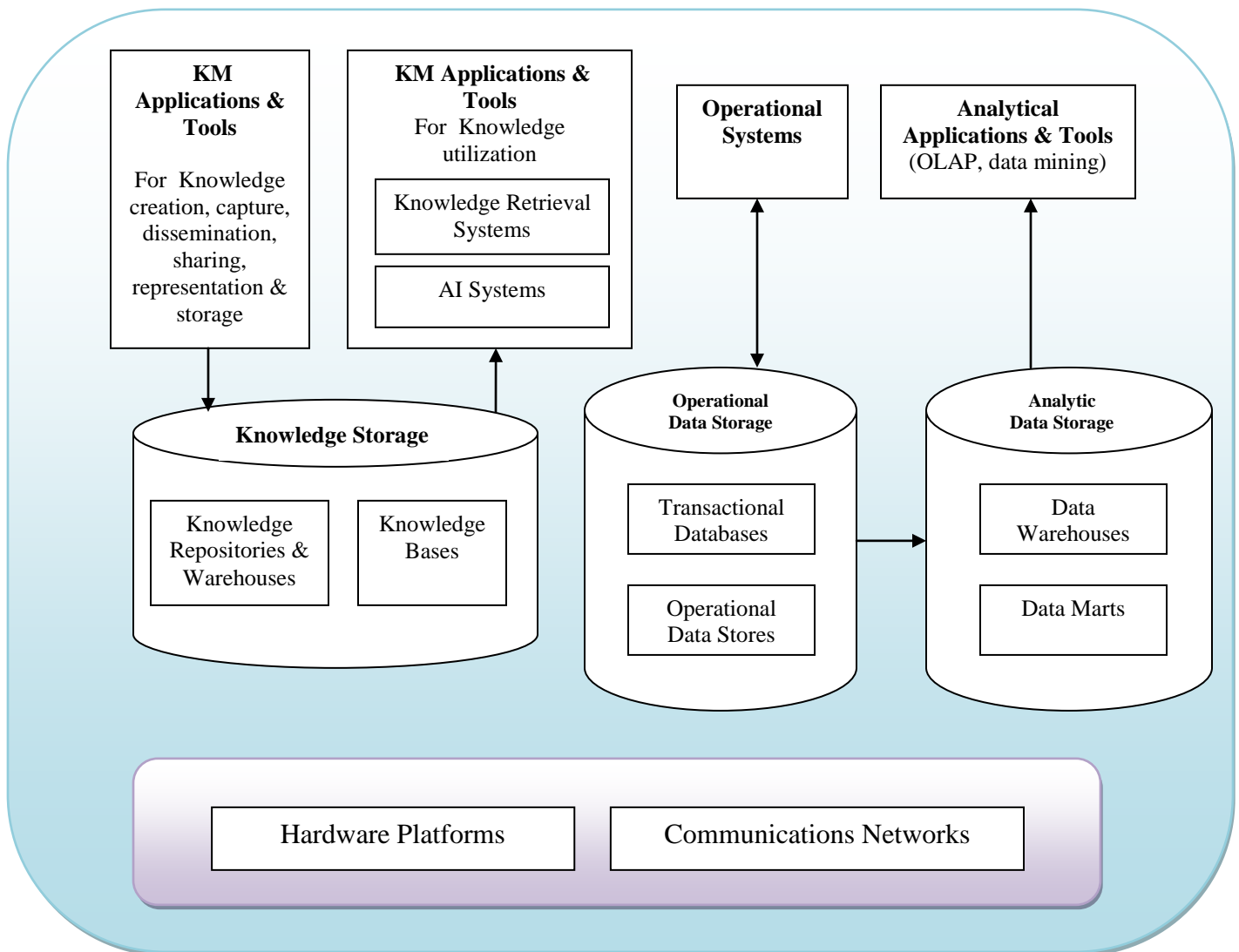
The Internal Enterprise

The internal enterprise level consists of data and knowledge storage, software applications and tools, hardware and communications networks. Figure 4 details the technical enterprise architecture for KM-ERM integration. The software applications level consists of *KM applications and tools*, *operational systems* and *analytical applications and tools*. KM application systems support the knowledge management processes of knowledge creation, acquisition, dissemination and sharing, representation, storage and utilization. Operational application systems consist of transactional systems, legacy systems, external systems and enterprise applications such as ERP, CRM, SRM, SCM and PRM. Analytical application systems consist of systems that support analytical processing, utilizing technologies such as statistical processing, OLAP and data mining. The data and knowledge storage level consists of *knowledge storage* that comprises *knowledge repositories* and *knowledge bases*, *operational data storage* that comprises *transactional databases* and *operational data stores*, and *analytic data storage* that comprises *data warehouses* and *data marts*. Knowledge is physically stored in knowledge repositories and knowledge bases respectively in human and machine readable formats, to be retrieved through *knowledge retrieval systems* and *AI systems* for utilization in operational processes. Operational systems are supported by operational data storage which consists of transactional databases and operational data stores. Conversely, data captured by operational systems are stored in operational data storage, which also provides the data feed to analytical data storage supporting analytical application systems. The hardware platforms and telecommunications networks are shared between operations, analytics and knowledge in an architecture that facilitates connectivity, interoperability and scalability across the enterprise. The data flows are represented by the respective arrows in the diagram.

Vertical Integration across the Enterprise

While the enterprise model provides a framework of integration within the external, conceptual and internal levels across the dimensions of operations, analytics and knowledge, it also provides the framework for vertical integration across the different levels. The conceptual enterprise model provides the blueprint for such integration. Various business processes in the external level may use data or knowledge elements in different data bases or knowledge bases that are mapped to the same conceptual definition. For example, the business processes of order entry and shipment may use customer address information stored in a file system in Chicago and a relational database in Hong Kong which are represented by the same conceptual definition in the conceptual data model. Similarly, a business function can be implemented by different processes supported by different systems. For example, the business function of providing customer service can be implemented by a call center process supported by call center systems and a self-service process supported by Web based systems.

Figure 4: The Technical Enterprise Architecture.



CONCLUSIONS

Knowledge management (KM) and relationship management (RM) are two key ingredients of value creation in the knowledge-based economy of the 21st century. This paper brings together the disciplines of knowledge management, enterprise relationship management (ERM) and enterprise modeling (EM) to provide a framework for the integration of knowledge management and enterprise relationship management in an enterprise environment. Prior research in this area focuses on the integration of KM and customer relationship management (CRM) from a process perspective. This paper extends this concept to the integration of KM and ERM, which includes CRM, supplier relationship management (SRM) and partner relationship management (PRM). Furthermore, it provides an enterprise framework of integration that spans the process level, conceptual level and the technical level across the dimensions of operations, analytics and knowledge. This paper presents the ERM process model, the KM process model, the knowledge requirements for ERM, an integrated KM-ERM process (IKEP) model and an enterprise model for KM-ERM integration. The enterprise model for KM-ERM provides a framework for future works in enterprise integration of relationship management and knowledge management. Specific areas of interest include: the real-time integration of the ERM ecosystem that consists of ERM operations, analytics, knowledge and collaboration across the domains of CRM, SRM and PRM; the sharing and reuse of knowledge across ERM processes and systems; enterprise modeling approaches that facilitate KM-ERM integration; the integration of customer, supplier and partner knowledge and its implication for the management of the combined knowledge in an integrated enterprise environment for EKM; and the business applications of the IKEP model and the KM-ERM enterprise model.

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