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An Integrated Architecture for Enterprise Relationship Management

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ABSTRACT

Value creation in the new economy powered by the Internet and globalization is characterized by relationship management, knowledge exchange and real-time connectivity. Enterprise relationship management is a business strategy that optimizes the relationships between a firm and its customers, channel partners, suppliers and other alliance partners, to maximize opportunities. This paper examines the characteristics of enterprise relationship management and its ecosystems in operations, analytics and collaboration enabled by technologies in e-business and knowledge management. An integrated architecture for enterprise relationship management is developed using the enterprise model framework.

INTRODUCTION

As we move further from the production economy to the knowledge-based economy, the focus of internal efficiency and product differentiation is shifted to value creation through relationship management. Empowered by the Internet and globalization, companies can often sell products they do not produce and can enter new lines of business with lower barriers. In this new business model, relationship management and knowledge management are critical strategies to gain competitive advantages. Customer relationship management (CRM) has been a dominant business strategy in which the focuses on customer satisfaction and loyalty have helped companies increase market share and profitability. Enterprise relationship management (ERM) extends beyond customer relationship management to partner relationship management (PRM) and supplier relationship management (SRM) in the extended business enterprise.

Past implementations of enterprise applications in ERP and CRM have suffered high percent failure rates. The lack of an enterprise-wide integration strategy was among the leading causes for failure. Value creation in the relationship age is characterized by knowledge exchange and real-time connectivity between a firm and its customers, suppliers and business partners. Technologies in e-business and knowledge management are critical enablers in ERM. This paper examines the characteristics of ERM and its ecosystem in operations, analytics and collaboration enabled by technologies in e-business and knowledge management. An integrated architecture for ERM is developed using the enterprise model that provides an enterprise-wide integration framework for business processes, data and technology. It bridges the linkage between ERM, e-business and knowledge management.

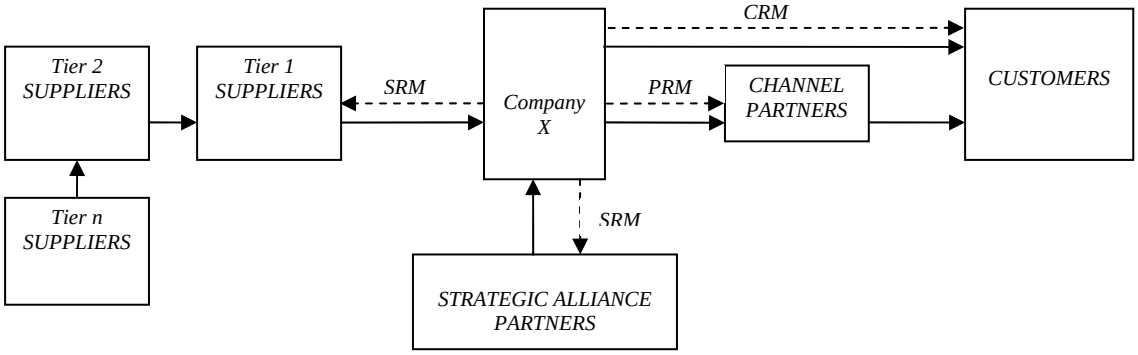
ENTERPRISE RELATIONSHIP MANAGEMENT

Porter (1985) described the concept of extending a firm's value chain to a value system to include the value chains of the suppliers, channels and buyers. Enterprise relationship management is a business strategy for value creation that optimizes the relationships between a firm and its customers, channel partners, suppliers and other alliance partners, to maximize opportunities. The relationship management age that succeeds the information age is characterized by attributes that include knowledge, relationship assets, 1-to-1 relationship management, dynamic pricing, mass customization and personalization (Galbreath, 2002). Technologies in e-business and knowledge

management are critical enablers of the ERM ecosystem that facilitate real-time connectivity and knowledge exchange.

Figure 1 illustrates a company's enterprise relationship management strategy. Downstream relationship management includes customer relationship management (CRM) and partner relationship management (PRM), whereas the upstream relationship management is supported by supplier relationship management (SRM). In this diagram, the end customers are represented by *CUSTOMERS*, channel partners such as distributors, retailers, dealerships, independent agents and value added resellers (VARs) are represented by *CHANNEL PARTNERS*, the multi-tier suppliers of raw materials and parts are represented by *Tier n SUPPLIERS* and other suppliers of products and services such as 3rd party logistics providers (3PLs), technology providers and contract manufacturers are represented by *STRATEGIC ALLIANCE PARTNERS*. The solid arrows indicate the flow in the supply chain and the dotted arrows indicate the flow of relationship management.

Figure 1: A Company's Enterprise Relationship Management Strategy.



CRM has been a dominant relationship management strategy as we moved from the production economy to the digital economy. It has helped businesses increase market share and profitability through enhanced customer satisfaction and loyalty. For businesses that have a high percentage of sales through indirect channels, such as in the high-tech industry (Tanoury et al., 2000), PRM becomes an important business strategy in sell-side relationship management. While the focus of relationship management has been on the customer side, the same emphasis on the supplier side can be equally important in a business strategy. According to the Aberdeen Group, procurement represents the single largest expense in most organizations (Aberdeen, 2001; Lang et al. 2002). Major components of SRM consist of procurement, sourcing, payments and analytics (Greenberg, 2004). SRM provides improved automated procurement processes, enhances supplier selection through analytics and allows collaboration with suppliers in all stages from sourcing to payment. Magretta (1998) described Dell Computer's long-term commitment to its suppliers in the virtual integration strategy where the suppliers effectively become its partners, meeting Dell's daily production requirements. Carey (2005) described the success of automakers Toyota and Honda through deep supplier relationships, which result in faster production times and reduced manufacturing costs.

The ERM Ecosystem

Extending the concept of the CRM ecosystem (Meta Group, 2002) to ERM, the ERM ecosystem consists of operational ERM, analytical ERM and collaborative ERM. Operational ERM is the automation of business processes in marketing, sales and service. Analytical ERM is the analysis of data created on the operational side of ERM. Collaborative ERM is the application of collaborative interfaces to facilitate interactions between a firm and its customers, suppliers and business partners.

The ERM ecosystem consists of sub-ecosystems in CRM, PRM and SRM. Operational CRM focuses on marketing and sales force automation, front-office automation, call center and customer service. While similar to CRM in many aspects, operational PRM has a business-to-business focus (Tanoury et al., 2000). It provides a firm and its selling partners with the ability to share information about leads and customers, product configurations and pricing.

An example of lead and referral management in PRM is Cisco's Channel Partner Referral Program (Cisco, 2007), in which Cisco channel partners can gain additional revenue streams after they become salesforce.com referral partners online. Customer interaction center operations for CRM have evolved into partner interaction center operations in PRM, providing service and support to partners. The SRM ecosystem pertains to the purchasing of products or services from suppliers. Marketing and sales functions for SRM are characterized by reverse auctions, identifying the needs and managing RFPs and bids (Lang et al., 2002). In service, SRM focuses on calls made to the suppliers for information and maintenance. Collaboration with suppliers may include CPFR (collaborative planning, forecasting and replenishment) and vendor-managed inventory. In all of these areas of CRM, PRM and SRM, analytics analyze data captured in operations to create business intelligence to enhance ERM operations.

Although each ERM component has its own ecosystem, the ERM ecosystem as a whole is greater than the sum of its parts. Many ERM operations span across CRM, PRM and SRM in real-time. Notable examples include Dell Computer's build-to-order process and Wal-mart's continuous replenishment process. ERM analytics leverage data from both the demand and supply chains to create enterprise level business intelligence. For example, business intelligence from customer demand, channel and supplier performance would be used in the development of effective product and sales strategies. ERM collaboration not only allows the interactions between a firm and its customers, suppliers and partners, it also facilitates interactions among them. A key concept in the ERM strategy is that its ecosystem is integrated at the enterprise level within and across each sub-ecosystem of CRM, PRM and SRM.

E-Business Enabled Enterprise Relationship Management

E-business enabled ERM (EERM) is an e-business model for ERM where the ERM ecosystem is enabled by e-business technologies. From the operations perspective, ECRM provides the online capabilities in marketing operations such as campaigns, promotions, advertising and surveys. E-business enabled sales operations may include online order processing, real-time product configuration, real-time point-of-sale inventory management and e-marketplaces. Real-time online services have become a critical part of business operations in many industries such as banking, retail and insurance. ECRM services may include online customer service, online technical support, self-service FAQ, automatic email responses, online invoicing and payment. EPRM provides the online capabilities in joint marketing campaigns and analysis, lead management, sales forecasting, catalog management and order management. B2B e-markets allow a firm and its channel partners to trade online. In services, EPRM provides the online capabilities of problem tracking and resolutions, product support, account and technical support, invoicing and payment. In ESRM, e-procurement systems provide online, real-time services such as e-sourcing, e-catalog, e-tendering, e-reverse auctions, automated requisitions and purchase orders, receiving, billing and payment (Turban et al., 2008). Companies in an industry may form purchasing-oriented consortium exchanges for procurement. A notable example is Covisint, which in 2002 united equity partners that included auto manufacturers and technology firms with many tier one suppliers and thousands of second and third tier suppliers (Applegate et al., 2003). From the analytics perspective, EERM provides an important channel to capture information about customer, partners and suppliers that can be used for analytical processing. From the collaborative perspective, EERM provides an effective communications tool for reaching customers, partners and suppliers. It provides the electronic interfaces to facilitate interactions between the organizations across the extended enterprise.

Knowledge Enabled Enterprise Relationship Management

Relationship management and knowledge management (KM) have in the past been treated as separate disciplines. These two complementary strategies are brought together in the new economy to drive competitive business advantages. Knowledge enabled relationship management in CRM, PRM and SRM are respectively referred to as KCRM, KPRM and KSRM. As described in Eppler et al. (1999) and Gebert et al. (2003) in the case of KCRM, knowledge enabled relationship management can be characterized by knowledge intensity, which is the measurement of the degree to which CRM processes require knowledge to pursue the process goals. Knowledge intensity increases as the complexity of the relationship management process increases. Knowledge-based systems leveraging artificial intelligence technologies are used in many areas of ERM, such as marketing decision support, marketing resource management, field sales, customer service, help desks, customer surveys, FAQs, supplier selection and evaluation (Bolloju 1996; Aliev et al., 2000; Tillett, 2000; Gartner, 2003; Choy et al., 2005; Lee et al., 2005).

ERM IMPLEMENTATION CHALLENGES

ERM implementations are confronted with challenges in dealing with disparate computer systems, integration issues and the lack of an enterprise-wide relationship management strategy. Integration issues in ERM implementation are many-fold. They include the integration with legacy systems, integration between ERM software applications and integration of processes, data and technology.

ERM implementation is not just a technology initiative and requires a business strategy that is understood by management, employees and other stake holders. The lack of an ERM business strategy is a major challenge to a successful ERM implementation. Different software components come in with their built-in processes, databases, reporting and business intelligence capabilities. While technical integration via interfaces provides the plumbing for system communication, it does not necessarily provide the rules for the usage of data and the coordination of processes across different ERM modules. An enterprise level roadmap of business rules regarding the management of information, knowledge, process and technology would be required.

Issues in ERM implementation are compounded by the many dimensions of disparity in an enterprise. Data processing anomalies may occur across multiple databases embedded in different ERM modules. Disparity may occur at the process level. As exemplified by Kmart's failure in 2002 (Konicki, 2002), the disconnection between demand and supply processes may cause retailers' on-sale merchandise to be out of stock. Disparity may exist between channels. For example, channel conflict may occur between traditional brick-and-mortar sales channels and online channels. Disparity may occur between operations and analytics. Operational data from transactional systems confined by system silos may not be utilized in analytics across the enterprise, and conversely, analytical results may not be tied to enterprise operations. Disparity also exists between a firm's knowledge management processes and ERM operations. Challenges in applying knowledge management in ERM include the lack of integration between KM processes and ERM processes, the incompatibility of KM and ERM technologies, disparate knowledge bases, incomplete and inconsistent knowledge through multiple communication channels across the enterprise.

There are other challenges of ERM implementation that include channel conflicts, cultural prohibition and trust issues. E-business models have facilitated the phenomenon of disintermediation, where the middle agents are eliminated. The multi-tiered distribution channels or alternative channels in the supply chain enabled by ERM could be disintermediated. Intermediaries would need to create added values in the supply chain in order to stay in the value creation network. Cultural problems can emerge. A procurement officer who has sole-sourced from one or two major suppliers in the past decades may be reluctant to operate under a more competitive situation in ERM where many suppliers from around the world are allowed to participate via the Internet in open bids based on performance criteria. The trust issue arises where suppliers and participating partners would use shared customer, product and other information to their own advantage such as jacking up prices for product or services.

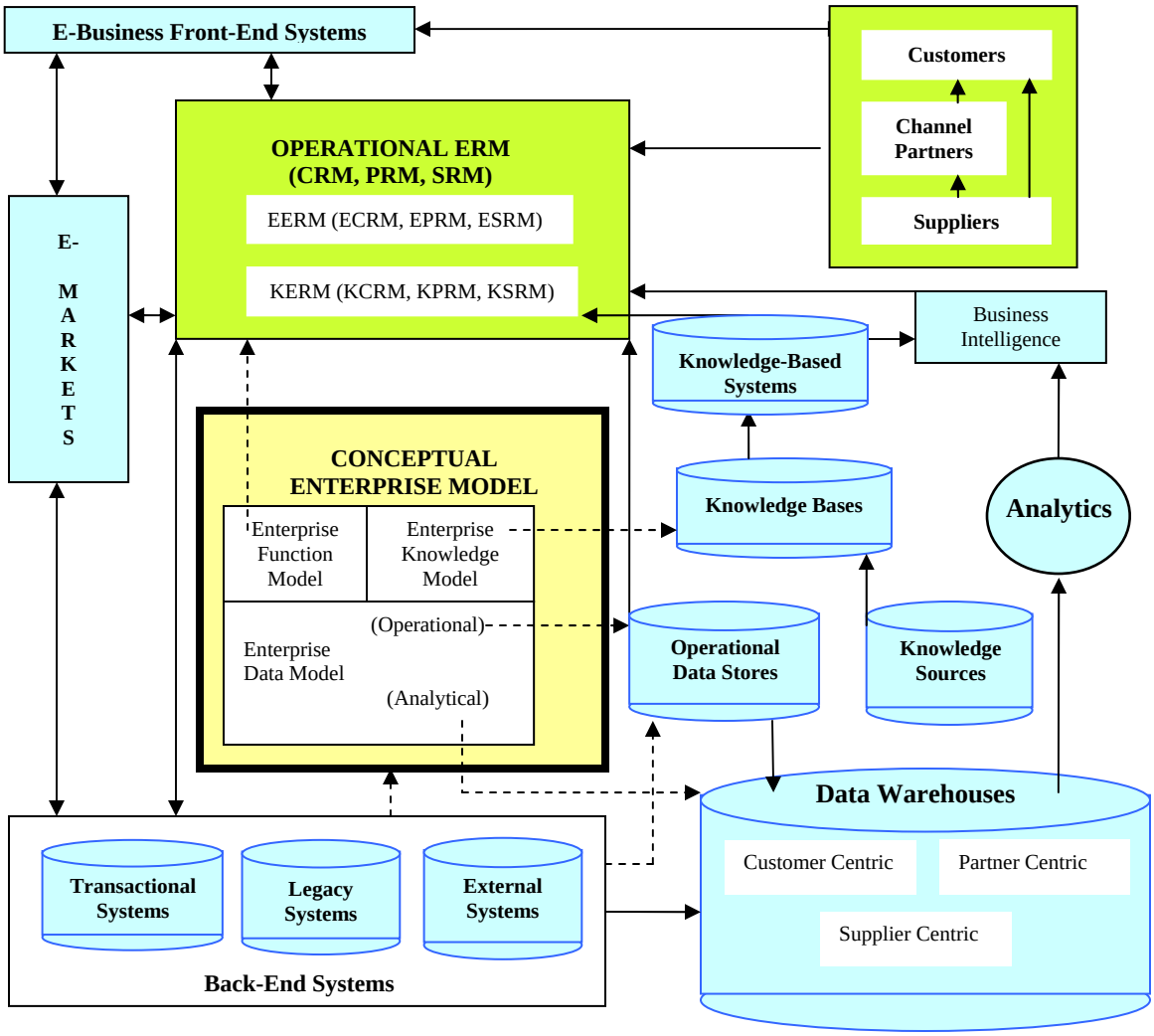
AN INTEGRATED ARCHITECTURE FOR ERM USING THE ENTERPRISE MODEL FRAMEWORK

The enterprise model framework as described by Chan (2004) consists of three levels: the external level, the conceptual level and the internal level. The external enterprise model consists of the user application views, business processes and organizational structures. The conceptual enterprise model consists of data and function models representing operational and analytical requirements for the enterprise. The internal enterprise model consists of the technical components in data structures, software and tools, hardware and communications networks. In this paper, the model is extended to include the dimension of enterprise knowledge management. Figure 2 illustrates the enterprise model framework that is used in the construction of an integrated architecture for ERM. The components of the architecture include the business organizations of customers, partners and suppliers, the conceptual enterprise model, e-business front-end systems, e-marketplaces, back-end systems, enterprise relationship management operations, knowledge sources, knowledge bases, knowledge-based systems, operational data stores, data warehouses, analytics and business intelligence (Figure 3). In the following, the characteristics of these components and how they are related in the enterprise model framework will be described.

Figure 2: The Enterprise Model Framework (Adapted from Chan, 2004).

<table>
<tr><th colspan="5">The Enterprise Model Framework</th></tr>
<tr><td rowspan="3">External Enterprise Model</td><td colspan="4">User Application Views</td></tr>
<tr><td colspan="4">Business Processes</td></tr>
<tr><td colspan="4">Organizational Structures</td></tr>
<tr><td rowspan="6">Conceptual Enterprise Model</td><td colspan="2" rowspan="2">Enterprise Data Model</td><td colspan="2">Operational data models</td></tr>
<tr><td colspan="2">Analytic data models</td></tr>
<tr><td colspan="2" rowspan="2">Enterprise Function Model</td><td colspan="2">Operational function models</td></tr>
<tr><td colspan="2">Analytic function models</td></tr>
<tr><td colspan="2" rowspan="2">Enterprise Knowledge Model</td><td colspan="2">Domain specific knowledge models</td></tr>
<tr><td colspan="2">Domain independent knowledge models</td></tr>
<tr><td>Internal Enterprise Model</td><td>Physical Data Storage & Structures</td><td>Software & Tools</td><td>Hardware Platforms</td><td>Communications Networks</td></tr>
</table>

Figure 3: An Integrated Architecture for Enterprise Relationship Management.



The External Enterprise Model for ERM

The external enterprise model in the architecture for ERM (Figure 3) consists of organizations for customers, channel partners and suppliers, the processes for operational ERM and e-marketplaces. A customer, channel partner or supplier may interact with a firm or a 3rd party e-marketplace via the e-business front-end. Operational ERM processes are the implementations of business functions described in the conceptual enterprise model. EERM and KERM are the enablement of operational ERM by e-business technologies and knowledge-based systems, respectively. Transactions in operations are supported by the back-end transactional systems. Business intelligence from analytical processing can be used to enhance operations, whereas operational results captured by the transactional systems provide the data feeds to data warehouses for further analysis to create new business intelligence.

The Conceptual Enterprise Model for ERM

The conceptual enterprise model consists of logical representations of enterprise data, knowledge and functional requirements for operations and analytics. It provides the enterprise-wide architectural blue-print for ERM. The enterprise data model consists of operational and analytic data models representing enterprise operational and analytical data requirements. The enterprise data model is the information blue-print that provides the linkage for various data structures across the enterprise. It serves as the information roadmap for system integration, new system deployment and system maintenance. The enterprise function model is the representation of business functions supporting operational and analytic functional requirements for the enterprise. It is the functional blue-print and provides the linkage within and across the external enterprise of organizational processes and the internal enterprise of computer systems. It is not uncommon to find different processes implementing the same business function to yield incompatible results. For example, a customer may receive different price quotes from different channels such as the Web, call centers or at retail outlets. Using the enterprise model framework, these processes are linked to the business function of providing price quote, which is mapped to the enterprise data model that contains the single source of pricing information.

As knowledge is an integral component of ERM, the conceptual enterprise model is extended to include knowledge models. Milton (2003) described knowledge models as "structured representations of knowledge using symbols to represent pieces of knowledge and relationships between them." They include the use of symbolic languages, diagrammatic and tabular representations, and structured text (Milton 2003). Strube (1996) described the four layers of knowledge modeling for knowledge-based systems that consist of the domain level, the inference level, the task level and the strategic level. It pointed out that the first two levels are domain-dependent and the strategic level is a domain-independent framework suited for problems at the abstraction level of generic tasks. The enterprise knowledge model provides the knowledge blue-print for the reusability of knowledge and the development of knowledge bases across the enterprise.

The Internal Enterprise Model for ERM

The internal enterprise model is a representation of the technical implementation of enterprise operational and analytic requirements utilizing physical data structures and storage, software applications and tools, hardware and communications networks. In the following, elements of the internal enterprise model specific to the architecture for ERM as illustrated in Figure 3 will be described.

The E-Business Front-End and Back-End Systems: The e-business front-end consists of systems that interact directly with customers, partners and suppliers through the use of computer networks and other digital technologies. They provide the user interfaces for a firm's ERM operations and e-marketplaces, which are connected to the back-end systems that consist of transactional systems, legacy systems and external systems. From the sell-side perspective, the front-end is part of the seller's ERM processes that interacts directly with the customers and channel partners. From the buy-side perspective, the front-end is part of the buyer's ERM processes that interacts directly with suppliers. Data captured in ERM operations are stored in databases and file systems in the back-end systems which provide the data feeds to the operational data stores and data warehouses.

Operational Data Stores, Data Warehouses and Analytics: Chan (2005) described the characteristics of transactional databases, operational data stores and data warehouses. Transactional databases are designed to support well-defined and targeted business processes. They are not equipped to support enterprise business processes that span across multiple transactional systems. Operational data stores (ODSs) are integrated data structures that support enterprise operations. ODSs contain current or near current data supporting the daily needs of a business (Sperley 1999). The ODSs, however, are not suitable for analytics that require long time-span of historic data. Data warehouses are integrated data structures for analytics that support strategic decision making. Inmon (1993) described the characteristics of a data warehouse as subject oriented, nonvolatile, integrated and time-variant. As described by Singh (1998), tactical decisions are based largely on data in the ODS, whereas, long-term strategic decisions, which require the historical trend analysis, are based on data in the data warehouse. As illustrated in Figure 3, ODSs support the day-to-day operations in ERM, whereas data warehouses support analytics for ERM. Data warehouses in the ERM architecture can be customer centric, partner centric or supplier centric, and are

connected across the enterprise via the conceptual enterprise model. Data structures such as transactional databases and file systems provide the data feeds to ODSs and data warehouses. Analytical processes utilizing methods such as statistical processing, OLAP and data mining can be deployed to create business intelligence to support ERM operations.

Knowledge Bases and Knowledge-Based Systems: Knowledge captured through the knowledge acquisition process from knowledge sources is stored in knowledge bases, which can be developed using the conceptual frameworks provided in the enterprise knowledge model. The knowledge enablement of ERM (KERM) is implemented via knowledge-based systems, which use the facts and rules in knowledge bases and, through inference mechanisms, produce solutions to specific problems. Operations in CRM, PRM and SRM enabled by knowledge-based systems are referred to as KCRM, KPRM and KSRM, respectively. Results from knowledge-based systems can be combined with analytics to create knowledge-based business intelligence.

THE NEXT STAGE OF ERM IMPLEMENTATION

Modern enterprises may have developed conceptual models and integrated their ERP with its supply chain, electronically connected with its partners, and implemented data warehousing and business intelligence. ERM modules are often implemented as add-ons over the past decades. They could be a hodgepodge of homegrown custom applications and packaged software from different vendors with different technology platforms. These software modules are often confined by the boundaries of systems, organizations and technologies and become information and decision silos in an enterprise. The ERM framework provides an enterprise architectural blue-print, enables enterprise-wide solutions and provides a real-time holistic view of ERM. It provides the capability of managing ERM processes, data, knowledge and analytics at the enterprise level across difference software applications, systems and organizations.

The Enterprise Architectural Blue-Print

While data models and function models are common concepts in the analysis phase of system development, they are mostly developed piecemeal overtime, confined by organization and application boundaries. The enterprise-wide synchronization and coordination of these models across the external and internal enterprises are rarely implemented. Enterprise level architectural blue-prints often do not exist in organizations. The conceptual enterprise model in the ERM framework provides the architectural blue-print that governs process and system implementations across the enterprise.

From Point Solution to Enterprise Solution

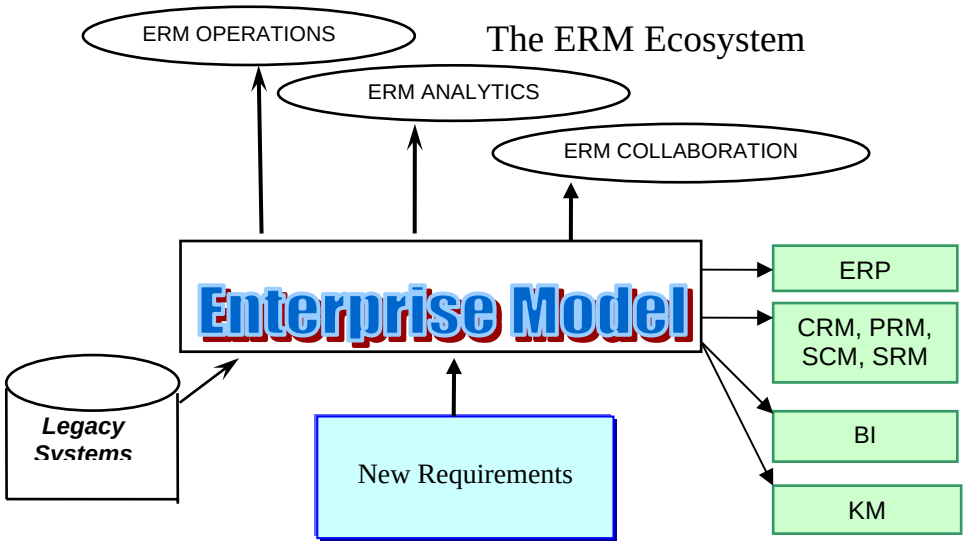
Individual software components of ERM provide point solutions in the specific areas of CRM, PRM and SRM but do not deliver enterprise solutions for ERM. Connectivity between these modules and their connectivity with legacy systems may occur overtime via point-to-point interfaces or through the deployment of middleware technologies. Such platform connectivity only provides the plumbing level of integration. The business level integration requires the use of business rules that govern how information, knowledge and functions are implemented and coordinated across the business and technical levels of the enterprise. Figure 4 illustrates the enterprise model framework that supports the ERM ecosystem of operations, analytics and collaboration across the enterprise, utilizing software applications in ERP, CRM, PRM, SCM, SRM, BI and KM. It further illustrates the logical connection of these enterprise applications to legacy systems and new ERM requirements through the enterprise model.

A Real-time Holistic View of ERM

The evolution of technologies in business as described by Porter (2001) has gone through the overlapping stages of automation of discrete transactions, functional enhancement of activities, cross-activity integration, integration of the entire value chain and the optimization of various activities in the value chain in real time. The enterprise model architecture provides the roadmap for real-time optimization of ERM activities at the enterprise level. While individual ERM software modules in CRM, PRM and SRM come with their embedded processes, databases,

knowledge bases and analytics, ERM operations often span across different systems and organizations. For example, the process of returning goods spans across CRM, ERP and SRM. It needs to reconcile the return with the original order, credit the return in billing, track defects with suppliers and respond to customer inquiries regarding the return and credits. By the same token, ERM analytics span across different systems and organizations. Enterprise business intelligence leverages analytics from all areas of customers, suppliers and business partners across the enterprise. ERM collaboration extends individual interactions in CRM, PRM and SRM to collaboration within and among all parties in the extended enterprise. The ERM framework provides a holistic view of customers, suppliers and business partners that is required for the real-time coordination and optimization of value chain activities across the enterprise.

Figure 4: An Enterprise View of the ERM Ecosystem.



CONCLUSIONS

Value creation models have evolved alongside the changes of the economy from production-based to service-based and from service-based to relationship-based. Business performance is measured by a firm's relationships with its customers, channel partners, suppliers and other alliance partners. Customer relationship management has been a dominant relationship management strategy that has helped companies to acquire and retain customers, driving market share and profitability. For businesses that have a high percentage of sales through indirect channels, partner relationship management has become an important business strategy in sell-side relationship management. Of equal importance is the management of relationships with suppliers, as procurement is a significant expense that can affect the bottom line of a company and supplier performance can affect the performance of the entire value chain. Effective supplier management can reduce procurement costs, improve product quality and ensure timely delivery.

Enterprise relationship management is a business strategy for value creation that optimizes the relationships between a firm and its customers, channel partners, suppliers and other alliance partners, to maximize opportunities. The relationship age has brought together ERM, the Internet and knowledge as key ingredients in value creation. This paper examines the characteristics of enterprise relationship management and its ecosystem in operations, analytics and collaboration enabled by technologies in e-business and knowledge management. It addresses ERM implementation challenges that include the disparity of computer systems, integration issues, the lack of enterprise-wide ERM strategy, channel conflicts and cultural issues. Past implementations of enterprise system modules have

created information and decision silos confined by the boundaries of systems, organizations and technologies. Successful ERM implementations require the integration of business processes, data, knowledge, business intelligence and technology across the enterprise. An integrated architecture for ERM is developed using the enterprise model framework, which provides an enterprise architectural blue-print that enables enterprise-wide solutions and real-time optimization of ERM operations.

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